

LIGHT UNFLAVORED MESONS

($S = C = B = 0$)

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

NODE=MXXX005

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NODE=M014

$f_0(500)$ or σ
was $f_0(600)$

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

A REVIEW GOES HERE – Check our WWW List of Reviews

NODE=M014

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

NODE=M014PP

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

NODE=M014PP

NODE=M014PP

→ UNCHECKED ←

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. • • •			
$(440 \pm 10) - i(238 \pm 10)$	¹ ALBALADEJO 12	RVUE	Compilation
$(445 \pm 25) - i(278^{+22}_{-18})$	^{2,3} GARCIA-MAR..11	RVUE	Compilation
$(457^{+14}_{-13}) - i(279^{+11}_{-7})$	^{2,4} GARCIA-MAR..11	RVUE	Compilation
$(442^{+5}_{-8}) - i(274^{+6}_{-5})$	⁵ MOUSSALLAM11	RVUE	Compilation
$(452 \pm 13) - i(259 \pm 16)$	⁶ MENNESSIER 10	RVUE	Compilation
$(448 \pm 43) - i(266 \pm 43)$	⁷ MENNESSIER 10	RVUE	Compilation
$(455 \pm 6^{+31}_{-13}) - i(278 \pm 6^{+34}_{-43})$	⁸ CAPRINI 08	RVUE	Compilation
$(463 \pm 6^{+31}_{-17}) - i(259 \pm 6^{+33}_{-34})$	⁹ CAPRINI 08	RVUE	Compilation
$(552^{+84}_{-106}) - i(232^{+81}_{-72})$	¹⁰ ABLIKIM 07A	BES2	$\psi(2S) \rightarrow \pi^+ \pi^- J/\psi$
$(466 \pm 18) - i(223 \pm 28)$	¹¹ BONVICINI 07	CLEO	$D^+ \rightarrow \pi^- \pi^+ \pi^+$
$(472 \pm 30) - i(271 \pm 30)$	¹² BUGG 07A	RVUE	Compilation
$(484 \pm 17) - i(255 \pm 10)$	GARCIA-MAR..07	RVUE	Compilation
$(430) - i(325)$	¹³ ANISOVICH 06	RVUE	Compilation
$(441^{+16}_{-8}) - i(272^{+9}_{-12.5})$	¹⁴ CAPRINI 06	RVUE	$\pi\pi \rightarrow \pi\pi$
$(470 \pm 50) - i(285 \pm 25)$	¹⁵ ZHOU 05	RVUE	
$(541 \pm 39) - i(252 \pm 42)$	¹⁶ ABLIKIM 04A	BES2	$J/\psi \rightarrow \omega \pi^+ \pi^-$
$(528 \pm 32) - i(207 \pm 23)$	¹⁷ GALLEGOS 04	RVUE	Compilation
$(440 \pm 8) - i(212 \pm 15)$	¹⁸ PELAEZ 04A	RVUE	$\pi\pi \rightarrow \pi\pi$
$(533 \pm 25) - i(249 \pm 25)$	¹⁹ BUGG 03	RVUE	
$517 - i240$	BLACK 01	RVUE	$\pi^0 \pi^0 \rightarrow \pi^0 \pi^0$
$(470 \pm 30) - i(295 \pm 20)$	¹⁴ 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	$\pi\pi \rightarrow \pi\pi, K\bar{K}$
$408 - i342$	^{26,29} ZOU 93	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$

OCCUR=2

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470 – $i208$ (750 ± 50) – $i(450 ± 50)$ (660 ± 100) – $i(320 ± 70)$ 650 – $i370$ ³⁰ VANBEVEREN 86 RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}, \eta\eta,$ ³¹ ESTABROOKS 79 RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}$
PROTOPOPO... 73 HBC $\pi\pi \rightarrow \pi\pi, K\bar{K}$ ³² BASDEVANT 72 RVUE $\pi\pi \rightarrow \pi\pi$ ¹ 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 73.² Uses the K_{e4} data of BATLEY 10C and the $\pi N \rightarrow \pi\pi N$ data of HYAMS 73, GRAYER 74, and PROTOPOPOESCU 73.³ Analytic continuation using Roy equations.⁴ Analytic continuation using GKPY equations.⁵ Using Roy equations.⁶ 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 74.⁷ 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.⁸ From the K_{e4} data of BATLEY 08A and $\pi N \rightarrow \pi\pi N$ data of HYAMS 73.⁹ From the K_{e4} data of BATLEY 08A and $\pi N \rightarrow \pi\pi N$ data of PROTOPOPOESCU 73, GRAYER 74, and ESTABROOKS 74.¹⁰ From a mean of three different $f_0(500)$ parametrizations. Uses 40k events.¹¹ From an isobar model using 2.6k events.¹² Reanalysis of ABLIKIM 04A, PISLAK 01, and HYAMS 73 data.¹³ Using the N/D method.¹⁴ 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.¹⁵ Reanalysis of the data from PROTOPOPOESCU 73, ESTABROOKS 74, GRAYER 74, ROSSELET 77, PISLAK 03, and AKHMETSHIN 04.¹⁶ From a mean of six different analyses and $f_0(500)$ parameterizations.¹⁷ 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 98.¹⁸ Reanalysis of data from PROTOPOPOESCU 73, ESTABROOKS 74, GRAYER 74, and COHEN 80 in the unitarized ChPT model.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, CORDEEN 79, BISWAS 81.³¹ Analysis of data from APEL 73, 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 $e^+e^- \approx 10$ GeV478 $^{+24}_{-23} \pm 17$ 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 $np \rightarrow np \pi^+ \pi^-$

NODE=M014M

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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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NODE=M014M;LINKAGE=D

$f_0(500)$ 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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NODE=M014W;LINKAGE=AA

NODE=M014W;LINKAGE=E

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$f_0(500)$ DECAY MODES

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

NODE=M014215;NODE=M014

DESIG=1;OUR EST;→ UNCHECKED ←

DESIG=5;OUR EST;→ UNCHECKED ←

 $f_0(500)$ PARTIAL WIDTHS

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

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

1.7 ± 0.4	55	HOERICHTER11	RVUE	Compilation
3.08 ± 0.82	56	MENNESSIER 11	RVUE	Compilation
2.08 ± 0.2 ^{+0.07} _{-0.04}	57	MOUSSALLAM11	RVUE	Compilation
2.08	58	MAO 09	RVUE	Compilation
1.2 ± 0.4	59	BERNABEU 08	RVUE	
3.9 ± 0.6	56	MENNESSIER 08	RVUE	$\gamma\gamma \rightarrow \pi^+\pi^-, \pi^0\pi^0$
1.8 ± 0.4	60	OLLER 08	RVUE	Compilation
1.68 ± 0.15	60,61	OLLER 08A	RVUE	Compilation
3.1 ± 0.5	62,63	PENNINGTON 08	RVUE	Compilation
2.4 ± 0.4	63,64	PENNINGTON 08	RVUE	Compilation
4.1 ± 0.3	65	PENNINGTON 06	RVUE	$\gamma\gamma \rightarrow \pi^0\pi^0$
3.8 ± 1.5	66,67	BOGLIONE 99	RVUE	$\gamma\gamma \rightarrow \pi^+\pi^-, \pi^0\pi^0$
5.4 ± 2.3	66	MORGAN 90	RVUE	$\gamma\gamma \rightarrow \pi^+\pi^-, \pi^0\pi^0$
10 ± 6		COURAU 86	DM1	$e^+e^- \rightarrow \pi^+\pi^- e^+e^-$

NODE=M014220

NODE=M014W2

NODE=M014W2

OCCUR=2

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

56 Using an analytic K-matrix model.

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

58 Used dispersion theory. The value quoted used the $f_0(500)$ pole position of 457 - i276 MeV.59 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.

60 Using twice-subtracted dispersion integrals.

61 Supersedes OLLER 08.

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

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

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

65 Using unitarity and the σ pole position from CAPRINI 06.66 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 $f_2(1270)$.

67 Supersedes MORGAN 90.

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NODE=M014W2;LINKAGE=A

NODE=M014W2;LINKAGE=BL

 $f_0(500)$ REFERENCES

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)
HOERICHTER 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	JPG 34 151	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.)
ANISOVICH 06	IJMP A21 3615	V.V. Anisovich	
CAPRINI 06	PRL 96 132001	I. Caprini, G. Colangelo, H. Leutwyler	(BCIP+)
PDG 06	JPG 33 1	W.-M. Yao <i>et al.</i>	(PDG Collab.)
PENNINGTON 06	PRL 97 011601	M.R. Pennington	
ZHOU 05	JHEP 0502 043	Z.Y. Zhou <i>et al.</i>	

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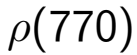
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REFID=51184

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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
GALLEGOS	04	PR D69 074033	A. Gallegos <i>et al.</i>		REFID=49769
PELAEZ	04A	MPL A19 2879	J.R. Pelaez		REFID=50347
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 (erratum)	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. Leytwyler		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
		Translated from UFN 168 481.			
LOCHER	98	EPJ C4 317	M.P. Locher <i>et al.</i>	(PSI)	REFID=46372
TROYAN	98	JINRRC 5-91 33	Yu. Troyan <i>et al.</i>		REFID=46615
ALDE	97	PL B397 350	D.M. Alde <i>et al.</i>	(GAMS Collab.)	REFID=45392
DOBADO	97	PR D56 3057	A. Dobado, J.R. Pelaez		REFID=53964
ISHIDA	97	PTP 98 1005	S. Ishida <i>et al.</i>	(TOKY, MIYA, KEK)	REFID=45998
KAMINSKI	97B	PL B413 130	R. Kaminski, L. Lesniak, B. Loiseau	(CRAC, IPN)	REFID=45778
Also		PTP 95 745	S. Ishida <i>et al.</i>	(TOKY, MIYA, KEK)	REFID=45770
SVEC	96	PR D53 2343	M. Svec	(MCGI)	REFID=44509
TORNQVIST	96	PRL 76 1575	N.A. Tornqvist, M. Roos	(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 R3948	B.S. Zou, D.V. Bugg	(LOQM)	REFID=43672
BEHREND	92	ZPHY C56 381	H.J. Behrend	(CELLO Collab.)	REFID=43172
ARMSTRONG	91B	ZPHY C52 389	T.A. Armstrong <i>et al.</i>	(ATHU, BARI, BIRM+)	REFID=41862
BOYER	90	PR D42 1350	J. Boyer <i>et al.</i>	(Mark II Collab.)	REFID=41362
MARSISKE	90	PR D41 3324	H. Marsiske <i>et al.</i>	(Crystal Ball Collab.)	REFID=41351
MORGAN	90	ZPHY C48 623	D. Morgan, M.R. Pennington	(RAL, DURH)	REFID=41583
AUGUSTIN	89	NP B320 1	J.E. Augustin, G. Cosme	(DM2 Collab.)	REFID=41004
ASTON	88	NP B296 493	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)	REFID=40262
FALVARD	88	PR D38 2706	A. Falvard <i>et al.</i>	(CLER, FRAS, LALO+)	REFID=40576
COURAU	86	NP B271 1	A. Courau <i>et al.</i>	(CLER, LALO)	REFID=44510
VANBEVEREN	86	ZPHY C30 615	E. van Beveren <i>et al.</i>	(NIJM, BIEL)	REFID=45769
CASON	83	PR D28 1586	N.M. Cason <i>et al.</i>	(NDAM, ANL)	REFID=20752
ETKIN	82B	PR D25 1786	A. Etkin <i>et al.</i>	(BNL, CUNY, TUFTS, VAND)	REFID=20390
BISWAS	81	PRL 47 1378	N.N. Biswas <i>et al.</i>	(NDAM, ANL)	REFID=21106
COHEN	80	PR D22 2595	D. Cohen <i>et al.</i>	(ANL) IJP	REFID=20381
MUKHIN	80	JETPL 32 601	K.N. Mukhin <i>et al.</i>	(KIAE)	REFID=44528
		Translated from ZETFP 32 616.			
CORDEN	79	NP B157 250	M.J. Corden <i>et al.</i>	(BIRM, RHEL, TELA+) JP	REFID=20374
ESTABROOKS	79	PR D19 2678	P. Estabrooks	(CARL)	REFID=20375
FROGGATT	77	NP B129 89	C.D. Froggatt, J.L. Petersen	(GLAS, NORD)	REFID=21072
PAWLICKI	77	PR D15 3196	A.J. Pawlicki <i>et al.</i>	(ANL) IJ	REFID=20367
ROSSELET	77	PR D15 574	L. Rosselet <i>et al.</i>	(GEVA, SACL)	REFID=11004
CASON	76	PRL 36 1485	N.M. Cason <i>et al.</i>	(NDAM, ANL) IJ	REFID=21064
ESTABROOKS	75	NP B95 322	P.G. Estabrooks, A.D. Martin	(DURH)	REFID=20642
HYAMS	75	NP B100 205	B.D. Hyams <i>et al.</i>	(CERN, MPIM)	REFID=20355
SRINIVASAN	75	PR D12 681	V. Srinivasan <i>et al.</i>	(NDAM, ANL)	REFID=21062
ESTABROOKS	74	NP B79 301	P.G. Estabrooks, A.D. Martin	(DURH)	REFID=20111
GRAYER	74	NP B75 189	G. Grayer <i>et al.</i>	(CERN, MPIM)	REFID=20113
APEL	73	PL 41B 542	W.D. Apel <i>et al.</i>	(KARL, PISA)	REFID=44532
ESTABROOKS	73	Tallahassee	P.G. Estabrooks <i>et al.</i>	(CERN, MPIM)	REFID=20345
HYAMS	73	NP B64 134	B.D. Hyams <i>et al.</i>	(CERN, MPIM)	REFID=20107
OCHS	73	Thesis	W. Ochs	(MPIM, MUNI)	REFID=20349
PROTOPOP...	73	PR D7 1279	S.D. Protopopescu <i>et al.</i>	(LBL)	REFID=20108
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. Reignier	(SACL)	REFID=20086
WALKER	67	RMP 39 695	W.D. Walker	(WISC)	REFID=20960



$$J^{PC} = 1^{++}$$

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$\rho(770)$ MASS

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

NEUTRAL ONLY, e^+e^-

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
775.26 ± 0.25 OUR AVERAGE				
[775.49 ± 0.34 MeV OUR 2012 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. • • •				
775.8 ± 0.5 ± 0.3	1.98M	⁹ ALOISIO	03 KLOE	$1.02 e^+e^- \rightarrow \pi^+\pi^-\pi^0$
775.9 ± 0.6 ± 0.5	1.98M	¹⁰ ALOISIO	03 KLOE	$1.02 e^+e^- \rightarrow \pi^+\pi^-\pi^0$
775.0 ± 0.6 ± 1.1	500k	¹¹ ACHASOV	02 SND	$1.02 e^+e^- \rightarrow \pi^+\pi^-\pi^0$
775.1 ± 0.7 ± 5.3		¹² BENAYOUN	98 RVUE	$e^+e^- \rightarrow \pi^+\pi^-$, $\mu^+\mu^-$
770.5 ± 1.9 ± 5.1		¹³ GARDNER	98 RVUE	$0.28-0.92 e^+e^- \rightarrow \pi^+\pi^-$
764.1 ± 0.7		¹⁴ O'CONNELL	97 RVUE	$e^+e^- \rightarrow \pi^+\pi^-$
757.5 ± 1.5		¹⁵ BERNICHA	94 RVUE	$e^+e^- \rightarrow \pi^+\pi^-$
768 ± 1		¹⁶ GESHKEN...	89 RVUE	$e^+e^- \rightarrow \pi^+\pi^-$

NODE=M009M0
NODE=M009M0
NEW

OCCUR=2

OCCUR=3

OCCUR=3

CHARGED ONLY, τ DECAYS and e^+e^-

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
775.11 ± 0.34 OUR AVERAGE					
774.6 ± 0.2 ± 0.5	5.4M	^{17,18} FUJIKAWA	08 BELL	±	$\tau^- \rightarrow \pi^-\pi^0\nu_\tau$
775.5 ± 0.7		^{18,19} SCHAEEL	05C ALEP		$\tau^- \rightarrow \pi^-\pi^0\nu_\tau$
775.5 ± 0.5 ± 0.4	1.98M	⁷ ALOISIO	03 KLOE		$1.02 e^+e^- \rightarrow \pi^+\pi^-\pi^0$
775.1 ± 1.1 ± 0.5	87k	^{20,21} ANDERSON	00A CLE2		$\tau^- \rightarrow \pi^-\pi^0\nu_\tau$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
774.8 ± 0.6 ± 0.4	1.98M	¹⁰ ALOISIO	03 KLOE	-	$1.02 e^+e^- \rightarrow \pi^+\pi^-\pi^0$
776.3 ± 0.6 ± 0.7	1.98M	¹⁰ ALOISIO	03 KLOE	+	$1.02 e^+e^- \rightarrow \pi^+\pi^-\pi^0$
773.9 ± 2.0 ^{+0.3} -1.0		²² SANZ-CILLERO	03 RVUE		$\tau^- \rightarrow \pi^-\pi^0\nu_\tau$
774.5 ± 0.7 ± 1.5	500k	⁷ ACHASOV	02 SND	±	$1.02 e^+e^- \rightarrow \pi^+\pi^-\pi^0$
775.1 ± 0.5		²³ PICH	01 RVUE		$\tau^- \rightarrow \pi^-\pi^0\nu_\tau$

NODE=M009M5
NODE=M009M5

OCCUR=2

OCCUR=3

OCCUR=2

MIXED CHARGES, OTHER REACTIONS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
763.0 ± 0.3 ± 1.2	600k	²⁴ ABELE	99E CBAR	0 ±	$0.0 \bar{p}p \rightarrow \pi^+\pi^-\pi^0$

NODE=M009M7
NODE=M009M7

NODE=M009M3

CHARGED ONLY, HADROPRODUCED

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
766.5 ± 1.1 OUR AVERAGE					
763.7 ± 3.2		ABELE	97 CBAR		$\bar{p}n \rightarrow \pi^-\pi^0\pi^0$
768 ± 9		AGUILAR...	91 EHS		400 pp
767 ± 3	2935	²⁵ CAPRARO	87 SPEC	-	$200 \pi^-\pi^0\text{Cu} \rightarrow \pi^-\pi^0\text{Cu}$
761 ± 5	967	²⁵ CAPRARO	87 SPEC	-	$200 \pi^-\pi^0\text{Pb} \rightarrow \pi^-\pi^0\text{Pb}$
771 ± 4		HUSTON	86 SPEC	+	$202 \pi^+\pi^0\text{A} \rightarrow \pi^+\pi^0\text{A}$
766 ± 7	6500	²⁶ BYERLY	73 OSPK	-	5 π^-p
766.8 ± 1.5	9650	²⁷ PISUT	68 RVUE	-	1.7-3.2 π^-p , $t < 10$
767 ± 6	900	²⁵ EISNER	67 HBC	-	4.2 π^-p , $t < 10$

NODE=M009M2
NODE=M009M2

OCCUR=2

NEUTRAL ONLY, PHOTOPRODUCED

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
769.0 ± 1.0 OUR AVERAGE				
[768.5 ± 1.1 MeV OUR 2012 AVERAGE]				
771 ± 2 $^{+2}_{-1}$	63.5k	28 ABRAMOWICZ12	ZEUS	$ep \rightarrow e\pi^+\pi^-p$
770 ± 2 ±1	79k	29 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	30 BREITWEG	98B ZEUS	50–100 γp

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 NODE=M009M0P
 NEW

OCCUR=2

OCCUR=2

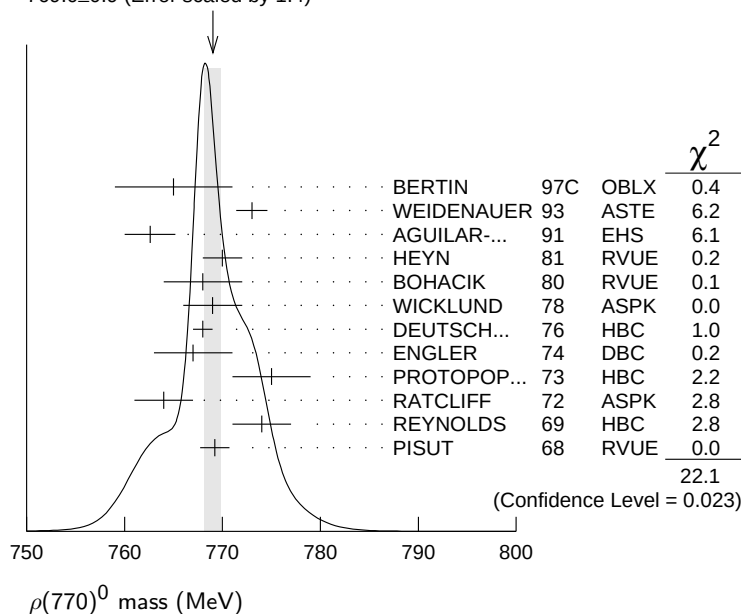
NEUTRAL ONLY, OTHER REACTIONS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	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		31 HEYN	81 RVUE		Pion form factor
768 ± 4		32,33 BOHACIK	80 RVUE	0	
769 ± 3		26 WICKLUND	78 ASPK	0	3,4,6 $\pi^\pm N$
768 ± 1	76000	DEUTSCH...	76 HBC	0	16 π^+p
767 ± 4	4100	ENGLER	74 DBC	0	6 $\pi^+n \rightarrow \pi^+\pi^-p$
775 ± 4	32000	32 PROTOPOP...	73 HBC	0	7.1 $\pi^+p, t < 0.4$
764 ± 3	6800	RATCLIFF	72 ASPK	0	15 $\pi^-p, t < 0.3$
774 ± 3	1700	REYNOLDS	69 HBC	0	2.26 π^-p
769.2 ± 1.5	13300	34 PISUT	68 RVUE	0	1.7–3.2 $\pi^-p, t < 10$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
773.5 ± 2.5		35 COLANGELO	01 RVUE		$\pi\pi \rightarrow \pi\pi$
762.3 ± 0.5 ± 1.2	600k	36 ABELE	99E CBAR	0	0.0 $\bar{p}p \rightarrow \pi^+\pi^-\pi^0$
777 ± 2	4943	37 ADAMS	97 E665		470 $\mu p \rightarrow \mu XB$
770 ± 2		38 BOGOLYUB...	97 MIRA		32 $\bar{p}p \rightarrow \pi^+\pi^-X$
768 ± 8		38 BOGOLYUB...	97 MIRA		32 $pp \rightarrow \pi^+\pi^-X$
761.1 ± 2.9		DUBNICKA	89 RVUE		π form factor
777.4 ± 2.0		39 CHABAUD	83 ASPK	0	17 π^-p polarized
769.5 ± 0.7		32,33 LANG	79 RVUE	0	
770 ± 9		33 ESTABROOKS	74 RVUE	0	17 $\pi^-p \rightarrow \pi^+\pi^-n$
773.5 ± 1.7	11200	25 JACOBS	72 HBC	0	2.8 π^-p
775 ± 3	2250	HYAMS	68 OSPK	0	11.2 π^-p

NODE=M009M0R
 NODE=M009M0R

OCCUR=2

WEIGHTED AVERAGE
 769.0 ± 0.9 (Error scaled by 1.4)



- 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 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 Assuming $m_{\rho^+} = m_{\rho^-} = m_{\rho^0}$, $\Gamma_{\rho^+} = \Gamma_{\rho^-} = \Gamma_{\rho^0}$.
- ¹⁰ Without limitations on masses and widths.
- ¹¹ Assuming $m_{\rho^0} = m_{\rho^\pm}$, $g_{\rho^0\pi\pi} = g_{\rho^\pm\pi\pi}$.
- ¹² Using the data of BARKOV 85 in the hidden local symmetry model.
- ¹³ 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.
- ¹⁴ A fit of BARKOV 85 data assuming the direct $\omega\pi\pi$ coupling.
- ¹⁵ Applying the S-matrix formalism to the BARKOV 85 data.
- ¹⁶ Includes BARKOV 85 data. Model-dependent width definition.
- ¹⁷ $|F_\pi(0)|^2$ fixed to 1.
- ¹⁸ From the GOUNARIS 68 parametrization of the pion form factor.
- ¹⁹ The error combines statistical and systematic uncertainties. Supersedes BARATE 97M.
- ²⁰ $\rho(1700)$ mass and width fixed at 1700 MeV and 235 MeV respectively.
- ²¹ 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.
- ²² Using the data of BARATE 97M and the effective chiral Lagrangian.
- ²³ From a fit of the model-independent parameterization of the pion form factor to the data of BARATE 97M.
- ²⁴ Assuming the equality of ρ^+ and ρ^- masses and widths.
- ²⁵ Mass errors enlarged by us to $\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.
- ²⁶ Phase shift analysis. Systematic errors added corresponding to spread of different fits.
- ²⁷ 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.
- ²⁸ Using the KUHN 90 parametrization of the pion form factor, neglecting ρ - ω interference.
- ²⁹ From the parametrization according to SOEDING 66.
- ³⁰ From the parametrization according to ROSS 66.
- ³¹ HEYN 81 includes all spacelike and timelike F_π values until 1978.
- ³² From pole extrapolation.
- ³³ From phase shift analysis of GRAYER 74 data.
- ³⁴ 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.
- ³⁵ Breit-Wigner mass from a phase-shift analysis of HYAMS 73 and PROTOPODESCU 73 data.
- ³⁶ Using relativistic Breit-Wigner and taking into account ρ - ω interference.
- ³⁷ Systematic errors not evaluated.
- ³⁸ Systematic effects not studied.
- ³⁹ From fit of 3-parameter relativistic Breit-Wigner to helicity-zero part of P -wave intensity. CHABAUD 83 includes data of GRAYER 74.

NODE=M009M0;LINKAGE=LE

NODE=M009M0;LINKAGE=AK

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NODE=M009M;LINKAGE=B6

NODE=M009M;LINKAGE=B

NODE=M009M;LINKAGE=C

NODE=M009M;LINKAGE=H

NODE=M009M;LINKAGE=R

NODE=M009M;LINKAGE=CL

NODE=M009M;LINKAGE=BL

NODE=M009M;LINKAGE=A1

NODE=M009M;LINKAGE=QQ

NODE=M009M;LINKAGE=G

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

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		⁴⁰ SCHAEAL	05C	ALEP	$\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$
0.4±0.7±0.6	1.98M	⁴¹ ALOISIO	03	KLOE	$1.02 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
1.3±1.1±2.0	500k	⁴¹ ACHASOV	02	SND	$1.02 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
1.6±0.6±1.7	600k	ABELE	99E	CBAR	$0.0 \bar{p} p \rightarrow \pi^+ \pi^- \pi^0$
-4 ±4	3000	⁴² REYNOLDS	69	HBC	-0 $2.26 \pi^- p$
-5 ±5	3600	⁴² FOSTER	68	HBC	±0 $0.0 \bar{p} p$
2.4±2.1	22950	⁴³ PISUT	68	RVUE	$\pi N \rightarrow \rho N$

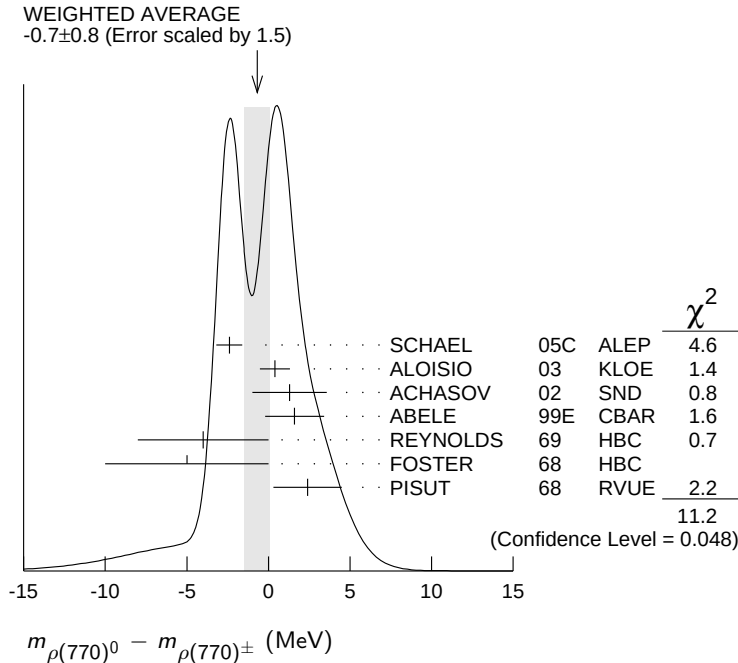
NODE=M009D

NODE=M009D

- 40 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. Supersedes BARATE 97M.
- 41 Assuming $m_{\rho^+} = m_{\rho^-}$, $\Gamma_{\rho^+} = \Gamma_{\rho^-}$.
- 42 From quoted masses of charged and neutral modes.
- 43 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, GOLDHABER 64, ABOLINS 63.

NODE=M009D;LINKAGE=SC

NODE=M009D;LINKAGE=CH
NODE=M009D;LINKAGE=A
NODE=M009D;LINKAGE=R



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

NODE=M009D1

NODE=M009D1

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1.5±0.8±0.7	1.98M	⁴⁴ ALOISIO	03	KLOE 1.02 e ⁺ e ⁻ → π ⁺ π ⁻ π ⁰
⁴⁴ Without limitations on masses and widths.				

NODE=M009D;LINKAGE=WO

ρ(770) RANGE PARAMETER

NODE=M009R

NODE=M009R

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

VALUE (GeV ⁻¹)	DOCUMENT ID	TECN	CHG	COMMENT
5.3 ^{+0.9} _{-0.7}	CHABAUD	83	ASPK	0 17 π ⁻ p polarized

NODE=M009R

ρ(770) WIDTH

NODE=M009220

NODE=M009220

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

NEUTRAL ONLY, e⁺e⁻

NODE=M009W0
NODE=M009W0
NEW

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
147.8 ±0.9 OUR AVERAGE					Error includes scale factor of 2.0. See the ideogram below. [146.2 ± 0.7 MeV OUR 2012 AVERAGE Scale factor = 1.1]
149.59±0.67		⁴⁵ LEES	12G	BABR	e ⁺ e ⁻ → π ⁺ π ⁻ γ
145.98±0.75±0.50	900k	⁴⁶ AKHMETSHIN	07		e ⁺ e ⁻ → π ⁺ π ⁻
146.1 ±0.8 ±1.5	800k	^{47,48} ACHASOV	06	SND	e ⁺ e ⁻ → π ⁺ π ⁻
143.85±1.33±0.80	114k	^{49,50} AKHMETSHIN	04	CMD2	e ⁺ e ⁻ → π ⁺ π ⁻

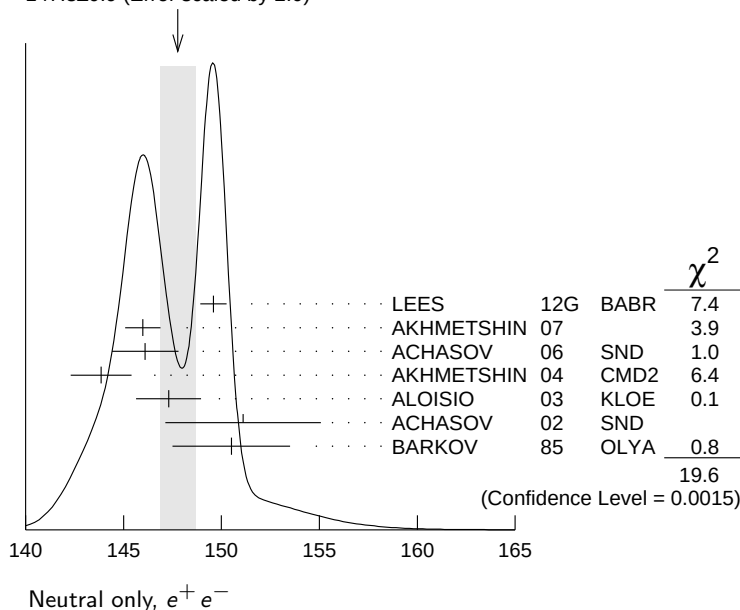
147.3 ±1.5 ±0.7	1.98M	51 ALOISIO	03	KLOE	$1.02 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
151.1 ±2.6 ±3.0	500k	51 ACHASOV	02	SND	$1.02 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
150.5 ±3.0		52 BARKOV	85	OLYA	$0 e^+ e^- \rightarrow \pi^+ \pi^-$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
143.9 ±1.3 ±1.1	1.98M	53 ALOISIO	03	KLOE	$1.02 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
147.4 ±1.5 ±0.7	1.98M	54 ALOISIO	03	KLOE	$1.02 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
149.8 ±2.2 ±2.0	500k	55 ACHASOV	02	SND	$1.02 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
147.9 ±1.5 ±7.5		56 BENAYOUN	98	RVUE	$e^+ e^- \rightarrow \pi^+ \pi^- , \mu^+ \mu^-$
153.5 ±1.3 ±4.6		57 GARDNER	98	RVUE	$0.28-0.92 e^+ e^- \rightarrow \pi^+ \pi^-$
145.0 ±1.7		58 O'CONNELL	97	RVUE	$e^+ e^- \rightarrow \pi^+ \pi^-$
142.5 ±3.5		59 BERNICHA	94	RVUE	$e^+ e^- \rightarrow \pi^+ \pi^-$
138 ±1		60 GESHKEN...	89	RVUE	$e^+ e^- \rightarrow \pi^+ \pi^-$

OCCUR=2

OCCUR=3

OCCUR=3

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	61,62 FUJIKAWA	08	BELL	$\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$
149.0±1.2		62,63 SCHAELE	05c	ALEP	$\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$
149.9±2.3±2.0	500k	51 ACHASOV	02	SND	$1.02 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
150.4±1.4±1.4	87k	64,65 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. ● ● ●

143.7±1.3±1.2	1.98M	51 ALOISIO	03	KLOE	$1.02 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
142.9±1.3±1.4	1.98M	54 ALOISIO	03	KLOE	$1.02 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
144.7±1.4±1.2	1.98M	54 ALOISIO	03	KLOE	$1.02 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
150.2±2.0 ^{+0.7} _{-1.6}		66 SANZ-CILLERO	03	RVUE	$\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$
150.9±2.2±2.0	500k	55 ACHASOV	02	SND	$1.02 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$

OCCUR=2

OCCUR=3

OCCUR=4

MIXED CHARGES, OTHER REACTIONS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

149.5±1.3	600k	67 ABELE	99E	CBAR	$0.0 \bar{p} p \rightarrow \pi^+ \pi^- \pi^0$

NODE=M009W7
NODE=M009W7

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	2935	68 CAPRARO 87	SPEC	—	$200 \pi^- \pi^0 \text{Cu} \rightarrow$
154 ±20	967	68 CAPRARO 87	SPEC	—	$200 \pi^- \pi^0 \text{Pb} \rightarrow$
150 ± 5		HUSTON 86	SPEC	+	$202 \pi^+ \pi^0 \text{A} \rightarrow$
146 ±12	6500	69 BYERLY 73	OSPK	—	$5 \pi^- p$
148.2± 4.1	9650	70 PISUT 68	RVUE	—	$1.7\text{--}3.2 \pi^- p, t < 10$
146 ±13	900	EISNER 67	HBC	—	$4.2 \pi^- p, t < 10$

NODE=M009W2
 NODE=M009W2

OCCUR=2

NEUTRAL ONLY, PHOTOPRODUCED

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
151.7± 2.6 OUR AVERAGE				
[150.7 ± 2.9 MeV OUR 2012 AVERAGE]				
155 ± 5 ± 2	63.5k	71 ABRAMOWICZ12	ZEUS	$ep \rightarrow e\pi^+ \pi^- p$
146 ± 3 ±13	79k	72 BREITWEG 98B	ZEUS	50–100 γp
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	73 BREITWEG 98B	ZEUS	50–100 γp
147 ±11		GLADDING 73	CNTR	2.9–4.7 γp
155 ±12	2430	BALLAM 72	HBC	4.7 γp
145 ±13	1930	BALLAM 72	HBC	2.8 γp
140 ± 5		ALVENSLEB... 70	CNTR	$\gamma A, t < 0.01$
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	$\gamma + \text{Pb}$

NODE=M009W0P
 NODE=M009W0P
 NEW

OCCUR=2

OCCUR=2

NEUTRAL ONLY, OTHER REACTIONS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	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	74,75	BOHACIK 80	RVUE	0	
152 ± 9	69	WICKLUND 78	ASPK	0	$3,4,6 \pi^\pm pN$
154 ± 2	76000	DEUTSCH... 76	HBC	0	$16 \pi^+ p$
157 ± 8	6800	RATCLIFF 72	ASPK	0	$15 \pi^- p, t < 0.3$
143 ± 8	1700	REYNOLDS 69	HBC	0	$2.26 \pi^- p$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
147.0± 2.5	600k	76 ABELE 99E	CBAR	0	$0.0 \bar{p}p \rightarrow \pi^+ \pi^- \pi^0$
146 ± 3	4943	77 ADAMS 97	E665		$470 \mu p \rightarrow \mu XB$
160.0 ⁺ 4.1 — 4.0		78 CHABAUD 83	ASPK	0	$17 \pi^- p$ polarized
155 ± 1		79 HEYN 81	RVUE	0	π form factor
148.0± 1.3	74,75	LANG 79	RVUE	0	
146 ±14	4100	ENGLER 74	DBC	0	$6 \pi^+ n \rightarrow \pi^+ \pi^- p$
143 ±13		75 ESTABROOKS 74	RVUE	0	$17 \pi^- p \rightarrow \pi^+ \pi^- n$
160 ±10	32000	74 PROTOPOP... 73	HBC	0	$7.1 \pi^+ p, t < 0.4$
145 ±12	2250	68 HYAMS 68	OSPK	0	$11.2 \pi^- p$
163 ±15	13300	80 PISUT 68	RVUE	0	$1.7\text{--}3.2 \pi^- p, t < 10$

NODE=M009W0R
 NODE=M009W0R

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=M009W;LINKAGE=DF
 NODE=M009W;LINKAGE=WO

NODE=M009W;LINKAGE=HC

⁴⁵ 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.

⁴⁶ A combined fit of AKHMETSHIN 07, AULCHENKO 06, and AULCHENKO 05.

⁴⁷ Supersedes ACHASOV 05A.

⁴⁸ 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.

⁴⁹ Using the GOUNARIS 68 parametrization with the complex phase of the ρ - ω interference.

⁵⁰ From a fit in the energy range 0.61 to 0.96 GeV. Update of AKHMETSHIN 02.

⁵¹ Assuming $m_{\rho^+} = m_{\rho^-}$, $\Gamma_{\rho^+} = \Gamma_{\rho^-}$.

⁵² From the GOUNARIS 68 parametrization of the pion form factor.

⁵³ Assuming $m_{\rho^+} = m_{\rho^-} = m_{\rho^0}$, $\Gamma_{\rho^+} = \Gamma_{\rho^-} = \Gamma_{\rho^0}$.

⁵⁴ Without limitations on masses and widths.

⁵⁵ Assuming $m_{\rho^0} = m_{\rho^\pm}$, $g_{\rho^0 \pi \pi} = g_{\rho^\pm \pi \pi}$.

- 56 Using the data of BARKOV 85 in the hidden local symmetry model.
- 57 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.
- 58 A fit of BARKOV 85 data assuming the direct $\omega\pi\pi$ coupling.
- 59 Applying the S-matrix formalism to the BARKOV 85 data.
- 60 Includes BARKOV 85 data. Model-dependent width definition.
- 61 $|F_\pi(0)|^2$ fixed to 1.
- 62 From the GOUNARIS 68 parametrization of the pion form factor.
- 63 The error combines statistical and systematic uncertainties. Supersedes BARATE 97M.
- 64 $\rho(1700)$ mass and width fixed at 1700 MeV and 235 MeV respectively.
- 65 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.
- 66 Using the data of BARATE 97M and the effective chiral Lagrangian.
- 67 Assuming the equality of ρ^+ and ρ^- masses and widths.
- 68 Width errors enlarged by us to $4\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.
- 69 Phase shift analysis. Systematic errors added corresponding to spread of different fits.
- 70 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.
- 71 Using the KUHN 90 parametrization of the pion form factor, neglecting $\rho-\omega$ interference.
- 72 From the parametrization according to SOEDING 66.
- 73 From the parametrization according to ROSS 66.
- 74 From pole extrapolation.
- 75 From phase shift analysis of GRAYER 74 data.
- 76 Using relativistic Breit-Wigner and taking into account $\rho-\omega$ interference.
- 77 Systematic errors not evaluated.
- 78 From fit of 3-parameter relativistic Breit-Wigner to helicity-zero part of P -wave intensity. CHABAUD 83 includes data of GRAYER 74.
- 79 HEYN 81 includes all spacelike and timelike F_π values until 1978.
- 80 Includes MALAMUD 69, ARMENISE 68, BACON 67, HUWE 67, MILLER 67B, ALFF-STEINBERGER 66, HAGOPIAN 66, HAGOPIAN 66B, JACOBS 66B, JAMES 66, WEST 66, GOLDBERGER 64, ABOLINS 63.

NODE=M009W;LINKAGE=K2
NODE=M009W;LINKAGE=G8

NODE=M009W;LINKAGE=AB
NODE=M009W;LINKAGE=AA
NODE=M009W;LINKAGE=F
NODE=M009W5;LINKAGE=FU
NODE=M009W5;LINKAGE=GO
NODE=M009W5;LINKAGE=SC
NODE=M009W;LINKAGE=A6
NODE=M009W;LINKAGE=K1

NODE=M009W5;LINKAGE=Z
NODE=M009W;LINKAGE=LB
NODE=M009W;LINKAGE=Z
NODE=M009W;LINKAGE=X
NODE=M009W;LINKAGE=A

NODE=M009W0P;LINKAGE=AB
NODE=M009W;LINKAGE=B5
NODE=M009W;LINKAGE=B6
NODE=M009W;LINKAGE=C
NODE=M009W;LINKAGE=H
NODE=M009W;LINKAGE=BL
NODE=M009W;LINKAGE=A1
NODE=M009W;LINKAGE=G

NODE=M009W;LINKAGE=B
NODE=M009W;LINKAGE=R

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

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.3 ± 1.3 OUR AVERAGE	Error includes scale factor of 1.4.			
-0.2 ± 1.0		⁸¹ SCHAEI	05C ALEP	$\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$
$3.6 \pm 1.8 \pm 1.7$	1.98M	⁸² ALOISIO	03 KLOE	$1.02 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$

NODE=M009W6
NODE=M009W6

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

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
$1.8 \pm 2.0 \pm 0.5$	1.98M	⁸³ ALOISIO	03 KLOE	$1.02 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$

NODE=M009W16
NODE=M009W16

- ⁸¹ From the combined fit of the τ^- data from ANDERSON 00A and SCHAEI 05C and e^+e^- data from the compilation of BARKOV 85, AKHMETSHIN 04, and ALOISIO 05. Supersedes BARATE 97M.

- ⁸² Assuming $m_{\rho^+} = m_{\rho^-}$, $\Gamma_{\rho^+} = \Gamma_{\rho^-}$.

- ⁸³ Without limitations on masses and widths.

NODE=M009W6;LINKAGE=SC

NODE=M009W6;LINKAGE=CH
NODE=M009W16;LINKAGE=WO

$\rho(770)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
$\Gamma_1 \quad \pi\pi$	~ 100	%
$\rho(770)^\pm$ decays		
$\Gamma_2 \quad \pi^\pm \pi^0$	~ 100	%
$\Gamma_3 \quad \pi^\pm \gamma$	$(4.5 \pm 0.5) \times 10^{-4}$	S=2.2
$\Gamma_4 \quad \pi^\pm \eta$	< 6	$\times 10^{-3}$ CL=84%
$\Gamma_5 \quad \pi^\pm \pi^+ \pi^- \pi^0$	< 2.0	$\times 10^{-3}$ CL=84%

NODE=M009225;NODE=M009

DESIG=1;OUR EVAL;→ UNCHECKED ←

NODE=M009;CLUMP=A
DESIG=11;OUR EVAL;→ UNCHECKED ←
DESIG=3
DESIG=5
DESIG=21

$\rho(770)^0$ decays

Γ_6	$\pi^+\pi^-$	~ 100	%
Γ_7	$\pi^+\pi^-\gamma$	(9.9 $\pm$ 1.6)	$\times 10^{-3}$
Γ_8	$\pi^0\gamma$	(6.0 $\pm$ 0.8)	$\times 10^{-4}$
Γ_9	$\eta\gamma$	(3.00 $\pm$ 0.20)	$\times 10^{-4}$
Γ_{10}	$\pi^0\pi^0\gamma$	(4.5 $\pm$ 0.8)	$\times 10^{-5}$
Γ_{11}	$\mu^+\mu^-$	[a] (4.55 $\pm$ 0.28)	$\times 10^{-5}$
Γ_{12}	e^+e^-	[a] (4.72 $\pm$ 0.05)	$\times 10^{-5}$
Γ_{13}	$\pi^+\pi^-\pi^0$	(1.01 $^{+0.54}_{-0.36}$ $\pm$ 0.34)	$\times 10^{-4}$
Γ_{14}	$\pi^+\pi^-\pi^+\pi^-$	(1.8 $\pm$ 0.9)	$\times 10^{-5}$
Γ_{15}	$\pi^+\pi^-\pi^0\pi^0$	(1.6 $\pm$ 0.8)	$\times 10^{-5}$
Γ_{16}	$\pi^0e^+e^-$	< 1.2	$\times 10^{-5}$ CL=90%
Γ_{17}	ηe^+e^-		

NODE=M009;CLUMP=B

DESIG=12;OUR EVAL; $\rightarrow$ UNCHECKED $\leftarrow$

DESIG=60

DESIG=40

DESIG=8

DESIG=80

DESIG=6

DESIG=4

DESIG=7;OUR EVAL; $\rightarrow$ UNCHECKED $\leftarrow$

DESIG=22

DESIG=30

DESIG=9

DESIG=10

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

LINKAGE=MD2

CONSTRAINED FIT INFORMATION

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

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

x_3		-100
Γ		15 -15
		x_2 x_3

	Mode	Rate (MeV)	Scale factor
Γ_2	$\pi^\pm\pi^0$	150.2 $\pm$ 2.4	
Γ_3	$\pi^\pm\gamma$	0.068 $\pm$ 0.007	2.3

DESIG=11

DESIG=3

CONSTRAINED FIT INFORMATION

An overall fit to the total width, a partial width, and 7 branching ratios uses 21 measurements and one constraint to determine 9 parameters. The overall fit has a $\chi^2 = 6.0$ 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_7	-100								
x_8	-5	0							
x_9	-1	0	1						
x_{10}	-1	0	0	0					
x_{11}	2	-3	0	0	0				
x_{12}	0	0	-8	-9	0	0			
x_{14}	-1	0	0	0	0	0	0		
Γ	0	0	4	5	0	0	-54	0	
	x_6	x_7	x_8	x_9	x_{10}	x_{11}	x_{12}	x_{14}	

Mode	Rate (MeV)	
Γ_6 $\pi^+ \pi^-$	147.5 $\pm$ 0.9	DESIG=12
Γ_7 $\pi^+ \pi^- \gamma$	1.48 $\pm$ 0.24	DESIG=60
Γ_8 $\pi^0 \gamma$	0.089 $\pm$ 0.012	DESIG=40
Γ_9 $\eta \gamma$	0.0447 $\pm$ 0.0031	DESIG=8
Γ_{10} $\pi^0 \pi^0 \gamma$	0.0066 $\pm$ 0.0012	DESIG=80
Γ_{11} $\mu^+ \mu^-$	[a] 0.0068 $\pm$ 0.0004	DESIG=6
Γ_{12} $e^+ e^-$	[a] 0.00704 $\pm$ 0.00006	DESIG=4
Γ_{14} $\pi^+ \pi^- \pi^+ \pi^-$	0.0027 $\pm$ 0.0014	DESIG=22

$\rho(770)$ PARTIAL WIDTHS

NODE=M009230

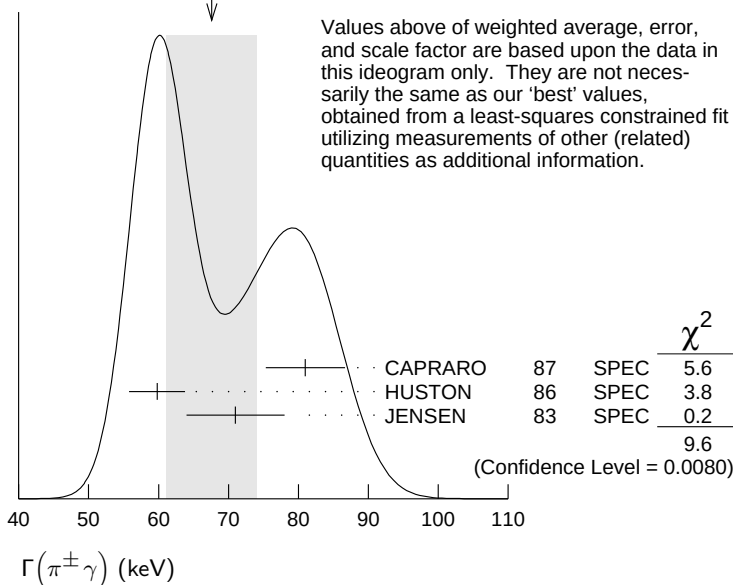
$\Gamma(\pi^\pm \gamma)$

Γ_3

VALUE (keV)	DOCUMENT ID	TECN	CHG	COMMENT
68 $\pm$ 7 OUR FIT	Error includes scale factor of 2.3.			
68 $\pm$ 7 OUR AVERAGE	Error includes scale factor of 2.2. See the ideogram below.			
81 $\pm$ 4 $\pm$ 4	CAPRARO	87	SPEC	- 200 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)



$\Gamma(e^+e^-)$ Γ_{12}

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
7.04 ±0.06 OUR FIT				
7.04 ±0.06 OUR AVERAGE				
7.048±0.057±0.050	900k	⁸⁴ AKHMETSHIN 07		$e^+e^- \rightarrow \pi^+\pi^-$
7.06 ±0.11 ±0.05	114k	^{85,86} AKHMETSHIN 04	CMD2	$e^+e^- \rightarrow \pi^+\pi^-$
6.77 ±0.10 ±0.30		BARKOV 85	OLYA	$e^+e^- \rightarrow \pi^+\pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
7.12 ±0.02 ±0.11	800k	⁸⁷ ACHASOV 06	SND	$e^+e^- \rightarrow \pi^+\pi^-$
6.3 ±0.1		⁸⁸ BENAYOUN 98	RVUE	$e^+e^- \rightarrow \pi^+\pi^-, \mu^+\mu^-$

NODE=M009W4
 NODE=M009W4

OCCUR=2

 $\Gamma(\pi^0\gamma)$ Γ_8

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
77±17±11	36500	⁸⁹ ACHASOV 03	SND	$0.60-0.97 e^+e^- \rightarrow \pi^0\gamma$
121±31		DOLINSKY 89	ND	$e^+e^- \rightarrow \pi^0\gamma$

NODE=M009W31
 NODE=M009W31

 $\Gamma(\eta\gamma)$ Γ_9

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
62±17	⁹⁰ DOLINSKY 89	ND	$e^+e^- \rightarrow \eta\gamma$

NODE=M009W32
 NODE=M009W32

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

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2.8±1.4±0.5	153	AKHMETSHIN 00	CMD2	$0.6-0.97 e^+e^- \rightarrow \pi^+\pi^-\pi^+\pi^-$

NODE=M009W33
 NODE=M009W33

- ⁸⁴ A combined fit of AKHMETSHIN 07, AULCHENKO 06, and AULCHENKO 05.
⁸⁵ Using the GOUNARIS 68 parametrization with the complex phase of the ρ - ω interference.
⁸⁶ From a fit in the energy range 0.61 to 0.96 GeV. Update of AKHMETSHIN 02.
⁸⁷ Supersedes ACHASOV 05A.
⁸⁸ Using the data of BARKOV 85 in the hidden local symmetry model.
⁸⁹ Using $\Gamma_{\text{total}} = 147.9 \pm 1.3$ MeV and $B(\rho \rightarrow \pi^0\gamma)$ from ACHASOV 03.
⁹⁰ Solution corresponding to constructive ω - ρ interference.

NODE=M009W4;LINKAGE=AK
 NODE=M009W4;LINKAGE=GS
 NODE=M009W4;LINKAGE=P2
 NODE=M009W4;LINKAGE=AC
 NODE=M009W4;LINKAGE=K2
 NODE=M009W31;LINKAGE=AV
 NODE=M009W32;LINKAGE=L

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

NODE=M009233

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

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
4.876±0.023±0.064	800k	^{91,92} ACHASOV 06	SND	$e^+e^- \rightarrow \pi^+\pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
4.72 ±0.02		⁹³ BENAYOUN 10	RVUE	$0.4-1.05 e^+e^-$

NODE=M009G4
 NODE=M009G4

- ⁹¹ Supersedes ACHASOV 05A.
⁹² 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.
⁹³ A simultaneous fit of $e^+e^- \rightarrow \pi^+\pi^-, \pi^+\pi^-\pi^0, \pi^0\gamma, \eta\gamma$ data.

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

NODE=M009G4;LINKAGE=BE

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

VALUE (units 10^{-8})	EVTS	DOCUMENT ID	TECN	COMMENT
1.42±0.10 OUR FIT				
1.45±0.12 OUR AVERAGE				
1.32±0.14±0.08	33k	⁹⁴ ACHASOV 07B	SND	$0.6-1.38 e^+e^- \rightarrow \eta\gamma$
1.50±0.65±0.09	17.4k	⁹⁵ AKHMETSHIN 05	CMD2	$0.60-1.38 e^+e^- \rightarrow \eta\gamma$
1.61±0.20±0.11	23k	^{96,97} AKHMETSHIN 01B	CMD2	$e^+e^- \rightarrow \eta\gamma$
1.85±0.49		⁹⁸ DOLINSKY 89	ND	$e^+e^- \rightarrow \eta\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1.05±0.02		⁹⁹ BENAYOUN 10	RVUE	$0.4-1.05 e^+e^-$

NODE=M009G1
 NODE=M009G1

- ⁹⁴ 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.
⁹⁵ From the $\eta \rightarrow 2\gamma$ decay and using $B(\eta \rightarrow \gamma\gamma) = 39.43 \pm 0.26\%$.
⁹⁶ From the $\eta \rightarrow 3\pi^0$ decay and using $B(\eta \rightarrow 3\pi^0) = (32.24 \pm 0.29) \times 10^{-2}$.
⁹⁷ 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).
⁹⁸ Recalculated by us from the cross section in the peak.
⁹⁹ A simultaneous fit of $e^+e^- \rightarrow \pi^+\pi^-, \pi^+\pi^-\pi^0, \pi^0\gamma, \eta\gamma$ data.

NODE=M009G1;LINKAGE=AH

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

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

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

$$\Gamma_{12}/\Gamma \times \Gamma_8/\Gamma$$

VALUE (units 10^{-8})

EVTS

DOCUMENT ID

TECN

COMMENT

2.8 ±0.4 OUR FIT**2.8 ±0.4 OUR AVERAGE**

2.90 $^{+0.60}_{-0.55}$ ±0.18 18680 AKHMETSHIN 05 CMD2 0.60-1.38 $e^+e^- \rightarrow \pi^0\gamma$

2.37 ±0.53 ±0.33 36500 ¹⁰⁰ACHASOV 03 SND 0.60-0.97 $e^+e^- \rightarrow \pi^0\gamma$

3.61 ±0.74 ±0.49 10625 ¹⁰¹DOLINSKY 89 ND $e^+e^- \rightarrow \pi^0\gamma$

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

1.875±0.026 ¹⁰²BENAYOUN 10 RVUE 0.4-1.05 e^+e^-

¹⁰⁰ 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 $(-10.2 \pm 7.0)^\circ$.

¹⁰¹ Recalculated by us from the cross section in the peak.

¹⁰² A simultaneous fit of $e^+e^- \rightarrow \pi^+\pi^-, \pi^+\pi^-\pi^0, \pi^0\gamma, \eta\gamma$ data.

NODE=M009G2
NODE=M009G2

NODE=M009G;LINKAGE=SH

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

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

$$\Gamma_{12}/\Gamma \times \Gamma_{13}/\Gamma$$

VALUE (units 10^{-9})

EVTS

DOCUMENT ID

TECN

COMMENT

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

0.903±0.076 ¹⁰³BENAYOUN 10 RVUE 0.4-1.05 e^+e^-

4.58 $^{+2.46}_{-1.64}$ ±1.56 1.2M ¹⁰⁴ACHASOV 03D RVUE 0.44-2.00 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$

¹⁰³ A simultaneous fit of $e^+e^- \rightarrow \pi^+\pi^-, \pi^+\pi^-\pi^0, \pi^0\gamma, \eta\gamma$ data.

¹⁰⁴ Statistical significance is less than 3σ .

NODE=M009G3
NODE=M009G3

NODE=M009G3;LINKAGE=BE
NODE=M009G3;LINKAGE=AC

$\rho(770)$ BRANCHING RATIOS

NODE=M009235

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

$$\Gamma_4/\Gamma_1$$

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

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

$$\Gamma_5/\Gamma_1$$

VALUE (units 10^{-4})

CL%

DOCUMENT ID

TECN

CHG

COMMENT

<20 84 FERBEL 66 HBC ± $\pi^\pm p$ above 2.5

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

35±40 JAMES 66 HBC + $2.1 \pi^+ p$

NODE=M009R1
NODE=M009R1

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

$$\Gamma_{11}/\Gamma_6$$

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 $^{+1.6}_{-3.6}$ ¹⁰⁵ROTHWELL 69 CNTR Photoproduction

5.6 ±1.5 ¹⁰⁶WEHMANN 69 OSPK 12 $\pi^- \text{C, Fe}$

9.7 $^{+3.1}_{-3.3}$ ¹⁰⁷HYAMS 67 OSPK 11 $\pi^- \text{Li, H}$

NODE=M009R5
NODE=M009R5

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

$$\Gamma_{12}/\Gamma_1$$

VALUE (units 10^{-4})

DOCUMENT ID

TECN

COMMENT

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

0.40±0.05 ¹⁰⁸BENAKSAS 72 OSPK $e^+e^- \rightarrow \pi^+\pi^-$

NODE=M009R3
NODE=M009R3

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

$$\Gamma_9/\Gamma$$

VALUE (units 10^{-4})

EVTS

DOCUMENT ID

TECN

CHG

COMMENT

3.00±0.21 OUR FIT**2.90±0.32 OUR AVERAGE**

2.79±0.34±0.03 33k ¹⁰⁹ACHASOV 07B SND 0.6-1.38 $e^+e^- \rightarrow \eta\gamma$

3.6 ±0.9 ¹¹⁰ANDREWS 77 CNTR 0 6.7-10 γCu

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

3.21±1.39±0.20 17.4k ^{111,112}AKHMETSHIN 05 CMD2 0.60-1.38 $e^+e^- \rightarrow \eta\gamma$

3.39±0.42±0.23 ^{110,113,114}AKHMETSHIN 01B CMD2 $e^+e^- \rightarrow \eta\gamma$

1.9 $^{+0.6}_{-0.8}$ ¹¹⁵BENAYOUN 96 RVUE 0.54-1.04 $e^+e^- \rightarrow \eta\gamma$

4.0 ±1.1 ^{110,112}DOLINSKY 89 ND $e^+e^- \rightarrow \eta\gamma$

NODE=M009R7
NODE=M009R7

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

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

NODE=M009R13
NODE=M009R13

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

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<15	90	ERBE 69	HBC	0	$2.5-5.8 \gamma p$
<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

 $\Gamma(\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$
 Γ_{13}/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	116 ACHASOV	03D RVUE	$0.44-2.00 e^+e^- \rightarrow \pi^+\pi^-\pi^0$
<1.2	90		VASSERMAN 88B	ND	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$

NODE=M009R10
NODE=M009R10

 $\Gamma(\pi^+\pi^-\pi^0)/\Gamma(\pi\pi)$
 Γ_{13}/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	117 ABRAMS 71	HBC	0	$3.7 \pi^+ p$

NODE=M009R6
NODE=M009R6

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

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
$1.60 \pm 0.74 \pm 0.18$		118 ACHASOV 09A	SND	$e^+e^- \rightarrow \pi^+\pi^-\pi^0\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
< 4	90	AULCHENKO 87C	ND	$e^+e^- \rightarrow \pi^+\pi^-\pi^0\pi^0$
<20	90	KURDADZE 86	OLYA	$e^+e^- \rightarrow \pi^+\pi^-\pi^0\pi^0$

NODE=M009R8
NODE=M009R8

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

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
0.0099 ± 0.0016 OUR FIT				
0.0099 ± 0.0016		119 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		120 VASSERMAN 88	ND	$e^+e^- \rightarrow \pi^+\pi^-\gamma$
<0.005	90	121 VASSERMAN 88	ND	$e^+e^- \rightarrow \pi^+\pi^-\gamma$

NODE=M009R12
NODE=M009R12

OCCUR=2

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

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$6.21^{+1.28}_{-1.18} \pm 0.39$	18680	122,123 AKHMETSHIN 05	CMD2	$0.60-1.38 e^+e^- \rightarrow \pi^0\gamma$
$5.22 \pm 1.17 \pm 0.75$	36500	123,124 ACHASOV 03	SND	$0.60-0.97 e^+e^- \rightarrow \pi^0\gamma$
6.8 ± 1.7		125 BENAYOUN 96	RVUE	$0.54-1.04 e^+e^- \rightarrow \pi^0\gamma$
7.9 ± 2.0		123 DOLINSKY 89	ND	$e^+e^- \rightarrow \pi^0\gamma$

NODE=M009R9
NODE=M009R9

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

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

NODE=M009R15
NODE=M009R15

$\Gamma(\eta e^+ e^-)/\Gamma_{\text{total}}$ Γ_{17}/Γ VALUE (units 10^{-5})

DOCUMENT ID

TECN

COMMENT

NODE=M009R16
NODE=M009R16

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

<0.7

AKHMETSHIN 05A CMD2 0.72-0.84 $e^+ e^-$ $\Gamma(\pi^0 \pi^0 \gamma)/\Gamma_{\text{total}}$ Γ_{10}/Γ VALUE (units 10^{-5})

EVTS

DOCUMENT ID

TECN

COMMENT

NODE=M009R14
NODE=M009R14**4.5±0.8 OUR FIT****4.5^{+0.9}_{-0.8} OUR AVERAGE**5.2^{+1.5}_{-1.3} ± 0.6 190 126 AKHMETSHIN 04B CMD2 0.6^{-0.97}₀ $e^+ e^- \rightarrow \pi^0 \pi^0 \gamma$ 4.1^{+1.0}_{-0.9} ± 0.3 295 127 ACHASOV 02F SND 0.36^{-0.97}₀ $e^+ e^- \rightarrow \pi^0 \pi^0 \gamma$

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

4.8^{+3.4}_{-1.8} ± 0.5 63 128 ACHASOV 00G SND $e^+ e^- \rightarrow \pi^0 \pi^0 \gamma$

OCCUR=2

105 Possibly large ρ - ω interference leads us to increase the minus error.106 Result contains $11 \pm 11\%$ correction using SU(3) for central value. The error on the correction takes account of possible ρ - ω interference and the upper limit agrees with the upper limit of $\omega \rightarrow \mu^+ \mu^-$ from this experiment.NODE=M009R5;LINKAGE=R
NODE=M009R5;LINKAGE=W107 HYAMS 67's mass resolution is 20 MeV. The ω region was excluded.108 The ρ' contribution is not taken into account.NODE=M009R5;LINKAGE=H
NODE=M009R;LINKAGE=KS
NODE=M009R7;LINKAGE=AO109 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.110 Solution corresponding to constructive ω - ρ interference.NODE=M009R7;LINKAGE=A
NODE=M009R;LINKAGE=AK
NODE=M009R7;LINKAGE=AZ
NODE=M009R;LINKAGE=BQ111 Using $B(\rho \rightarrow e^+ e^-) = (4.67 \pm 0.09) \times 10^{-5}$ and $B(\eta \rightarrow \gamma \gamma) = 39.43 \pm 0.26\%$.112 Not independent of the corresponding $\Gamma(e^+ e^-) \times \Gamma(\eta \gamma)/\Gamma_{\text{total}}^2$.113 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).114 Using $B(\rho \rightarrow e^+ e^-) = (4.75 \pm 0.10) \times 10^{-5}$ from AKHMETSHIN 02 and $B(\eta \rightarrow 3\pi^0) = (32.24 \pm 0.29) \times 10^{-2}$.

NODE=M009R;LINKAGE=BX

115 Reanalysis of DRUZHININ 84, DOLINSKY 89, and DOLINSKY 91 taking into account a triangle anomaly contribution. Constructive ρ - ω interference solution.

NODE=M009R7;LINKAGE=C

116 Statistical significance is less than 3σ .117 Model dependent, assumes $I = 1, 2$, or 3 for the 3π system.118 Assuming no interference between the ρ and ω contributions.

119 Bremsstrahlung from a decay pion and for photon energy above 50 MeV.

120 Superseded by DOLINSKY 91.

121 Structure radiation due to quark rearrangement in the decay.

122 Using $B(\rho \rightarrow e^+ e^-) = (4.67 \pm 0.09) \times 10^{-5}$.123 Not independent of the corresponding $\Gamma(e^+ e^-) \times \Gamma(\pi^0 \gamma)/\Gamma_{\text{total}}^2$.124 Using $B(\rho \rightarrow e^+ e^-) = (4.54 \pm 0.10) \times 10^{-5}$.

125 Reanalysis of DRUZHININ 84, DOLINSKY 89, and DOLINSKY 91 taking into account a triangle anomaly contribution.

NODE=M009R;LINKAGE=NS
NODE=M009R6;LINKAGE=G
NODE=M009R8;LINKAGE=AC
NODE=M009R12;LINKAGE=J
NODE=M009R12;LINKAGE=I
NODE=M009R12;LINKAGE=N
NODE=M009R9;LINKAGE=AK
NODE=M009R9;LINKAGE=BZ
NODE=M009R9;LINKAGE=AS
NODE=M009R9;LINKAGE=A126 This branching ratio includes the conventional VMD mechanism $\rho \rightarrow \omega \pi^0$, $\omega \rightarrow \pi^0 \gamma$, and the new decay mode $\rho \rightarrow f_0(500) \gamma$, $f_0(500) \rightarrow \pi^0 \pi^0$ with a branching ratio $(2.0^{+1.1}_{-0.9} \pm 0.3) \times 10^{-5}$ differing from zero by 2.0 standard deviations.

NODE=M009R14;LINKAGE=AH

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

NODE=M009R;LINKAGE=FF

128 Superseded by ACHASOV 02F.

NODE=M009R;LINKAGE=GF

$\rho(770)$ REFERENCES

NODE=M009

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
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
ACHASOV	08	Translated from ZETF 136 442.			
ACHASOV	08	JETP 107 61	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=52258
FUJIKAWA	08	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. 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.			
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
AULCHENKO	06	Translated from ZETFP 84 491.			
ACHASOV	05A	JETP 101 1053	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=51045
ACHASOV	05A	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
AULCHENKO	05	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
ACHASOV	03	PL B559 171	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=49187
ACHASOV	03D	PR D68 052006	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=49577
ALOISIO	03	PL B561 55	A. Aloisio <i>et al.</i>	(KLOE Collab.)	REFID=49404
SANZ-CILLERO	03	EPJ C27 587	J.J. Sanz-Cillero, A. Pich		REFID=49399
ACHASOV	02	PR D65 032002	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=48549
ACHASOV	02F	PL B537 201	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=48816
AKHMETSHIN	02	PL B527 161	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=48565
AKHMETSHIN	01B	PL B509 217	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=48167
COLANGELO	01	NP B603 125	G. Colangelo, J. Gasser, H. Leytwyler		REFID=49180
PICH	01	PR D63 093005	A. Pich, J. Portoles		REFID=48313
ACHASOV	00	EPJ C12 25	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47417
ACHASOV	00D	JETPL 72 282	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47882
ACHASOV	00G	Translated from ZETFP 72 411.			
ACHASOV	00G	JETPL 71 355	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47929
ACHASOV	00G	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
GARDNER	98	PR D62 019903 (errata)	S. Gardner, H.B. O'Connell		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
BOGOLYUB...	97	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	JPG 15 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
KURDADZE	88	Translated from ZETFP 47 432.			
VASSERMAN	88	SJNP 47 1035	I.B. Vasserman <i>et al.</i>	(NOVO)	REFID=41019
VASSERMAN	88B	Translated from YAF 47 1635.			
VASSERMAN	88B	SJNP 48 480	I.B. Vasserman <i>et al.</i>	(NOVO)	REFID=41020
VASSERMAN	88B	Translated from YAF 48 753.			
AULCHENKO	87C	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
KURDADZE	86	Translated from ZETFP 43 497.			
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	(SLOV, WIEN)	REFID=20128
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
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. Protopopescu <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

NODE=M001

 $\omega(782)$

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

 $\omega(782)$ 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 $\pi^-\pi^0$
783.2 ±1.6		⁹ BIGGS 70B	CNTR	<4.1 $\gamma C \rightarrow \pi^+\pi^-\pi^0$
782.4 ±0.5	2400	BIZZARRI 69	HBC	0.0 $\bar{p}p$

NODE=M001M

OCCUR=2

OCCUR=2

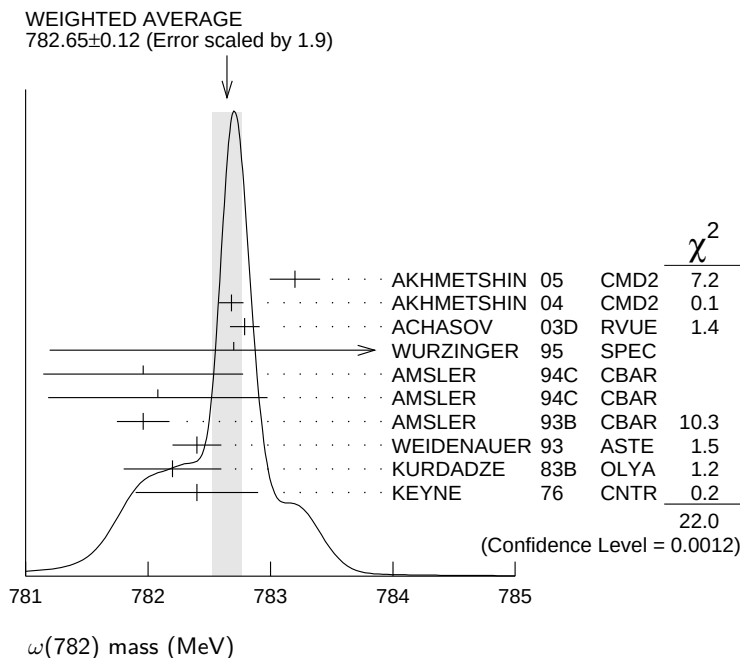
OCCUR=2

- 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	$1.33 p d \rightarrow {}^3\text{He} \omega$
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	$0.7-0.8 \bar{p} p \rightarrow 5\pi$
9.4 ± 2.5	2100	GESSAROLI 77	HBC	$11 \pi^- p \rightarrow \omega n$
10.22 ± 0.43	20000	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	$2.5 \pi^- p \rightarrow n \text{MM}$
10.3 ± 1.4	510	BIZZARRI 71	HBC	$0.0 p \bar{p} \rightarrow K_1^+ K_1^- \omega$
12.8 ± 3.0	248	BIZZARRI 71	HBC	$0.0 p \bar{p} \rightarrow K^+ K^- \omega$
9.5 ± 1.0	3583	COYNE 71	HBC	$3.7 \pi^+ p \rightarrow p \pi^+ \pi^+ \pi^- \pi^0$

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

NODE=M001215;NODE=M001

$\omega(782)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
$\Gamma_1 \quad \pi^+\pi^-\pi^0$	$(89.2 \pm 0.7) \%$	
$\Gamma_2 \quad \pi^0\gamma$	$(8.28 \pm 0.28) \%$	S=2.1
$\Gamma_3 \quad \pi^+\pi^-$	$(1.53^{+0.11}_{-0.13}) \%$	S=1.2
$\Gamma_4 \quad \text{neutrals (excluding } \pi^0\gamma)$	$(8^{+8}_{-5}) \times 10^{-3}$	S=1.1
$\Gamma_5 \quad \eta\gamma$	$(4.6 \pm 0.4) \times 10^{-4}$	S=1.1
$\Gamma_6 \quad \pi^0 e^+ e^-$	$(7.7 \pm 0.6) \times 10^{-4}$	
$\Gamma_7 \quad \pi^0 \mu^+ \mu^-$	$(1.3 \pm 0.4) \times 10^{-4}$	S=2.1
$\Gamma_8 \quad \eta e^+ e^-$		
$\Gamma_9 \quad e^+ e^-$	$(7.28 \pm 0.14) \times 10^{-5}$	S=1.3
$\Gamma_{10} \quad \pi^+\pi^-\pi^0\pi^0$	$< 2 \times 10^{-4}$	CL=90%
$\Gamma_{11} \quad \pi^+\pi^-\gamma$	$< 3.6 \times 10^{-3}$	CL=95%
$\Gamma_{12} \quad \pi^+\pi^-\pi^+\pi^-$	$< 1 \times 10^{-3}$	CL=90%
$\Gamma_{13} \quad \pi^0\pi^0\gamma$	$(6.6 \pm 1.1) \times 10^{-5}$	
$\Gamma_{14} \quad \eta\pi^0\gamma$	$< 3.3 \times 10^{-5}$	CL=90%
$\Gamma_{15} \quad \mu^+\mu^-$	$(9.0 \pm 3.1) \times 10^{-5}$	
$\Gamma_{16} \quad 3\gamma$	$< 1.9 \times 10^{-4}$	CL=95%

DESIG=1

DESIG=3

DESIG=2

DESIG=13

DESIG=6

DESIG=14

DESIG=11

DESIG=18

DESIG=7

DESIG=12

DESIG=4

DESIG=15

DESIG=5

DESIG=17

DESIG=8

DESIG=10

Charge conjugation (C) violating modes

$\Gamma_{17} \quad \eta\pi^0$	C	$< 2.1 \times 10^{-4}$	CL=90%
$\Gamma_{18} \quad 2\pi^0$	C	$< 2.1 \times 10^{-4}$	CL=90%
$\Gamma_{19} \quad 3\pi^0$	C	$< 2.3 \times 10^{-4}$	CL=90%

NODE=M001;CLUMP=A

DESIG=9

DESIG=193

DESIG=16

CONSTRAINED FIT INFORMATION

An overall fit to 15 branching ratios uses 51 measurements and one constraint to determine 10 parameters. The overall fit has a $\chi^2 = 51.8$ for 42 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	22								
x_3	-18	-4							
x_4	-92	-56	1						
x_5	7	7	-1	-9					
x_6	-1	0	0	0	0				
x_7	-1	0	0	0	0	0			
x_9	-38	-33	7	44	-21	0	0		
x_{13}	1	4	0	-2	0	0	0	-1	
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. • • •				
788 $\pm$ 12 $\pm$ 27	36500	¹ ACHASOV	03	SND 0.60–0.97 $e^+e^- \rightarrow \pi^0\gamma$
764 $\pm$ 51	10625	DOLINSKY	89	ND $e^+e^- \rightarrow \pi^0\gamma$

¹ Using $\Gamma_\omega = 8.44 \pm 0.09$ MeV and $B(\omega \rightarrow \pi^0\gamma)$ from ACHASOV 03.

 $\Gamma(\eta\gamma)$ Γ_5

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
6.1 $\pm$ 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.

 $\Gamma(e^+e^-)$ Γ_9

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
0.60 $\pm$ 0.02 OUR EVALUATION				
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.591 $\pm$ 0.015	11200	^{1,2} AKHMETSHIN	04	CMD2 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
0.653 $\pm$ 0.003 $\pm$ 0.021	1.2M	³ ACHASOV	03D	RVUE 0.44–2.00 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
0.600 $\pm$ 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 $B(\omega \rightarrow \pi^+\pi^-) = (1.70 \pm 0.28)\%$.

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

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
6.49$\pm$0.11 OUR FIT	Error includes scale factor of 1.3.			
6.38$\pm$0.10 OUR AVERAGE	Error includes scale factor of 1.1.			
6.24 $\pm$ 0.11 $\pm$ 0.08	11.2k	¹ AKHMETSHIN	04	CMD2 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
6.70 $\pm$ 0.06 $\pm$ 0.27		AUBERT,B	04N	BABR 10.6 $e^+e^- \rightarrow \pi^+\pi^-\pi^0\gamma$
6.74 $\pm$ 0.04 $\pm$ 0.24	1.2M	^{2,3} ACHASOV	03D	RVUE 0.44–2.00 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
6.37 $\pm$ 0.35		² DOLINSKY	89	ND $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
6.45 $\pm$ 0.24		² BARKOV	87	CMD $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
5.79 $\pm$ 0.42	1488	² KURDADZE	83B	OLYA $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
5.89 $\pm$ 0.54	433	² CORDIER	80	DM1 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
7.54 $\pm$ 0.84	451	² BENAKSAS	72B	OSPK $e^+e^- \rightarrow \pi^+\pi^-\pi^0$

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

6.20 $\pm$ 0.13 ⁴BENAYOUN 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.

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

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
6.02$\pm$0.20 OUR FIT	Error includes scale factor of 1.9.			
6.45$\pm$0.17 OUR AVERAGE				
6.47 $\pm$ 0.14 $\pm$ 0.39	18680	AKHMETSHIN	05	CMD2 0.60–1.38 $e^+e^- \rightarrow \pi^0\gamma$
6.50 $\pm$ 0.11 $\pm$ 0.20	36500	¹ ACHASOV	03	SND 0.60–0.97 $e^+e^- \rightarrow \pi^0\gamma$
6.34 $\pm$ 0.21 $\pm$ 0.21	10625	² DOLINSKY	89	ND $e^+e^- \rightarrow \pi^0\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
6.80 $\pm$ 0.13		³ BENAYOUN	10	RVUE 0.4–1.05 e^+e^-

¹ 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 $(-10.2 \pm 7.0)^\circ$.

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

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

NODE=M001218

NODE=M001W1
NODE=M001W1

NODE=M001W1;LINKAGE=AD

NODE=M001W2
NODE=M001W2

NODE=M001W2;LINKAGE=DA

NODE=M001W7
NODE=M001W7
→ UNCHECKED ←

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

NODE=M001225

NODE=M001G2
NODE=M001G2

NODE=M001G;LINKAGE=PT
NODE=M001G;LINKAGE=LP
NODE=M001G;LINKAGE=VH

NODE=M001G2;LINKAGE=BE

NODE=M001G4
NODE=M001G4

NODE=M001G;LINKAGE=SH

NODE=M001G4;LINKAGE=LP
NODE=M001G4;LINKAGE=BE

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

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. • • •

1.146±0.057		² BENAYOUN	10 RVUE	0.4–1.05 e^+e^-

¹ Supersedes ACHASOV 05A.

² A simultaneous fit of $e^+e^- \rightarrow \pi^+\pi^-, \pi^+\pi^-\pi^0, \pi^0\gamma, \eta\gamma$ data.

NODE=M001G5
NODE=M001G5

NODE=M001G5;LINKAGE=AC
NODE=M001G5;LINKAGE=BE

$$\Gamma(e^+e^-)/\Gamma_{\text{total}} \times \Gamma(\eta\gamma)/\Gamma_{\text{total}} \quad \Gamma_9/\Gamma \times \Gamma_5/\Gamma$$

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	¹ ACHASOV	07B SND	0.6–1.38 $e^+e^- \rightarrow \eta\gamma$

3.17 ^{+1.85} _{-1.31} ±0.21	17.4k	² AKHMETSHIN	05 CMD2	0.60–1.38 $e^+e^- \rightarrow \eta\gamma$

3.41±0.52±0.21	23k	^{3,4} AKHMETSHIN	01B CMD2	$e^+e^- \rightarrow \eta\gamma$

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

4.50±0.10		⁵ BENAYOUN	10 RVUE	0.4–1.05 e^+e^-

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

$\omega(782)$ BRANCHING RATIOS

NODE=M001220

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

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

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

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

0.9024±0.0019		¹ AMBROSINO	08G KLOE	1.0–1.03 $e^+e^- \rightarrow \pi^+\pi^-\pi^0, 2\pi^0\gamma$

0.8965±0.0016±0.0048	1.2M	^{2,3} ACHASOV	03D RVUE	0.44–2.00 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$

0.880 ±0.020 ±0.032	11200	^{3,4} AKHMETSHIN	00C CMD2	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$

0.8942±0.0062		³ DOLINSKY	89 ND	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$

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

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

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

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

NODE=M001R21

NODE=M001R21

NODE=M001R21

NODE=M001R21;LINKAGE=AM
NODE=M001R;LINKAGE=VF
NODE=M001R;LINKAGE=ZL
NODE=M001R;LINKAGE=KH

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

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

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

8.09±0.14		¹ AMBROSINO	08G KLOE	$e^+e^- \rightarrow \pi^+\pi^-\pi^0, 2\pi^0\gamma$

9.06±0.20±0.57	18680	^{2,3} AKHMETSHIN	05 CMD2	0.60–1.38 $e^+e^- \rightarrow \pi^0\gamma$

9.34±0.15±0.31	36500	³ ACHASOV	03 SND	0.60–0.97 $e^+e^- \rightarrow \pi^0\gamma$

8.65±0.16±0.42	1.2M	^{4,5} ACHASOV	03D RVUE	0.44–2.00 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$

8.39±0.24	9975	⁶ BENAYOUN	96 RVUE	$e^+e^- \rightarrow \pi^0\gamma$

8.88±0.62	10625	³ DOLINSKY	89 ND	$e^+e^- \rightarrow \pi^0\gamma$

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

² Using $B(\omega \rightarrow e^+e^-) = (7.14 \pm 0.13) \times 10^{-5}$.

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

⁴ Using ACHASOV 03, ACHASOV 03D and $B(\omega \rightarrow \pi^+\pi^-) = (1.70 \pm 0.28)\%$.

⁵ Not independent of the corresponding $\Gamma(e^+e^-) \times \Gamma(\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}^2$.

⁶ Reanalysis of DRUZHININ 84, DOLINSKY 89, DOLINSKY 91 taking into account the triangle anomaly contributions.

NODE=M001R28
NODE=M001R28

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

9.28±0.31 OUR FIT Error includes scale factor of 2.3.**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^{+0.11}_{-0.13} OUR FIT Error includes scale factor of 1.2.**1.49±0.13 OUR AVERAGE** Error includes scale factor of 1.3. See the ideogram below.1.46±0.12±0.02 900k ¹ AKHMETSHIN 07 $e^+e^- \rightarrow \pi^+\pi^-$ 1.30±0.24±0.05 11.2k ² AKHMETSHIN 04 CMD2 $e^+e^- \rightarrow \pi^+\pi^-$ 2.38^{+1.77}_{-0.90}±0.18 5.4k ³ ACHASOV 02E SND $1.1-1.38 e^+e^- \rightarrow \pi^+\pi^-\pi^0$ 2.3 ±0.5 BARKOV 85 OLYA $e^+e^- \rightarrow \pi^+\pi^-$ 1.6^{+0.9}_{-0.7} QUENZER 78 DM1 $e^+e^- \rightarrow \pi^+\pi^-$ 3.6 ±1.9 BENAKSAS 72 OSPK $e^+e^- \rightarrow \pi^+\pi^-$

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

1.75±0.11 4.5M ⁴ ACHASOV 05A SND $e^+e^- \rightarrow \pi^+\pi^-$ 2.01±0.29 ⁵ BENAYOUN 03 RVUE $e^+e^- \rightarrow \pi^+\pi^-$ 1.9 ±0.3 ⁶ GARDNER 99 RVUE $e^+e^- \rightarrow \pi^+\pi^-$ 2.3 ±0.4 ⁷ BENAYOUN 98 RVUE $e^+e^- \rightarrow \pi^+\pi^-, \mu^+\mu^-$ 1.0 ±0.11 ⁸ WICKLUND 78 ASPK $3,4,6\pi^\pm N$

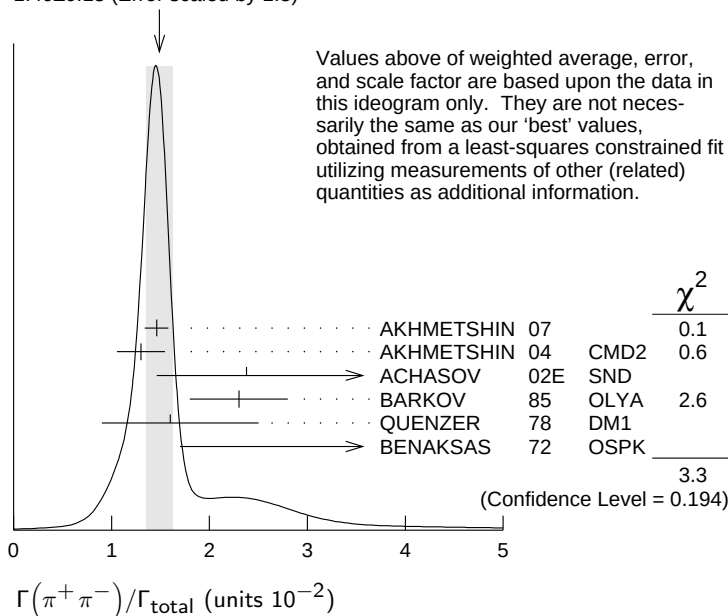
1.22±0.30 ALVENSLEB... 71C CNTR Photoproduction

1.3^{+1.2}_{-0.9} MOFFEIT 71 HBC $2.8,4.7\gamma p$ 0.80^{+0.28}_{-0.20} ⁹ BIGGS 70B CNTR $4.2\gamma C \rightarrow \pi^+\pi^-C$ ¹ A combined fit of AKHMETSHIN 07, AULCHENKO 06, and AULCHENKO 05.² Update of AKHMETSHIN 02.³ From the $m_{\pi^+\pi^-}$ spectrum taking into account the interference of the $\rho\pi$ and $\omega\pi$ amplitudes.⁴ Using $\Gamma(\omega \rightarrow e^+e^-)$ from the 2004 Edition of this Review (PDG 04).⁵ Using the data of AKHMETSHIN 02 in the hidden local symmetry model.⁶ Using the data of BARKOV 85.⁷ Using the data of BARKOV 85 in the hidden local symmetry model.⁸ From a model-dependent analysis assuming complete coherence.⁹ 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

NODE=M001R15
NODE=M001R15NODE=M001R15;LINKAGE=AK
NODE=M001R15;LINKAGE=PT
NODE=M001R;LINKAGE=VENODE=M001R;LINKAGE=SN
NODE=M001R;LINKAGE=BY
NODE=M001R15;LINKAGE=H4
NODE=M001R15;LINKAGE=Q
NODE=M001R15;LINKAGE=F
NODE=M001R15;LINKAGE=B

WEIGHTED AVERAGE
1.49±0.13 (Error scaled by 1.3)



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

Γ_3/Γ_1

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

VALUE	DOCUMENT ID	TECN	COMMENT
0.0172±0.0014 OUR FIT	Error includes scale factor of 1.2.		
0.026 ±0.005 OUR AVERAGE			
0.021 +0.028 -0.009	^{1,2} RATCLIFF	72	ASPK 15 $\pi^- p \rightarrow n 2\pi$
0.028 ±0.006	¹ BEHREND	71	ASPK Photoproduction
0.022 +0.009 -0.01	³ ROOS	70	RVUE

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

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

³ ROOS 70 combines ABRAMOVICH 70 and BIZZARRI 70.

NODE=M001R2

NODE=M001R2
NODE=M001R2

NODE=M001R2;LINKAGE=A

NODE=M001R2;LINKAGE=S
NODE=M001R2;LINKAGE=R

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

Γ_3/Γ_2

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.20±0.04	1.98M	¹ ALOISIO	03	KLOE 1.02 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$

¹ Using the data of ALOISIO 02D.

NODE=M001R33
NODE=M001R33

NODE=M001R;LINKAGE=KL

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

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

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.091±0.006 OUR FIT				
0.081±0.011 OUR AVERAGE				
0.075±0.025		BIZZARRI	71	HBC 0.0 $p\bar{p}$
0.079±0.019		DEINET	69B	OSPK 1.5 $\pi^- p$
0.084±0.015		BOLLINI	68C	CNTR 2.1 $\pi^- p$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.073±0.018	42	BASILE	72B	CNTR 1.67 $\pi^- p$

NODE=M001R14
NODE=M001R14

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

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

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.102±0.008 OUR FIT				
0.103^{+0.011}_{-0.010} OUR AVERAGE				
0.15 ±0.04	46	AGUILAR-...	72B	HBC 3.9,4.6 $K^- p$
0.10 ±0.03	19	BARASH	67B	HBC 0.0 $\bar{p}p$
0.134±0.026	850	DIGIUGNO	66B	CNTR 1.4 $\pi^- p$
0.097±0.016	348	FLATTE	66	HBC 1.4 – 1.7 $K^- p \rightarrow \Lambda MM$
0.06 +0.05 -0.02		JAMES	66	HBC 2.1 $\pi^+ p$
0.08 ±0.03	35	KRAEMER	64	DBC 1.2 $\pi^+ d$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.11 ±0.02	20	BUSCHBECK	63	HBC 1.5 $K^- p$

NODE=M001R1
NODE=M001R1

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

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

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

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

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

NODE=M001R18
NODE=M001R18

NODE=M001R18;LINKAGE=D

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

VALUE	DOCUMENT ID	TECN	COMMENT

0.100 ± 0.008 OUR FIT

0.124 ± 0.021

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

NODE=M001R9
NODE=M001R9

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

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

4.6 ± 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	$6.7\text{--}10 \gamma \text{Cu}$

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

$4.3 \pm 0.5 \pm 0.1$	33k	³ ACHASOV	07B	SND	$0.6\text{--}1.38 e^+ e^- \rightarrow \eta\gamma$
$4.44^{+2.59}_{-1.83} \pm 0.28$	17.4k	^{4,5} AKHMETSHIN	05	CMD2	$0.60\text{--}1.38 e^+ e^- \rightarrow \eta\gamma$
$5.10 \pm 0.72 \pm 0.34$	23k	⁶ AKHMETSHIN	01B	CMD2	$e^+ e^- \rightarrow \eta\gamma$
$0.7 \text{ to } 5.5$		⁷ CASE	00	CBAR	$0.0 p\bar{p} \rightarrow \eta\eta\gamma$
$6.56^{+2.41}_{-2.55}$	3525	^{2,8} BENAYOUN	96	RVUE	$e^+ e^- \rightarrow \eta\gamma$
7.3 ± 2.9		^{2,4} DOLINSKY	89	ND	$e^+ e^- \rightarrow \eta\gamma$

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

² Solution corresponding to constructive 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 $B(\omega(782) \rightarrow e^+ e^-) = (7.28 \pm 0.14) \times 10^{-5}$. 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=M001R;LINKAGE=EA
NODE=M001R19;LINKAGE=A
NODE=M001R19;LINKAGE=AO

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

NODE=M001R;LINKAGE=CS

NODE=M001R19;LINKAGE=A1

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

VALUE	DOCUMENT ID	TECN	COMMENT

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

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

¹ Model independent determination.

² Solution corresponding to constructive ω - ρ interference.

NODE=M001R11
NODE=M001R11

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

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

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

7.7 ± 0.6 OUR FIT

7.7 ± 0.6 OUR AVERAGE

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

NODE=M001R23
NODE=M001R23

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

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

1.3 ± 0.4 OUR FIT Error includes scale factor of 2.1.**1.3 ± 0.4 OUR AVERAGE** Error includes scale factor of 2.1.

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

0.728 ± 0.014 OUR FIT Error includes scale factor of 1.3.

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

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

0.65 ± 0.13 33 5 ASTVACAT... 68 OSPK Assume SU(3)+mixing

¹ Using $B(\omega \rightarrow \pi^+ \pi^- \pi^0) = 0.891 \pm 0.007$. Update of AKHMETSHIN 00C.² Not independent of the corresponding $\Gamma(e^+ e^-) \times \Gamma(\pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}^2$.³ Using ACHASOV 03, ACHASOV 03D and $B(\omega \rightarrow \pi^+ \pi^-) = (1.70 \pm 0.28)\%$.⁴ Rescaled by us to correspond to ω width 8.4 MeV. Systematic errors underestimated.⁵ Not resolved from ρ decay. Error statistical only.NODE=M001R13
NODE=M001R13NODE=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 $p\bar{p} \rightarrow \pi^+ \pi^- \pi^+ \pi^- \gamma$

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

<0.004 95 BITYUKOV 88B SPEC 32 $\pi^- p \rightarrow \pi^+ \pi^- \gamma X$ 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 × 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

6.6 ± 1.1 OUR FIT**6.5 ± 1.2 OUR AVERAGE**6.4^{+2.4}_{-2.0} ± 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} ± 0.6 295 ACHASOV 02F SND 0.36-0.97 $e^+ e^- \rightarrow$
 $\pi^0 \pi^0 \gamma$ NODE=M001R29
NODE=M001R29

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

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

OCCUR=2

OCCUR=2

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

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

³ Superseded by ACHASOV 02F.

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

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

 Γ_{13}/Γ_1

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.00045	90	DOLINSKY	89	ND $e^+e^- \rightarrow \pi^0\pi^0\gamma$

NODE=M001R10
NODE=M001R10

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

<0.08	95	JACQUET	69B	HLBC	$2.05 \pi^+p \rightarrow \pi^+p\omega$

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

 Γ_{13}/Γ_2

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
8.0$\pm$1.3 OUR FIT					
8.5$\pm$2.9	40 $\pm$ 14		ALDE	94B	GAM2 $38\pi^-p \rightarrow \pi^0\pi^0\gamma n$

NODE=M001R7
NODE=M001R7

• • • 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	$1.3-2.8 \pi^-p$

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

 $\Gamma_{13}/(\Gamma_2+\Gamma_4)$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

NODE=M001R17
NODE=M001R17

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

0.22 ± 0.07		¹ DAKIN	72	OSPK	$1.4 \pi^-p \rightarrow nMM$
<0.19	90	DEINET	69B	OSPK	

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

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
9.0$\pm$3.1 OUR FIT				
9.0$\pm$2.9$\pm$1.1	18	HEISTER	02C	ALEP $Z \rightarrow \mu^+\mu^- + X$

NODE=M001R30
NODE=M001R30

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

 Γ_{15}/Γ_1

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

NODE=M001R6
NODE=M001R6

• • • 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	$2.7 K^-p$

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

 Γ_7/Γ_{15}

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

NODE=M001R20
NODE=M001R20

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

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

¹ Superseded by DZHELYADIN 81B result above.

NODE=M001R20;LINKAGE=S

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

 Γ_{16}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.9	95	¹ ABELE	97E	CBAR $0.0 \bar{p}p \rightarrow 3\gamma$

NODE=M001R27
NODE=M001R27

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

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

¹ From direct 3γ decay search.

NODE=M001R27;LINKAGE=A

$\Gamma(\eta\pi^0)/\Gamma_{\text{total}}$ Violates C conservation.

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

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

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

 Γ_{17}/Γ

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 $2.05 \pi^+ p \rightarrow \pi^+ p\omega$

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

NODE=M001R8

NODE=M001R8

NODE=M001R8;LINKAGE=A

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

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

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

¹ STAROSTIN 09 reports $[\Gamma(\omega(782) \rightarrow \eta\pi^0)/\Gamma(\omega(782) \rightarrow \pi^0\gamma)] \times [B(\eta \rightarrow 2\gamma)] < 1.01 \times 10^{-3}$ which we divide by our best value $B(\eta \rightarrow 2\gamma) = 39.41 \times 10^{-2}$.

NODE=M001R35

NODE=M001R35

NODE=M001R35

NODE=M001R35;LINKAGE=ST

 $\Gamma(2\pi^0)/\Gamma(\pi^0\gamma)$ Γ_{18}/Γ_2 Violates C conservation and Bose-Einstein statistics.

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

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

NODE=M001R36

NODE=M001R36

NODE=M001R36

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

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

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

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

NODE=M001R26

NODE=M001R26

NODE=M001R26

 $\Gamma(3\pi^0)/\Gamma(\pi^0\gamma)$ Γ_{19}/Γ_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

 $\Gamma(3\pi^0)/\Gamma(\pi^+\pi^-\pi^0)$ Γ_{19}/Γ_1 Violates C conservation.

VALUE	CL%	DOCUMENT ID	COMMENT

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

<0.009	90	BARBERIS	01 450 $pp \rightarrow p_f 3\pi^0 p_s$

NODE=M001R31

NODE=M001R31

NODE=M001R31

PARAMETER Λ IN $\omega \rightarrow \pi^0\mu^+\mu^-$ DECAYIn 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 $\eta \rightarrow \mu^+\mu^-\gamma$ decay ARNALDI 09 and DZHELYADIN 80 obtain the value of Λ consistent with vector dominance.

NODE=M001LAM

NODE=M001LAM

VALUE (GeV)	EVTS	DOCUMENT ID	TECN	COMMENT

0.668 ± 0.009 ± 0.003	3k	ARNALDI	09	NA60 158A In-In collisions

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

0.65 ± 0.03		DZHELYADIN	81B	CNTR 25-33 $\pi^- p \rightarrow \omega n$

NODE=M001LAM

$\omega(782)$ REFERENCES

NODE=M001

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
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
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. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=51615
ACHASOV	06	JETP 103 380	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=51113
		Translated from ZETF 130 437.			
ACHASOV	06A	PR D74 014016	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=51133
AULCHENKO	06	JETPL 84 413	V.M. Aulchenko <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=51513
		Translated from ZETFP 84 491.			
ACHASOV	05A	JETP 101 1053	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=51045
		Translated from ZETF 128 1201.			
AKHMETSHIN	05	PL B605 26	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=50330
AKHMETSHIN	05A	PL B613 29	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=50508
AULCHENKO	05	JETPL 82 743	V.M. Aulchenko <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=51060
		Translated from ZETFP 82 841.			
AKHMETSHIN	04	PL B578 285	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=49609
AKHMETSHIN	04B	PL B580 119	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=49610
AUBERT,B	04N	PR D70 072004	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=50184
PDG	04	PL B592 1	S. Eidelman <i>et al.</i>	(PDG Collab.)	REFID=49653
ACHASOV	03	PL B559 171	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=49187
ACHASOV	03D	PR D68 052006	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=49577
ALOISIO	03	PL B561 55	A. Aloisio <i>et al.</i>	(KLOE Collab.)	REFID=49404
BENAYOUN	03	EPJ C29 397	M. Benayoun <i>et al.</i>		REFID=49477
ACHASOV	02E	PR D66 032001	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=48815
ACHASOV	02F	PL B537 201	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=48816
AKHMETSHIN	02	PL B527 161	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=48565
ALOISIO	02D	PL B537 21	A. Aloisio <i>et al.</i>	(KLOE Collab.)	REFID=48824
HEISTER	02C	PL B528 19	A. Heister <i>et al.</i>	(ALEPH Collab.)	REFID=48564
ACHASOV	01E	PR D63 072002	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=48311
AKHMETSHIN	01B	PL B509 217	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=48167
BARBERIS	01	PL B507 14	D. Barberis <i>et al.</i>		REFID=48324
ACHASOV	00	EPJ C12 25	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47417
ACHASOV	00D	JETPL 72 282	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47882
		Translated from ZETFP 72 411.			
ACHASOV	00G	JETPL 71 355	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47929
		Translated from ZETFP 71 519.			
AKHMETSHIN	00C	PL B476 33	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=47423
AULCHENKO	00A	JETP 90 927	V.M. Aulchenko <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47953
		Translated from ZETF 117 1067.			
CASE	00	PR D61 032002	T. Case <i>et al.</i>	(Crystal Barrel Collab.)	REFID=47409
ACHASOV	99E	PL B462 365	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47391
GARDNER	99	PR D59 076002	S. Gardner, H.B. O'Connell		REFID=46919
BENAYOUN	98	EPJ C2 269	M. Benayoun <i>et al.</i>	(IPNP, NOVO, ADLD+)	REFID=45859
ABELE	97E	PL B411 361	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)	REFID=45755
BENAYOUN	96	ZPHY C72 221	M. Benayoun <i>et al.</i>	(IPNP, NOVO)	REFID=45753
PROKOSHIN	95	SPD 40 273	Y.D. Prokoshkin, V.D. Samoilenko	(SERP)	REFID=44616
		Translated from DANS 342 610.			
WURZINGER	95	PR C51 443	R. Wurzinger <i>et al.</i>	(BONN, ORSAY, SACL+)	REFID=45209
ALDE	94B	PL B340 122	D.M. Alde <i>et al.</i>	(SERP, BELG, LANL, LAPP+)	REFID=44100
AMSLER	94C	PL B327 425	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=44091
ALDE	93	PAN 56 1229	D.M. Alde <i>et al.</i>	(SERP, LAPP, LANL, BELG+)	REFID=43603
		Translated from YAF 56 137.			
Also		ZPHY C61 35	D.M. Alde <i>et al.</i>	(SERP, LAPP, LANL, BELG+)	REFID=43790
AMSLER	93B	PL B311 362	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=43602
WEIDENAUER	93	ZPHY C59 387	P. Weidenauer <i>et al.</i>	(ASTERIX Collab.)	REFID=43585
ANTONELLI	92	ZPHY C56 15	A. Antonelli <i>et al.</i>	(DM2 Collab.)	REFID=43168
DOLINSKY	91	PRPL 202 99	S.I. Dolinsky <i>et al.</i>	(NOVO)	REFID=41369
WEIDENAUER	90	ZPHY C47 353	P. Weidenauer <i>et al.</i>	(ASTERIX Collab.)	REFID=41368
DOLINSKY	89	ZPHY C42 511	S.I. Dolinsky <i>et al.</i>	(NOVO)	REFID=41003
BITYUKOV	88B	SJNP 47 800	S.I. Bitukov <i>et al.</i>	(SERP)	REFID=41021
		Translated from YAF 47 1258.			
DOLINSKY	88	SJNP 48 277	S.I. Dolinsky <i>et al.</i>	(NOVO)	REFID=41022
		Translated from YAF 48 442.			
KURDADZE	88	JETPL 47 512	L.M. Kurdadze <i>et al.</i>	(NOVO)	REFID=41121
		Translated from ZETFP 47 432.			
AULCHENKO	87	PL B186 432	V.M. Aulchenko <i>et al.</i>	(NOVO)	REFID=40007
BARKOV	87	JETPL 46 164	L.M. Barkov <i>et al.</i>	(NOVO)	REFID=40280
		Translated from ZETFP 46 132.			
KURDADZE	86	JETPL 43 643	L.M. Kurdadze <i>et al.</i>	(NOVO)	REFID=40287
		Translated from ZETFP 43 497.			
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
KURDADZE	83B	JETPL 36 274	A.M. Kurdadze <i>et al.</i>	(NOVO)	REFID=20244
		Translated from ZETFP 36 221.			
DZHELYADIN	81B	PL 102B 296	R.I. Dzheilyadin <i>et al.</i>	(SERP)	REFID=20242
CORDIER	80	NP B172 13	A. Cordier <i>et al.</i>	(LALO)	REFID=20240
DZHELYADIN	80	PL 94B 548	R.I. Dzheilyadin <i>et al.</i>	(SERP)	REFID=10831
ROOS	80	LNC 27 321	M. Roos, A. Pellinen	(HELs)	REFID=20241
BENKHEIRI	79	NP B150 268	P. Benkheiri <i>et al.</i>	(EPOL, CERN, CDEF+)	REFID=20238
DZHELYADIN	79	PL 84B 143	R.I. Dzheilyadin <i>et al.</i>	(SERP)	REFID=20239
COOPER	78B	NP B146 1	A.M. Cooper <i>et al.</i>	(TATA, CERN, CDEF+)	REFID=20235
QUENZER	78	PL 76B 512	A. Quenzer <i>et al.</i>	(LALO)	REFID=20123
VANAPEL...	78	NP B133 245	G.W. van Apeldoorn <i>et al.</i>	(ZEEM)	REFID=20234
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
GESSAROLI	77	NP B126 382	R. Gessaroli <i>et al.</i>	(BGNA, FIRZ, GENO+)	REFID=20230
KEYNE	76	PR D14 28	J. Keyne <i>et al.</i>	(LOIC, SHMP)	REFID=20226
		Also			
		PR D8 2789	D.M. Binnie <i>et al.</i>	(LOIC, SHMP)	REFID=20216
KALBFLEISCH	75	PR D11 987	G.R. Kalbfleisch, R.C. Strand, J.W. Chapman	(BNL+)	REFID=20223
AGUILAR-...	72B	PR D6 29	M. Aguilar-Benitez <i>et al.</i>	(BNL)	REFID=20205
APEL	72B	PL 41B 234	W.D. Apel <i>et al.</i>	(KARLK, KARLE, PISA)	REFID=20206
BASILE	72B	Phil. Conf. 153	M. Basile <i>et al.</i>	(CERN)	REFID=20207
BENAKSAS	72	PL 39B 289	D. Benaksas <i>et al.</i>	(ORSAY)	REFID=20096
BENAKSAS	72B	PL 42B 507	D. Benaksas <i>et al.</i>	(ORSAY)	REFID=20209
BENAKSAS	72C	PL 42B 511	D. Benaksas <i>et al.</i>	(ORSAY)	REFID=20517
BORENSTEIN	72	PR D5 1559	S.R. Borenstein <i>et al.</i>	(BNL, MICH)	REFID=20215
BROWN	72	PL 42B 117	R.M. Brown <i>et al.</i>	(ILL, ILLC)	REFID=20211
DAKIN	72	PR D6 2321	J.T. Dakin <i>et al.</i>	(PRIN)	REFID=20212
RATCLIFF	72	PL 38B 345	B.N. Ratcliff <i>et al.</i>	(SLAC)	REFID=20102
ALVENSLEB...	71C	PRL 27 888	H. Alvensleben <i>et al.</i>	(DESY)	REFID=20193
BALDIN	71	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)
BARASH	67B	PR 156 1399	N. Barash <i>et al.</i>	(COLU)
FELDMAN	67C	PR 159 1219	M. Feldman <i>et al.</i>	(PENN)
DIUGNO	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
REFID=20179
REFID=20084
REFID=20055
REFID=20164
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
0.198 ±0.009 OUR FIT					
[0.199 ± 0.009 MeV OUR 2012 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
NEW

$\eta'(958)$ DECAY MODES

NODE=M002215;NODE=M002

	Mode	Fraction (Γ_i/Γ)	Confidence level	
Γ_1	$\pi^+\pi^-\eta$	$(42.9 \pm 0.7) \%$		DESIG=1
Γ_2	$\rho^0\gamma$ (including non-resonant $\pi^+\pi^-\gamma$)	$(29.1 \pm 0.5) \%$		DESIG=9
Γ_3	$\pi^0\pi^0\eta$	$(22.2 \pm 0.8) \%$		DESIG=2
Γ_4	$\omega\gamma$	$(2.75 \pm 0.23) \%$		DESIG=7
Γ_5	$\gamma\gamma$	$(2.20 \pm 0.08) \%$		DESIG=6
Γ_6	$3\pi^0$	$(2.14 \pm 0.20) \times 10^{-3}$		DESIG=8
Γ_7	$\mu^+\mu^-\gamma$	$(1.08 \pm 0.27) \times 10^{-4}$		DESIG=20
Γ_8	$\pi^+\pi^-\mu^+\mu^-$	$< 2.2 \times 10^{-4}$	90%	DESIG=201
Γ_9	$\pi^+\pi^-\pi^0$	$(3.8 \pm 0.4) \times 10^{-3}$		DESIG=121
Γ_{10}	$\pi^0\rho^0$	$< 4 \%$	90%	DESIG=18
Γ_{11}	$2(\pi^+\pi^-)$	$< 2.4 \times 10^{-4}$	90%	DESIG=131
Γ_{12}	$\pi^+\pi^-2\pi^0$	$< 2.5 \times 10^{-3}$	90%	DESIG=202
Γ_{13}	$2(\pi^+\pi^-)$ neutrals	$< 1 \%$	95%	DESIG=132
Γ_{14}	$2(\pi^+\pi^-)\pi^0$	$< 1.9 \times 10^{-3}$	90%	DESIG=141
Γ_{15}	$2(\pi^+\pi^-)2\pi^0$	$< 1 \%$	95%	DESIG=15
Γ_{16}	$3(\pi^+\pi^-)$	$< 5 \times 10^{-4}$	90%	DESIG=203
Γ_{17}	$\pi^+\pi^-e^+e^-$	$(2.4^{+1.3}_{-1.0}) \times 10^{-3}$		DESIG=10
Γ_{18}	$\pi^+e^-\nu_e + \text{c.c.}$	$< 2.1 \times 10^{-4}$	90%	DESIG=204
Γ_{19}	γe^+e^-	$< 9 \times 10^{-4}$	90%	DESIG=28
Γ_{20}	$\pi^0\gamma\gamma$	$< 8 \times 10^{-4}$	90%	DESIG=24
Γ_{21}	$4\pi^0$	$< 5 \times 10^{-4}$	90%	DESIG=26
Γ_{22}	e^+e^-	$< 2.1 \times 10^{-7}$	90%	DESIG=150
Γ_{23}	invisible	$< 5 \times 10^{-4}$	90%	DESIG=200

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

NODE=M002;CLUMP=B

Γ_{24}	$\pi^+\pi^-$	P, CP	$< 6 \times 10^{-5}$	90%	DESIG=111
Γ_{25}	$\pi^0\pi^0$	P, CP	$< 4 \times 10^{-4}$	90%	DESIG=25
Γ_{26}	$\pi^0e^+e^-$	C [a]	$< 1.4 \times 10^{-3}$	90%	DESIG=16
Γ_{27}	ηe^+e^-	C [a]	$< 2.4 \times 10^{-3}$	90%	DESIG=17
Γ_{28}	3γ	C	$< 1.0 \times 10^{-4}$	90%	DESIG=23
Γ_{29}	$\mu^+\mu^-\pi^0$	C [a]	$< 6.0 \times 10^{-5}$	90%	DESIG=22
Γ_{30}	$\mu^+\mu^-\eta$	C [a]	$< 1.5 \times 10^{-5}$	90%	DESIG=21
Γ_{31}	$e\mu$	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 15 branching ratios uses 43 measurements and one constraint to determine 9 parameters. The overall fit has a $\chi^2 = 48.0$ for 35 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	0							
x_3	-76	-58						
x_4	-19	-23	4					
x_5	-29	-25	32	-1				
x_6	-24	-18	29	1	9			
x_9	0	-2	-3	-1	-1	-1		
x_{17}	-4	-6	-5	-2	-3	-2	0	
Γ	25	5	-19	5	-71	-5	1	3
	x_1	x_2	x_3	x_4	x_5	x_6	x_9	x_{17}

Mode	Rate (MeV)	
Γ_1 $\pi^+ \pi^- \eta$	0.085 $\pm$ 0.004	DESIG=1
Γ_2 $\rho^0 \gamma$ (including non-resonant $\pi^+ \pi^- \gamma$)	0.0575 $\pm$ 0.0028	DESIG=9
Γ_3 $\pi^0 \pi^0 \eta$	0.0439 $\pm$ 0.0023	DESIG=2
Γ_4 $\omega \gamma$	0.0054 $\pm$ 0.0005	DESIG=7
Γ_5 $\gamma \gamma$	0.00435 $\pm$ 0.00013	DESIG=6
Γ_6 $3\pi^0$	(4.2 $\pm$ 0.4) $\times 10^{-4}$	DESIG=8
Γ_9 $\pi^+ \pi^- \pi^0$	(7.5 $\pm$ 0.8) $\times 10^{-4}$	DESIG=121
Γ_{17} $\pi^+ \pi^- e^+ e^-$	(4.7 $\pm^{+2.6}_{-1.9}$) $\times 10^{-4}$	DESIG=10

$\eta'(958)$ PARTIAL WIDTHS

NODE=M002220

$\Gamma(\gamma\gamma)$

Γ_5

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
4.35$\pm$0.14 OUR FIT				
[4.34 $\pm$ 0.14 keV OUR 2012 FIT]				
4.28$\pm$0.19 OUR AVERAGE				
4.17 $\pm$ 0.10 $\pm$ 0.27	2000	⁴ 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		⁵ 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	⁶ 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	⁷ 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	⁸ GIDAL	87 MRK2	$e^+ e^- \rightarrow e^+ e^- \eta \pi^+ \pi^-$
4.0 $\pm$ 0.9		⁹ BARTEL	85E JADE	$e^+ e^- \rightarrow e^+ e^- 2\gamma$

⁴ No non-resonant $\pi^+ \pi^-$ contribution found.

⁵ Reevaluated by us using $B(\eta' \rightarrow \rho(770)\gamma) = (30.2 \pm 1.3)\%$.

⁶ Reevaluated by us using $B(\eta' \rightarrow \gamma\gamma) = (2.11 \pm 0.13)\%$.

⁷ Reevaluated by us using $B(\eta' \rightarrow \gamma\gamma) = (2.11 \pm 0.13)\%$.

⁸ Superseded by BUTLER 90.

⁹ Systematic error not evaluated.

NODE=M002W4
NODE=M002W4
NEW

NODE=M002W4;LINKAGE=AC
NODE=M002W4;LINKAGE=K1
NODE=M002W4;LINKAGE=K2
NODE=M002W4;LINKAGE=K3
NODE=M002W4;LINKAGE=C
NODE=M002W4;LINKAGE=A

$\eta'(958) \Gamma(i) \Gamma(\gamma\gamma) / \Gamma(\text{total})$

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

NODE=M002223

 $\Gamma(\gamma\gamma) \times \Gamma(\rho^0 \gamma (\text{including non-resonant } \pi^+ \pi^- \gamma)) / \Gamma_{\text{total}} \quad \Gamma_5 \Gamma_2 / \Gamma$

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
1.27±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 83B	CELL	$e^+ e^- \rightarrow e^+ e^- \rho \gamma$

NODE=M002G1
NODE=M002G1 $\Gamma(\gamma\gamma) \times \Gamma(\pi^0 \pi^0 \eta) / \Gamma_{\text{total}} \quad \Gamma_5 \Gamma_3 / \Gamma$

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
0.97±0.05 OUR FIT			
[0.94 ± 0.05 keV OUR 2012 FIT]			
0.92±0.06±0.11	¹⁰ 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	¹¹ KARCH 90	CBAL	$e^+ e^- \rightarrow e^+ e^- \eta \pi^0 \pi^0$
1.00±0.08±0.10	^{11,12} ANTREASYAN 87	CBAL	$e^+ e^- \rightarrow e^+ e^- \eta \pi^0 \pi^0$
¹⁰ Reevaluated by us using $B(\eta \rightarrow \gamma\gamma) = (39.21 \pm 0.34)\%$. Supersedes ANTREASYAN 87 and KARCH 90.			
¹¹ Superseded by KARCH 92.			
¹² Using $BR(\eta \rightarrow 2\gamma) = (38.9 \pm 0.5)\%$.			

NODE=M002G2
NODE=M002G2
NEW

NODE=M002G2;LINKAGE=K4

NODE=M002G2;LINKAGE=A
NODE=M002G2;LINKAGE=D $\eta'(958) \rightarrow \eta \pi \pi$ 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

 $Re(\alpha)$ decay parameter

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
-0.033±0.005±0.003	44k	¹³ ABLIKIM 11	BES3	$J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$
-0.072±0.012±0.006	7k	¹⁴ AMELIN 05A	VES	$28 \pi^- A \rightarrow \eta \pi^+ \pi^- \pi^- A^*$
-0.021±0.018±0.017	6.7k	¹⁵ BRIERE 00	CLEO	$10.6 e^+ e^- \rightarrow \eta \pi^+ \pi^- X$
-0.058±0.013±0.003	5.4k	¹⁶ ALDE 86	GAM2	$38 \pi^- p \rightarrow n \eta \pi^0 \pi^0$
-0.08 ±0.03		^{16,17} KALBFLEISCH 74	RVUE	$\eta' \rightarrow \eta \pi^+ \pi^-$

NODE=M002A0
NODE=M002A0¹³ See ABLIKIM 11 for the full correlation matrix.¹⁴ Superseded by DOROFEEV 07, which found this parameterization unacceptable. See below.¹⁵ Assuming $\text{Im}(\alpha) = 0$, $C = 0$, and $D = 0$.¹⁶ Assuming $C = 0$.¹⁷ From the data of DAUBER 64, RITTENBERG 69, AGUILAR-BENITEZ 72B, JACOBS 73, and DANBURG 73.NODE=M002A0;LINKAGE=AB
NODE=M002A0;LINKAGE=AMNODE=M002A0;LINKAGE=BR
NODE=M002A0;LINKAGE=A
NODE=M002A0;LINKAGE=KA

$Im(\alpha)$ decay parameter

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$0.000 \pm 0.049 \pm 0.001$	44k	¹⁸ ABLIKIM	11 BES3	$J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$
$0.0 \pm 0.1 \pm 0.0$	7k	¹⁹ AMELIN	05A VES	$28 \pi^- A \rightarrow \eta \pi^+ \pi^- \pi^- A^*$
$-0.00 \pm 0.13 \pm 0.00$	5.4k	²⁰ ALDE	86 GAM2	$38 \pi^- p \rightarrow n \eta \pi^0 \pi^0$
0.0 ± 0.3		^{20,21} KALBFLEISCH	74 RVUE	$\eta' \rightarrow \eta \pi^+ \pi^-$

¹⁸ See ABLIKIM 11 for the full correlation matrix.

¹⁹ Superseded by DOROFEEV 07, which found this parameterization unacceptable. See below.

²⁰ Assuming $C = 0$.

²¹ From the data of DAUBER 64, RITTENBERG 69, AGUILAR-BENITEZ 72B, JACOBS 73, and DANBURG 73.

NODE=M002IA0
NODE=M002IA0

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. • • •				
$+0.018 \pm 0.009 \pm 0.003$	44k	²² ABLIKIM	11 BES3	$J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$
$0.020 \pm 0.018 \pm 0.004$	7k	²³ AMELIN	05A VES	$28 \pi^- A \rightarrow \eta \pi^+ \pi^- \pi^- A^*$

²² See ABLIKIM 11 for the full correlation matrix.

²³ Superseded by DOROFEEV 07, which found this parameterization unacceptable. See below.

NODE=M002C0
NODE=M002C0

NODE=M002C0;LINKAGE=AB
NODE=M002C0;LINKAGE=AM

D decay parameter

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$-0.059 \pm 0.012 \pm 0.004$	44k	²⁴ ABLIKIM	11 BES3	$J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$
$-0.066 \pm 0.030 \pm 0.015$	7k	²⁵ AMELIN	05A VES	$28 \pi^- A \rightarrow \eta \pi^+ \pi^- \pi^- A^*$
$0.00 \pm 0.03 \pm 0.00$	5.4k	²⁶ ALDE	86 GAM2	$38 \pi^- p \rightarrow n \eta \pi^0 \pi^0$
0		^{26,27} KALBFLEISCH	74 RVUE	$\eta' \rightarrow \eta \pi^+ \pi^-$

²⁴ See ABLIKIM 11 for the full correlation matrix.

²⁵ Superseded by DOROFEEV 07, which found this parameterization unacceptable. See below.

²⁶ Assuming $C = 0$.

²⁷ From the data of DAUBER 64, RITTENBERG 69, AGUILAR-BENITEZ 72B, JACOBS 73, and DANBURG 73.

NODE=M002D0
NODE=M002D0

NODE=M002D0;LINKAGE=AB
NODE=M002D0;LINKAGE=AM

NODE=M002D0;LINKAGE=AL
NODE=M002D0;LINKAGE=KA

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

$$|\text{MATRIX ELEMENT}|^2 \propto 1 + a Y + b Y^2 + c X + d X^2$$

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

NODE=M002227

a decay parameter

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$-0.047 \pm 0.011 \pm 0.003$	44k	²⁸ ABLIKIM	11 BES3	$J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$
$-0.066 \pm 0.016 \pm 0.003$	15k	²⁹ BLIK	09 GAM4	$32.5 \pi^- p \rightarrow \eta' n$
$-0.127 \pm 0.016 \pm 0.008$	20k	³⁰ DOROFEEV	07 VES	$27 \pi^- p \rightarrow \eta' n,$ $\pi^- A \rightarrow \eta' \pi^- A^*$

²⁸ See ABLIKIM 11 for the full correlation matrix.

²⁹ From $\eta' \rightarrow \eta \pi^0 \pi^0$ decay.

³⁰ From $\eta' \rightarrow \eta \pi^+ \pi^-$ decay.

NODE=M002DPA
NODE=M002DPA

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. • • •				
$-0.069 \pm 0.019 \pm 0.009$	44k	³¹ ABLIKIM	11 BES3	$J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$
$-0.063 \pm 0.028 \pm 0.004$	15k	³² BLIK	09 GAM4	$32.5 \pi^- p \rightarrow \eta' n$
$-0.106 \pm 0.028 \pm 0.014$	20k	³³ DOROFEEV	07 VES	$27 \pi^- p \rightarrow \eta' n,$ $\pi^- A \rightarrow \eta' \pi^- A^*$

³¹ See ABLIKIM 11 for the full correlation matrix.

³² From $\eta' \rightarrow \eta \pi^0 \pi^0$ decay.

³³ From $\eta' \rightarrow \eta \pi^+ \pi^-$ decay.

NODE=M002DPB
NODE=M002DPB

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. • • •				
$+0.019 \pm 0.011 \pm 0.003$	44k	³⁴ ABLIKIM	11 BES3	$J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$
$-0.107 \pm 0.096 \pm 0.003$	15k	³⁵ BLIK	09 GAM4	$32.5 \pi^- p \rightarrow \eta' n$
$0.015 \pm 0.011 \pm 0.014$	20k	³⁶ DOROFEEV	07 VES	$27 \pi^- p \rightarrow \eta' n,$ $\pi^- A \rightarrow \eta' \pi^- A^*$

³⁴ See ABLIKIM 11 for the full correlation matrix.

³⁵ From $\eta' \rightarrow \eta \pi^0 \pi^0$ decay.

³⁶ From $\eta' \rightarrow \eta \pi^+ \pi^-$ decay.

NODE=M002DPC
NODE=M002DPC

NODE=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. • • •				
$-0.073 \pm 0.012 \pm 0.003$	44k	³⁷ ABLIKIM	11 BES3	$J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$
$0.018 \pm 0.078 \pm 0.006$	15k	³⁸ BLIK	09 GAM4	$32.5 \pi^- p \rightarrow \eta' n$
$-0.082 \pm 0.017 \pm 0.008$	20k	³⁹ DOROFEEV	07 VES	$27 \pi^- p \rightarrow \eta' n,$ $\pi^- A \rightarrow \eta' \pi^- A^*$

³⁷ See ABLIKIM 11 for the full correlation matrix.

³⁸ From $\eta' \rightarrow \eta \pi^0 \pi^0$ decay. If $c \equiv 0$ from Bose-Einstein symmetry, $d = -0.067 \pm 0.020 \pm 0.003$.

³⁹ From $\eta' \rightarrow \eta \pi^+ \pi^-$ decay.

NODE=M002DPD
NODE=M002DPD

NODE=M002DPD;LINKAGE=AB
NODE=M002DPD;LINKAGE=BL

NODE=M002DPD;LINKAGE=DO

$\eta'(958) \beta$ 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
-0.46 ± 0.22 OUR AVERAGE	Error includes scale factor of 1.4.			
-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

 $\eta'(958)$ BRANCHING RATIOS

$\Gamma(\pi^+ \pi^- \eta)/\Gamma_{\text{total}}$	VALUE	EVTs	DOCUMENT ID	TECN	COMMENT	Γ_1/Γ
0.429 ± 0.007 OUR FIT	0.434 ± 0.007	OUR 2012 FIT]				

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

$0.424 \pm 0.011 \pm 0.004$ 1.2k ⁴⁰ PEDLAR 09 CLEO $J/\psi \rightarrow \gamma \eta'$

⁴⁰ Not independent of other η' branching fractions and ratios in PEDLAR 09.

NODE=M002230

NODE=M002R47
NODE=M002R47
NEW

NODE=M002R47;LINKAGE=PE

$\Gamma(\pi^+ \pi^- \eta(\text{charged decay}))/\Gamma_{\text{total}}$	VALUE	EVTs	DOCUMENT ID	TECN	COMMENT	$0.286\Gamma_1/\Gamma$
0.1228 ± 0.0020 OUR FIT	0.1240 ± 0.0020	OUR 2012 FIT]				

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

0.123 ± 0.014 107 RITTENBERG 69 HBC $1.7-2.7 K^- p$
 0.10 ± 0.04 10 LONDON 66 HBC $2.24 K^- p \rightarrow \Lambda 2\pi^+ 2\pi^- \pi^0$
 0.07 ± 0.04 7 BADIER 65B HBC $3 K^- p$

NODE=M002R3
NODE=M002R3
NEW

$\Gamma(\pi^+ \pi^- \eta(\text{neutral decay}))/\Gamma_{\text{total}}$	VALUE	EVTs	DOCUMENT ID	TECN	COMMENT	$0.714\Gamma_1/\Gamma$
0.307 ± 0.005 OUR FIT	0.310 ± 0.005	OUR 2012 FIT]				

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

0.314 ± 0.026 281 RITTENBERG 69 HBC $1.7-2.7 K^- p$

NODE=M002R1
NODE=M002R1
NEW

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

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

0.291±0.006 OUR FIT

[0.293 ± 0.006 OUR 2012 FIT]

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

0.287±0.007±0.004	0.2k	⁴¹ PEDLAR	09	CLEO	$J/\psi \rightarrow \gamma \eta'$
0.329±0.033	298	RITTENBERG	69	HBC	1.7–2.7 $K^- p$
0.2 ± 0.1	20	LONDON	66	HBC	2.24 $K^- p \rightarrow \Lambda \pi^+ \pi^- \gamma$
0.34 ± 0.09	35	BADIER	65B	HBC	3 $K^- p$

⁴¹ Not independent of other η' branching fractions and ratios in PEDLAR 09.

NODE=M002R6
 NODE=M002R6
 NEW

NODE=M002R6;LINKAGE=PE

 $\Gamma(\rho^0 \gamma (\text{including non-resonant } \pi^+ \pi^- \gamma))/\Gamma(\pi^+ \pi^- \eta)$ Γ_2/Γ_1

VALUE	DOCUMENT ID	TECN	COMMENT

0.677±0.017 OUR FIT

[0.676 ± 0.017 OUR 2012 FIT]

0.683±0.020 OUR AVERAGE

0.677±0.024±0.011	PEDLAR	09	CLE3	$J/\psi \rightarrow \eta' \gamma$
0.69 ± 0.03	ABLIKIM	06E	BES2	$J/\psi \rightarrow \eta' \gamma$

NODE=M002R43
 NODE=M002R43
 NEW

 $\Gamma(\rho^0 \gamma (\text{including non-resonant } \pi^+ \pi^- \gamma))/\Gamma(\pi^+ \pi^- \eta (\text{neutral decay}))$ $\Gamma_2/0.714\Gamma_1$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

0.949±0.024 OUR FIT

[0.947 ± 0.024 OUR 2012 FIT]

0.97 ± 0.09 OUR AVERAGE

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

NODE=M002R27
 NODE=M002R27
 NEW

 $\Gamma(\pi^0 \pi^0 \eta)/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

0.222±0.008 OUR FIT

[0.216 ± 0.008 OUR 2012 FIT]

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

0.235±0.013±0.004	3.2k	⁴² PEDLAR	09	CLEO	$J/\psi \rightarrow \gamma \eta'$

⁴² Not independent of other η' branching fractions and ratios in PEDLAR 09.

NODE=M002R48
 NODE=M002R48
 NEW

NODE=M002R48;LINKAGE=PE

 $\Gamma(\pi^0 \pi^0 \eta (3\pi^0 \text{ decay}))/\Gamma_{\text{total}}$ $0.321\Gamma_3/\Gamma$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

0.0712±0.0026 OUR FIT

[0.0694 ± 0.0026 OUR 2012 FIT]

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

0.11 ± 0.06	4	BENSINGER	70	DBC	2.2 $\pi^+ d$

NODE=M002R26
 NODE=M002R26
 NEW

 $\Gamma(\pi^0 \pi^0 \eta)/\Gamma(\pi^+ \pi^- \eta)$ Γ_3/Γ_1

VALUE	DOCUMENT ID	TECN	COMMENT

0.517±0.026 OUR FIT

[0.498 ± 0.025 OUR 2012 FIT]

0.555±0.043±0.013

PEDLAR	09	CLE3	$J/\psi \rightarrow \eta' \gamma$

NODE=M002R45
 NODE=M002R45
 NEW

 $\Gamma(\rho^0 \gamma (\text{including non-resonant } \pi^+ \pi^- \gamma))/\Gamma(\pi \pi \eta)$ $\Gamma_2/(\Gamma_1+\Gamma_3)$

VALUE	DOCUMENT ID	TECN	COMMENT

0.447±0.012 OUR FIT

[0.451 ± 0.012 OUR 2012 FIT]

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
 NEW

 $\Gamma(\omega \gamma)/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

0.0275±0.0023 OUR FIT

[0.0275 ± 0.0022 OUR 2012 FIT]

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

0.0234±0.0030±0.0004	70	⁴³ PEDLAR	09	CLEO	$J/\psi \rightarrow \gamma \eta'$

⁴³ Not independent of other η' branching fractions and ratios in PEDLAR 09.

NODE=M002R49
 NODE=M002R49
 NEW

NODE=M002R49;LINKAGE=PE

$\Gamma(\omega\gamma)/\Gamma(\pi^+\pi^-\eta)$ Γ_4/Γ_1

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.064±0.006 OUR FIT				
[0.063 ± 0.005 OUR 2012 FIT]				
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
 NEW

 $\Gamma(\omega\gamma)/\Gamma(\pi^0\pi^0\eta)$ Γ_4/Γ_3

VALUE	DOCUMENT ID	TECN	COMMENT
0.124±0.011 OUR FIT			
[0.127 ± 0.011 OUR 2012 FIT]			
0.147±0.016	ALDE	87B	GAM2 $38 \pi^- p \rightarrow n4\gamma$

NODE=M002R33
 NODE=M002R33
 NEW

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

$$\Gamma_2/(\Gamma_1+\Gamma_3+\Gamma_4)$$

VALUE	DOCUMENT ID	TECN	COMMENT
0.428±0.011 OUR FIT			
[0.433 ± 0.012 OUR 2012 FIT]			
• • • 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
 NEW

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

$$(0.286\Gamma_3+0.89\Gamma_4)/\Gamma$$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.0880±0.0031 OUR FIT				
[0.0863 ± 0.0032 OUR 2012 FIT]				
• • • 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
 NEW

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

$$(0.714\Gamma_1+0.286\Gamma_3+0.89\Gamma_4)/\Gamma$$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.395±0.004 OUR FIT				
[0.396 ± 0.004 OUR 2012 FIT]				
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.4 ± 0.1	39	LONDON	66	HBC $2.24 K^- p \rightarrow \Lambda \pi^+ \pi^- \text{ neutrals}$
0.35 ± 0.06	33	BADIER	65B	HBC $3 K^- p$

NODE=M002R2
 NODE=M002R2
 NEW

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

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
2.20±0.08 OUR FIT				
[(2.18 ± 0.08) × 10^{-2} OUR 2012 FIT]				
2.00±0.15 OUR AVERAGE				
$1.98^{+0.31}_{-0.27} \pm 0.07$	114	44 WICHT	08	BELL $B^\pm \rightarrow K^\pm \gamma\gamma$
2.00 ± 0.18		45 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. • • •				
$2.25 \pm 0.16 \pm 0.03$	0.3k	46 PEDLAR	09	CLEO $J/\psi \rightarrow \gamma\eta'$
1.8 ± 0.2	6000	47 APEL	79	NICE $15-40 \pi^- p \rightarrow n2\gamma$
2.5 ± 0.7		DUANE	74	MMS $\pi^- p \rightarrow nMM$
1.71 ± 0.33	68	DALPIAZ	72	CNTR $1.6 \pi^- p \rightarrow nX^0$
$2.0^{+0.8}_{-0.6}$	31	HARVEY	71	OSPK $3.65 \pi^- p \rightarrow nX^0$

NODE=M002R19
 NODE=M002R19
 NEW

⁴⁴WICHT 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 $B(B^+ \rightarrow \eta' K^+) = (7.06 \pm 0.25) \times 10^{-5}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

⁴⁵Includes APEL 79 result.

⁴⁶Not independent of other η' branching fractions and ratios in PEDLAR 09.

⁴⁷Data is included in STANTON 80 evaluation.

NODE=M002R19;LINKAGE=W

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

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

VALUE	DOCUMENT ID	TECN	COMMENT
0.0513±0.0022 OUR FIT			
[0.0503 ± 0.0022 OUR 2012 FIT]			
0.053 ± 0.004 ± 0.001	PEDLAR	09	CLE3 $J/\psi \rightarrow \eta'\gamma$

NODE=M002R46
 NODE=M002R46
 NEW

$\Gamma(\gamma\gamma)/\Gamma(\rho^0\gamma(\text{including non-resonant } \pi^+\pi^-\gamma))$ Γ_5/Γ_2

VALUE	DOCUMENT ID	TECN	COMMENT
0.0757±0.0033 OUR FIT [0.0744 ± 0.0033 OUR 2012 FIT]			
0.080 ±0.008	ABLIKIM	06E	BES2 $J/\psi \rightarrow \eta'\gamma$

NODE=M002R42
 NODE=M002R42
 NEW

 $\Gamma(\gamma\gamma)/\Gamma(\pi^0\pi^0\eta)$ Γ_5/Γ_3

VALUE	DOCUMENT ID	TECN	COMMENT
0.099±0.004 OUR FIT [0.101 ± 0.004 OUR 2012 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 $\pi^-\bar{p} \rightarrow n2\gamma$

NODE=M002R38
 NODE=M002R38
 NEW

 $\Gamma(\gamma\gamma)/\Gamma(\pi^0\pi^0\eta(\text{neutral decay}))$ $\Gamma_5/0.714\Gamma_3$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.139±0.006 OUR FIT [0.141 ± 0.006 OUR 2012 FIT]				
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.188±0.058	16	APEL	72	OSPK 3.8 $\pi^-\bar{p} \rightarrow n\chi^0$

NODE=M002R28
 NODE=M002R28
 NEW

 $\Gamma(\text{neutrals})/\Gamma_{\text{total}}$ $(0.714\Gamma_3+0.09\Gamma_4+\Gamma_5)/\Gamma$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.183±0.006 OUR FIT [0.179 ± 0.006 OUR 2012 FIT]				
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.185±0.022	535	BASILE	71	CNTR 1.6 $\pi^-\bar{p} \rightarrow n\chi^0$
0.189±0.026	123	RITTENBERG	69	HBC 1.7–2.7 $K^-\bar{p}$

NODE=M002R5
 NODE=M002R5
 NEW

 $\Gamma(3\pi^0)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
2.14±0.20 OUR FIT				
3.56±0.22±0.34	309	ABLIKIM	12E	BES3 $J/\psi \rightarrow \gamma(3\pi^0)$

NODE=M002R55
 NODE=M002R55

 $\Gamma(3\pi^0)/\Gamma(\pi^0\pi^0\eta)$ Γ_6/Γ_3

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
96±9 OUR FIT [(78 ± 10) × 10^{-4} OUR 2012 FIT]				
78±10 OUR AVERAGE				
86±19	235	BLIK	08	GAMS 32 $\pi^-\bar{p} \rightarrow \eta'n$
74±15		ALDE	87B	GAM2 38 $\pi^-\bar{p} \rightarrow n6\gamma$
75±18		BINON	84	GAM2 30–40 $\pi^-\bar{p} \rightarrow n6\gamma$

NODE=M002R32
 NODE=M002R32
 NEW

 $\Gamma(\mu^+\mu^-\gamma)/\Gamma(\gamma\gamma)$ Γ_7/Γ_5

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
4.9±1.2	33	VIKTOROV	80	CNTR 25,33 $\pi^-\bar{p} \rightarrow 2\mu\gamma$

NODE=M002R29
 NODE=M002R29

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

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<2.4	90	48 NAIK	09	CLEO $J/\psi \rightarrow \gamma\eta'$
48 Not independent of measured value of Γ_8/Γ_1 from NAIK 09.				

NODE=M002R50
 NODE=M002R50

NODE=M002R50;LINKAGE=NA

 $\Gamma(\pi^+\pi^-\mu^+\mu^-)/\Gamma(\pi^+\pi^-\eta)$ Γ_8/Γ_1

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<0.5	90	49 NAIK	09	CLEO $J/\psi \rightarrow \gamma\eta'$
49 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

 $\Gamma(\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
3.8 ±0.4 OUR FIT [(0.36 ^{+0.11} _{-0.09}) × 10^{-2} OUR 2012 FIT]				
3.8 ±0.4 OUR AVERAGE				
3.83±0.15±0.39	1014	ABLIKIM	12E	BES3 $J/\psi \rightarrow \gamma(\pi^+\pi^-\pi^0)$
3.7 ^{+1.1} _{-0.9} ±0.4	50	NAIK	09	CLEO $J/\psi \rightarrow \gamma\eta'$

NODE=M002R21
 NODE=M002R21
 NEW

50 Not independent of measured value of Γ_9/Γ_1 from NAIK 09.

NODE=M002R21;LINKAGE=NA

$\Gamma(\pi^+\pi^-\pi^0)/\Gamma(\pi^+\pi^-\eta)$ Γ_9/Γ_1 VALUE (units 10^{-3}) CL% DOCUMENT ID TECN COMMENT**8.8 ± 0.9 OUR FIT**[(8.3 $^{+2.5}_{-2.1}$) × 10⁻³ OUR 2012 FIT]**8.28 $^{+2.49}_{-2.12}$ ± 0.04**

20

51 NAIK

09

CLEO

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

⁵¹ NAIK 09 reports [$\Gamma(\eta'(958) \rightarrow \pi^+\pi^-\pi^0)/\Gamma(\eta'(958) \rightarrow \pi^+\pi^-\eta)] / [B(\eta \rightarrow 2\gamma)] = (21^{+6}_{-5} \pm 2) \times 10^{-3}$ which we multiply by our best value $B(\eta \rightarrow 2\gamma) = (39.41 \pm 0.20) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M002R01

NODE=M002R01

NEW

NODE=M002R01;LINKAGE=NA

 $\Gamma(\pi^0\rho^0)/\Gamma_{\text{total}}$ Γ_{10}/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_{11}/Γ VALUE (units 10^{-4}) CL% DOCUMENT ID TECN COMMENT

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

< 2.4

90

52 NAIK

09

CLEO

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

<100

90

RITTENBERG

69

HBC

1.7–2.7 K^-p

⁵² Not independent of measured value of Γ_{11}/Γ_1 from NAIK 09.

NODE=M002R24

NODE=M002R24

NODE=M002R24;LINKAGE=NA

 $\Gamma(2(\pi^+\pi^-))/\Gamma(\pi^+\pi^-\eta)$ Γ_{11}/Γ_1 VALUE (units 10^{-3}) CL% DOCUMENT ID TECN COMMENT**<0.6**

90

53 NAIK

09

CLEO

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

⁵³ 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

NODE=M002R04

NODE=M002R04;LINKAGE=NA

 $\Gamma(\pi^+\pi^-2\pi^0)/\Gamma_{\text{total}}$ Γ_{12}/Γ VALUE (units 10^{-4}) CL% DOCUMENT ID TECN COMMENT

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

<27

90

54 NAIK

09

CLEO

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

⁵⁴ Not independent of measured value of Γ_{12}/Γ_1 from NAIK 09.

NODE=M002R51

NODE=M002R51

NODE=M002R51;LINKAGE=NA

 $\Gamma(\pi^+\pi^-2\pi^0)/\Gamma(\pi^+\pi^-\eta)$ Γ_{12}/Γ_1 VALUE (units 10^{-3}) CL% DOCUMENT ID TECN COMMENT**<6**

90

55 NAIK

09

CLEO

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

⁵⁵ 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

NODE=M002R05

NODE=M002R05;LINKAGE=NA

 $\Gamma(2(\pi^+\pi^-)\text{ neutrals})/\Gamma_{\text{total}}$ Γ_{13}/Γ

VALUE CL% DOCUMENT ID TECN COMMENT

<0.01

95

DANBURG

73

HBC

2.2 $K^-p \rightarrow \Lambda X^0$

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

<0.01

90

RITTENBERG

69

HBC

1.7–2.7 K^-p

NODE=M002R22

NODE=M002R22

 $\Gamma(2(\pi^+\pi^-)\pi^0)/\Gamma_{\text{total}}$ Γ_{14}/Γ

VALUE CL% DOCUMENT ID TECN COMMENT

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

<0.002

90

56 NAIK

09

CLEO

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

<0.01

90

RITTENBERG

69

HBC

1.7–2.7 K^-p

⁵⁶ Not independent of measured value of Γ_{14}/Γ_1 from NAIK 09.

NODE=M002R23

NODE=M002R23

NODE=M002R23;LINKAGE=NA

 $\Gamma(2(\pi^+\pi^-)\pi^0)/\Gamma(\pi^+\pi^-\eta)$ Γ_{14}/Γ_1 VALUE (units 10^{-3}) CL% DOCUMENT ID TECN COMMENT**<4**

90

57 NAIK

09

CLEO

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

⁵⁷ 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

NODE=M002R06

NODE=M002R06;LINKAGE=NA

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

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

NODE=M002R16
 NODE=M002R16

 $\Gamma(3(\pi^+\pi^-))/\Gamma_{\text{total}}$ Γ_{16}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<0.53	90	⁵⁸ NAIK	09	CLEO $J/\psi \rightarrow \gamma\eta'$
<5	95	KALBFLEISCH 64B	HBC	$K^- p \rightarrow \Lambda 2(\pi^+\pi^-)$
⁵⁸ Not independent of measured value of Γ_{16}/Γ_1 from NAIK 09.				

NODE=M002R07
 NODE=M002R07

NODE=M002R07;LINKAGE=NA

 $\Gamma(3(\pi^+\pi^-))/\Gamma(\pi^+\pi^-\eta)$ Γ_{16}/Γ_1

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<1.2	90	⁵⁹ NAIK	09	CLEO $J/\psi \rightarrow \gamma\eta'$
⁵⁹ 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

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

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
$2.4^{+1.3}_{-1.0}$ OUR FIT				
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$2.5^{+1.2}_{-0.9} \pm 0.5$		⁶⁰ NAIK	09	CLEO $J/\psi \rightarrow \gamma\eta'$
<6	90	RITTENBERG 65	HBC	$2.7 K^- p$
⁶⁰ Not independent of measured value of Γ_{17}/Γ_1 from NAIK 09.				

NODE=M002R12
 NODE=M002R12

NODE=M002R12;LINKAGE=NA

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

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$5.6^{+3.0}_{-2.2}$ OUR FIT				
$5.52^{+3.00}_{-2.30} \pm 0.03$	8	⁶¹ NAIK	09	CLEO $J/\psi \rightarrow \gamma\eta'$
⁶¹ NAIK 09 reports $[\Gamma(\eta'(958) \rightarrow \pi^+\pi^-e^+e^-)/\Gamma(\eta'(958) \rightarrow \pi^+\pi^-\eta)] / [B(\eta \rightarrow 2\gamma)] = (14^{+7}_{-5} \pm 3) \times 10^{-3}$ which we multiply by our best value $B(\eta \rightarrow 2\gamma) = (39.41 \pm 0.20) \times 10^{-2}$. 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

 $\Gamma(\pi^+e^-\nu_e + \text{c.c.})/\Gamma(\pi^+\pi^-\eta)$ Γ_{18}/Γ_1

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

NODE=M002R54
 NODE=M002R54

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

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

NODE=M002R40
 NODE=M002R40

 $\Gamma(\pi^0\gamma\gamma)/\Gamma(\pi^0\pi^0\eta)$ Γ_{20}/Γ_3

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

NODE=M002R35
 NODE=M002R35

 $\Gamma(4\pi^0)/\Gamma(\pi^0\pi^0\eta)$ Γ_{21}/Γ_3

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<23	90	ALDE	87B	GAM2 $38 \pi^- p \rightarrow n 8\gamma$

NODE=M002R37
 NODE=M002R37

 $\Gamma(e^+e^-)/\Gamma_{\text{total}}$ Γ_{22}/Γ

VALUE (units 10^{-7})	CL%	DOCUMENT ID	TECN	COMMENT
<2.1	90	VOROBYEV	88	ND $e^+e^- \rightarrow \pi^+\pi^-\eta$

NODE=M002R39
 NODE=M002R39

$\Gamma(\text{invisible})/\Gamma_{\text{total}}$ Γ_{23}/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	⁶² NAIK	09	CLEO $J/\psi \rightarrow \gamma \eta'$

⁶² Not independent of measured value of Γ_{23}/Γ_1 from NAIK 09.

NODE=M002R52
NODE=M002R52

NODE=M002R52;LINKAGE=NA

 $\Gamma(\text{invisible})/\Gamma(\gamma\gamma)$ Γ_{23}/Γ_5

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

<2.4 (CL = 90%) [$<6.69 \times 10^{-2}$ (CL = 90%) OUR 2008 BEST LIMIT]

<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_{23}/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	⁶³ NAIK	09	CLEO $J/\psi \rightarrow \gamma \eta'$

⁶³ NAIK 09 reports $[\Gamma(\eta'(958) \rightarrow \text{invisible})/\Gamma(\eta'(958) \rightarrow \pi^+\pi^-\eta)] / [B(\eta \rightarrow 2\gamma)]$
< 5.4×10^{-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_{24}/Γ

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

< 0.6	90	⁶⁴ ABLIKIM	11G	BES3 $J/\psi \rightarrow \gamma \pi^+\pi^-$

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

< 29	90	⁶⁵ MORI	07A	BELL $\gamma\gamma \rightarrow \pi^+\pi^-$

< 3.3	90	⁶⁶ 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 $1.7-2.7 K^- p$

⁶⁴ 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 $B(J/\psi(1S) \rightarrow \gamma \eta'(958)) = 5.15 \times 10^{-3}$.

⁶⁵ Taking into account interference with the $\gamma\gamma \rightarrow \pi^+\pi^-$ continuum.

⁶⁶ Without interference with the $\gamma\gamma \rightarrow \pi^+\pi^-$ continuum.

NODE=M002R20
NODE=M002R20

OCCUR=2

NODE=M002R20;LINKAGE=AL

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

 $\Gamma(\pi^0\pi^0)/\Gamma_{\text{total}}$ Γ_{25}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<4 $\times 10^{-4}$	90	⁶⁷ ABLIKIM	11G	BES3 $J/\psi \rightarrow \gamma \pi^0 \pi^0$

⁶⁷ 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 $B(J/\psi(1S) \rightarrow \gamma \eta'(958)) = 5.15 \times 10^{-3}$.

NODE=M002R53
NODE=M002R53

NODE=M002R53;LINKAGE=AL

 $\Gamma(\pi^0\pi^0)/\Gamma(\pi^0\pi^0\eta)$ Γ_{25}/Γ_3

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_{26}/Γ

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

< 1.4	90	BRIERE	00	CLEO $10.6 e^+ e^-$

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

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

NODE=M002R8
NODE=M002R8

 $\Gamma(\eta e^+ e^-)/\Gamma_{\text{total}}$ Γ_{27}/Γ

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

< 2.4	90	BRIERE	00	CLEO $10.6 e^+ e^-$

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

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

NODE=M002R9
NODE=M002R9

 $\Gamma(3\gamma)/\Gamma(\pi^0\pi^0\eta)$ Γ_{28}/Γ_3

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_{29}/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

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

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

NODE=M002R30
 NODE=M002R30

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

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT	Γ_{31}/Γ
<4.7	90	BRIERE 00	CLEO	$10.6 e^+ e^-$	

NODE=M002R41
 NODE=M002R41

 $\eta'(958)$ 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	EVT%	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

 $\eta'(958)$ REFERENCES

NODE=M002

ABLIKIM	13	PR D87 012009	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=54829
ABLIKIM	13G	PR D87 032006	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=54952
ABLIKIM	12E	PRL 108 182001	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=54270
ABLIKIM	11	PR D83 012003	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=53646
ABLIKIM	11G	PR D84 032006	M. Ablikim <i>et al.</i>	(BES III 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	PR D50 1173	L. Montanet <i>et al.</i>	(CERN, LBL, BOST+)	REFID=43653
AMSLER	93	ZPHY C58 175	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=43311
BELADIDZE	92C	SJNP 55 1535	G.M. Beladidze, S.I. Bitukov, G.V. Borisov	(SERP+)	REFID=43175
Translated from YAF 55 2748.					
KARCH	92	ZPHY C54 33	K. Karch <i>et al.</i>	(Crystal Ball Collab.)	REFID=42170
ARMSTRONG	91B	ZPHY C52 389	T.A. Armstrong <i>et al.</i>	(ATHU, BARI, BIRM+)	REFID=41862
BEHREND	91	ZPHY C49 401	H.J. Behrend <i>et al.</i>	(CELLO Collab.)	REFID=41497
AUGUSTIN	90	PR D42 10	J.E. Augustin <i>et al.</i>	(DM2 Collab.)	REFID=41352
BARU	90	ZPHY C48 581	S.E. Baru <i>et al.</i>	(MD-1 Collab.)	REFID=41366
BUTLER	90	PR D42 1368	F. Butler <i>et al.</i>	(Mark II Collab.)	REFID=41363
KARCH	90	PL B249 353	K. Karch <i>et al.</i>	(Crystal Ball Collab.)	REFID=41377
ROE	90	PR D41 17	N.A. Roe <i>et al.</i>	(ASP Collab.)	REFID=41014
AIHARA	88C	PR D38 1	H. Aihara <i>et al.</i>	(TPC-2 γ Collab.)	REFID=40564
VOROBYEV	88	SJNP 48 273	P.V. Vorobiev <i>et al.</i>	(NOVO)	REFID=41023
Translated from YAF 48 436.					
WILLIAMS	88	PR D38 1365	D.A. Williams <i>et al.</i>	(Crystal Ball Collab.)	REFID=40567
AIHARA	87	PR D35 2650	H. Aihara <i>et al.</i>	(TPC-2 γ Collab.) JP	REFID=40009
ALBRECHT	87B	PL B199 457	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=40265
ALDE	87B	ZPHY C36 603	D.M. Alde <i>et al.</i>	(LANL, BELG, SERP, LAPP)	REFID=40236
ANTREASYAN	87	PR D36 2633	D. Antreasyan <i>et al.</i>	(Crystal Ball Collab.)	REFID=40008
GIDAL	87	PRL 59 2012	G. Gidal <i>et al.</i>	(LBL, SLAC, HARV)	REFID=40223
ALDE	86	PL B177 115	D.M. Alde <i>et al.</i>	(SERP, BELG, LANL, LAPP)	REFID=20310
BARTEL	85E	PL 160B 421	W. Bartel <i>et al.</i>	(JADE Collab.)	REFID=10843
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
BEHREND	83B	PL 125B 518 (erratum)	H.J. Behrend <i>et al.</i>	(CELLO Collab.)	REFID=20302
Also		PL 114B 378	H.J. Behrend <i>et al.</i>	(CELLO Collab.)	REFID=20303
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
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+)
BINNIE	79	PL 83B 141	D.M. Binnie <i>et al.</i> (LOIC)
ZANFINO	77	PRL 38 930	C. Zanfino <i>et al.</i> (CARL, MCGI, OHIO+)
GRIGORIAN	75	NP B91 232	A. Grigorian <i>et al.</i> (+)
KALBFLEISCH	75	PR D11 987	G.R. Kalbfleisch, R.C. Strand, J.W. Chapman (BNL+)
DUANE	74	PRL 32 425	A. Duane <i>et al.</i> (LOIC, SHMP)
KALBFLEISCH	74	PR D10 916	G.R. Kalbfleisch (BNL)
DANBURG	73	PR D8 3744	J.S. Danburg <i>et al.</i> (BNL, MICH) JP
JACOBS	73	PR D8 18	S.M. Jacobs <i>et al.</i> (BRAN, UMD, SYRA+) JP
AGUILAR-...	72B	PR D6 29	M. Aguilar-Benitez <i>et al.</i> (BNL)
APEL	72	PL 40B 680	W.D. Apel <i>et al.</i> (KARLK, KARLE, PISA)
DALPIAZ	72	PL 42B 377	P.F. Dalpiaz <i>et al.</i> (CERN)
BASILE	71	NC 3A 371	M. Basile <i>et al.</i> (CERN, BGNA, STRB)
HARVEY	71	PRL 27 885	E.H. Harvey <i>et al.</i> (MINN, MICH)
BENSINGER	70	PL 33B 505	J.R. Bensinger <i>et al.</i> (WISC)
RITTENBERG	69	Thesis UCRL 18863	A. Rittenberg (LRL) I
DAVIS	68	PL 27B 532	R. Davis <i>et al.</i> (NWES, ANL)
LONDON	66	PR 143 1034	G.W. London <i>et al.</i> (BNL, SYRA) IJP
BADIER	65B	PL 17 337	J. Badier <i>et al.</i> (EPOL, SACL, AMST)
RITTENBERG	65	PRL 15 556	A. Rittenberg, G.R. Kalbfleisch (LRL, BNL)
DAUBER	64	PRL 13 449	P.M. Dauber <i>et al.</i> (UCLA) JP
KALBFLEISCH	64B	PRL 13 349	G.R. Kalbfleisch, O.I. Dahl, A. Rittenberg (LRL) JP

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REFID=20252

NODE=M003

$f_0(980)$

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

See also the minireview on scalar mesons under $f_0(500)$. (See the index for the page number.)

NODE=M003

$f_0(980)$ MASS

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
990 ± 20 OUR ESTIMATE				
• • • We do not use the following data for averages, fits, limits, etc. • • •				
989.9 ± 0.4	706	ABLIKIM	12E BES3	$J/\psi \rightarrow \gamma 3\pi$
1003 $^{+5}_{-27}$		1,2 GARCIA-MAR..11	RVUE	Compilation
996 ± 7		1,3 GARCIA-MAR..11	RVUE	Compilation
996 $^{+4}_{-14}$		4 MOUSSALLAM11	RVUE	Compilation
981 ± 43		5 MENNESSIER 10	RVUE	Compilation
1030 $^{+30}_{-10}$		6 ANISOVICH 09	RVUE	0.0 $\bar{p}p, \pi N$
977 $^{+11}_{-9} \pm 1$	44	7 ECKLUND 09	CLEO	4.17 $e^+e^- \rightarrow D_s^- D_s^{*+} + \text{c.c.}$
982.2 ± 1.0 $^{+8.1}_{-8.0}$		8 UEHARA 08A	BELL	10.6 $e^+e^- \rightarrow e^+e^-\pi^0\pi^0$
976.8 ± 0.3 $^{+10.1}_{-0.6}$	64k	9 AMBROSINO 07	KLOE	1.02 $e^+e^- \rightarrow \pi^0\pi^0\gamma$
984.7 ± 0.4 $^{+2.4}_{-3.7}$	64k	10 AMBROSINO 07	KLOE	1.02 $e^+e^- \rightarrow \pi^0\pi^0\gamma$
973 ± 3	262 ± 30	11 AUBERT 07AKBABR		10.6 $e^+e^- \rightarrow \phi\pi^+\pi^-\gamma$
970 ± 7	54 ± 9	11 AUBERT 07AKBABR		10.6 $e^+e^- \rightarrow \phi\pi^0\pi^0\gamma$
953 ± 20	2.6k	12 BONVICINI 07	CLEO	$D^+ \rightarrow \pi^-\pi^+\pi^+$
985.6 $^{+1.2}_{-1.5} \pm 1.1$		13 MORI 07	BELL	10.6 $e^+e^- \rightarrow e^+e^-\pi^+\pi^-$
983.0 ± 0.6 $^{+4.0}_{-3.0}$		14 AMBROSINO 06B	KLOE	1.02 $e^+e^- \rightarrow \pi^+\pi^-\gamma$
977.3 ± 0.9 $^{+3.7}_{-4.3}$		15 AMBROSINO 06B	KLOE	1.02 $e^+e^- \rightarrow \pi^+\pi^-\gamma$
950 ± 9	4286	16 GARMASH 06	BELL	$B^+ \rightarrow K^+\pi^+\pi^-$
965 ± 10		17 ABLIKIM 05	BES2	$J/\psi \rightarrow \phi\pi^+\pi^-, \phi K^+K^-$
1031 ± 8		18 ANISOVICH 03	RVUE	
1037 ± 31		TIKHOMIROV 03	SPEC	40.0 $\pi^-\bar{C} \rightarrow K_S^0 K_S^0 K_L^0 X$
973 ± 1	2438	19 ALOISIO 02D	KLOE	$e^+e^- \rightarrow \pi^0\pi^0\gamma$
977 ± 3 ± 2	848	20 AITALA 01A	E791	$D_s^+ \rightarrow \pi^-\pi^+\pi^+$
969.8 ± 4.5	419	21 ACHASOV 00H	SND	$e^+e^- \rightarrow \pi^0\pi^0\gamma$
985 $^{+16}_{-12}$	419	22,23 ACHASOV 00H	SND	$e^+e^- \rightarrow \pi^0\pi^0\gamma$
976 ± 5 ± 6		24 AKHMETSHIN 99B	CMD2	$e^+e^- \rightarrow \pi^+\pi^-\gamma$
977 ± 3 ± 6	268	24 AKHMETSHIN 99C	CMD2	$e^+e^- \rightarrow \pi^0\pi^0\gamma$

NODE=M003M1

NODE=M003M1

→ UNCHECKED ←

OCCUR=2

OCCUR=2

OCCUR=2

OCCUR=2

OCCUR=2

975 ± 4 ± 6		25 AKHMETSHIN 99C	CMD2	$e^+e^- \rightarrow \pi^0\pi^0\gamma$	OCCUR=2
975 ± 4 ± 6		26 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 ± 6 ± 6		27 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		28 KAMINSKI	99 RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}, \sigma\sigma$	
~ 980		28 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		28 OLLER	99C RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}, \eta\eta$	
957 ± 6		29 ACKERSTAFF	98Q OPAL	$Z \rightarrow f_0 X$	
960 ± 10		ALDE	98 GAM4		
1015 ± 15		28 ANISOVICH	98B RVUE	Compilation	
1008		30 LOCHER	98 RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$	
955 ± 10		29 ALDE	97 GAM2	450 $pp \rightarrow pp \pi^0 \pi^0$	
994 ± 9		31 BERTIN	97C OBLX	0.0 $\bar{p}p \rightarrow \pi^+ \pi^- \pi^0$	
993.2 ± 6.5 ± 6.9		32 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	33 ALDE	95B GAM2	38 $\pi^- p \rightarrow \pi^0 \pi^0 n$	
960 ± 10	10k	34 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		35 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		36 ANISOVICH	95 RVUE		
1015		JANSEN	95 RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$	
983		37 BUGG	94 RVUE	$\bar{p}p \rightarrow \eta 2\pi^0$	
973 ± 2		38 KAMINSKI	94 RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$	
988		39 ZOU	94B RVUE		
988 ± 10		40 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		29 AGUILAR-...	91 EHS	400 pp	
979 ± 4		41 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		29 AUGUSTIN	89 DM2	$J/\psi \rightarrow \omega\pi^+ \pi^-$	
978 ± 9		29 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		41 GIDAL	81 MRK2	$J/\psi \rightarrow \pi^+ \pi^- X$	
975		42 ACHASOV	80 RVUE		
986 ± 10		41 AGUILAR-...	78 HBC	0.7 $\bar{p}p \rightarrow K_S^0 K_S^0$	
969 ± 5		41 LEEPER	77 ASPK	2-2.4 $\pi^- p \rightarrow$ $\pi^+ \pi^- n, K^+ K^- n$	
987 ± 7		41 BINNIE	73 CNTR	$\pi^- p \rightarrow nMM$	
1012 ± 6		43 GRAYER	73 ASPK	17 $\pi^- p \rightarrow \pi^+ \pi^- n$	
1007 ± 20		43 HYAMS	73 ASPK	17 $\pi^- p \rightarrow \pi^+ \pi^- n$	
997 ± 6		43 PROTOPOP...	73 HBC	7 $\pi^+ p \rightarrow \pi^+ p \pi^+ \pi^-$	

¹ Quoted number refers to real part of pole position.

² Analytic continuation using Roy equations. Uses the K_{e4} data of BATLEY 10C and the $\pi N \rightarrow \pi\pi N$ data of HYAMS 73, GRAYER 74, and PROTOPODESCU 73.

³ Analytic continuation using GKPY equations. Uses the K_{e4} data of BATLEY 10C and the $\pi N \rightarrow \pi\pi N$ data of HYAMS 73, GRAYER 74, and PROTOPODESCU 73.

⁴ Pole position. Used Roy equations.

⁵ 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.

⁶ On sheet II in a 2-pole solution. The other pole is found on sheet III at (850–100i) MeV

⁷ Using a relativistic Breit-Wigner function and taking into account the finite D_s mass.

⁸ Breit-Wigner mass. Using finite width corrections according to FLATTE 76 and ACHASOV 05, and the ratio $g_{f_0 K K}/g_{f_0 \pi\pi} = 0$.

⁹ In the kaon-loop fit.

¹⁰ In the no-structure fit.

¹¹ Systematic errors not estimated.

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- 12 FLATTE 76 parameterization. $g_{f_0\pi\pi} = 329 \pm 96 \text{ MeV}/c^2$ assuming $g_{f_0K\bar{K}}/g_{f_0\pi\pi}=2$.
- 13 Breit-Wigner mass. Using finite width corrections according to FLATTE 76 and ACHASOV 05, and the ratio $g_{f_0KK}/g_{f_0\pi\pi} = 4.21 \pm 0.25 \pm 0.21$ from ABLIKIM 05.
- 14 In the kaon-loop fit following formalism of ACHASOV 89.
- 15 In the no-structure fit assuming a direct coupling of ϕ to $f_0\gamma$.
- 16 FLATTE 76 parameterization. Supersedes GARMASH 05.
- 17 FLATTE 76 parameterization, $g_{f_0K\bar{K}}/g_{f_0\pi\pi} = 4.21 \pm 0.25 \pm 0.21$.
- 18 K-matrix pole from combined analysis of $\pi^-p \rightarrow \pi^0\pi^0n$, $\pi^-p \rightarrow K\bar{K}n$, $\pi^+\pi^- \rightarrow \pi^+\pi^-$, $\bar{p}p \rightarrow \pi^0\pi^0\pi^0$, $\pi^0\eta\eta$, $\pi^0\pi^0\eta$, $\pi^+\pi^-\pi^0$, $K^+K^-\pi^0$, $K_S^0K_S^0\pi^0$, $K^+K_S^0\pi^-$ at rest, $\bar{p}n \rightarrow \pi^-\pi^-\pi^+$, $K_S^0K^-\pi^0$, $K_S^0K_S^0\pi^-$ at rest.
- 19 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.
- 20 Coupled-channel Breit-Wigner, couplings $g_\pi=0.09 \pm 0.01 \pm 0.01$, $g_K=0.02 \pm 0.04 \pm 0.03$.
- 21 Supersedes ACHASOV 98i. Using the model of ACHASOV 89.
- 22 Supersedes ACHASOV 98i.
- 23 In the "narrow resonance" approximation.
- 24 Assuming $\Gamma(f_0)=40 \text{ MeV}$.
- 25 From a narrow pole fit taking into account $f_0(980)$ and $f_0(1200)$ intermediate mechanisms.
- 26 From the combined fit of the photon spectra in the reactions $e^+e^- \rightarrow \pi^+\pi^-\gamma$, $\pi^0\pi^0\gamma$.
- 27 Supersedes BARBERIS 99 and BARBERIS 99B
- 28 T-matrix pole.
- 29 From invariant mass fit.
- 30 On sheet II in a 2 pole solution. The other pole is found on sheet III at $(1039-93i) \text{ MeV}$.
- 31 On sheet II in a 2 pole solution. The other pole is found on sheet III at $(963-29i) \text{ MeV}$.
- 32 Reanalysis of data from HYAMS 73, GRAYER 74, SRINIVASAN 75, and ROSSELET 77 using the interfering amplitude method.
- 33 At high $|t|$.
- 34 At low $|t|$.
- 35 On sheet II in a 4-pole solution, the other poles are found on sheet III at $(953-55i) \text{ MeV}$ and on sheet IV at $(938-35i) \text{ MeV}$.
- 36 Combined fit of ALDE 95B, ANISOVICH 94, AMSLER 94D.
- 37 On sheet II in a 2 pole solution. The other pole is found on sheet III at $(996-103i) \text{ MeV}$.
- 38 From sheet II pole position.
- 39 On sheet II in a 2 pole solution. The other pole is found on sheet III at $(797-185i) \text{ MeV}$ and can be interpreted as a shadow pole.
- 40 On sheet II in a 2 pole solution. The other pole is found on sheet III at $(978-28i) \text{ MeV}$.
- 41 From coupled channel analysis.
- 42 Coupled channel analysis with finite width corrections.
- 43 Included in AGUILAR-BENITEZ 78 fit.

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$f_0(980)$ WIDTH

Width determination very model dependent. Peak width in $\pi\pi$ is about 50 MeV, but decay width can be much larger.

NODE=M003W1

NODE=M003W1

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
40 to 100 OUR ESTIMATE				
9.5 ± 1.1	706	ABLIKIM	12E BES3	$J/\psi \rightarrow \gamma 3\pi$
42 +20 -16		1,2 GARCIA-MAR..11	RVUE	Compilation
50 +20 -12		2,3 GARCIA-MAR..11	RVUE	Compilation
48 +22 -6		4 MOUSSALLAM11	RVUE	Compilation
36 ± 22		5 MENNESSIER 10	RVUE	Compilation
70 +20 -32		6 ANISOVICH 09	RVUE	0.0 $\bar{p}p$, πN
91 +30 -22 ± 3	44	7 ECKLUND 09	CLEO	4.17 $e^+e^- \rightarrow D_s^- D_s^{*+} + \text{c.c.}$
66.9 ± 2.2 +17.6 -12.5		8 UEHARA 08A	BELL	10.6 $e^+e^- \rightarrow e^+e^-\pi^0\pi^0$
65 ± 13	262 ± 30	9 AUBERT 07AK	BABR	10.6 $e^+e^- \rightarrow \phi\pi^+\pi^-\gamma$

NODE=M003W1
→ UNCHECKED ←

OCCUR=2

81 ± 21	54 ± 9	9	AUBERT	07AK	BABR	$10.6 e^+ e^- \rightarrow \phi \pi^0 \pi^0 \gamma$	OCCUR=2
$51.3^{+20.8+13.2}_{-17.7-3.8}$		10	MORI	07	BELL	$10.6 e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^-$	
61 ± 9 $^{+14}_{-8}$	2584	11	GARMASH	05	BELL	$B^+ \rightarrow K^+ \pi^+ \pi^-$	
64 ± 16		12	ANISOVICH	03	RVUE		
121 ± 23			TIKHOMIROV	03	SPEC	$40.0 \pi^- \rightarrow K_S^0 K_S^0 K_L^0 X$	
~ 70		13	BRAMON	02	RVUE	$1.02 e^+ e^- \rightarrow \pi^0 \pi^0 \gamma$	
44 ± 2 ± 2	848	14	AITALA	01A	E791	$D_s^+ \rightarrow \pi^- \pi^+ \pi^+$	
201 ± 28	419	15	ACHASOV	00H	SND	$e^+ e^- \rightarrow \pi^0 \pi^0 \gamma$	OCCUR=2
122 ± 13	419	16,17	ACHASOV	00H	SND	$e^+ e^- \rightarrow \pi^0 \pi^0 \gamma$	
56 ± 20		18	AKHMETSHIN	99C	CMD2	$e^+ e^- \rightarrow \pi^0 \pi^0 \gamma$	
65 ± 20			BARBERIS	99	OMEG	$450 p p \rightarrow p_s p_f K^+ K^-$	
80 ± 10			BARBERIS	99B	OMEG	$450 p p \rightarrow p_s p_f \pi^+ \pi^-$	
80 ± 10			BARBERIS	99C	OMEG	$450 p p \rightarrow p_s p_f \pi^0 \pi^0$	
48 ± 12 ± 8		19	BARBERIS	99D	OMEG	$450 p p \rightarrow K^+ K^-, \pi^+ \pi^-$	
65 ± 25			BELLAZZINI	99	GAM4	$450 p p \rightarrow p p \pi^0 \pi^0$	
71 ± 14		20	KAMINSKI	99	RVUE	$\pi \pi \rightarrow \pi \pi, K \bar{K}, \sigma \sigma$	
~ 28		20	OLLER	99	RVUE	$\pi \pi \rightarrow \pi \pi, K \bar{K}$	
~ 25			OLLER	99B	RVUE	$\pi \pi \rightarrow \pi \pi, K \bar{K}$	
~ 14		20	OLLER	99C	RVUE	$\pi \pi \rightarrow \pi \pi, K \bar{K}, \eta \eta$	
70 ± 20			ALDE	98	GAM4		
86 ± 16		20	ANISOVICH	98B	RVUE	Compilation	
54		21	LOCHER	98	RVUE	$\pi \pi \rightarrow \pi \pi, K \bar{K}$	
69 ± 15		22	ALDE	97	GAM2	$450 p p \rightarrow p p \pi^0 \pi^0$	
38 ± 20		23	BERTIN	97C	OBLX	$0.0 \bar{p} p \rightarrow \pi^+ \pi^- \pi^0$	
~ 100		24	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	25	ALDE	95B	GAM2	$38 \pi^- p \rightarrow \pi^0 \pi^0 n$	OCCUR=2
95 ± 20	10k	26	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		27	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		28	ANISOVICH	95	RVUE		
30			JANSSEN	95	RVUE	$\pi \pi \rightarrow \pi \pi, K \bar{K}$	
74		29	BUGG	94	RVUE	$\bar{p} p \rightarrow \eta 2 \pi^0$	
29 ± 2		30	KAMINSKI	94	RVUE	$\pi \pi \rightarrow \pi \pi, K \bar{K}$	
46		31	ZOU	94B	RVUE		
48 ± 12		32	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		22	AGUILAR-...	91	EHS	$400 p p$	
72 ± 8		33	ARMSTRONG	91	OMEG	$300 p p \rightarrow p p \pi \pi, p p K \bar{K}$	
110 ± 30			BREAKSTONE	90	SFM	$p p \rightarrow p p \pi^+ \pi^-$	
29 ± 13		22	ABACHI	86B	HRS	$e^+ e^- \rightarrow \pi^+ \pi^- X$	
120 ± 281 ± 20			ETKIN	82B	MPS	$23 \pi^- p \rightarrow n 2 K_S^0$	
28 ± 10		33	GIDAL	81	MRK2	$J/\psi \rightarrow \pi^+ \pi^- X$	
70 to 300		34	ACHASOV	80	RVUE		
100 ± 80		35	AGUILAR-...	78	HBC	$0.7 \bar{p} p \rightarrow K_S^0 K_S^0$	
30 ± 8		33	LEEPER	77	ASPK	$2-2.4 \pi^- p \rightarrow \pi^+ \pi^- n, K^+ K^- n$	
48 ± 14		33	BINNIE	73	CNTR	$\pi^- p \rightarrow n M M$	
32 ± 10		36	GRAYER	73	ASPK	$17 \pi^- p \rightarrow \pi^+ \pi^- n$	
30 ± 10		36	HYAMS	73	ASPK	$17 \pi^- p \rightarrow \pi^+ \pi^- n$	
54 ± 16		36	PROTOPOP...	73	HBC	$7 \pi^+ p \rightarrow \pi^+ p \pi^+ \pi^-$	

- ¹ Analytic continuation using Roy equations. Uses the K_{e4} data of BATLEY 10C and the $\pi N \rightarrow \pi\pi N$ data of HYAMS 73, GRAYER 74, and PROTOPOPESCU 73.
- ² Quoted number refers to twice imaginary part of pole position.
- ³ Analytic continuation using GKPY equations. Uses the K_{e4} data of BATLEY 10C and the $\pi N \rightarrow \pi\pi N$ data of HYAMS 73, GRAYER 74, and PROTOPOPESCU 73.
- ⁴ Pole position. Used Roy equations.
- ⁵ 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.
- ⁶ On sheet II in a 2-pole solution. The other pole is found on sheet III at (850–100*i*) MeV
- ⁷ Using a relativistic Breit-Wigner function and taking into account the finite D_S mass.
- ⁸ Breit-Wigner $\pi\pi$ width. Using finite width corrections according to FLATTE 76 and ACHASOV 05, and the ratio $g_{f_0}^0 K K / g_{f_0}^0 \pi\pi = 0$.
- ⁹ Systematic errors not estimated.
- ¹⁰ Breit-Wigner $\pi\pi$ width. Using finite width corrections according to FLATTE 76 and ACHASOV 05, and the ratio $g_{f_0}^0 K K / g_{f_0}^0 \pi\pi = 4.21 \pm 0.25 \pm 0.21$ from ABLIKIM 05.
- ¹¹ Breit-Wigner, solution 1, PWA ambiguous.
- ¹² K-matrix pole from combined analysis of $\pi^- p \rightarrow \pi^0 \pi^0 n$, $\pi^- p \rightarrow K \bar{K} n$, $\pi^+ \pi^- \rightarrow \pi^+ \pi^-$, $\bar{p} p \rightarrow \pi^0 \pi^0 \pi^0$, $\pi^0 \pi^0 \eta$, $\pi^0 \pi^0 \eta$, $\pi^+ \pi^- \pi^0$, $K^+ K^- \pi^0$, $K_S^0 K_S^0 \pi^0$, $K^+ K_S^0 \pi^-$ at rest, $\bar{p} n \rightarrow \pi^- \pi^- \pi^+$, $K_S^0 K^- \pi^0$, $K_S^0 K_S^0 \pi^-$ at rest.
- ¹³ Using the data of AKHMETSHIN 99C, ACHASOV 00H, and ALOISIO 02D.
- ¹⁴ Breit-Wigner width.
- ¹⁵ Supersedes ACHASOV 98I. Using the model of ACHASOV 89.
- ¹⁶ Supersedes ACHASOV 98I.
- ¹⁷ In the “narrow resonance” approximation.
- ¹⁸ From the combined fit of the photon spectra in the reactions $e^+ e^- \rightarrow \pi^+ \pi^- \gamma$, $\pi^0 \pi^0 \gamma$.
- ¹⁹ Supersedes BARBERIS 99 and BARBERIS 99B
- ²⁰ T-matrix pole.
- ²¹ On sheet II in a 2 pole solution. The other pole is found on sheet III at (1039–93*i*) MeV.
- ²² From invariant mass fit.
- ²³ On sheet II in a 2 pole solution. The other pole is found on sheet III at (963–29*i*) MeV.
- ²⁴ Reanalysis of data from HYAMS 73, GRAYER 74, SRINIVASAN 75, and ROSSELET 77 using the interfering amplitude method.
- ²⁵ At high $|t|$.
- ²⁶ At low $|t|$.
- ²⁷ On sheet II in a 4-pole solution, the other poles are found on sheet III at (953–55*i*) MeV and on sheet IV at (938–35*i*) MeV.
- ²⁸ Combined fit of ALDE 95B, ANISOVICH 94,
- ²⁹ On sheet II in a 2 pole solution. The other pole is found on sheet III at (996–103*i*) MeV.
- ³⁰ From sheet II pole position.
- ³¹ On sheet II in a 2 pole solution. The other pole is found on sheet III at (797–185*i*) MeV and can be interpreted as a shadow pole.
- ³² On sheet II in a 2 pole solution. The other pole is found on sheet III at (978–28*i*) MeV.
- ³³ From coupled channel analysis.
- ³⁴ Coupled channel analysis with finite width corrections.
- ³⁵ From coupled channel fit to the HYAMS 73 and PROTOPOPESCU 73 data. With a simultaneous fit to the $\pi\pi$ phase-shifts, inelasticity and to the $K_S^0 K_S^0$ invariant mass.
- ³⁶ Included in AGUILAR-BENITEZ 78 fit.

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$f_0(980)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $\pi\pi$	dominant
Γ_2 $K\bar{K}$	seen
Γ_3 $\gamma\gamma$	seen
Γ_4 $e^+ e^-$	

$f_0(980)$ PARTIAL WIDTHS

 $\Gamma(\gamma\gamma)$ Γ_3

VALUE (keV)	DOCUMENT ID	TECN	COMMENT

0.29 $^{+0.07}_{-0.06}$ OUR AVERAGE

0.286 ± 0.017 $^{+0.211}_{-0.070}$	¹ UEHARA	08A	BELL	10.6 $e^+ e^- \rightarrow e^+ e^- \pi^0 \pi^0$
0.205 $^{+0.095+0.147}_{-0.083-0.117}$	² MORI	07	BELL	10.6 $e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^-$
0.28 $^{+0.09}_{-0.13}$	³ BOGLIONE	99	RVUE	$\gamma\gamma \rightarrow \pi^+ \pi^-, \pi^0 \pi^0$
0.42 $\pm 0.06 \pm 0.18$	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
0.29 ± 0.07 ± 0.12	^{10,11} BOYER 90	MRK2	$e^+e^- \rightarrow e^+e^-\pi^+\pi^-$
0.31 ± 0.14 ± 0.09	^{10,11} MARSISKE 90	CBAL	$e^+e^- \rightarrow e^+e^-\pi^0\pi^0$
0.63 ± 0.14	¹² MORGAN 90	RVUE	$\gamma\gamma \rightarrow \pi^+\pi^-, \pi^0\pi^0$

¹ Using finite width corrections according to FLATTE 76 and ACHASOV 05, and the ratio $g_{f_0} K K / g_{f_0} \pi \pi = 0$.

² Using finite width corrections according to FLATTE 76 and ACHASOV 05, and the ratio $g_{f_0} K K / g_{f_0} \pi \pi = 4.21 \pm 0.25 \pm 0.21$ from ABLIKIM 05.

³ Supersedes MORGAN 90.

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

⁵ Uses an analytic K-matrix model. Compilation.

⁶ Using dispersion integral with phase input from Roy equations and data from MARSISKE 90, BOYER 90, BEHREND 92, UEHARA 08A, and MORI 07.

⁷ Solution A (preferred solution based on χ^2 -analysis).

⁸ Dispersion theory based amplitude analysis of BOYER 90, MARSISKE 90, BEHREND 92, and MORI 07.

⁹ Solution B (worse than solution A; still acceptable when systematic uncertainties are included).

¹⁰ From analysis allowing arbitrary background unconstrained by unitarity.

¹¹ Data included in MORGAN 90, BOGLIONE 99 analyses.

¹² From amplitude analysis of BOYER 90 and MARSISKE 90, data corresponds to resonance parameters $m = 989$ MeV, $\Gamma = 61$ MeV.

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

Γ_4

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<8.4	90	VOROBIEV	88 ND	$e^+e^- \rightarrow \pi^0\pi^0$

$f_0(980)$ BRANCHING RATIOS

$\Gamma(\pi\pi) / [\Gamma(\pi\pi) + \Gamma(K\bar{K})]$ $\Gamma_1 / (\Gamma_1 + \Gamma_2)$

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
0.52 ± 0.12	9.9k	¹ AUBERT	06O 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	$4\pi^- p \rightarrow n 2K_S^0$
0.81 ^{+0.09} _{-0.04}		⁴ CASON	78 STRC	$7\pi^- p \rightarrow n 2K_S^0$
0.78 ± 0.03		⁴ WETZEL	76 OSPK	$8.9\pi^- p \rightarrow n 2K_S^0$

¹ Recalculated by us using $\Gamma(K^+K^-) / \Gamma(\pi^+\pi^-) = 0.69 \pm 0.32$ from AUBERT 06O and isospin relations.

² Using data from ABLIKIM 04G.

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.

⁴ Measure $\pi\pi$ elasticity assuming two resonances coupled to the $\pi\pi$ and $K\bar{K}$ channels only.

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GARCIA-MAR... 11	PRL 107 072001	R. Garcia-Martin <i>et al.</i>	(MADR, CRAC)
MENNESSIER 11	PL B696 40	G. Mennessier, S. Narison, X.-G. Wang	
MOUSSALLAM 11	EPJ C71 1814	B. Moussallam	
BATLEY 10C	EPJ C70 635	J.R. Batley <i>et al.</i>	(CERN NA48/2 Collab.)
MENNESSIER 10	PL B688 59	G. Mennessier, S. Narison, X.-G. Wang	
ANISOVICH 09	IJMP A24 2481	V.V. Anisovich, A.V. Sarantsev	
ECKLUND 09	PR D80 052009	K.M. Ecklund <i>et al.</i>	(CLEO Collab.)
BATLEY 08A	EPJ C54 411	J.R. Batley <i>et al.</i>	(CERN NA48/2 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.)
AMBROSINO 07	EPJ C49 473	F. Ambrosino <i>et al.</i>	(KLOE Collab.)
AUBERT 07AK	PR D76 012008	B. Aubert <i>et al.</i>	(BABAR Collab.)
BONVICINI 07	PR D76 012001	G. Bonvicini <i>et al.</i>	(CLEO Collab.)
MORI 07	PR D75 051101	T. Mori <i>et al.</i>	(BELLE Collab.)
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AUBERT 06O	PR D74 032003	B. Aubert <i>et al.</i>	(BABAR Collab.)

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REFID=51616
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REFID=51652
REFID=51043
REFID=51141

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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
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ABLIKIM	04G	PR D70 092002	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50187
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
ALOISIO	02D	Translated from YAF 66 860.	A. Aloisio <i>et al.</i>	(KLOE Collab.)	REFID=48824
ANISOVICH	02D	PL B537 21	V.V. Anisovich <i>et al.</i>		REFID=48831
BRAMON	02	PAN 65 1545			
ACHASOV	01F	Translated from YAF 65 1583.	A. Bramon <i>et al.</i>		REFID=49178
AITALA	01A	EPJ C26 253	N.N. Achasov, V.V. Gubin	(Novosibirsk SND Collab.)	REFID=48312
AITALA	01B	PR D63 094007	E.M. Aitala <i>et al.</i>	(FNAL E791 Collab.)	REFID=48004
ACHASOV	00H	PRL 86 765	E.M. Aitala <i>et al.</i>	(FNAL E791 Collab.)	REFID=48005
AKHMETSHIN	99B	PRL 86 770	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47930
AKHMETSHIN	99C	PL B462 371	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=47392
BARBERIS	99	PL B462 380	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=47393
BARBERIS	99B	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
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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. Akerstaff <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
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LOCHER	98	SPU 41 419			
ALDE	97	Translated from UFN 168 481.	M.P. Locher <i>et al.</i>	(PSI)	REFID=46372
BERTIN	97C	EPJ C4 317	D.M. Alde <i>et al.</i>	(GAMS Collab.)	REFID=45392
ISHIDA	96	PL B397 350	A. Bertin <i>et al.</i>	(OBELIX Collab.)	REFID=45701
TORNQVIST	96	PL B408 476	S. Ishida <i>et al.</i>	(TOKY, MIYA, KEK)	REFID=45770
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AMSLER	95B	PRL 76 1575	D.M. Alde <i>et al.</i>	(GAMS Collab.)	REFID=44375
AMSLER	95D	ZPHY C66 375	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=44377
ANISOVICH	95	PL B342 433	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=44441
JANSEN	95	PL B355 425	V.V. Anisovich <i>et al.</i>	(PNPI, SERP)	REFID=44442
AMSLER	94D	PL B355 363	G. Janssen <i>et al.</i>	(STON, ADLD, JULI)	REFID=44508
ANISOVICH	94	PR D52 2690	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=44093
BUGG	94	PL B323 233	V.V. Anisovich <i>et al.</i>	(Crystal Barrel Collab.)	REFID=43659
KAMINSKI	94	PR D50 4412	D.V. Bugg <i>et al.</i>	(LOQM)	REFID=44078
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MORGAN	93	PR D50 591	B.S. Zou, D.V. Bugg	(LOQM)	REFID=44072
BEHREND	92	PR D48 1185	D. Morgan, M.R. Pennington	(RAL, DURH)	REFID=43614
AGUILAR-...	91	ZPHY C56 381	H.J. Behrend	(CELLO Collab.)	REFID=43172
ARMSTRONG	91	ZPHY C50 405	M. Aguilar-Benitez <i>et al.</i>	(LEBC-EHS Collab.)	REFID=41637
BOYER	90	ZPHY C51 351	T.A. Armstrong <i>et al.</i>	(ATHU, BARI, BIRM+)	REFID=41744
BREAKSTONE	90	PR D42 1350	J. Boyer <i>et al.</i>	(Mark II Collab.)	REFID=41362
MARSISKE	90	ZPHY C48 569	A.M. Breakstone <i>et al.</i>	(ISU, BGNA, CERN+)	REFID=41376
MORGAN	90	PR D41 3324	H. Marsiske <i>et al.</i>	(Crystal Ball Collab.)	REFID=41351
OEST	90	ZPHY C48 623	D. Morgan, M.R. Pennington	(RAL, DURH)	REFID=41583
ACHASOV	89	ZPHY C47 343	T. Oest <i>et al.</i>	(JADE Collab.)	REFID=41358
AUGUSTIN	89	NP B315 465	N.N. Achasov, V.N. Ivanchenko		REFID=48021
VOROBYEV	88	NP B320 1	J.E. Augustin, G. Cosme	(DM2 Collab.)	REFID=41004
ABACHI	86B	SJNP 48 273	P.V. Vorobiev <i>et al.</i>	(NOVO)	REFID=41023
ETKIN	82B	Translated from YAF 48 436.	S. Abachi <i>et al.</i>	(PURD, ANL, IND, MICH+)	REFID=20394
GIDAL	81	PRL 57 1990	A. Etkin <i>et al.</i>	(BNL, CUNY, TUFTS, VAND)	REFID=20390
ACHASOV	80	PR D25 1786	G. Gidal <i>et al.</i>	(SLAC, LBL)	REFID=20386
COHEN	80	PL 107B 153	N.N. Achasov, S.A. Devyanin, G.N. Shestakov	(NOVM)	REFID=20458
LOVERRE	80	SJNP 32 566			
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CASON	78	PR D22 2595	P.F. Loverre <i>et al.</i>	(CERN, CDEF, MADR+) IJP	REFID=20382
LEEPER	77	ZPHY C6 187	M. Aguilar-Benitez <i>et al.</i>	(MADR, BOMB+)	REFID=20368
ROSSELET	77	NP B140 73	N.M. Cason <i>et al.</i>	(NDAM, ANL)	REFID=20370
FLATTE	76	PRL 41 271	R.J. Leeper <i>et al.</i>	(ISU)	REFID=20365
WETZEL	76	PR D16 2054	L. Rosselet <i>et al.</i>	(GEVA, SACL)	REFID=11004
SRINIVASAN	75	PL D15 574	S.M. Flatte	(CERN)	REFID=20446
GRAY	74	PL 63B 224	W. Wetzel <i>et al.</i>	(ETH, CERN, LOIC)	REFID=20362
BINNIE	73	NP B115 208	V. Srinivasan <i>et al.</i>	(NDAM, ANL)	REFID=21062
GRAY	73	PR D12 681	G. Grayer <i>et al.</i>	(CERN, MPIM)	REFID=20113
HYAMS	73	NP B75 189	D.M. Binnie <i>et al.</i>	(LOIC, SHMP)	REFID=20343
PROTOPOP...	73	PRL 31 1534	G. Grayer <i>et al.</i>	(CERN, MPIM)	REFID=20347
		Tallahassee	B.D. Hyams <i>et al.</i>	(CERN, MPIM)	REFID=20107
		NP B64 134	S.D. Protopopescu <i>et al.</i>	(LBL)	REFID=20108
		PR D7 1279			

$a_0(980)$

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

See our minireview on scalar mesons under $f_0(500)$. (See the index for the page number.)

NODE=M036

NODE=M036

$a_0(980)$ MASS

NODE=M036205

NODE=M036MX

→ UNCHECKED ←

VALUE (MeV)

DOCUMENT ID

980±20 OUR ESTIMATE Mass determination very model dependent

$\eta\pi$ FINAL STATE ONLY

VALUE (MeV)

EVTS

DOCUMENT ID

TECN

CHG

COMMENT

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

982.5 ± 1.6 ± 1.1	16.9k	¹ AMBROSINO	09F	KLOE	1.02 $e^+e^- \rightarrow \eta\pi^0\gamma$
986 ± 4		ANISOVICH	09	RVUE	0.0 $\bar{p}p, \pi N$
982.3 + 0.6 + 3.1 - 0.7 - 4.7		² UEHARA	09A	BELL	$\gamma\gamma \rightarrow \pi^0\eta$
987.4 ± 1.0 ± 3.0		^{3,4} BUGG	08A	RVUE 0	$\bar{p}p \rightarrow \pi^0\pi^0\eta$
989.1 ± 1.0 ± 3.0		^{4,5} BUGG	08A	RVUE 0	$\bar{p}p \rightarrow \pi^0\pi^0\eta$
985 ± 4 ± 6	318	ACHARD	02B	L3	183-209 $e^+e^- \rightarrow e^+e^-\eta\pi^+\pi^-$
995 + 52 - 10	36	⁶ ACHASOV	00F	SND	$e^+e^- \rightarrow \eta\pi^0\gamma$
994 + 33 - 8	36	⁷ ACHASOV	00F	SND	$e^+e^- \rightarrow \eta\pi^0\gamma$
975 ± 7		BARBERIS	00H		450 $pp \rightarrow p_f\eta\pi^0p_s$
988 ± 8		BARBERIS	00H		450 $pp \rightarrow \Delta_f^{++}\eta\pi^-p_s$
~ 1055		⁸ OLLER	99	RVUE	$\eta\pi, K\bar{K}$
~ 1009.2		⁸ OLLER	99B	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$
993.1 ± 2.1		⁹ TEIGE	99	B852	18.3 $\pi^-p \rightarrow \eta\pi^+\pi^-n$
988 ± 6		⁸ 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 ± 1.23 ± 0.34		AMSLER	94C	CBAR	0.0 $\bar{p}p \rightarrow \omega\eta\pi^0$
982 ± 2		¹⁰ AMSLER	92	CBAR	0.0 $\bar{p}p \rightarrow \eta\eta\pi^0$
984 ± 4	1040	¹⁰ ARMSTRONG	91B	OMEG ±	300 $pp \rightarrow pp\eta\pi^+\pi^-$
976 ± 6		ATKINSON	84E	OMEG ±	25-55 $\gamma p \rightarrow \eta\pi n$
986 ± 3	500	¹¹ EVANGELIS...	81	OMEG ±	12 $\pi^-p \rightarrow \eta\pi^+\pi^-\pi^-p$
990 ± 7	145	¹¹ 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 π^+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 Using the model of ACHASOV 89 and ACHASOV 03B.

² From a fit with the S-wave amplitude including two interfering Breit-Wigners plus a background term.

³ Parameterizes couplings to $\bar{K}K$, $\pi\eta$, and $\pi\eta'$.

⁴ Using AMSLER 94D and ABELE 98.

⁵ From the T-matrix pole on sheet II.

⁶ Using the model of ACHASOV 89. Supersedes ACHASOV 98B.

⁷ Using the model of JAFFE 77. Supersedes ACHASOV 98B.

⁸ T-matrix pole.

⁹ Breit-Wigner fit, average between $a_0^\pm$ and a_0^0 . The fit favors a slightly heavier $a_0^\pm$.

¹⁰ From a single Breit-Wigner fit.

¹¹ From $f_1(1285)$ decay.

NODE=M036M1;LINKAGE=AM

NODE=M036M1;LINKAGE=UE

NODE=M036M1;LINKAGE=BP

NODE=M036M1;LINKAGE=BU

NODE=M036M1;LINKAGE=BT

NODE=M036M1;LINKAGE=V1

NODE=M036M1;LINKAGE=M2

NODE=M036M1;LINKAGE=AN

NODE=M036M1;LINKAGE=BF

NODE=M036M1;LINKAGE=A

NODE=M036M1;LINKAGE=R

$K\bar{K}$ ONLY

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
~ 1053		¹² OLLER	99C	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$
982 $\pm$ 3		¹³ ABELE	98	CBAR	$0.0 \bar{p}p \rightarrow K_L^0 K^\pm \pi^\mp$
975 $\pm$ 15		BERTIN	98B	OBLX $\pm$	$0.0 \bar{p}p \rightarrow K^\pm K_S \pi^\mp$
976 $\pm$ 6	316	DEBILLY	80	HBC $\pm$	$1.2\text{--}2 \bar{p}p \rightarrow f_1(1285)\omega$
1016 $\pm$ 10	100	¹⁴ ASTIER	67	HBC $\pm$	$0.0 \bar{p}p$
1003.3 $\pm$ 7.0	143	¹⁵ ROSENFELD	65	RVUE $\pm$	

¹² T-matrix pole.¹³ T-matrix pole on sheet II, the pole on sheet III is at 1006-i49 MeV.¹⁴ ASTIER 67 includes data of BARLOW 67, CONFORTO 67, ARMENTEROS 65.¹⁵ Plus systematic errors.

NODE=M036M2
 NODE=M036M2

NODE=M036M2;LINKAGE=AN
 NODE=M036M2;LINKAGE=Q
 NODE=M036M2;LINKAGE=A
 NODE=M036M2;LINKAGE=S

 $a_0(980)$ 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. • • •

75.6 $\pm$ 1.6	^{+17.4} _{-10.0}	¹⁶ UEHARA	09A	BELL	$\gamma\gamma \rightarrow \pi^0\eta$
80.2 $\pm$ 3.8	$\pm$ 5.4	¹⁷ BUGG	08A	RVUE 0	$\bar{p}p \rightarrow \pi^0\pi^0\eta$
50 $\pm$ 13	$\pm$ 4	318 ACHARD	02B	L3	$183\text{--}209 e^+e^- \rightarrow e^+e^-\eta\pi^+\pi^-$
72 $\pm$ 16		BARBERIS	00H		$450 p\bar{p} \rightarrow p_f\eta\pi^0 p_s$
61 $\pm$ 19		BARBERIS	00H		$450 p\bar{p} \rightarrow \Delta_f^{++}\eta\pi^- p_s$
~ 42		¹⁸ OLLER	99	RVUE	$\eta\pi, K\bar{K}$
~ 112		¹⁸ OLLER	99B	RVUE	$\pi\pi \rightarrow \eta\pi, K\bar{K}$
71 $\pm$ 7		TEIGE	99	B852	$18.3 \pi^- p \rightarrow \eta\pi^+\pi^- n$
92 $\pm$ 20		¹⁸ ANISOVICH	98B	RVUE	Compilation
65 $\pm$ 10		¹⁹ 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	$0.0 \bar{p}p \rightarrow \omega\eta\pi^0$
54 $\pm$ 10		²⁰ AMSLER	92	CBAR	$0.0 \bar{p}p \rightarrow \eta\eta\pi^0$
95 $\pm$ 14	1040	²⁰ ARMSTRONG	91B	OMEG $\pm$	$300 p\bar{p} \rightarrow p\bar{p}\eta\pi^+\pi^-$
62 $\pm$ 15	500	²¹ EVANGELIS...	81	OMEG $\pm$	$12 \pi^- p \rightarrow \eta\pi^+\pi^-\pi^- p$
60 $\pm$ 20	145	²¹ GURTU	79	HBC $\pm$	$4.2 K^- p \rightarrow \Lambda\eta 2\pi$
60 ⁺⁵⁰ ₋₃₀	47	CONFORTO	78	OSPK -	$4.5 \pi^- p \rightarrow pX^-$
86.0 ^{+60.0} _{-50.0}	50	CORDEN	78	OMEG $\pm$	$12\text{--}15 \pi^- p \rightarrow n\eta 2\pi$
44 $\pm$ 22		GRASSLER	77	HBC -	$16 \pi^\mp p \rightarrow p\eta 3\pi$
80 to 300		²² FLATTE	76	RVUE -	$4.2 K^- p \rightarrow \Lambda\eta 2\pi$
16.0 ^{+25.0} _{-16.0}	70	WELLS	75	HBC -	$3.1\text{--}6 K^- p \rightarrow \Lambda\eta 2\pi$
30 $\pm$ 5	150	DEFOIX	72	HBC $\pm$	$0.7 \bar{p}p \rightarrow 7\pi$
40 $\pm$ 15		CAMPBELL	69	DBC $\pm$	$2.7 \pi^+ d$
60 $\pm$ 30	15	MILLER	69B	HBC -	$4.5 K^- N \rightarrow \eta\pi\Lambda$
80 $\pm$ 30	30	AMMAR	68	HBC $\pm$	$5.5 K^- p \rightarrow \Lambda\eta 2\pi$

¹⁶ From a fit with the S-wave amplitude including two interfering Breit-Wigners plus a background term.¹⁷ From the T-matrix pole on sheet II, using AMSLER 94D and ABELE 98.¹⁸ T-matrix pole.¹⁹ The $\eta\pi$ width.²⁰ From a single Breit-Wigner fit.²¹ From $f_1(1285)$ decay.²² Using a two-channel resonance parametrization of GAY 76B data.

NODE=M036210

NODE=M036W1

→ UNCHECKED ←

OCCUR=2

NODE=M036W1;LINKAGE=UE

NODE=M036W1;LINKAGE=BU

NODE=M036W1;LINKAGE=AN

NODE=M036W1;LINKAGE=BE

NODE=M036W1;LINKAGE=A

NODE=M036W1;LINKAGE=R

NODE=M036W1;LINKAGE=F

$K\bar{K}$ ONLY

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
92 ± 8		23 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		24 OLLER	99C	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$
~ 25	100	25 ASTIER	67	HBC	$\pm$
57 ± 13	143	26 ROSENFELD	65	RVUE	$\pm$

²³ T-matrix pole on sheet II, the pole on sheet III is at 1006-i49 MeV.

²⁴ T-matrix pole.

²⁵ ASTIER 67 includes data of BARLOW 67, CONFORTO 67, ARMENTEROS 65.

²⁶ Plus systematic errors.

NODE=M036W2
NODE=M036W2

NODE=M036W2;LINKAGE=Q
NODE=M036W2;LINKAGE=AN
NODE=M036W2;LINKAGE=A
NODE=M036W2;LINKAGE=S

 $a_0(980)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \eta\pi$	dominant
$\Gamma_2 \quad K\bar{K}$	seen
$\Gamma_3 \quad \rho\pi$	
$\Gamma_4 \quad \gamma\gamma$	seen
$\Gamma_5 \quad e^+e^-$	

NODE=M036215;NODE=M036

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

 $a_0(980)$ PARTIAL WIDTHS **$\Gamma(\gamma\gamma)$**

VALUE (keV)	DOCUMENT ID	TECN

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

0.30 ± 0.10 ²⁷ AMSLER 98 RVUE

²⁷ Using $\Gamma_{\gamma\gamma} B(a_0(980) \rightarrow \eta\pi) = 0.24 \pm 0.08$ keV.

 Γ_4

NODE=M036217

NODE=M036W4
NODE=M036W4

NODE=M036W4;LINKAGE=A

 $a_0(980)$ $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$ **$\Gamma(\eta\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$**

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT

$0.21^{+0.08}_{-0.04}$ OUR AVERAGE

$0.128^{+0.003+0.502}_{-0.002-0.043}$		²⁸ UEHARA	09A	BELL	$\gamma\gamma \rightarrow \pi^0\eta$
$0.28 \pm 0.04 \pm 0.10$	44	OEST	90	JADE	$e^+e^- \rightarrow e^+e^-\pi^0\eta$
$0.19 \pm 0.07^{+0.10}_{-0.07}$		ANTREASYAN	86	CBAL	$e^+e^- \rightarrow e^+e^-\pi^0\eta$

²⁸ From a fit with the S-wave amplitude including two interfering Breit-Wigners plus a background term.

NODE=M036220

NODE=M036G1
NODE=M036G1

NODE=M036G1;LINKAGE=UE

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

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT

<1.5 90 VOROBYEV 88 ND $e^+e^- \rightarrow \pi^0\eta$

 $\Gamma_1\Gamma_5/\Gamma$

NODE=M036G2
NODE=M036G2

 $a_0(980)$ BRANCHING RATIOS **$\Gamma(K\bar{K})/\Gamma(\eta\pi)$**

VALUE	DOCUMENT ID	TECN	CHG	COMMENT

0.183 ± 0.024 OUR AVERAGE Error includes scale factor of 1.2.

0.57 ±0.16	²⁹ BARGIOTTI	03	OBLX	$\bar{p}p$
0.23 ±0.05	³⁰ ABELE	98	CBAR	$0.0 \bar{p}p \rightarrow K_L^0 K^\pm \pi^\mp$
0.166±0.01 ±0.02	³¹ BARBERIS	98C	OMEG	$450 p\bar{p} \rightarrow p_f f_1(1285) p_s$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
1.20 ±0.15	³² ANISOVICH	09	RVUE	$0.0 \bar{p}p, \pi N$
1.05 ±0.07 ±0.05	³³ 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	³¹ CORDEN	78	OMEG	$12\text{--}15 \pi^- p \rightarrow n\eta 2\pi$
0.25 ±0.08	³¹ DEFOIX	72	HBC	$\pm 0.7 \bar{p} \rightarrow 7\pi$

 Γ_2/Γ_1

NODE=M036225

NODE=M036R2
NODE=M036R2

$\Gamma(\rho\pi)/\Gamma(\eta\pi)$ $\rho\pi$ forbidden.

VALUE	CL%	DOCUMENT ID	TECN	CHG	COMMENT

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

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

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

30 Using $\pi^0 \pi^0 \eta$ from AMSLER 94D.

31 From the decay of $f_1(1285)$.

32 This is a ratio of couplings.

33 A ratio of couplings, using AMSLER 94D and ABELE 98. Supersedes BUGG 94.

NODE=M036R1

NODE=M036R1

NODE=M036R1

NODE=M036R;LINKAGE=BG

NODE=M036R2;LINKAGE=Q

NODE=M036R2;LINKAGE=L

NODE=M036R2;LINKAGE=AN

NODE=M036R2;LINKAGE=BU

 $a_0(980)$ REFERENCES

NODE=M036

AMBROSINO	09F	PL B681 5	F. Ambrosino <i>et al.</i>	(KLOE 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)
ACHASOV	03B	PR D68 014006	N.N. Achasov, A.V. Kiselev	
BARGIOTTI	03	EPJ C26 371	M. Bargiotti <i>et al.</i>	(OBELIX Collab.)
ACHARD	02B	PL B526 269	P. Achard <i>et al.</i>	(L3 Collab.)
ACHASOV	00F	PL B479 53	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)
BARBERIS	00H	PL B488 225	D. Barberis <i>et al.</i>	(WA 102 Collab.)
OLLER	99	PR D60 099906 (erratum)	J.A. Oller <i>et al.</i>	
OLLER	99B	NP A652 407 (erratum)	J.A. Oller, E. Oset	
OLLER	99C	PR D60 074023	J.A. Oller, E. Oset	
TEIGE	99	PR D59 012001	S. Teige <i>et al.</i>	(BNL E852 Collab.)
ABELE	98	PL D57 3860	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
ACHASOV	98B	PL B438 441	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)
AMSLER	98	RMP 70 1293	C. Amsler	
ANISOVICH	98B	SPU 41 419	V.V. Anisovich <i>et al.</i>	
		Translated from UFN 168 481.		
BARBERIS	98C	PL B440 225	D. Barberis <i>et al.</i>	(WA 102 Collab.)
BERTIN	98B	PL B434 180	A. Bertin <i>et al.</i>	(OBELIX Collab.)
TORNQVIST	96	PRL 76 1575	N.A. Tornqvist, M. Roos	(HELS)
JANSEN	95	PR D52 2690	G. Janssen <i>et al.</i>	(STON, ADLD, JULI)
AMSLER	94C	PL B327 425	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
AMSLER	94D	PL B333 277	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
BUGG	94	PR D50 4412	D.V. Bugg <i>et al.</i>	(LOQM)
AMSLER	92	PL B291 347	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
ARMSTRONG	91B	ZPHY C52 389	T.A. Armstrong <i>et al.</i>	(ATHU, BARI, BIRM+)
OEST	90	ZPHY C47 343	T. Oest <i>et al.</i>	(JADE Collab.)
ACHASOV	89	NP B315 465	N.N. Achasov, V.N. Ivanchenko	
VOROBYEV	88	SJNP 48 273	P.V. Vorobiev <i>et al.</i>	(NOVO)
		Translated from YAF 48 436.		
ANTREASYAN	86	PR D33 1847	D. Antreasyan <i>et al.</i>	(Crystal Ball Collab.)
ATKINSON	84E	PL 138B 459	M. Atkinson <i>et al.</i>	(BONN, CERN, GLAS+)
EVANGELIS...	81	NP B178 197	C. Evangelista <i>et al.</i>	(BARI, BONN, CERN+)
DEBILLY	80	NP B176 1	L. de Billy <i>et al.</i>	(CURIN, LAUS, NEUC+)
GURTU	79	NP B151 181	A. Gurtu <i>et al.</i>	(CERN, ZEEM, NIJM, OXF)
CONFORTO	78	LNC 23 419	B. Conforto <i>et al.</i>	(RHEL, TINTO, CHIC+)
CORDEN	78	NP B144 253	M.J. Corden <i>et al.</i>	(BIRM, RHEL, TELA+)
GRASSLER	77	NP B121 189	H. Grassler <i>et al.</i>	(AACH3, BERL, BONN+)
JAFFE	77	PR D15 267,281	R. Jaffe	(MIT)
FLATTE	76	PL 63B 224	S.M. Flatte	(CERN)
GAY	76B	PL 63B 220	J.B. Gay <i>et al.</i>	(CERN, AMST, NIJM) JP
WELLS	75	NP B101 333	J. Wells <i>et al.</i>	(OXF)
DEFOIX	72	NP B44 125	C. Defoix <i>et al.</i>	(CDEF, CERN)
AMMAR	70	PR D2 430	R. Ammar <i>et al.</i>	(KANS, NWES, ANL, WISC)
BARNES	69C	PRL 23 610	V.E. Barnes <i>et al.</i>	(BNL, SYRA)
CAMPBELL	69	PRL 22 1204	J.H. Campbell <i>et al.</i>	(PURD)
MILLER	69B	PL 29B 255	D.H. Miller <i>et al.</i>	(PURD)
Also		PR 188 2011	W.L. Yen <i>et al.</i>	(PURD)
AMMAR	68	PRL 21 1832	R. Ammar <i>et al.</i>	(NWES, ANL)
ASTIER	67	PL 25B 294	A. Astier <i>et al.</i>	(CDEF, CERN, IRAD)
		Includes data of BARLOW 67, CONFORTO 67, and ARMENTEROS 65.		
BARLOW	67	NC 50A 701	J. Barlow <i>et al.</i>	(CERN, CDEF, IRAD, LIPV)
CONFORTO	67	NP B3 469	G. Conforto <i>et al.</i>	(CERN, CDEF, IPNP+)
ARMENTEROS	65	PL 17 344	R. Armenteros <i>et al.</i>	(CERN, CDEF)
ROSENFELD	65	Oxford Conf. 58	A.H. Rosenfeld	(LRL)

REFID=53105

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REFID=20399

$\phi(1020)$

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

NODE=M004

 $\phi(1020)$ MASS

NODE=M004M

NODE=M004M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1019.455±0.020 OUR AVERAGE		Error includes scale factor of 1.1.		
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	¹ AKHMETSHIN 04	CMD2	$e^+e^- \rightarrow K_L^0 K_S^0$
1019.42 ±0.05	1900k	² ACHASOV 01E	SND	$e^+e^- \rightarrow K^+K^-, K_S^0 K_L^0, \pi^+\pi^-\pi^0$
1019.40 ±0.04 ±0.05	23k	AKHMETSHIN 01B	CMD2	$e^+e^- \rightarrow \eta\gamma$
1019.36 ±0.12		³ ACHASOV 00B	SND	$e^+e^- \rightarrow \eta\gamma$
1019.38 ±0.07 ±0.08	2200	⁴ AKHMETSHIN 99F	CMD2	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
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 polar. $pp \rightarrow KK$
1019.67 ±0.17	25080	⁵ 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. ● ● ●				
1019.441±0.008±0.080	542k	⁶ AKHMETSHIN 08	CMD2	1.02 $e^+e^- \rightarrow K^+K^-$
1019.63 ±0.07	12540	⁷ 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	⁷ ATKINSON 86	OMEG	20-70 γp
1019.7 ±1.0		BEBEK 86	CLEO	$e^+e^- \rightarrow \mathcal{T}(4S)$
1019.411±0.008	642k	⁸ DIJKSTRA 86	SPEC	100-200 $\pi^\pm, \bar{p}, p, K^\pm$, on Be
1020.9 ±0.2		⁷ FRAME 86	OMEG	13 $K^+p \rightarrow \phi K^+p$
1021.0 ±0.2		⁷ ARMSTRONG 83B	OMEG	18.5 $K^-p \rightarrow K^-K^+\Lambda$
1020.0 ±0.5		⁷ ARMSTRONG 83B	OMEG	18.5 $K^-p \rightarrow K^-K^+\Lambda$
1019.7 ±0.3		⁷ 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	⁷ 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 γp
1019.4 ±0.7		BINNIE 73B	CNTR	$\pi^-p \rightarrow \phi n$
1019.6 ±0.5	120	⁹ AGUILAR-... 72B	HBC	3.9,4.6 $K^-p \rightarrow \Lambda K^+K^-$
1019.9 ±0.5	100	⁹ AGUILAR-... 72B	HBC	3.9,4.6 $K^-p \rightarrow K^-pK^+K^-$
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

OCCUR=2

OCCUR=2

¹ Update of AKHMETSHIN 99D² 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.³ Using a total width of 4.43 ± 0.05 MeV. Systematic uncertainty included.⁴ Using a total width of 4.43 ± 0.05 MeV.

NODE=M004M;LINKAGE=GS

NODE=M004M;LINKAGE=AE

NODE=M004M;LINKAGE=G2

NODE=M004M;LINKAGE=F2

⁵PELLINEN 82 review includes AKERLOF 77, DAUM 81, BALDI 77, AYRES 74, DE-GROOT 74.

⁶Strongly correlated with AKHMETSHIN 04.

⁷Systematic errors not evaluated.

⁸Weighted and scaled average of 12 measurements of DIJKSTRA 86.

⁹Mass errors enlarged by us to $\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.

NODE=M004M;LINKAGE=R

NODE=M004M;LINKAGE=AH

NODE=M004M;LINKAGE=A

NODE=M004M;LINKAGE=B

NODE=M004M;LINKAGE=D

$\phi(1020)$ WIDTH

NODE=M004W

NODE=M004W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
4.26 ±0.04 OUR AVERAGE		Error includes scale factor of 1.4. See the ideogram below.		
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	¹ AKHMETSHIN 04	CMD2	$e^+e^- \rightarrow K_L^0 K_S^0$
4.21 ±0.04	1900k	² 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	³ IVANOV	81	OLYA $1-1.4 e^+e^- \rightarrow K^+K^-$
4.3 ±0.6		³ CORDIER	80	DM1 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
4.36 ±0.29	3681	³ BUKIN	78C	OLYA $e^+e^- \rightarrow$ hadrons
4.4 ±0.6	984	³ BESCH	74	CNTR $2\gamma p \rightarrow pK^+K^-$
4.67 ±0.72	681	³ 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. ● ● ●				
4.24 ±0.02 ±0.03	542k	⁴ AKHMETSHIN 08	CMD2	1.02 $e^+e^- \rightarrow K^+K^-$
4.28 ±0.13	12540	⁵ 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	³ COOPER	78B	HBC $0.7-0.8 \bar{p}p \rightarrow K_S^0 K_L^0 \pi^+\pi^-$
4.5 ±0.50	1300	^{3,5} AKERLOF	77	SPEC 400 $pA \rightarrow K^+K^-X$
4.5 ±0.8	500	^{3,5} 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	³ BORENSTEIN	72	HBC $2.18 K^-p \rightarrow K \bar{K} n$

¹Update of AKHMETSHIN 99D

²From 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.

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

⁴Strongly correlated with AKHMETSHIN 04.

⁵Systematic errors not evaluated.

NODE=M004W;LINKAGE=GS

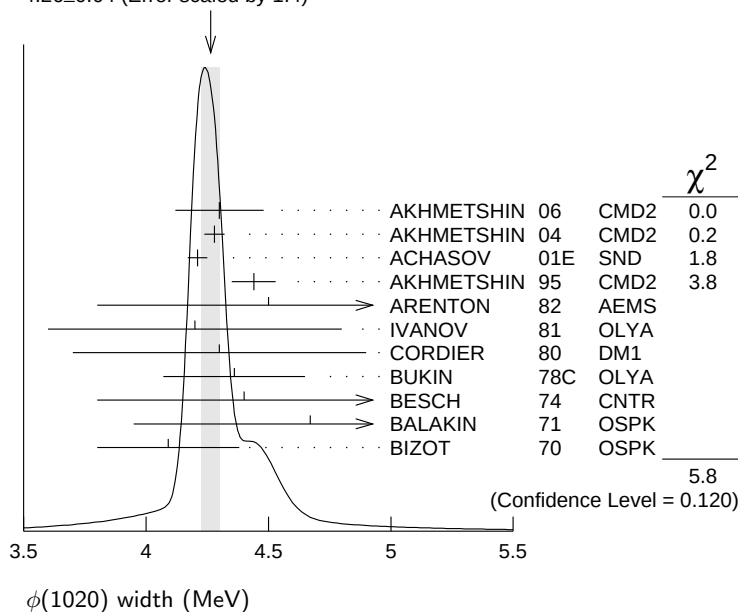
NODE=M004W;LINKAGE=AE

NODE=M004W;LINKAGE=D

NODE=M004W;LINKAGE=AH

NODE=M004W;LINKAGE=A

WEIGHTED AVERAGE
4.26±0.04 (Error scaled by 1.4)



$\phi(1020)$ DECAY MODES

NODE=M004215;NODE=M004

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
$\Gamma_1 \quad K^+ K^-$	(48.9 $\pm$ 0.5) %	S=1.1
$\Gamma_2 \quad K_L^0 K_S^0$	(34.2 $\pm$ 0.4) %	S=1.1
$\Gamma_3 \quad \rho\pi^+ \pi^+ \pi^- \pi^0$	(15.32 $\pm$ 0.32) %	S=1.1
$\Gamma_4 \quad \rho\pi$		
$\Gamma_5 \quad \pi^+ \pi^- \pi^0$		
$\Gamma_6 \quad \eta\gamma$	(1.309 $\pm$ 0.024) %	S=1.2
$\Gamma_7 \quad \pi^0\gamma$	(1.27 $\pm$ 0.06) $\times 10^{-3}$	
$\Gamma_8 \quad \ell^+ \ell^-$	—	
$\Gamma_9 \quad e^+ e^-$	(2.954 $\pm$ 0.030) $\times 10^{-4}$	S=1.1
$\Gamma_{10} \quad \mu^+ \mu^-$	(2.87 $\pm$ 0.19) $\times 10^{-4}$	
$\Gamma_{11} \quad \eta e^+ e^-$	(1.15 $\pm$ 0.10) $\times 10^{-4}$	
$\Gamma_{12} \quad \pi^+ \pi^-$	(7.4 $\pm$ 1.3) $\times 10^{-5}$	
$\Gamma_{13} \quad \omega\pi^0$	(4.7 $\pm$ 0.5) $\times 10^{-5}$	
$\Gamma_{14} \quad \omega\gamma$	< 5 %	CL=84%
$\Gamma_{15} \quad \rho\gamma$	< 1.2 $\times 10^{-5}$	CL=90%
$\Gamma_{16} \quad \pi^+ \pi^- \gamma$	(4.1 $\pm$ 1.3) $\times 10^{-5}$	
$\Gamma_{17} \quad f_0(980)\gamma$	(3.22 $\pm$ 0.19) $\times 10^{-4}$	S=1.1
$\Gamma_{18} \quad \pi^0\pi^0\gamma$	(1.13 $\pm$ 0.06) $\times 10^{-4}$	
$\Gamma_{19} \quad \pi^+ \pi^- \pi^+ \pi^-$	(4.0 $^{+2.8}_{-2.2}$) $\times 10^{-6}$	
$\Gamma_{20} \quad \pi^+ \pi^+ \pi^- \pi^- \pi^0$	< 4.6 $\times 10^{-6}$	CL=90%
$\Gamma_{21} \quad \pi^0 e^+ e^-$	(1.12 $\pm$ 0.28) $\times 10^{-5}$	
$\Gamma_{22} \quad \pi^0 \eta\gamma$	(7.27 $\pm$ 0.30) $\times 10^{-5}$	S=1.5
$\Gamma_{23} \quad a_0(980)\gamma$	(7.6 $\pm$ 0.6) $\times 10^{-5}$	
$\Gamma_{24} \quad K^0 \bar{K}^0 \gamma$	< 1.9 $\times 10^{-8}$	CL=90%
$\Gamma_{25} \quad \eta'(958)\gamma$	(6.25 $\pm$ 0.21) $\times 10^{-5}$	
$\Gamma_{26} \quad \eta\pi^0\pi^0\gamma$	< 2 $\times 10^{-5}$	CL=90%
$\Gamma_{27} \quad \mu^+ \mu^- \gamma$	(1.4 $\pm$ 0.5) $\times 10^{-5}$	
$\Gamma_{28} \quad \rho\gamma\gamma$	< 1.2 $\times 10^{-4}$	CL=90%
$\Gamma_{29} \quad \eta\pi^+ \pi^-$	< 1.8 $\times 10^{-5}$	CL=90%
$\Gamma_{30} \quad \eta\mu^+ \mu^-$	< 9.4 $\times 10^{-6}$	CL=90%
Lepton Family number (LF) violating modes		
$\Gamma_{31} \quad e^\pm \mu^\mp$	LF < 2 $\times 10^{-6}$	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
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DESIG=22
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DESIG=257
DESIG=194
DESIG=195
DESIG=196
DESIG=250
DESIG=255
DESIG=26

NODE=M004;CLUMP=A
DESIG=258

CONSTRAINED FIT INFORMATION

An overall fit to 30 branching ratios uses 79 measurements and one constraint to determine 14 parameters. The overall fit has a $\chi^2 = 57.4$ for 66 degrees of freedom.

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

x_2	-72									
x_3	-53	-21								
x_6	-13	7	2							
x_7	-5	3	1	5						
x_9	30	-25	-10	-32	-15					
x_{10}	-4	3	1	3	2	-11				
x_{12}	-2	1	0	2	1	-5	1			
x_{13}	-2	2	1	2	1	-7	1	0		
x_{17}	0	0	0	0	0	0	0	0	0	
x_{18}	-6	4	2	17	3	-17	2	1	1	0
x_{19}	0	0	0	0	0	-1	0	0	0	0
x_{23}	0	0	0	0	0	0	0	0	0	0
x_{25}	-4	2	1	32	2	-10	1	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}	5	0	0
	x_{18}	x_{19}	x_{23}

 $\phi(1020)$ PARTIAL WIDTHS

NODE=M004218

 $\Gamma(\eta\gamma)$ **Γ_6**

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

NODE=M004W6
NODE=M004W6 **$\Gamma(\pi^0\gamma)$** **Γ_7**

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

NODE=M004W7
NODE=M004W7 **$\Gamma(e^+e^-)$** **Γ_8**

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 $1.02 e^+e^- \rightarrow \mu^+\mu^-$

NODE=M004W5
NODE=M004W5 **$\Gamma(e^+e^-)$** **Γ_9**

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.			
$1.235 \pm 0.006 \pm 0.022$	² AKHMETSHIN	11	CMD2 $1.02 e^+e^- \rightarrow \phi$
$1.32 \pm 0.05 \pm 0.03$	³ AMBROSINO	05	KLOE $1.02 e^+e^- \rightarrow e^+e^-$
1.28 ± 0.05	AKHMETSHIN	95	CMD2 $1.02 e^+e^- \rightarrow \phi$

NODE=M004W8
NODE=M004W8
→ UNCHECKED ← **$(\Gamma(e^+e^-) \times \Gamma(\mu^+\mu^-))^{\frac{1}{2}}$** **$(\Gamma_9\Gamma_{10})^{\frac{1}{2}}$**

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
1.320 $\pm 0.018 \pm 0.017$	AMBROSINO	05	KLOE $1.02 e^+e^- \rightarrow \mu^+\mu^-$

NODE=M004W9
NODE=M004W9

¹ Weighted average of Γ_{ee} and $\sqrt{\Gamma_{ee}\Gamma_{\mu\mu}}$ from AMBROSINO 05 assuming lepton universality.

NODE=M004W5;LINKAGE=AM

² 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 .

NODE=M004W8;LINKAGE=AK

³ 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=AM

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

NODE=M004224

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

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
14.46 ± 0.23 OUR FIT Error includes scale factor of 1.1.				
14.24 ± 0.30 OUR AVERAGE				
$14.27 \pm 0.05 \pm 0.31$	542k	AKHMETSHIN	08	CMD2 $1.02 e^+e^- \rightarrow K^+K^-$
$13.93 \pm 0.14 \pm 0.99$	1000k	¹ ACHASOV	01E	SND $e^+e^- \rightarrow K^+K^-, K_S K_L, \pi^+\pi^-\pi^0$

NODE=M004G10
NODE=M004G10 **$\Gamma(K_L^0 K_S^0)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$** **$\Gamma_2/\Gamma \times \Gamma_9/\Gamma$**

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
10.10 ± 0.13 OUR FIT				
10.06 ± 0.16 OUR AVERAGE				
$10.01 \pm 0.04 \pm 0.17$	272k	² AKHMETSHIN	04	CMD2 $e^+e^- \rightarrow K_L^0 K_S^0$
$10.27 \pm 0.07 \pm 0.34$	500k	¹ ACHASOV	01E	SND $e^+e^- \rightarrow K^+K^-, K_S K_L, \pi^+\pi^-\pi^0$

NODE=M004G6
NODE=M004G6

$$\frac{[\Gamma(\rho\pi) + \Gamma(\pi^+\pi^-\pi^0)]}{\Gamma_{\text{total}}} \times \frac{\Gamma(e^+e^-)}{\Gamma_{\text{total}}} \quad \Gamma_3/\Gamma \times \Gamma_9/\Gamma$$

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	³ 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^-

NODE=M004G7
NODE=M004G7

$$\frac{\Gamma(\eta\gamma)}{\Gamma_{\text{total}}} \times \frac{\Gamma(e^+e^-)}{\Gamma_{\text{total}}} \quad \Gamma_6/\Gamma \times \Gamma_9/\Gamma$$

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	⁴ ACHASOV	07B	SND 0.6–1.38 $e^+e^- \rightarrow \eta\gamma$

4.093 ^{+0.040} _{-0.043} ±0.247	17.4k	⁵ AKHMETSHIN 05	CMD2	0.60–1.38 $e^+e^- \rightarrow \eta\gamma$

3.850 ±0.041 ±0.159	23k	^{6,7} AKHMETSHIN 01B	CMD2	$e^+e^- \rightarrow \eta\gamma$

4.00 ±0.04 ±0.11		⁸ ACHASOV	00	SND $e^+e^- \rightarrow \eta\gamma$

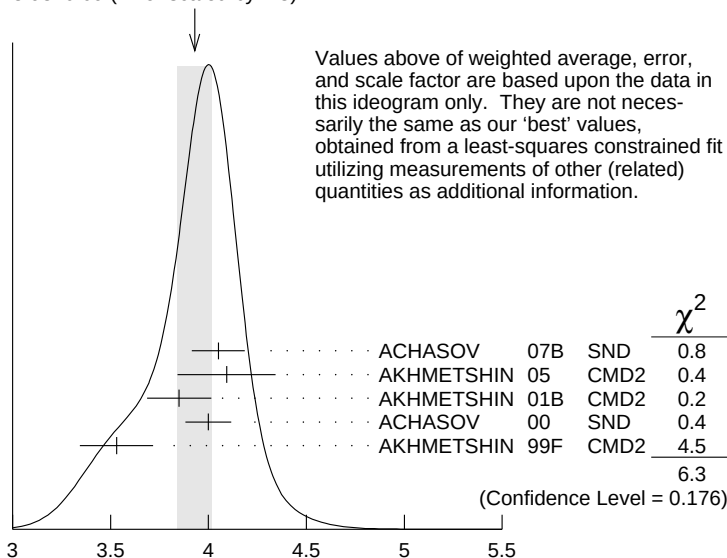
3.53 ±0.08 ±0.17	2200	^{9,10} AKHMETSHIN 99F	CMD2	$e^+e^- \rightarrow \eta\gamma$

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

4.19 ±0.06		¹¹ BENAYOUN	10	RVUE 0.4–1.05 e^+e^-

NODE=M004G2
NODE=M004G2

WEIGHTED AVERAGE
3.93±0.09 (Error scaled by 1.3)



$$\frac{\Gamma(\eta\gamma)}{\Gamma_{\text{total}}} \times \frac{\Gamma(e^+e^-)}{\Gamma_{\text{total}}} \quad \Gamma_6/\Gamma \times \Gamma_9/\Gamma$$

$$\frac{\Gamma(\pi^0\gamma)}{\Gamma_{\text{total}}} \times \frac{\Gamma(e^+e^-)}{\Gamma_{\text{total}}} \quad \Gamma_7/\Gamma \times \Gamma_9/\Gamma$$

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

3.74 ±0.18 OUR FIT

3.71 ±0.21 OUR AVERAGE

3.75 ±0.11 ±0.29	18680	AKHMETSHIN 05	CMD2	0.60–1.38 $e^+e^- \rightarrow \pi^0\gamma$

3.67 ±0.10 ^{+0.27} _{-0.25}		¹² 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		¹¹ BENAYOUN	10	RVUE 0.4–1.05 e^+e^-

NODE=M004G3
NODE=M004G3

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

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

VALUE (units 10^{-8})

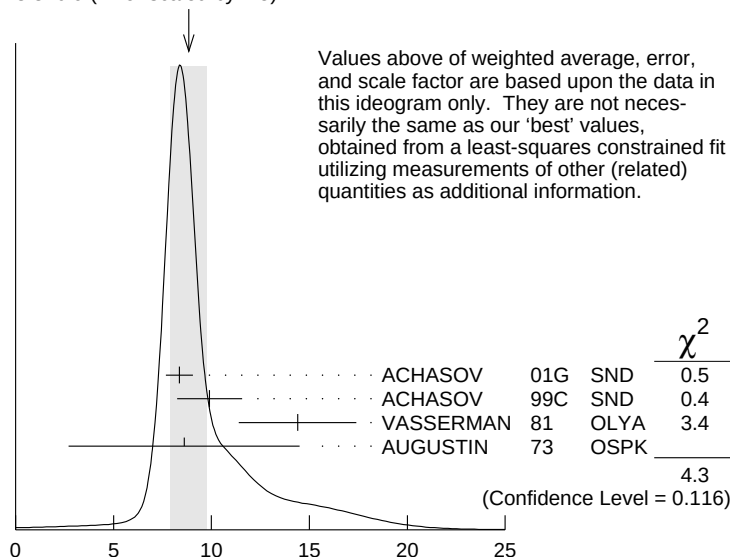
DOCUMENT ID

TECN

COMMENT

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 $\pm 0.59 \pm 0.37$	ACHASOV	01G	SND	$e^+e^- \rightarrow \mu^+\mu^-$
9.9 $\pm 1.4 \pm 0.9$	⁹ ACHASOV	99C	SND	$e^+e^- \rightarrow \mu^+\mu^-$
14.4 ± 3.0	³ VASSERMAN	81	OLYA	$e^+e^- \rightarrow \mu^+\mu^-$
8.6 ± 5.9	³ AUGUSTIN	73	OSPK	$e^+e^- \rightarrow \mu^+\mu^-$

WEIGHTED AVERAGE
8.8 ± 0.9 (Error scaled by 1.5)

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

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

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

$$\Gamma_{12}/\Gamma \times \Gamma_9/\Gamma$$

VALUE (units 10^{-8})

DOCUMENT ID

TECN

COMMENT

NODE=M004G4
NODE=M004G4**2.2 ± 0.4 OUR FIT****2.2 ± 0.4 OUR AVERAGE**

2.1 $\pm 0.3 \pm 0.3$	⁹ ACHASOV	00C	SND	$e^+e^- \rightarrow \pi^+\pi^-$
1.95 ± 1.15 -0.87	³ GOLUBEV	86	ND	$e^+e^- \rightarrow \pi^+\pi^-$
6.01 ± 3.19 -2.51	³ VASSERMAN	81	OLYA	$e^+e^- \rightarrow \pi^+\pi^-$

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

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

VALUE (units 10^{-8})

DOCUMENT ID

TECN

COMMENT

NODE=M004G11
NODE=M004G11**1.40 ± 0.15 OUR FIT****1.37 $\pm 0.17 \pm 0.01$** ^{13,14}AMBROSINO 08G KLOE $e^+e^- \rightarrow \pi^+\pi^-2\pi^0, 2\pi^0\gamma$

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

$$\Gamma_{18}/\Gamma \times \Gamma_9/\Gamma$$

VALUE (units 10^{-8})

DOCUMENT ID

TECN

COMMENT

NODE=M004G9
NODE=M004G9**3.34 ± 0.17 OUR FIT****3.33 $\pm 0.04 \pm 0.19$
-0.09 -0.20** ¹⁵AMBROSINO 07 KLOE $e^+e^- \rightarrow \pi^0\pi^0\gamma$

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

$$\Gamma_{19}/\Gamma \times \Gamma_9/\Gamma$$

VALUE (units 10^{-9})

EVTS

DOCUMENT ID

TECN

COMMENT

NODE=M004G8
NODE=M004G8**1.2 ± 0.8
-0.7 OUR FIT****1.17 $\pm 0.52 \pm 0.64$** 3285 ⁹AKHMETSHIN 00E CMD2 $e^+e^- \rightarrow \pi^+\pi^-\pi^+\pi^-$

¹ From the combined fit assuming that the total $\phi(1020)$ production cross section is saturated by those of K^+K^- , $K_S^0K_L^0$, $\pi^+\pi^-\pi^0$, and $\eta\gamma$ decays modes and using ACHASOV 00B for the $\eta\gamma$ decay mode.

² Update of AKHMETSHIN 99D

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

NODE=M004G;LINKAGE=AE

NODE=M004G;LINKAGE=GS

NODE=M004G;LINKAGE=B

⁴ 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.

⁵ From the $\eta \rightarrow 2\gamma$ decay and using $B(\eta \rightarrow \gamma\gamma) = 39.43 \pm 0.26\%$.

⁶ From the $\eta \rightarrow 3\pi^0$ decay and using $B(\eta \rightarrow 3\pi^0) = (32.24 \pm 0.29) \times 10^{-2}$.

⁷ 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).

⁸ From the $\eta \rightarrow 2\gamma$ decay and using $B(\eta \rightarrow 2\gamma) = (39.21 \pm 0.34) \times 10^{-2}$.

⁹ Recalculated by the authors from the cross section in the peak.

¹⁰ From the $\eta \rightarrow \pi^+\pi^-\pi^0$ decay and using $B(\eta \rightarrow \pi^+\pi^-\pi^0) = (23.1 \pm 0.5) \times 10^{-2}$.

¹¹ A simultaneous fit of $e^+e^- \rightarrow \pi^+\pi^-$, $\pi^+\pi^-\pi^0$, $\pi^0\gamma$, $\eta\gamma$ data.

¹² From the $\pi^0 \rightarrow 2\gamma$ decay and using $B(\pi^0 \rightarrow 2\gamma) = (98.798 \pm 0.032) \times 10^{-2}$.

¹³ Recalculated by the authors from the cross section at the peak.

¹⁴ AMBROSINO 08G reports $[\Gamma(\phi(1020) \rightarrow \omega\pi^0)/\Gamma_{\text{total}} \times \Gamma(\phi(1020) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\omega(782) \rightarrow \pi^+\pi^-\pi^0)] = (1.22 \pm 0.13 \pm 0.08) \times 10^{-8}$ which we divide by our best value $B(\omega(782) \rightarrow \pi^+\pi^-\pi^0) = (89.2 \pm 0.7) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

¹⁵ Calculated by the authors from the cross section at the peak.

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

NODE=M004G3;LINKAGE=A

NODE=M004G11;LINKAGE=AB

NODE=M004G11;LINKAGE=AM

NODE=M004G9;LINKAGE=AM

NODE=M004220

NODE=M004R1

NODE=M004R1

NODE=M004R2

NODE=M004R2

NODE=M004R19

NODE=M004R19

$\phi(1020)$ BRANCHING RATIOS

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

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

0.489±0.005 OUR FIT Error includes scale factor of 1.1.

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	$2.1-2.7 K^-p \rightarrow \Lambda K^+K^-$

• • • 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	$e^+e^- \rightarrow K^+K^-, K_S^0 K_L^0, \pi^+\pi^-\pi^0$

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

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

0.342±0.004 OUR FIT Error includes scale factor of 1.1.

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	$e^+e^- \rightarrow K_L^0 K_S^0$

• • • 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	BALAKIN 71	OSPK	$e^+e^- \rightarrow K_L^0 K_S^0$
0.40 ±0.04	167	LINDSEY 66	HBC	$2.1-2.7 K^-p \rightarrow \Lambda K_L^0 K_S^0$

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

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

0.698±0.014 OUR FIT Error includes scale factor of 1.1.

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	$3.9, 4.6 K^-p$

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

0.68 ±0.03		³ AKHMETSHIN 95	CMD2	$e^+e^- \rightarrow K_L^0 K_S^0, K^+K^-$

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

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

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.411±0.005 OUR FIT	Error includes scale factor of 1.1.			
0.45 ±0.04 OUR AVERAGE				
0.44 ±0.07		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 $K^- p \rightarrow \Lambda K \bar{K}$

NODE=M004R5
NODE=M004R5

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

$$\Gamma_3/\Gamma$$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.1532±0.0032 OUR FIT	Error includes scale factor of 1.1.			
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	⁴ AKHMETSHIN 98	CMD2	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
0.139 ±0.007		⁵ PARROUR	76B OSPK	e^+e^-

NODE=M004R3
NODE=M004R3

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

$$\Gamma_3/\Gamma_1$$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.313±0.009 OUR FIT	Error includes scale factor of 1.1.			
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
0.184±0.005 OUR FIT	Error includes scale factor of 1.1.		
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±0.012 OUR FIT	Error includes scale factor of 1.1.			
0.51 ±0.05 OUR AVERAGE				
0.56 ±0.07	3681	BUKIN	78C OLYA	$e^+e^- \rightarrow K_L^0 K_S^0, \pi^+\pi^-\pi^0$
0.47 ±0.06	516	COSME	74 OSPK	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$

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	^{6,7} ALOISIO	03 KLOE	1.02 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
<0.0006	90		⁸ ACHASOV	02 SND	1.02 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
<0.23	90		⁸ CORDIER	80 DM1	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
<0.20	90		⁸ PARROUR	76B OSPK	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$

NODE=M004R46
NODE=M004R46

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

$$\Gamma_6/\Gamma$$

VALUE (units 10 ⁻²)	EVTS	DOCUMENT ID	TECN	COMMENT
1.309±0.024 OUR FIT	Error includes scale factor of 1.2.			
1.26 ±0.04 OUR AVERAGE				
1.246±0.025±0.057	10k	⁹ ACHASOV	98F SND	$e^+e^- \rightarrow 7\gamma$
1.18 ±0.11	279	¹⁰ AKHMETSHIN 95	CMD2	$e^+e^- \rightarrow \pi^+\pi^-\pi^0 3\gamma$
1.30 ±0.06		¹¹ DRUZHININ 84	ND	$e^+e^- \rightarrow 3\gamma$
1.4 ±0.2		¹² DRUZHININ 84	ND	$e^+e^- \rightarrow 6\gamma$
0.88 ±0.20	290	KURDADZE	83C OLYA	$e^+e^- \rightarrow 3\gamma$
1.35 ±0.29		ANDREWS	77 CNTR	6.7–10 γ Cu
1.5 ±0.4	54	¹¹ COSME	76 OSPK	e^+e^-
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1.38 ±0.02 ±0.02		¹ AKHMETSHIN 11	CMD2	1.02 $e^+e^- \rightarrow \eta\gamma$
1.37 ±0.05 ±0.01	33k	¹³ ACHASOV	07B SND	0.6–1.38 $e^+e^- \rightarrow \eta\gamma$
1.373±0.014±0.085	17.4k	^{14,15} AKHMETSHIN 05	CMD2	0.60–1.38 $e^+e^- \rightarrow \eta\gamma$
1.287±0.013±0.063		^{16,17} AKHMETSHIN 01B	CMD2	$e^+e^- \rightarrow \eta\gamma$
1.338±0.012±0.052		¹⁸ ACHASOV	00 SND	$e^+e^- \rightarrow \eta\gamma$
1.18 ±0.03 ±0.06	2200	¹⁹ AKHMETSHIN 99F	CMD2	$e^+e^- \rightarrow \eta\gamma$
1.21 ±0.07		²⁰ BENAYOUN	96 RVUE	0.54–1.04 $e^+e^- \rightarrow \eta\gamma$

NODE=M004R11
NODE=M004R11

OCCUR=2

$\Gamma(\pi^0\gamma)/\Gamma_{\text{total}}$ Γ_7/Γ VALUE (units 10^{-3}) EVTS

DOCUMENT ID TECN COMMENT

1.27 $\pm$ 0.06 OUR FIT**1.31 $\pm$ 0.13 OUR AVERAGE**1.30 $\pm$ 0.13DRUZHININ 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. • • •

1.258 $\pm$ 0.037 $\pm$ 0.077 18680 ^{21,22} AKHMETSHIN 05 CMD2 0.60-1.38 $e^+e^- \rightarrow \pi^0\gamma$ 1.226 $\pm$ 0.036 ^{+0.096}_{-0.089} ²³ ACHASOV 00 SND $e^+e^- \rightarrow \pi^0\gamma$ 1.26 $\pm$ 0.17 ²⁰ BENAYOUN 96 RVUE 0.54-1.04 $e^+e^- \rightarrow \pi^0\gamma$ $\Gamma(\eta\gamma)/\Gamma(\pi^0\gamma)$ Γ_6/Γ_7

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

2.954 $\pm$ 0.030 OUR FIT Error includes scale factor of 1.1.**2.98 $\pm$ 0.07 OUR AVERAGE** Error includes scale factor of 1.1.2.93 $\pm$ 0.14 1900k ²⁴ ACHASOV 01E SND $e^+e^- \rightarrow K^+K^-, K_S^0K_L^0, \pi^+\pi^-\pi^0$ 2.88 $\pm$ 0.09 55600 AKHMETSHIN 95 CMD2 $e^+e^- \rightarrow$ hadrons3.00 $\pm$ 0.21 3681 BUKIN 78C OLYA $e^+e^- \rightarrow$ hadrons3.10 $\pm$ 0.14 ²⁵ PARROUR 76 OSPK e^+e^- 3.3 $\pm$ 0.3 COSME 74 OSPK $e^+e^- \rightarrow$ hadrons2.81 $\pm$ 0.25 681 BALAKIN 71 OSPK $e^+e^- \rightarrow$ hadrons3.50 $\pm$ 0.27 CHATELUS 71 OSPK e^+e^- $\Gamma(\mu^+\mu^-)/\Gamma_{\text{total}}$ Γ_{10}/Γ VALUE (units 10^{-4})

DOCUMENT ID TECN COMMENT

2.87 $\pm$ 0.19 OUR FIT**2.5 $\pm$ 0.4 OUR AVERAGE**2.69 $\pm$ 0.46 ²⁶ HAYES 71 CNTR 8.3,9.8 $\gamma C \rightarrow \mu^+\mu^- X$ 2.17 $\pm$ 0.60 ²⁶ 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 $\pm$ 0.20 $\pm$ 0.14 ²⁷ ACHASOV 01G SND $e^+e^- \rightarrow \mu^+\mu^-$ 3.30 $\pm$ 0.45 $\pm$ 0.32 ⁴ ACHASOV 99C SND $e^+e^- \rightarrow \mu^+\mu^-$ 4.83 $\pm$ 1.02 ²⁸ VASSERMAN 81 OLYA $e^+e^- \rightarrow \mu^+\mu^-$ 2.87 $\pm$ 1.98 ²⁸ AUGUSTIN 73 OSPK $e^+e^- \rightarrow \mu^+\mu^-$ $\Gamma(\eta e^+e^-)/\Gamma_{\text{total}}$ Γ_{11}/Γ VALUE (units 10^{-4}) EVTS

DOCUMENT ID TECN COMMENT

1.15 $\pm$ 0.10 OUR AVERAGE1.19 $\pm$ 0.19 $\pm$ 0.12 213 ²⁹ ACHASOV 01B SND $e^+e^- \rightarrow \gamma\gamma e^+e^-$ 1.14 $\pm$ 0.10 $\pm$ 0.06 355 ³⁰ AKHMETSHIN 01 CMD2 $e^+e^- \rightarrow \eta e^+e^-$ 1.3 ^{+0.8}_{-0.6} 7 GOLUBEV 85 ND $e^+e^- \rightarrow \gamma\gamma e^+e^-$

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

1.13 $\pm$ 0.14 $\pm$ 0.07 183 ³¹ AKHMETSHIN 01 CMD2 $e^+e^- \rightarrow \eta e^+e^-$ 1.21 $\pm$ 0.14 $\pm$ 0.09 130 ³² AKHMETSHIN 01 CMD2 $e^+e^- \rightarrow \eta e^+e^-$ 1.04 $\pm$ 0.20 $\pm$ 0.08 42 ³³ AKHMETSHIN 01 CMD2 $e^+e^- \rightarrow \eta e^+e^-$ $\Gamma(\pi^+\pi^-)/\Gamma_{\text{total}}$ 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 ⁴ ACHASOV 00C SND $e^+e^- \rightarrow \pi^+\pi^-$ 0.65 ^{+0.38}_{-0.29} ⁴ GOLUBEV 86 ND $e^+e^- \rightarrow \pi^+\pi^-$ 2.01 ^{+1.07}_{-0.84} ⁴ 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 $\gamma C \rightarrow C\pi^+\pi^-$ NODE=M004R17
NODE=M004R17NODE=M004R42
NODE=M004R42NODE=M004R16
NODE=M004R16NODE=M004R10
NODE=M004R10NODE=M004R24
NODE=M004R24OCCUR=2
OCCUR=3
OCCUR=4NODE=M004R18
NODE=M004R18

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

DOCUMENT ID

TECN

COMMENT

 Γ_{13}/Γ NODE=M004R28
NODE=M004R28**4.7±0.5 OUR FIT****5.2^{+1.3}_{-1.1}**34,35 AULCHENKO 00A SND $e^+e^- \rightarrow \pi^+\pi^-\pi^0\pi^0$

OCCUR=2

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

4.4±0.6

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

~ 5.4

37 ACHASOV 00E SND $e^+e^- \rightarrow \pi^0\pi^0\gamma$ 5.5^{+1.6}_{-1.4}±0.335,38 AULCHENKO 00A SND $e^+e^- \rightarrow \pi^+\pi^-\pi^0\pi^0$ 4.8^{+1.9}_{-1.7}±0.837 ACHASOV 99 SND $e^+e^- \rightarrow \pi^+\pi^-\pi^0\pi^0$ $\Gamma(\omega\gamma)/\Gamma_{\text{total}}$

VALUE CL%

DOCUMENT ID

TECN

COMMENT

 Γ_{14}/Γ NODE=M004R14
NODE=M004R14**<0.05**

84

LINDSEY

66

HBC

2.1–2.7 $K^-p \rightarrow \Lambda\pi^+\pi^-$ neutrals $\Gamma(\rho\gamma)/\Gamma_{\text{total}}$ VALUE (units 10^{-4}) CL%

DOCUMENT ID

TECN

COMMENT

 Γ_{15}/Γ NODE=M004R15
NODE=M004R15**< 0.12**

90

39 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 $\Gamma(\pi^+\pi^-\gamma)/\Gamma_{\text{total}}$ VALUE (units 10^{-4}) CL%

EVTS

DOCUMENT ID

TECN

COMMENT

 Γ_{16}/Γ NODE=M004R12
NODE=M004R12**0.41±0.12±0.04**

30175

40 AKHMETSHIN 99B CMD2 $e^+e^- \rightarrow \pi^+\pi^-\gamma$

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

< 0.3

90

41 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 $\Gamma(f_0(980)\gamma)/\Gamma_{\text{total}}$ VALUE (units 10^{-4}) CL%

EVTS

DOCUMENT ID

TECN

COMMENT

 Γ_{17}/Γ NODE=M004R30
NODE=M004R30**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}±0.1842 AMBROSINO 07 KLOE $e^+e^- \rightarrow \pi^0\pi^0\gamma$

2.90±0.21±1.54

43 AKHMETSHIN 99C CMD2 $e^+e^- \rightarrow \pi^+\pi^-\gamma, \pi^0\pi^0\gamma$

OCCUR=3

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

4.47±0.21

2438

44 ALOISIO 02D KLOE $e^+e^- \rightarrow \pi^0\pi^0\gamma$ 3.5 ±0.3 ^{+1.3}_{-0.5}

419

45,46 ACHASOV 00H SND $e^+e^- \rightarrow \pi^0\pi^0\gamma$

1.93±0.46±0.50

27188

47 AKHMETSHIN 99B CMD2 $e^+e^- \rightarrow \pi^+\pi^-\gamma$

3.05±0.25±0.72

268

48 AKHMETSHIN 99C CMD2 $e^+e^- \rightarrow \pi^0\pi^0\gamma$

1.5 ±0.5

268

49 AKHMETSHIN 99C CMD2 $e^+e^- \rightarrow \pi^0\pi^0\gamma$

OCCUR=2

3.42±0.30±0.36

164

45 ACHASOV 98I SND $e^+e^- \rightarrow 5\gamma$

< 1

90

50 AKHMETSHIN 97C CMD2 $e^+e^- \rightarrow \pi^+\pi^-\gamma$

< 7

90

51 AKHMETSHIN 97C CMD2 $e^+e^- \rightarrow \pi^+\pi^-\gamma$

OCCUR=2

< 20

90

DRUZHININ 87 ND $e^+e^- \rightarrow \pi^0\pi^0\gamma$ $\Gamma(f_0(980)\gamma)/\Gamma(\eta\gamma)$ VALUE (units 10^{-2})

EVTS

DOCUMENT ID

TECN

COMMENT

 Γ_{17}/Γ_6 NODE=M004R44
NODE=M004R44**2.46±0.15 OUR FIT** Error includes scale factor of 1.1.**2.6 ±0.2 ^{+0.8}_{-0.3}**

419

45 ACHASOV 00H SND $e^+e^- \rightarrow \pi^0\pi^0\gamma$

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

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
1.07 ± 0.06 OUR AVERAGE					
1.07 $+0.01$ $+0.06$ -0.03 -0.06			52 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	ACHASOV	00H SND	$e^+e^- \rightarrow \pi^0\pi^0\gamma$
<10		90	DRUZHININ	87 ND	$e^+e^- \rightarrow 5\gamma$

NODE=M004R26
NODE=M004R26

 $\Gamma(\pi^0\pi^0\gamma)/\Gamma(\eta\gamma)$ Γ_{18}/Γ_6

VALUE (units 10^{-2})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
0.86 ± 0.04 OUR FIT					
0.865 ± 0.070 ± 0.017		419	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	$e^+e^- \rightarrow 5\gamma$

NODE=M004R39
NODE=M004R39

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

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
3.93 ± 1.74 ± 2.14		3285	AKHMETSHIN	00E CMD2	$e^+e^- \rightarrow \pi^+\pi^-\pi^+\pi^-$
< 870		90	CORDIER	79 WIRE	$e^+e^- \rightarrow \pi^+\pi^-\pi^+\pi^-$

NODE=M004R22
NODE=M004R22

 $\Gamma(\pi^+\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{20}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
< 4.6	90	AKHMETSHIN 00E	CMD2	$e^+e^- \rightarrow \pi^+\pi^-\pi^+\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<150	95	BARKOV	88 CMD	$e^+e^- \rightarrow \pi^+\pi^-\pi^+\pi^0$

NODE=M004R27
NODE=M004R27

 $\Gamma(\pi^0e^+e^-)/\Gamma_{\text{total}}$ Γ_{21}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
1.12 ± 0.28 OUR AVERAGE					
1.01 ± 0.28 ± 0.29		52	ACHASOV	02D SND	$e^+e^- \rightarrow \pi^0e^+e^-$
1.22 ± 0.34 ± 0.21		46	AKHMETSHIN	01C CMD2	$e^+e^- \rightarrow \pi^0e^+e^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<12	90		DOLINSKY	88 ND	$e^+e^- \rightarrow \pi^0e^+e^-$

NODE=M004R31
NODE=M004R31

 $\Gamma(\pi^0\eta\gamma)/\Gamma_{\text{total}}$ Γ_{22}/Γ

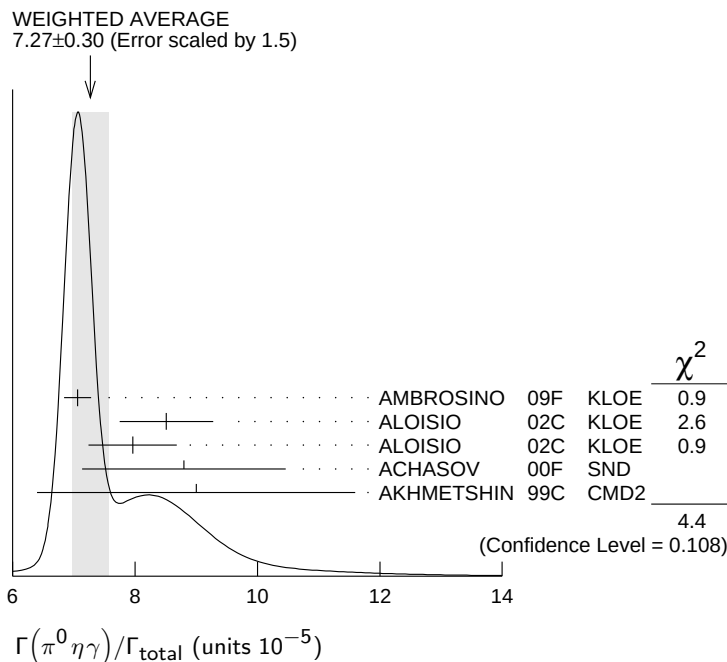
VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
7.27 ± 0.30 OUR AVERAGE					
Error includes scale factor of 1.5. See the ideogram below.					
7.06 ± 0.22		16.9k	56 AMBROSINO	09F KLOE	$1.02 e^+e^- \rightarrow \eta\pi^0\gamma$
8.51 ± 0.51 ± 0.57		607	57 ALOISIO	02C KLOE	$e^+e^- \rightarrow \eta\pi^0\gamma$
7.96 ± 0.60 ± 0.40		197	58 ALOISIO	02C KLOE	$e^+e^- \rightarrow \eta\pi^0\gamma$
8.8 ± 1.4 ± 0.9		36	59 ACHASOV	00F SND	$e^+e^- \rightarrow \eta\pi^0\gamma$
9.0 ± 2.4 ± 1.0		80	AKHMETSHIN	99C CMD2	$e^+e^- \rightarrow \eta\pi^0\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
7.01 ± 0.10 ± 0.20		13.3k	57,60 AMBROSINO	09F KLOE	$1.02 e^+e^- \rightarrow \eta\pi^0\gamma$
7.12 ± 0.13 ± 0.22		3.6k	58,61 AMBROSINO	09F KLOE	$1.02 e^+e^- \rightarrow \eta\pi^0\gamma$
8.3 ± 2.3 ± 1.2		20	ACHASOV	98B SND	$e^+e^- \rightarrow 5\gamma$
<250	90		DOLINSKY	91 ND	$e^+e^- \rightarrow \pi^0\eta\gamma$

NODE=M004R32
NODE=M004R32

OCCUR=2

OCCUR=2

OCCUR=3

 **$\Gamma(a_0(980)\gamma)/\Gamma_{\text{total}}$** **$\Gamma_{23}/\Gamma$**

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			62 ALOISIO	02C KLOE	$e^+e^- \rightarrow \eta\pi^0\gamma$
8.8±1.7	36		63 ACHASOV	00F SND	$e^+e^- \rightarrow \eta\pi^0\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
11 ±2			64 GOKALP	02 RVUE	$e^+e^- \rightarrow \eta\pi^0\gamma$
<500	90		DOLINSKY	91 ND	$e^+e^- \rightarrow \pi^0\eta\gamma$

NODE=M004R33
NODE=M004R33

 $\Gamma(f_0(980)\gamma)/\Gamma(a_0(980)\gamma)$ **Γ_{17}/Γ_{23}**

VALUE	DOCUMENT ID	TECN	COMMENT
6.1±0.6	65 ALOISIO	02C KLOE	$e^+e^- \rightarrow \eta\pi^0\gamma$

NODE=M004R47
NODE=M004R47

 $\Gamma(K^0\bar{K}^0\gamma)/\Gamma_{\text{total}}$ **Γ_{24}/Γ**

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<1.9 × 10⁻⁸	90	AMBROSINO	09C KLOE	$e^+e^- \rightarrow K_S^0 K_S^0 \gamma$

NODE=M004R48
NODE=M004R48

 $\Gamma(\eta'(958)\gamma)/\Gamma_{\text{total}}$ **Γ_{25}/Γ**

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
6.25±0.21 OUR FIT					
6.25±0.30 OUR AVERAGE					
6.25±0.28±0.11	3407		66 AMBROSINO	07A KLOE	$1.02 e^+e^- \rightarrow \pi^+\pi^-\gamma$
6.7 ^{+2.8} _{-2.4} ±0.8	12		67 AULCHENKO	03B SND	$e^+e^- \rightarrow \eta'\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
6.7 ^{+5.0} _{-4.2} ±1.5	7		AULCHENKO	03B SND	$e^+e^- \rightarrow 7\gamma$
6.10±0.61±0.43	120		68 ALOISIO	02E KLOE	$1.02 e^+e^- \rightarrow \pi^+\pi^-3\gamma$
8.2 ^{+2.1} _{-1.9} ±1.1	21		69 AKHMETSHIN	00B CMD2	$e^+e^- \rightarrow \pi^+\pi^-3\gamma$
4.9 ^{+2.2} _{-1.8} ±0.6	9		70 AKHMETSHIN	00F CMD2	$e^+e^- \rightarrow \pi^+\pi^-\pi^+\pi^- \geq 2\gamma$
6.4 ±1.6	30		71 AKHMETSHIN	00F CMD2	$e^+e^- \rightarrow \eta'(958)\gamma$
6.7 ^{+3.4} _{-2.9} ±1.0	5		72 AULCHENKO	99 SND	$e^+e^- \rightarrow \pi^+\pi^-3\gamma$
<11	90		AULCHENKO	98 SND	$e^+e^- \rightarrow 7\gamma$
12 ⁺⁷ ₋₅ ±2	6		69 AKHMETSHIN	97B CMD2	$e^+e^- \rightarrow \pi^+\pi^-3\gamma$
<41	90		DRUZHININ	87 ND	$e^+e^- \rightarrow \gamma\eta\pi^+\pi^-$

NODE=M004R25
NODE=M004R25

OCCUR=2

OCCUR=2

$\Gamma(\eta'(958)\gamma)/\Gamma(K_L^0 K_S^0)$ Γ_{25}/Γ_2 VALUE (units 10^{-4}) EVTS

DOCUMENT ID

TECN

COMMENT

1.83±0.06 OUR FIT**1.46^{+0.64}_{-0.54}±0.18**

9

73

AKHMETSHIN 00F

CMD2

 $e^+e^- \rightarrow \pi^+\pi^-\pi^+\pi^- \geq 2\gamma$ NODE=M004R43
NODE=M004R43 $\Gamma(\eta'(958)\gamma)/\Gamma(\eta\gamma)$ 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

74

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

75

AKHMETSHIN 97B

CMD2

 $e^+e^- \rightarrow \pi^+\pi^- 3\gamma$ NODE=M004R34
NODE=M004R34 $\Gamma(\eta\pi^0\pi^0\gamma)/\Gamma_{\text{total}}$ 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

47

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

76

AKHMETSHIN 97C

CMD2

 $e^+e^- \rightarrow \mu^+\mu^-\gamma$ NODE=M004R35
NODE=M004R35 $\Gamma(\rho\gamma\gamma)/\Gamma_{\text{total}}$ 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

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 Theoretical analysis of BRAMON 00 taking into account phase-space difference, electromagnetic radiative corrections, as well as isospin breaking, predicts 0.62. FLOREZ-BAEZ 08 predicts 0.63 considering also structure-dependent radiative corrections. FIS-CHBACH 02 calculates additional corrections caused by the close threshold and predicts 0.68. See also BENAYOUN 01 and DUBYNSKIY 07. BENAYOUN 12 obtains 0.71 ± 0.01 in the HLS model.

⁴ Using $B(\phi \rightarrow e^+e^-) = (2.99 \pm 0.08) \times 10^{-4}$.

⁵ 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.

⁶ From a fit without limitations on charged and neutral ρ masses and widths.

⁷ Adding the direct and $\omega\pi$ contributions and considering the interference between the $\rho\pi$ and $\pi^+\pi^-\pi^0$.

⁸ Neglecting the interference between the $\rho\pi$ and $\pi^+\pi^-\pi^0$.

⁹ Using $B(\phi \rightarrow e^+e^-) = (2.99 \pm 0.08) \times 10^{-4}$ and $B(\eta \rightarrow 3\pi^0) = (32.2 \pm 0.4) \times 10^{-2}$.

¹⁰ From $\pi^+\pi^-\pi^0$ decay mode of η .

¹¹ From 2γ decay mode of η .

¹² From $3\pi^0$ decay mode of η .

NODE=M004R1;LINKAGE=AK

NODE=M004R;LINKAGE=B2
NODE=M004R19;LINKAGE=KHNODE=M004R;LINKAGE=8D
NODE=M004R3;LINKAGE=ENODE=M004R;LINKAGE=L1
NODE=M004R;LINKAGE=L2NODE=M004R;LINKAGE=46
NODE=M004R11;LINKAGE=AC
NODE=M004R11;LINKAGE=Z3
NODE=M004R11;LINKAGE=A
NODE=M004R11;LINKAGE=C

- 13 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 $B(\phi(1020) \rightarrow e^+e^-) = (2.954 \pm 0.030) \times 10^{-4}$. 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.
- 14 Using $B(\phi \rightarrow e^+e^-) = (2.98 \pm 0.04) \times 10^{-4}$ and $B(\eta \rightarrow \gamma\gamma) = 39.43 \pm 0.26\%$.
- 15 Not independent of the corresponding $\Gamma(e^+e^-) \times \Gamma(\eta\gamma)/\Gamma_{\text{total}}^2$.
- 16 Using $B(\phi \rightarrow e^+e^-) = (2.99 \pm 0.08) \times 10^{-4}$ and $B(\eta \rightarrow 3\pi^0) = (32.24 \pm 0.29) \times 10^{-2}$.
- 17 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).
- 18 From the $\eta \rightarrow 2\gamma$ decay and using $B(\phi \rightarrow e^+e^-) = (2.99 \pm 0.08) \times 10^{-4}$.
- 19 From $\pi^+\pi^-\pi^0$ decay mode of η and using $B(\phi \rightarrow e^+e^-) = (2.99 \pm 0.08) \times 10^{-4}$.
- 20 Reanalysis of DRUZHININ 84, DOLINSKY 89, and DOLINSKY 91 taking into account a triangle anomaly contribution.
- 21 Using $B(\phi \rightarrow e^+e^-) = (2.98 \pm 0.04) \times 10^{-4}$.
- 22 Not independent of the corresponding $\Gamma(e^+e^-) \times \Gamma(\pi^0\gamma)/\Gamma_{\text{total}}^2$.
- 23 From the $\pi^0 \rightarrow 2\gamma$ decay and using $B(\phi \rightarrow e^+e^-) = (2.99 \pm 0.08) \times 10^{-4}$.
- 24 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.
- 25 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.
- 26 Neglecting interference between resonance and continuum.
- 27 Using $B(\phi \rightarrow e^+e^-) = (2.91 \pm 0.07) \times 10^{-4}$.
- 28 Recalculated by us using $B(\phi \rightarrow e^+e^-) = (2.99 \pm 0.08) \times 10^{-4}$.
- 29 Using $B(\eta \rightarrow \gamma\gamma) = (39.25 \pm 0.32)\%$, $B(\phi \rightarrow \eta\gamma) = (1.26 \pm 0.06)\%$, and $B(\phi \rightarrow e^+e^-) = (3.00 \pm 0.06) \times 10^{-4}$.
- 30 The average of the branching ratios separately obtained from the $\eta \rightarrow \gamma\gamma$, $3\pi^0$, $\pi^+\pi^-\pi^0$ decays.
- 31 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 $B(\phi \rightarrow \eta\gamma) = (1.297 \pm 0.033) \times 10^{-2}$.
- 32 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 $B(\phi \rightarrow \eta\gamma) = (1.297 \pm 0.033) \times 10^{-2}$.
- 33 From $\eta \rightarrow \pi^+\pi^-\pi^0$ decays and using $B(\pi^0 \rightarrow \gamma\gamma) = (98.798 \pm 0.033) \times 10^{-2}$, $B(\pi^0 \rightarrow e^+e^-\gamma) = (1.198 \pm 0.032) \times 10^{-2}$, $B(\eta \rightarrow \pi^+\pi^-\pi^0) = (23.0 \pm 0.4) \times 10^{-2}$, $B(\phi \rightarrow \pi^+\pi^-\pi^0) = (15.5 \pm 0.6) \times 10^{-2}$, and $B(\phi \rightarrow \eta\gamma) = (1.297 \pm 0.033) \times 10^{-2}$.
- 34 Using the 1996 and 1998 data.
- 35 $(2.3 \pm 0.3)\%$ correction for other decay modes of the $\omega(782)$ applied.
- 36 Not independent of the corresponding $\Gamma(\omega\pi^0) \times \Gamma(e^+e^-) / \Gamma^2(\text{total})$.
- 37 Using the 1996 data.
- 38 Using the 1998 data.
- 39 Supersedes AKHMETSHIN 97C.
- 40 For $E_\gamma > 20$ MeV and assuming that $B(\phi(1020) \rightarrow f_0(980)\gamma)$ is negligible. Supersedes AKHMETSHIN 97C.
- 41 For $E_\gamma > 20$ MeV and assuming that $B(\phi(1020) \rightarrow f_0(980)\gamma)$ is negligible.
- 42 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.
- 43 From the combined fit of the photon spectra in the reactions $e^+e^- \rightarrow \pi^+\pi^-\gamma$, $\pi^0\pi^0\gamma$.
- 44 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.
- 45 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 $B(f_0 \rightarrow \pi^+\pi^-) = 2B(f_0 \rightarrow \pi^0\pi^0)$.
- 46 Using the value $B(\phi \rightarrow \eta\gamma) = (1.338 \pm 0.053) \times 10^{-2}$.
- 47 For $E_\gamma > 20$ MeV. Supersedes AKHMETSHIN 97C.
- 48 Neglecting other intermediate mechanisms ($\rho\pi$, $\sigma\gamma$).
- 49 A narrow pole fit taking into account $f_0(980)$ and $f_0(1200)$ intermediate mechanisms.
- 50 For destructive interference with the Bremsstrahlung process
- 51 For constructive interference with the Bremsstrahlung process
- 52 Supersedes ALOISIO 02D.
- 53 Supersedes ACHASOV 98I. Excluding $\omega\pi^0$.
- 54 Using various branching ratios from the 2000 Edition of this Review (PDG 00).
- 55 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 $B(\eta \rightarrow \pi^+\pi^-\gamma) = (4.75 \pm 0.11) \times 10^{-2}$.
- 56 Combined results of $\eta \rightarrow \gamma\gamma$ and $\eta \rightarrow \pi^+\pi^-\pi^0$ decay modes measurements.
- 57 From the decay mode $\eta \rightarrow \gamma\gamma$.

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

NODE=M004R17;LINKAGE=AH

NODE=M004R17;LINKAGE=AK

NODE=M004R;LINKAGE=3G

NODE=M004R;LINKAGE=AE

NODE=M004R16;LINKAGE=E

NODE=M004R10;LINKAGE=A

NODE=M004R;LINKAGE=GZ

NODE=M004R;LINKAGE=VA

NODE=M004R;LINKAGE=VM

NODE=M004R;LINKAGE=H1

NODE=M004R;LINKAGE=H2

NODE=M004R;LINKAGE=H3

NODE=M004R;LINKAGE=H4

NODE=M004R28;LINKAGE=K2

NODE=M004R28;LINKAGE=K3

NODE=M004R28;LINKAGE=AM

NODE=M004R28;LINKAGE=VS

NODE=M004R28;LINKAGE=K1

NODE=M004R;LINKAGE=1N

NODE=M004R;LINKAGE=2N

NODE=M004R12;LINKAGE=Z3

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

NODE=M004R26;LINKAGE=MB

NODE=M004R;LINKAGE=V8

NODE=M004R;LINKAGE=DS

NODE=M004R;LINKAGE=5H

NODE=M004R32;LINKAGE=AM

NODE=M004R;LINKAGE=C1

- 58 From the decay mode $\eta \rightarrow \pi^+ \pi^- \pi^0$.
 59 Supersedes ACHASOV 98B.
 60 Using $B(\phi \rightarrow \eta\gamma) = (1.304 \pm 0.025)\%$, $B(\eta \rightarrow 3\pi^0) = (32.56 \pm 0.23)\%$, and $B(\eta \rightarrow \gamma\gamma) = (39.31 \pm 0.20)\%$.
 61 Using $B(\phi \rightarrow \eta\gamma) = (1.304 \pm 0.025)\%$, $B(\eta \rightarrow 3\pi^0) = (32.56 \pm 0.23)\%$, and $B(\eta \rightarrow \pi^+ \pi^- \pi^0) = (22.73 \pm 0.28)\%$.
 62 Using $M_{a_0(980)} = 984.8$ MeV and assuming $a_0(980)\gamma$ dominance.
 63 Assuming $a_0(980)\gamma$ dominance in the $\eta\pi^0\gamma$ final state.
 64 Using data of ACHASOV 00F.
 65 Using results of ALOISIO 02D and assuming that $f_0(980)$ decays into $\pi\pi$ only and $a_0(980)$ into $\eta\pi$ only.
 66 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 $B(\phi(1020) \rightarrow \eta\gamma) = (1.309 \pm 0.024) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.
 67 Averaging AULCHENKO 03B with AULCHENKO 99.
 68 Using $B(\phi \rightarrow \eta\gamma) = (1.297 \pm 0.033)\%$.
 69 Using the value $B(\phi \rightarrow \eta\gamma) = (1.26 \pm 0.06) \times 10^{-2}$.
 70 Using $B(\phi \rightarrow K_L^0 K_S^0) = (33.8 \pm 0.6)\%$.
 71 Averaging AKHMETSHIN 00B with AKHMETSHIN 00F.
 72 Using the value $B(\eta' \rightarrow \eta\pi^+\pi^-) = (43.7 \pm 1.5) \times 10^{-2}$ and $B(\eta \rightarrow \gamma\gamma) = (39.25 \pm 0.31) \times 10^{-2}$.
 73 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.
 74 From the decay mode $\eta' \rightarrow \eta\pi^+\pi^-$, $\eta \rightarrow \gamma\gamma$.
 75 Superseded by AKHMETSHIN 00B.
 76 For $E_\gamma > 20$ MeV.

NODE=M004R;LINKAGE=C2
 NODE=M004R32;LINKAGE=AF
 NODE=M004R32;LINKAGE=AB

 NODE=M004R32;LINKAGE=AR

 NODE=M004R;LINKAGE=C3
 NODE=M004R33;LINKAGE=AF
 NODE=M004R;LINKAGE=GK
 NODE=M004R;LINKAGE=C4

 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

 NODE=M004R;LINKAGE=T1

 NODE=M004R;LINKAGE=E1
 NODE=M004R;LINKAGE=KS
 NODE=M004R35;LINKAGE=A

 NODE=M00422A

Lepton Family number (LF) violating modes

$\Gamma(e^\pm \mu^\mp)/\Gamma_{\text{total}}$					Γ_{31}/Γ
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
$< 2 \times 10^{-6}$	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 $\phi \rightarrow \pi^+ \pi^- \pi^0$

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
 NODE=M004D1

VALUE (units 10^{-2})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
9.1$\pm$1.2 OUR AVERAGE					
10.1 $\pm$ 4.4 $\pm$ 1.7	80k		¹ AKHMETSHIN 06	CMD2	1.017–1.021 $e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
9.0 $\pm$ 1.1 $\pm$ 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.					

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 NODE=M004D;LINKAGE=L3
 NODE=M004D1;LINKAGE=KL

$\phi(1020)$ REFERENCES

BENAYOUN	12	EPJ C72 1848	M. Benayoun <i>et al.</i>	
NIECKNIG	12	EPJ C72 2014	F. Niecknig, B. Kubis, S.P. Schneider	(BONN)
AKHMETSHIN	11	PL B695 412	R. Akhmetshin <i>et al.</i>	(CMD2 Collab.)
ACHASOV	10A	PR D81 057102	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)
BENAYOUN	10	EPJ C65 211	M. Benayoun <i>et al.</i>	
AMBROSINO	09C	PL B679 10	F. Ambrosino <i>et al.</i>	(KLOE Collab.)
AMBROSINO	09F	PL B681 5	F. Ambrosino <i>et al.</i>	(KLOE Collab.)
AKHMETSHIN	08	PL B669 217	R.R. Akhmetshin <i>et al.</i>	(CMD-2 Collab.)
AMBROSINO	08G	PL B669 223	F. Ambrosino <i>et al.</i>	(KLOE Collab.)
AULCHENKO	08	JETPL 88 85	V. Aulchenko <i>et al.</i>	(CMD-2 Collab.)
Translated from ZETFP 88 93.				

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FLOREZ-BAEZ	08	PR D78 077301	F.V. Florez-Baez, G. Lopez Castro		REFID=52584
ACHASOV	07B	PR D76 077101	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=51942
AMBROSINO	07	EPJ C49 473	F. Ambrosino <i>et al.</i>	(KLOE Collab.)	REFID=51616
AMBROSINO	07A	PL B648 267	F. Ambrosino <i>et al.</i>	(KLOE Collab.)	REFID=51646
DUBYSNKIY	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.	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=48549
ACHASOV	02D	PR D65 032002	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=48814
ACHASOV	02D	JETPL 75 449	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	
ACHASOV	02C	Translated from ZETFP 75 539.	A. Aloisio <i>et al.</i>	(KLOE Collab.)	REFID=48823
ACHASOV	02D	PL B536 209	A. Aloisio <i>et al.</i>	(KLOE Collab.)	REFID=48824
ACHASOV	02E	PL B537 21	A. Aloisio <i>et al.</i>	(KLOE Collab.)	REFID=48825
ACHASOV	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	JPG 28 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.	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47431
ACHASOV	00D	PL B474 188	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47882
ACHASOV	00D	JETPL 72 282	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	
ACHASOV	00E	Translated from ZETFP 72 411.	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47927
ACHASOV	00E	NP B569 158	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47928
ACHASOV	00F	PL B479 53	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47930
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.	A. Bramon <i>et al.</i>		REFID=47969
PDG	00	PL B486 406	D.E. Groom <i>et al.</i>		REFID=47469
ACHASOV	99	EPJ C15 1	D.E. Groom <i>et al.</i>		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
AKHMETSHIN	99F	Also PL B508 217 (errata)	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.	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=46317
ACHASOV	98F	PL B438 441	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=46321
ACHASOV	98I	JETPL 68 573	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=46600
AKHMETSHIN	98	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
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.	S.I. Dolinsky <i>et al.</i>	(NOVO)	REFID=41022
DOLINSKY	88	SJNP 48 277	S.I. Dolinsky <i>et al.</i>	(NOVO)	
DOLINSKY	88	Translated from YAF 48 442.	S.I. Dolinsky <i>et al.</i>	(NOVO)	REFID=40448
DRUZHININ	87	ZPHY C37 1	V.P. Druzhinin <i>et al.</i>	(NOVO)	REFID=20563
ARMSTRONG	86	PL 166B 245	T.A. Armstrong <i>et al.</i>	(ATHU, BARI, BIRM+)	REFID=20564
ATKINSON	86	ZPHY C30 521	M. Atkinson <i>et al.</i>	(BONN, CERN, GLAS+)	REFID=11540
BEbek	86	PRL 56 1893	C. Bebek <i>et al.</i>	(CLEO Collab.)	REFID=20567
DAVENPORT	86	PR D33 2519	T.F. Davenport (TUFTS, ARIZ, FNAL, FSU, NDAM+)		REFID=20568
DIJKSTRA	86	ZPHY C31 375	H. Dijkstra <i>et al.</i>	(ANIK, BRIS, CERN+)	REFID=20569
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.	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=20562
GOLUBEV	85	PL 153B 343	V.B. Golubev <i>et al.</i>	(NOVO)	REFID=40450
GOLUBEV	85	SJNP 41 756	V.B. Golubev <i>et al.</i>	(NOVO)	
DRUZHININ	84	Translated from YAF 41 1183.	V.P. Druzhinin <i>et al.</i>	(NOVO)	REFID=20561
ARMSTRONG	83B	PL 144B 136	T.A. Armstrong <i>et al.</i>	(BARI, BIRM, CERN+)	REFID=20558
BARATE	83	NP B224 193	R. Barate <i>et al.</i>	(SACL, LOIC, SHMP, IND)	REFID=12177
KURDADZE	83C	PL 121B 449	R. Barate <i>et al.</i>	(NOVO)	REFID=20560
KURDADZE	83C	JETPL 38 366	L.M. Kurdadze <i>et al.</i>	(NOVO)	
ARENTON	82	Translated from ZETFP 38 306.	M.W. Arenton <i>et al.</i>	(ANL, ILL)	REFID=20556
PELLINEN	82	PR D25 2241	A. Pellinen, M. Roos	(HELs)	REFID=20557
DAUM	81	PS 25 599	A. Pellinen, M. Roos	(AMST, BRIS, CERN, CRAC+)	REFID=20552
IVANOV	81	PL 100B 439	C. Daum <i>et al.</i>	(NOVO)	REFID=20553
IVANOV	81	PL 107B 297	P.M. Ivanov <i>et al.</i>	(NOVO)	REFID=20554
VASSERMAN	81	Private Comm.	S.I. Eidelman	(NOVO)	REFID=20555
VASSERMAN	81	PL 99B 62	I.B. Vasserman <i>et al.</i>	(NOVO)	REFID=47475
VASSERMAN	81	Also SJNP 35 240	L.M. Kurdadze <i>et al.</i>		
VASSERMAN	81	Also Translated from YAF 35 352.	L.M. Kurdadze <i>et al.</i>		

CORDIER	80	NP B172 13	A. Cordier <i>et al.</i>	(LALO)
CORDIER	79	PL 81B 389	A. Cordier <i>et al.</i>	(LALO)
BUKIN	78B	SJNP 27 521	A.D. Bukin <i>et al.</i>	(NOVO)
		Translated from YAF 27 985		
BUKIN	78C	SJNP 27 516	A.D. Bukin <i>et al.</i>	(NOVO)
		Translated from YAF 27 976		
COOPER	78B	NP B146 1	A.M. Cooper <i>et al.</i>	(TATA, CERN, CDEF+)
LOSTY	78	NP B133 38	M.J. Losty <i>et al.</i>	(CERN, AMST, NIJM+)
AKERLOF	77	PRL 39 861	C.W. Akerlof <i>et al.</i>	(FNAL, MICH, PURD)
ANDREWS	77	PRL 38 198	D.E. Andrews <i>et al.</i>	(ROCH)
BALDI	77	PL 68B 381	R. Baldi <i>et al.</i>	(GEVA)
CERRADA	77B	NP B126 241	M. Cerrada <i>et al.</i>	(AMST, CERN, NIJM+)
COHEN	77	PRL 38 269	D. Cohen <i>et al.</i>	(ANL)
LAVEN	77	NP B127 43	H. Laven <i>et al.</i>	(AACH3, BERL, CERN, LOIC+)
LYONS	77	NP B125 207	L. Lyons, A.M. Cooper, A.G. Clark	(OXF)
COSME	76	PL 63B 352	G. Cosme <i>et al.</i>	(ORSAY)
KALBFLEISCH	76	PR D13 22	G.R. Kalbfleisch, R.C. Strand, J.W. Chapman	(BNL+)
PARROUR	76	PL 63B 357	G. Parrou <i>et al.</i>	(ORSAY)
PARROUR	76B	PL 63B 362	G. Parrou <i>et al.</i>	(ORSAY)
KALBFLEISCH	75	PR D11 987	G.R. Kalbfleisch, R.C. Strand, J.W. Chapman	(BNL+)
AYRES	74	PRL 32 1463	D.S. Ayres <i>et al.</i>	(ANL)
BESCH	74	NP B70 257	H.J. Besch <i>et al.</i>	(BONN)
COSME	74	PL 48B 155	G. Cosme <i>et al.</i>	(ORSAY)
COSME	74B	PL 48B 159	G. Cosme <i>et al.</i>	(ORSAY)
DEGROOT	74	NP B74 77	A.J. de Groot <i>et al.</i>	(AMST, NIJM)
AUGUSTIN	73	PRL 30 462	J.E. Augustin <i>et al.</i>	(ORSAY)
BALLAM	73	PR D7 3150	J. Ballam <i>et al.</i>	(SLAC, LBL)
BINNIE	73B	PR D8 2789	D.M. Binnie <i>et al.</i>	(LOIC, SHMP)
AGUILAR-...	72B	PR D6 29	M. Aguilar-Benitez <i>et al.</i>	(BNL)
ALVENSLEB...	72	PRL 28 66	H. Alvensleben <i>et al.</i>	(MIT, DESY)
BORENSTEIN	72	PR D5 1559	S.R. Borenstein <i>et al.</i>	(BNL, MICH)
COLLEY	72	NP B50 1	D.C. Colley <i>et al.</i>	(BIRM, GLAS)
BALAKIN	71	PL 34B 328	V.E. Balakin <i>et al.</i>	(NOVO)
CHATELUS	71	Thesis LAL 1247	Y. Chatelus	(STRB)
Also		PL 32B 416	J.C. Bizot <i>et al.</i>	(ORSAY)
HAYES	71	PR D4 899	S. Hayes <i>et al.</i>	(CORN)
STOTTLE...	71	Thesis ORO 2504 170	A.R. Stottlemeyer	(UMD)
BIZOT	70	PL 32B 416	J.C. Bizot <i>et al.</i>	(ORSAY)
Also		Liverpool Sym. 69	J.P. Perez-y-Jorba	
EARLES	70	PRL 25 1312	D.R. Earles <i>et al.</i>	(NEAS)
LINDSEY	66	PR 147 913	J.S. Lindsey, G. Smith	(LRL)
LONDON	66	PR 143 1034	G.W. London <i>et al.</i>	(BNL, SYRA) IGJPC
BADIER	65B	PL 17 337	J. Badier <i>et al.</i>	(EPOL, SACL, AMST)
LINDSEY	65	PRL 15 221	J.S. Lindsey, G.A. Smith	(LRL)
LINDSEY 65 data included in LINDSEY 66.				
SCHLEIN	63	PRL 10 368	P.E. Schlein <i>et al.</i>	(UCLA) IGJP

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NODE=M030W;LINKAGE=C

$h_1(1170)$

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

$h_1(1170)$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
1170±20 OUR ESTIMATE				
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
1168± 4	ANDO	92	SPEC	$8 \pi^- p \rightarrow \pi^+ \pi^- \pi^0 n$
1166± 5±3	¹ 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.				

$h_1(1170)$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
360±40 OUR ESTIMATE				
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
345± 6	ANDO	92	SPEC	$8 \pi^- p \rightarrow \pi^+ \pi^- \pi^0 n$
375± 6±34	³ 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.				

$h_1(1170)$ DECAY MODES

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

 $h_1(1170)$ BRANCHING RATIOS

$\Gamma(\rho\pi)/\Gamma_{\text{total}}$				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	$8 \pi p \rightarrow 3 \pi n$

 $h_1(1170)$ 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)

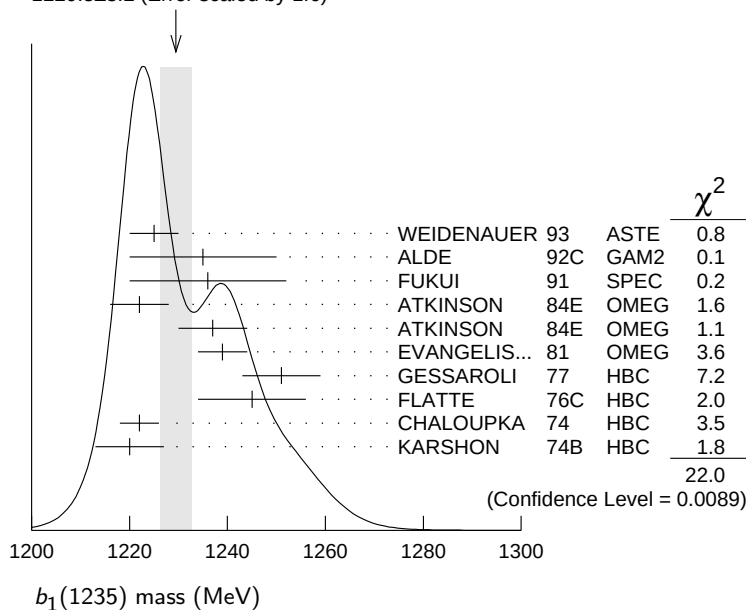
 $b_1(1235)$

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

 $b_1(1235)$ MASS

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 +	$200 \pi^+ Z \rightarrow Z \pi \omega$

WEIGHTED AVERAGE
1229.5±3.2 (Error scaled by 1.6)



NODE=M030215;NODE=M030

DESIG=1;OUR EST;→ UNCHECKED ←

NODE=M030220

NODE=M030R1
NODE=M030R1

NODE=M030

REFID=43171
REFID=20574
REFID=20572
REFID=20571

NODE=M011

NODE=M011M

NODE=M011M

OCCUR=2

$b_1(1235)$ 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 γp
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]	dominant	
Γ_2 $\pi^\pm \gamma$	(1.6±0.4) × 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 $(K\bar{K})^\pm \pi^0$	< 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

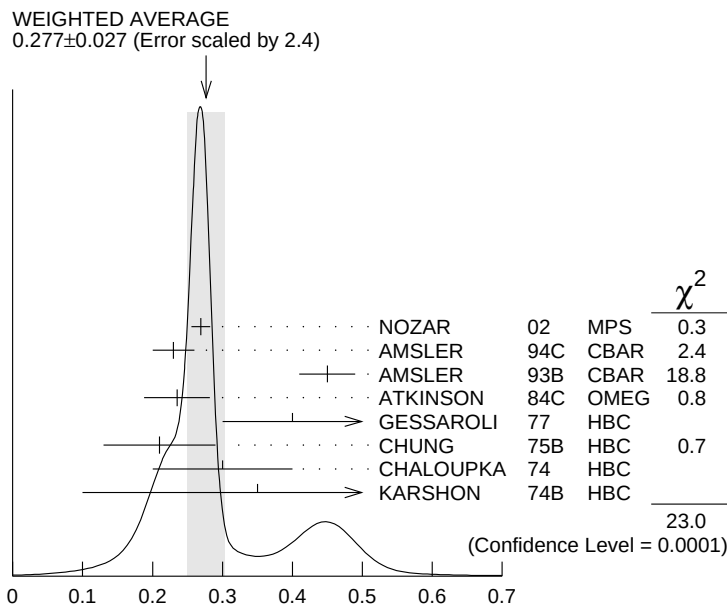
$\Gamma(\pi^\pm \gamma)$					Γ_2
VALUE (keV)	DOCUMENT ID	TECN	CHG	COMMENT	
230±60	COLLICK 84	SPEC	+	200 $\pi^+ Z \rightarrow Z \pi \omega$	

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 γp
0.4 $\begin{smallmatrix} +0.1 \\ -0.1 \end{smallmatrix}$		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 ratio in decay of $b_1(1235) \rightarrow \omega \pi$

$b_1(1235)$ 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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REFID=20006 **$a_1(1260)$**

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

See also our review under the $a_1(1260)$ in PDG 06, Journal of Physics, G **33** 1 (2006).

NODE=M010

NODE=M010

 $a_1(1260)$ MASS

NODE=M010M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1230±40 OUR ESTIMATE				
1255± 6⁺⁷₋₁₇	420k	ALEKSEEV	10	COMP 190 $\pi^- Pb \rightarrow \pi^- \pi^- \pi^+ Pb'$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1243±12±20		¹ AUBERT	07AU BABR	10.6 $e^+ e^- \rightarrow \rho^0 \rho^\pm \pi^\mp \gamma$
1230-1270	6360	² LINK	07A FOCUS	$D^0 \rightarrow \pi^- \pi^+ \pi^- \pi^+$
1203± 3		³ 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	⁴ ASNER	00 CLE2	10.6 $e^+ e^- \rightarrow \tau^+ \tau^-$, $\tau^- \rightarrow \pi^- \pi^0 \pi^0 \nu_\tau$
1255± 7± 6	5904	⁵ ABREU	98G DLPH	$e^+ e^-$
1207± 5± 8	5904	⁶ ABREU	98G DLPH	$e^+ e^-$
1196± 4± 5	5904	^{7,8} ABREU	98G DLPH	$e^+ e^-$
1240±10		BARBERIS	98B	450 $pp \rightarrow p_f \pi^+ \pi^- \pi^0 p_s$
1262± 9± 7		^{5,9} ACKERSTAFF	97R OPAL	$E_{cm}^{ee} = 88-94, \tau \rightarrow 3\pi \nu$
1210± 7± 2		^{6,9} ACKERSTAFF	97R OPAL	$E_{cm}^{ee} = 88-94, \tau \rightarrow 3\pi \nu$
1211± 7 ⁺⁵⁰ ₋₀		⁶ ALBRECHT	93C ARG	$\tau^+ \rightarrow \pi^+ \pi^+ \pi^- \nu$
1121± 8		¹⁰ ANDO	92 SPEC	8 $\pi^- p \rightarrow \pi^+ \pi^- \pi^0 n$
1242±37		¹¹ IVANOV	91 RVUE	$\tau \rightarrow \pi^+ \pi^+ \pi^- \nu$
1260±14		¹² IVANOV	91 RVUE	$\tau \rightarrow \pi^+ \pi^+ \pi^- \nu$
1250± 9		¹³ IVANOV	91 RVUE	$\tau \rightarrow \pi^+ \pi^+ \pi^- \nu$
1208±15		ARMSTRONG	90 OMEG	300.0 $pp \rightarrow pp \pi^+ \pi^- \pi^0$
1220±15		¹⁴ ISGUR	89 RVUE	$\tau^+ \rightarrow \pi^+ \pi^+ \pi^- \nu$
1260±25		¹⁵ BOWLER	88 RVUE	
1166±18±11		BAND	87 MAC	$\tau^+ \rightarrow \pi^+ \pi^+ \pi^- \nu$
1164±41±23		BAND	87 MAC	$\tau^+ \rightarrow \pi^+ \pi^0 \pi^0 \nu$
1250±40		¹⁴ 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		¹⁶ DANKOWY...	81 SPEC	8.45 $\pi^- p \rightarrow n 3\pi$
1280±30		¹⁶ DAUM	81B CNTR	63,94 $\pi^- p \rightarrow p 3\pi$
1041±13		¹⁷ GAVILLET	77 HBC	4.2 $K^- p \rightarrow \Sigma 3\pi$

NODE=M010M

→ UNCHECKED ←

OCCUR=2

OCCUR=3

OCCUR=2

OCCUR=2

OCCUR=3

OCCUR=2

- ¹ The $\rho^\pm \pi^\mp$ state can be also due to the $\pi(1300)$.
- ² Using the Breit-Wigner parameterization; strong correlation between mass and width.
- ³ Using the data of BARATE 98R.
- ⁴ From a fit to the 3π mass spectrum including the $K\bar{K}^*(892)$ threshold.
- ⁵ Uses the model of KUHN 90.
- ⁶ Uses the model of ISGUR 89.
- ⁷ Includes the effect of a possible a_1' state.
- ⁸ Uses the model of FEINDT 90.
- ⁹ Supersedes AKERS 95P.
- ¹⁰ Average and spread of values using 2 variants of the model of BOWLER 75.
- ¹¹ Reanalysis of RUCKSTUHL 86.
- ¹² Reanalysis of SCHMIDKE 86.
- ¹³ Reanalysis of ALBRECHT 86B.
- ¹⁴ From a combined reanalysis of ALBRECHT 86B, SCHMIDKE 86, and RUCKSTUHL 86.
- ¹⁵ From a combined reanalysis of ALBRECHT 86B and DAUM 81B.
- ¹⁶ Uses the model of BOWLER 75.
- ¹⁷ Produced in K^- backward scattering.

NODE=M010M;LINKAGE=AU
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 NODE=M010M;LINKAGE=F

$a_1(1260)$ WIDTH

NODE=M010W

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
250 to 600 OUR ESTIMATE				
$367 \pm 9 \pm \frac{28}{25}$	420k	ALEKSEEV	10	COMP $190 \pi^- Pb \rightarrow \pi^- \pi^- \pi^+ Pb'$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$410 \pm 31 \pm 30$		¹⁸ AUBERT	07AU BABR	$10.6 e^+ e^- \rightarrow \rho^0 \rho^\pm \pi^\mp \gamma$
$520-680$	6360	¹⁹ LINK	07A FOCUS	$D^0 \rightarrow \pi^- \pi^+ \pi^- \pi^+$
480 ± 20		²⁰ 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	²¹ DRUTSKOY	02 BELL	$B \rightarrow D^{(*)} K^- K^{*0}$
$814 \pm 36 \pm 13$	37k	²² ASNER	00 CLE2	$10.6 e^+ e^- \rightarrow \tau^+ \tau^-$, $\tau^- \rightarrow \pi^- \pi^0 \pi^0 \nu_\tau$
450 ± 50	22k	²³ AKHMETSHIN 99E	CMD2	$1.05-1.38 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0 \pi^0$
570 ± 10		²⁴ BONDAR	99 RVUE	$e^+ e^- \rightarrow 4\pi, \tau \rightarrow 3\pi \nu_\tau$
$587 \pm 27 \pm 21$	5904	²⁵ ABREU	98G DLPH	$e^+ e^-$
$478 \pm 3 \pm 15$	5904	²⁶ ABREU	98G DLPH	$e^+ e^-$
$425 \pm 14 \pm 8$	5904	^{27,28} ABREU	98G DLPH	$e^+ e^-$
400 ± 35		BARBERIS	98B	$450 p p \rightarrow p_f \pi^+ \pi^- \pi^0 p_s$
$621 \pm 32 \pm 58$		^{25,29} ACKERSTAFF	97R OPAL	$E_{cm}^{ee} = 88-94, \tau \rightarrow 3\pi \nu$
$457 \pm 15 \pm 17$		^{26,29} ACKERSTAFF	97R OPAL	$E_{cm}^{ee} = 88-94, \tau \rightarrow 3\pi \nu$
$446 \pm 21 \pm \frac{140}{0}$		²⁶ ALBRECHT	93C ARG	$\tau^+ \rightarrow \pi^+ \pi^+ \pi^- \nu$
239 ± 11		ANDO	92 SPEC	$8 \pi^- p \rightarrow \pi^+ \pi^- \pi^0 n$
$266 \pm 13 \pm 4$		³⁰ ANDO	92 SPEC	$8 \pi^- p \rightarrow \pi^+ \pi^- \pi^0 n$
$465 \pm \frac{228}{-143}$		³¹ IVANOV	91 RVUE	$\tau \rightarrow \pi^+ \pi^+ \pi^- \nu$
$298 \pm \frac{40}{-34}$		³² IVANOV	91 RVUE	$\tau \rightarrow \pi^+ \pi^+ \pi^- \nu$
488 ± 32		³³ IVANOV	91 RVUE	$\tau \rightarrow \pi^+ \pi^+ \pi^- \nu$
430 ± 50		ARMSTRONG	90 OMEG	$300.0 p p \rightarrow p p \pi^+ \pi^- \pi^0$
420 ± 40		³⁴ ISGUR	89 RVUE	$\tau^+ \rightarrow \pi^+ \pi^+ \pi^- \nu$
396 ± 43		³⁵ BOWLER	88 RVUE	
$405 \pm 75 \pm 25$		BAND	87 MAC	$\tau^+ \rightarrow \pi^+ \pi^+ \pi^- \nu$
$419 \pm 108 \pm 57$		BAND	87 MAC	$\tau^+ \rightarrow \pi^+ \pi^0 \pi^0 \nu$
521 ± 27		ALBRECHT	86B ARG	$\tau^+ \rightarrow \pi^+ \pi^+ \pi^- \nu$
$476 \pm \frac{132}{-120} \pm 54$		RUCKSTUHL	86 DLCO	$\tau^+ \rightarrow \pi^+ \pi^+ \pi^- \nu$
$462 \pm 56 \pm 30$		SCHMIDKE	86 MRK2	$\tau^+ \rightarrow \pi^+ \pi^+ \pi^- \nu$
292 ± 40		BELLINI	85 SPEC	$40 \pi^- A \rightarrow \pi^- \pi^+ \pi^- A$
380 ± 100		³⁶ DANKOWY...	81 SPEC	$8.45 \pi^- p \rightarrow n 3\pi$
300 ± 50		³⁶ DAUM	81B CNTR	$63,94 \pi^- p \rightarrow p 3\pi$
230 ± 50		³⁷ GAVILLET	77 HBC	$4.2 K^- p \rightarrow \Sigma 3\pi$

NODE=M010W
 → UNCHECKED ←

OCCUR=2
 OCCUR=3

OCCUR=2

OCCUR=3

OCCUR=2

OCCUR=3

OCCUR=2

- 18 The $\rho^\pm \pi^\mp$ state can be also due to the $\pi(1300)$.
 19 Using the Breit-Wigner parameterization; strong correlation between mass and width.
 20 Using the data of BARATE 98R.
 21 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.
 22 From a fit to the 3π mass spectrum including the $K\bar{K}^*(892)$ threshold.
 23 Using the $a_1(1260)$ mass of 1230 MeV.
 24 From AKHMETSHIN 99E and ASNER 00 data using the $a_1(1260)$ mass of 1230 MeV.
 25 Uses the model of KUHN 90.
 26 Uses the model of ISGUR 89.
 27 Includes the effect of a possible a'_1 state.
 28 Uses the model of FEINDT 90.
 29 Supersedes AKERS 95P.
 30 Average and spread of values using 2 variants of the model of BOWLER 75.
 31 Reanalysis of RUCKSTUHL 86.
 32 Reanalysis of SCHMIDKE 86.
 33 Reanalysis of ALBRECHT 86B.
 34 From a combined reanalysis of ALBRECHT 86B, SCHMIDKE 86, and RUCKSTUHL 86.
 35 From a combined reanalysis of ALBRECHT 86B and DAUM 81B.
 36 Uses the model of BOWLER 75.
 37 Produced in K^- backward scattering.

NODE=M010W;LINKAGE=AU
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$a_1(1260)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \pi^+ \pi^- \pi^0$	
$\Gamma_2 \quad \pi^0 \pi^0 \pi^0$	
$\Gamma_3 \quad (\rho\pi)_{S\text{-wave}}$	seen
$\Gamma_4 \quad (\rho\pi)_{D\text{-wave}}$	seen
$\Gamma_5 \quad (\rho(1450)\pi)_{S\text{-wave}}$	seen
$\Gamma_6 \quad (\rho(1450)\pi)_{D\text{-wave}}$	seen
$\Gamma_7 \quad \sigma\pi$	seen
$\Gamma_8 \quad f_0(980)\pi$	not seen
$\Gamma_9 \quad f_0(1370)\pi$	seen
$\Gamma_{10} \quad f_2(1270)\pi$	seen
$\Gamma_{11} \quad K\bar{K}^*(892) + \text{c.c.}$	seen
$\Gamma_{12} \quad \pi\gamma$	seen

NODE=M010215;NODE=M010

DESIG=22
 DESIG=23
 DESIG=7;OUR EST;→ UNCHECKED ←
 DESIG=8;OUR EST;→ UNCHECKED ←
 DESIG=9;OUR EST;→ UNCHECKED ←
 DESIG=10;OUR EST;→ UNCHECKED ←
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 DESIG=11;OUR EST;→ UNCHECKED ←
 DESIG=12;OUR EST;→ UNCHECKED ←
 DESIG=13;OUR EST;→ UNCHECKED ←
 DESIG=14;OUR EST;→ UNCHECKED ←
 DESIG=4;OUR EST;→ UNCHECKED ←

$a_1(1260)$ PARTIAL WIDTHS

$\Gamma(\pi\gamma)$	Γ_{12}
VALUE (keV)	DOCUMENT ID TECN COMMENT
640 ± 246	ZIELINSKI 84C SPEC 200 $\pi^+ Z \rightarrow Z 3\pi$

NODE=M010220

NODE=M010W4
 NODE=M010W4

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

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 $D^0 \rightarrow \pi^- \pi^+ \pi^- \pi^+$
$-0.14 \pm 0.04 \pm 0.07$	³⁸ CHUNG	02	B852 $18.3 \pi^- p \rightarrow \pi^+ \pi^- \pi^- p$
$-0.10 \pm 0.02 \pm 0.02$	^{39,40} ACKERSTAFF	97R	OPAL $E_{\text{cm}}^{\text{ee}} = 88\text{--}94, \tau \rightarrow 3\pi\nu$
-0.11 ± 0.02	³⁹ ALBRECHT	93C	ARG $\tau^+ \rightarrow \pi^+ \pi^+ \pi^- \nu$

³⁸ Deck-type background not subtracted.

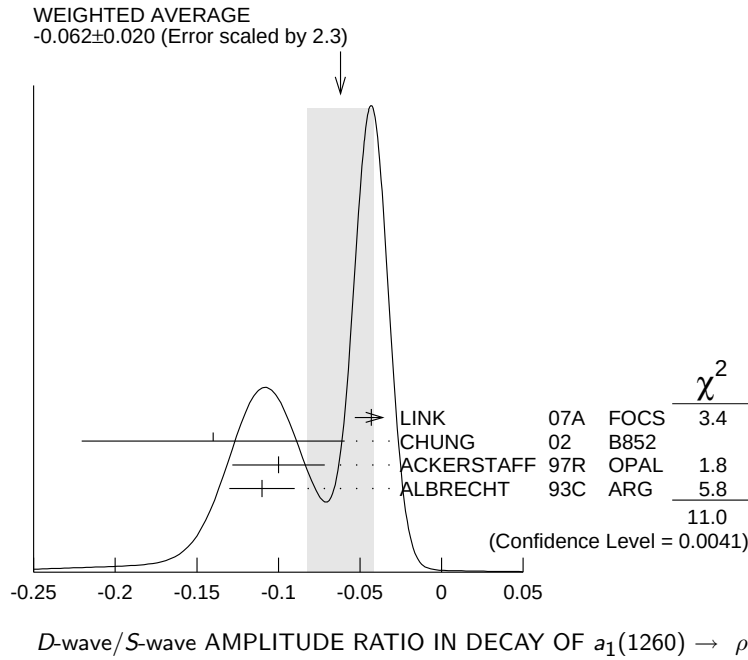
³⁹ Uses the model of ISGUR 89.

⁴⁰ Supersedes AKERS 95P.

NODE=M010DS

NODE=M010DS

NODE=M010DS;LINKAGE=C
 NODE=M010DS;LINKAGE=IM
 NODE=M010DS;LINKAGE=X



$a_1(1260)$ BRANCHING RATIOS

NODE=M010225

$\Gamma((\rho\pi)_{S\text{-wave}})/\Gamma_{\text{total}}$

 Γ_3/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
60.19	37k	⁴¹ ASNER	00	CLE2 10.6 $e^+e^- \rightarrow \tau^+\tau^-$, $\tau^- \rightarrow \pi^-\pi^0\pi^0\nu_\tau$

NODE=M010R5
NODE=M010R5

$\Gamma((\rho\pi)_{D\text{-wave}})/\Gamma_{\text{total}}$

 Γ_4/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$1.30 \pm 0.60 \pm 0.22$	37k	⁴¹ ASNER	00	CLE2 10.6 $e^+e^- \rightarrow \tau^+\tau^-$, $\tau^- \rightarrow \pi^-\pi^0\pi^0\nu_\tau$

NODE=M010R6
NODE=M010R6

$\Gamma((\rho(1450)\pi)_{S\text{-wave}})/\Gamma_{\text{total}}$

 Γ_5/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$0.56 \pm 0.84 \pm 0.32$	37k	^{41,42} ASNER	00	CLE2 10.6 $e^+e^- \rightarrow \tau^+\tau^-$, $\tau^- \rightarrow \pi^-\pi^0\pi^0\nu_\tau$

NODE=M010R7
NODE=M010R7

$\Gamma((\rho(1450)\pi)_{D\text{-wave}})/\Gamma_{\text{total}}$

 Γ_6/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$2.04 \pm 1.20 \pm 0.28$	37k	^{41,42} ASNER	00	CLE2 10.6 $e^+e^- \rightarrow \tau^+\tau^-$, $\tau^- \rightarrow \pi^-\pi^0\pi^0\nu_\tau$

NODE=M010R8
NODE=M010R8

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

 Γ_7/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
seen		CHUNG	02	B852 18.3 $\pi^-p \rightarrow$ $\pi^+\pi^-\pi^-p$
$18.76 \pm 4.29 \pm 1.48$	37k	^{41,43} ASNER	00	CLE2 10.6 $e^+e^- \rightarrow \tau^+\tau^-$, $\tau^- \rightarrow \pi^-\pi^0\pi^0\nu_\tau$

NODE=M010R9
NODE=M010R9

$\Gamma(f_0(980)\pi)/\Gamma_{\text{total}}$

 Γ_8/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
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

$\Gamma(f_0(1370)\pi)/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE (units 10^{-2})	EVTs	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$7.40 \pm 2.71 \pm 1.26$	37k	^{41,44} ASNER	00 CLE2	$10.6 e^+ e^- \rightarrow \tau^+ \tau^-$, $\tau^- \rightarrow \pi^- \pi^0 \pi^0 \nu_\tau$

NODE=M010R11
 NODE=M010R11

 $\Gamma(f_2(1270)\pi)/\Gamma_{\text{total}}$ Γ_{10}/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	^{41,45} ASNER	00 CLE2	$10.6 e^+ e^- \rightarrow \tau^+ \tau^-$, $\tau^- \rightarrow \pi^- \pi^0 \pi^0 \nu_\tau$

NODE=M010R12
 NODE=M010R12

 $\Gamma(K\bar{K}^*(892)+\text{c.c.})/\Gamma_{\text{total}}$ Γ_{11}/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	⁴⁶ COAN	04 CLEO	$\tau^- \rightarrow K^- \pi^- K^+ \nu_\tau$
8 to 15	205	⁴⁷ DRUTSKOY	02 BELL	$B \rightarrow D(*) K^- K^{*0}$
$3.3 \pm 0.5 \pm 0.1$	37k	⁴⁸ ASNER	00 CLE2	$10.6 e^+ e^- \rightarrow \tau^+ \tau^-$, $\tau^- \rightarrow \pi^- \pi^0 \pi^0 \nu_\tau$
2.6 ± 0.3		⁴⁹ BARATE	99R ALEP	$\tau \rightarrow K \bar{K} \pi \nu_\tau$

NODE=M010R13
 NODE=M010R13

 $\Gamma(\sigma\pi)/\Gamma((\rho\pi)_{S\text{-wave}})$ Γ_7/Γ_3

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		⁵⁰ LONGACRE	82 RVUE	

NODE=M010R4
 NODE=M010R4

 $\Gamma(\pi^0 \pi^0 \pi^0)/\Gamma(\pi^+ \pi^- \pi^0)$ Γ_2/Γ_1

VALUE	CL%	DOCUMENT ID	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
< 0.008	90	⁵¹ BARBERIS	01 450 $pp \rightarrow p_f 3\pi^0 p_s$
⁴¹ From a fit to the Dalitz plot. ⁴² Assuming for $\rho(1450)$ mass and width of 1370 and 386 MeV respectively. ⁴³ Assuming for σ mass and width of 860 and 880 MeV respectively. ⁴⁴ Assuming for $f_0(1370)$ mass and width of 1186 and 350 MeV respectively. ⁴⁵ Assuming for $f_2(1270)$ mass and width of 1275 and 185 MeV respectively. ⁴⁶ 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. ⁴⁷ From a comparison to ALAM 94 assuming purely resonant production of the $K^- K^{*0}$ system. ⁴⁸ From a fit to the 3π mass spectrum including the $K\bar{K}^*(892)$ threshold. ⁴⁹ Assuming $a_1(1260)$ dominance and taking $B(\tau \rightarrow a_1(1260) \nu_\tau)$ from BUSKULIC 96. ⁵⁰ Uses multichannel Aitchison-Bowler model (BOWLER 75). Uses data from GAVIL-LET 77, DAUM 80, and DANKOWYCH 81. ⁵¹ Inconsistent with observations of $\sigma\pi$, $f_0(1370)\pi$, and $f_2(1270)\pi$ decay modes.			

NODE=M010R15
 NODE=M010R15

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 NODE=M010R;LINKAGE=B2
 NODE=M010R;LINKAGE=B3
 NODE=M010R;LINKAGE=B4
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NODE=M010R;LINKAGE=DR

NODE=M010R;LINKAGE=B6
 NODE=M010R13;LINKAGE=BA
 NODE=M010R4;LINKAGE=E

NODE=M010R;LINKAGE=RB

 $a_1(1260)$ REFERENCES

NODE=M010

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	JPG 33 1	W.-M. Yao <i>et al.</i>	(PDG Collab.)
COAN	04	PRL 92 232001	T.E. Coan <i>et al.</i>	(CLEO Collab.)
GOMEZ-DUM...	04	PR D69 073002	D. Gomez Dumm, A. Pich, J. Portoles	
SALVINI	04	EPJ C35 21	P. Salvini <i>et al.</i>	(OBELIX Collab.)
BRIERE	03	PRL 90 181802	R. A. Briere <i>et al.</i>	(CLEO Collab.)
CHUNG	02	PR D65 072001	S.U. Chung <i>et al.</i>	(BNL 852 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.)

REFID=53356
 REFID=52049
 REFID=51713
 REFID=51004
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 REFID=46147
 REFID=46345
 REFID=45616
 REFID=44588
 REFID=44366
 REFID=43738

ALBRECHT	93C	ZPHY C58 61	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
DECKER	93A	ZPHY C58 445	R. Decker <i>et al.</i>	
ANDO	92	PL B291 496	A. Ando <i>et al.</i>	(KEK, KYOT, NIRS, SAGA+)
KUHN	92	ZPHY C56 661	J.H. Kuhn, E. Mirkes	
IVANOV	91	ZPHY C49 563	Y.P. Ivanov, A.A. Osipov, M.K. Volkov	(JINR)
ARMSTRONG	90	ZPHY C48 213	T.A. Armstrong, M. Benayoun, W. Beusch	(WA76 Coll.)
FEINDT	90	ZPHY C48 681	M. Feindt	(HAMB)
KUHN	90	ZPHY C48 445	J.H. Kuhn <i>et al.</i>	(MPIM)
ISGUR	89	PR D39 1357	N. Isgur, C. Morningstar, C. Reader	(TNTO)
BOWLER	88	PL B209 99	M.G. Bowler	(OXF)
BAND	87	PL B198 297	H.R. Band <i>et al.</i>	(MAC Collab.)
TORNQVIST	87	ZPHY C36 695	N.A. Tornqvist	(HELS)
ALBRECHT	86B	ZPHY C33 7	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
RUCKSTUHL	86	PRL 56 2132	W. Ruckstuhl <i>et al.</i>	(DELCO Collab.)
SCHMIDKE	86	PRL 57 527	W.B. Schmidke <i>et al.</i>	(Mark II Collab.)
BELLINI	85	SJNP 41 781	D. Bellini <i>et al.</i>	
		Translated from YAF 41 1223.		
ZIELINSKI	84C	PRL 52 1195	M. Zielinski <i>et al.</i>	(ROCH, MINN, FNAL)
LONGACRE	82	PR D26 82	R.S. Longacre	(BNL)
DANKOWY...	81	PRL 46 580	J.A. Dankowycz <i>et al.</i>	(TNTO, BNL, CARL+)
DAUM	81B	NP B182 269	C. Daum <i>et al.</i>	(AMST, CERN, CRAC, MPIM+)
DAUM	80	PL 89B 281	C. Daum <i>et al.</i>	(AMST, CERN, CRAC, MPIM+) 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)

REFID=43310
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REFID=20571

NODE=M005

$f_2(1270)$

$$I^G(J^{PC}) = 0^+(2^{++})$$

$f_2(1270)$ MASS

NODE=M005M

NODE=M005M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1275.1 ± 1.2 OUR AVERAGE		Error includes scale factor of 1.1.		
1262 $^{+1}_{-2}$ ±8		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		¹ 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	² ALDE	87 GAM4	$100\pi^-p \rightarrow 4\pi^0n$
1274 ± 5		² AUGUSTIN	87 DM2	$J/\psi \rightarrow \gamma\pi^+\pi^-$
1283 ± 6		³ 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		⁴ CHABAUD	83 ASPK	$17\pi^-p$ polarized
1280 ± 4		⁵ CASON	82 STRC	$8\pi^+p \rightarrow \Delta^{++}\pi^0\pi^0$
1281 ± 7	11600	GIDAL	81 MRK2	J/ψ decay
1282 ± 5		⁶ 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		² 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. ● ● ●				
1270 ± 8		⁷ ANISOVICH	09 RVUE	$0.0\bar{p}p, \pi N$
1277 ± 6	870	⁸ SCHEGELSKY	06A RVUE	$\gamma\gamma \rightarrow K_S^0 K_S^0$
1251 ±10		TIKHOMIROV	03 SPEC	$40.0\pi^-C \rightarrow K_S^0 K_S^0 K_L^0 X$
1260 ±10		⁹ ALDE	97 GAM2	$450pp \rightarrow pp\pi^0\pi^0$
1278 ± 6		⁹ GRYGOREV	96 SPEC	$40\pi^-N \rightarrow K_S^0 K_S^0 X$
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	² ARMENISE	68 DBC	$5.1\pi^+n \rightarrow p\pi^+MM^-$
1270 ±10	360	² ARMENISE	68 DBC	$5.1\pi^+n \rightarrow p\pi^0MM$
1268 ± 6		¹⁰ JOHNSON	68 HBC	$3.7-4.2\pi^-p$

OCCUR=2

OCCUR=2

- ¹ T-matrix pole.
² Mass errors enlarged by us to $\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.
³ From a partial-wave analysis of data using a K-matrix formalism with 5 poles.
⁴ From an energy-independent partial-wave analysis.
⁵ From an amplitude analysis of the reaction $\pi^+\pi^- \rightarrow 2\pi^0$.
⁶ From an amplitude analysis of $\pi^+\pi^- \rightarrow \pi^+\pi^-$ scattering data.
⁷ 4-poles, 5-channel K matrix fit.
⁸ From analysis of L3 data at 91 and 183–209 GeV.
⁹ Systematic uncertainties not estimated.
¹⁰ JOHNSON 68 includes BONDAR 63, LEE 64, DERADO 65, EISNER 67.

NODE=M005M;LINKAGE=A
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 NODE=M005M;LINKAGE=L
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 NODE=M005M;LINKAGE=P
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 NODE=M005M;LINKAGE=SC
 NODE=M005M;LINKAGE=QQ
 NODE=M005M;LINKAGE=J

$f_2(1270)$ WIDTH

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT

185.1^{+2.9}_{-2.4} OUR FIT Error includes scale factor of 1.5.

184.2^{+4.0}_{-2.4} OUR AVERAGE Error includes scale factor of 1.5. See the ideogram below.

175	± 6 -4	± 10	ABLIKIM	06V	BES2	$e^+e^- \rightarrow J/\psi \rightarrow \gamma\pi^+\pi^-$
190	± 20		ABLIKIM	05	BES2	$J/\psi \rightarrow \phi\pi^+\pi^-$
171	± 10		ALDE	98	GAM4	$100\pi^-p \rightarrow \pi^0\pi^0n$
204	± 20		¹¹ BERTIN	97C	OBLX	$0.0\bar{p}p \rightarrow \pi^+\pi^-\pi^0$
192	± 5	200k	PROKOSHKIN	94	GAM2	$38\pi^-p \rightarrow \pi^0\pi^0n$
180	± 24		AGUILAR-...	91	EHS	$400pp$
169	± 9	5730	¹² AUGUSTIN	89	DM2	$e^+e^- \rightarrow 5\pi$
150	± 30	400	¹² ALDE	87	GAM4	$100\pi^-p \rightarrow 4\pi^0n$
186	± 9 -2		¹³ LONGACRE	86	MPS	$22\pi^-p \rightarrow n2K_S^0$
179.2 ^{+6.9} _{-6.6}			¹⁴ CHABAUD	83	ASPK	$17\pi^-p$ polarized
160	± 11		DENNEY	83	LASS	$10\pi^+N$
196	± 10	3k	APEL	82	CNTR	$25\pi^-p \rightarrow n2\pi^0$
152	± 9		¹⁵ CASON	82	STRC	$8\pi^+p \rightarrow \Delta^{++}\pi^0\pi^0$
186	± 27	11600	GIDAL	81	MRK2	J/ψ decay
216	± 13		¹⁶ CORDEN	79	OMEG	$12-15\pi^-p \rightarrow n2\pi$
190	± 10	10k	APEL	75	NICE	$40\pi^-p \rightarrow n2\pi^0$
192	± 16	4600	ENGLER	74	DBC	$6\pi^+n \rightarrow \pi^+\pi^-p$
183	± 15	5300	FLATTE	71	HBC	$7\pi^+p \rightarrow \Delta^{++}f_2$
196	± 30		¹² STUNTEBECK	70	HBC	$8\pi^-p, 5.4\pi^+d$
216	± 20	1960	¹² ARMENISE	68	DBC	$5.1\pi^+n \rightarrow p\pi^+MM^-$
128	± 27		¹² BOESEBECK	68	HBC	$8\pi^+p$
176	± 21		^{12,17} JOHNSON	68	HBC	$3.7-4.2\pi^-p$

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

194	± 36		¹⁸ ANISOVICH	09	RVUE	$0.0\bar{p}p, \pi N$
195	± 15	870	¹⁹ SCHEGELSKY	06A	RVUE	$\gamma\gamma \rightarrow K_S^0 K_S^0$
121	± 26		TIKHOMIROV	03	SPEC	$40.0\pi^-C \rightarrow K_S^0 K_S^0 K_L^0 X$
187	± 20		²⁰ ALDE	97	GAM2	$450pp \rightarrow pp\pi^0\pi^0$
184	± 10		²⁰ GRYGOREV	96	SPEC	$40\pi^-N \rightarrow K_S^0 K_S^0 X$
200	± 10		AKER	91	CBAR	$0.0\bar{p}p \rightarrow 3\pi^0$
240	± 40	3k	BINON	83	GAM2	$38\pi^-p \rightarrow n2\eta$
187	± 30	650	¹² ANTIPOV	77	CIBS	$25\pi^-p \rightarrow p3\pi$
225	± 38	16000	DEUTSCH...	76	HBC	$16\pi^+p$
166	± 28	600	¹² TAKAHASHI	72	HBC	$8\pi^-p \rightarrow n2\pi$
173	± 53		¹² ARMENISE	70	HBC	$9\pi^+n \rightarrow p\pi^+\pi^-$

- ¹¹ T-matrix pole.
¹² Width errors enlarged by us to $4\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.
¹³ From a partial-wave analysis of data using a K-matrix formalism with 5 poles.
¹⁴ From an energy-independent partial-wave analysis.
¹⁵ From an amplitude analysis of the reaction $\pi^+\pi^- \rightarrow 2\pi^0$.
¹⁶ From an amplitude analysis of $\pi^+\pi^- \rightarrow \pi^+\pi^-$ scattering data.
¹⁷ JOHNSON 68 includes BONDAR 63, LEE 64, DERADO 65, EISNER 67.
¹⁸ 4-poles, 5-channel K matrix fit.
¹⁹ From analysis of L3 data at 91 and 183–209 GeV.
²⁰ Systematic uncertainties not estimated.

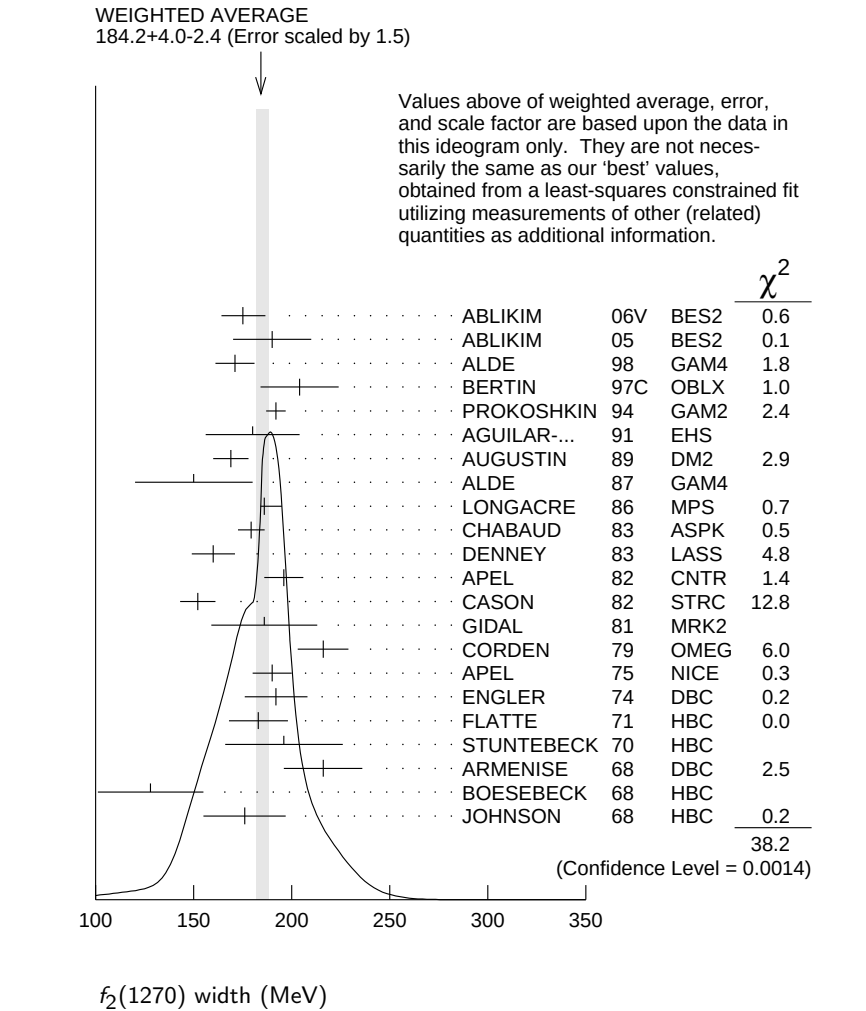
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NODE=M005W

OCCUR=2

OCCUR=2

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 NODE=M005W;LINKAGE=U
 NODE=M005W;LINKAGE=J
 NODE=M005W;LINKAGE=AN
 NODE=M005W;LINKAGE=SC
 NODE=M005W;LINKAGE=QQ



$f_2(1270)$ DECAY MODES

Mode		Fraction (Γ_i/Γ)	Scale factor/ Confidence level
Γ_1	$\pi\pi$	$(84.8^{+2.4}_{-1.2})\%$	S=1.2
Γ_2	$\pi^+\pi^-2\pi^0$	$(7.1^{+1.4}_{-2.7})\%$	S=1.3
Γ_3	$K\bar{K}$	$(4.6\pm0.4)\%$	S=2.8
Γ_4	$2\pi^+2\pi^-$	$(2.8\pm0.4)\%$	S=1.2
Γ_5	$\eta\eta$	$(4.0\pm0.8)\times10^{-3}$	S=2.1
Γ_6	$4\pi^0$	$(3.0\pm1.0)\times10^{-3}$	
Γ_7	$\gamma\gamma$	$(1.64\pm0.19)\times10^{-5}$	S=1.9
Γ_8	$\eta\pi\pi$	$<8\times10^{-3}$	CL=95%
Γ_9	$K^0K^-\pi^++\text{c.c.}$	$<3.4\times10^{-3}$	CL=95%
Γ_{10}	e^+e^-	$<6\times10^{-10}$	CL=90%

NODE=M005215;NODE=M005

DESIG=1

DESIG=3

DESIG=4

DESIG=2

DESIG=7

DESIG=9

DESIG=8

DESIG=6

DESIG=5

DESIG=10

CONSTRAINED FIT INFORMATION

An overall fit to the total width, 4 partial widths, a combination of partial widths obtained from integrated cross sections, and 6 branching ratios uses 44 measurements and one constraint to determine 8 parameters. The overall fit has a $\chi^2 = 81.8$ for 37 degrees of freedom.

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

x_2	−91						
x_3	11	−39					
x_4	10	−37	1				
x_5	1	−6	0	0			
x_6	0	−7	0	0	0		
x_7	8	−5	−6	1	0	0	
Γ	−78	71	−11	−8	−1	0	−11
	x_1	x_2	x_3	x_4	x_5	x_6	x_7

Mode	Rate (MeV)	Scale factor
Γ_1 $\pi\pi$	156.9 $^{+4.0}_{-1.2}$	
Γ_2 $\pi^+\pi^-2\pi^0$	13.2 $^{+2.8}_{-5.0}$	1.3
Γ_3 $K\bar{K}$	8.5 ± 0.8	2.9
Γ_4 $2\pi^+2\pi^-$	5.2 ± 0.7	1.2
Γ_5 $\eta\eta$	0.74 ± 0.14	2.1
Γ_6 $4\pi^0$	0.55 ± 0.18	
Γ_7 $\gamma\gamma$	0.00303 ± 0.00035	1.9

$f_2(1270)$ PARTIAL WIDTHS

NODE=M005220

$\Gamma(\pi\pi)$

 Γ_1

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT

156.9 $^{+4.0}_{-1.2}$ OUR FIT

157.0 $^{+6.0}_{-1.0}$ ²¹ 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 ²² 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

8.5 ± 0.8 OUR FIT Error includes scale factor of 2.9.

9.0 $^{+0.7}_{-0.3}$ ²¹ 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 ²² SCHEGELSKY 06A RVUE $\gamma\gamma \rightarrow K_S^0 K_S^0$

$\Gamma(\eta\eta)$

 Γ_5

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT

0.74 ± 0.14 OUR FIT Error includes scale factor of 2.1.

1.0 ± 0.1 ²¹ 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 ²² 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).

VALUE (keV)	EVTs	DOCUMENT ID	TECN	COMMENT

3.03 ± 0.35 OUR FIT Error includes scale factor of 1.9.

3.14 ± 0.20 ^{23,24} PENNINGTON 08 RVUE Compilation

NODE=M005W8

OCCUR=2

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

3.82 ± 0.30	24,25	PENNINGTON 08	RVUE	Compilation
2.55 ± 0.15	870	22 SCHEGELSKY 06A	RVUE	$\gamma\gamma \rightarrow K_S^0 K_S^0$
2.84 ± 0.35		BOGLIONE 99	RVUE	$\gamma\gamma \rightarrow \pi^+ \pi^-, \pi^0 \pi^0$
$2.93 \pm 0.23 \pm 0.32$	26	YABUKI 95	VNS	
$2.58 \pm 0.13^{+0.36}_{-0.27}$	27	BEHREND 92	CELL	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^-$
$3.10 \pm 0.35 \pm 0.35$	28	BLINOV 92	MD1	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^-$
$2.27 \pm 0.47 \pm 0.11$		ADACHI 90D	TOPZ	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^-$
$3.15 \pm 0.04 \pm 0.39$		BOYER 90	MRK2	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^-$
$3.19 \pm 0.16^{+0.29}_{-0.28}$		MARSISKE 90	CBAL	$e^+ e^- \rightarrow e^+ e^- \pi^0 \pi^0$
2.35 ± 0.65	29	MORGAN 90	RVUE	$\gamma\gamma \rightarrow \pi^+ \pi^-, \pi^0 \pi^0$
$3.19 \pm 0.09^{+0.22}_{-0.38}$	2177	OEST 90	JADE	$e^+ e^- \rightarrow e^+ e^- \pi^0 \pi^0$
$3.2 \pm 0.1 \pm 0.4$	30	AIHARA 86B	TPC	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^-$
$2.5 \pm 0.1 \pm 0.5$		BEHREND 84B	CELL	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^-$
$2.85 \pm 0.25 \pm 0.5$	31	BERGER 84	PLUT	$e^+ e^- \rightarrow e^+ e^- 2\pi$
$2.70 \pm 0.05 \pm 0.20$		COURAU 84	DLCO	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^-$
$2.52 \pm 0.13 \pm 0.38$	32	SMITH 84C	MRK2	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^-$
$2.7 \pm 0.2 \pm 0.6$		EDWARDS 82F	CBAL	$e^+ e^- \rightarrow e^+ e^- 2\pi^0$
$2.9^{+0.6}_{-0.4} \pm 0.6$	33	EDWARDS 82F	CBAL	$e^+ e^- \rightarrow e^+ e^- 2\pi^0$
$3.2 \pm 0.2 \pm 0.6$		BRANDELIK 81B	TASS	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^-$
$3.6 \pm 0.3 \pm 0.5$		ROUSSARIE 81	MRK2	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^-$
2.3 ± 0.8	34	BERGER 80B	PLUT	$e^+ e^-$

OCCUR=3

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

Γ_{10}

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

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

<1.7	90	VOROBIEV	88	ND $e^+ e^- \rightarrow \pi^0 \pi^0$
21		From a partial-wave analysis of data using a K-matrix formalism with 5 poles.		
22		From analysis of L3 data at 91 and 183–209 GeV and using SU(3) relations.		
23		Solution A (preferred solution based on χ^2 -analysis).		
24		Dispersion theory based amplitude analysis of BOYER 90, MARSISKE 90, BEHREND 92, and MORI 07.		
25		Solution B (worse than solution A; still acceptable when systematic uncertainties are included).		
26		With a narrow scalar state around 1220 MeV.		
27		Using a unitarized model with a 300 - 500 keV wide scalar at 1100 MeV.		
28		Using the unitarized model of LYTH 85.		
29		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.		
30		Radiative corrections modify the partial widths; for instance the COURAU 84 value becomes 2.66 ± 0.21 in the calculation of LANDRO 86.		
31		Using the MENNESSIER 83 model.		
32		Superseded by BOYER 90.		
33		If helicity = 2 assumption is not made.		
34		Using mass, width and $B(f_2(1270) \rightarrow 2\pi)$ from PDG 78.		

NODE=M005W9
NODE=M005W9

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

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

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

$\Gamma_3 \Gamma_7 / \Gamma$

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
0.139 ± 0.019 OUR FIT	Error includes scale factor of 1.9.		

0.091 ± 0.007 ± 0.027 35 ALBRECHT 90G ARG $e^+ e^- \rightarrow e^+ e^- K^+ K^-$

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

0.104 ± 0.007 ± 0.072 36 ALBRECHT 90G ARG $e^+ e^- \rightarrow e^+ e^- K^+ K^-$

35 Using an incoherent background.

36 Using a coherent background.

OCCUR=2

NODE=M005G1;LINKAGE=A
NODE=M005G1;LINKAGE=K

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

$\Gamma_5 \Gamma_7 / \Gamma$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
11.5^{+1.8+4.5}_{-2.0-3.7}	37	UEHARA 10A	BELL $10.6 e^+ e^- \rightarrow e^+ e^- \eta\eta$

37 Including interference with the $f_2'(1525)$ (parameters fixed to the values from the 2008 edition of this review, PDG 08) and $f_0(\Upsilon)$.

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. • • •			
13	38,39 PENNINGTON 08	RVUE	Compilation
26	39,40 PENNINGTON 08	RVUE	Compilation
38 Solution A (preferred solution based on χ^2 -analysis).			
39 Dispersion theory based amplitude analysis of BOYER 90, MARSISKE 90, BEHREND 92, and MORI 07.			
40 Solution B (worse than solution A; still acceptable when systematic uncertainties are included).			

NODE=M005HR0
NODE=M005HR0

OCCUR=2
OCCUR=3

NODE=M005HR0;LINKAGE=P1
NODE=M005HR0;LINKAGE=P3

NODE=M005HR0;LINKAGE=P2

 $f_2(1270)$ BRANCHING RATIOS

NODE=M005225

$\Gamma(\pi\pi)/\Gamma_{\text{total}}$	VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_1/Γ
$0.848^{+0.024}_{-0.012}$ OUR FIT	Error includes scale factor of 1.2.					
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	$1.26 \pi^- p \rightarrow \pi^+ \pi^- n$	

NODE=M005R10
NODE=M005R10

$\Gamma(\pi^+ \pi^- 2\pi^0)/\Gamma(\pi\pi)$	VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_2/Γ_1
Should be twice $\Gamma(2\pi^+ 2\pi^-)/\Gamma(\pi\pi)$ if decay is $\rho\rho$. (See ASCOLI 68D.)						
$0.084^{+0.018}_{-0.033}$ OUR FIT	Error includes scale factor of 1.3.					
0.15 ± 0.06	600		EISENBERG	74 HBC	$4.9 \pi^+ p \rightarrow \Delta^{++} f_2$	
• • • We do not use the following data for averages, fits, limits, etc. • • •						
0.07			EMMS	75D DBC	$4 \pi^+ n \rightarrow p f_2$	

NODE=M005R2

NODE=M005R2
NODE=M005R2

$\Gamma(K\bar{K})/\Gamma(\pi\pi)$	VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	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.						
$0.054^{+0.005}_{-0.006}$ OUR FIT	Error includes scale factor of 2.8.					
$0.041^{+0.004}_{-0.005}$ OUR AVERAGE						
0.045 ± 0.01			41 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			42 COSTA...	80 OMEG	$1-2.2 \pi^- p \rightarrow K^+ K^- n$	
0.030 ± 0.005			43 MARTIN	79 RVUE		
0.027 ± 0.009			44 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	$8 \pi^+ p \rightarrow K^+ K^- \pi^+ p$	

NODE=M005R3

NODE=M005R3

NODE=M005R3

$\Gamma(2\pi^+ 2\pi^-)/\Gamma(\pi\pi)$	VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_4/Γ_1
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 $\pi^- p \rightarrow 2\eta n$

NODE=M005R7
NODE=M005R7

$\Gamma(\eta\eta)/\Gamma(\pi\pi)$ Γ_5/Γ_1

VALUE

CL%

DOCUMENT ID

TECN

COMMENT

0.003±0.001

BARBERIS

00E

450 $p p \rightarrow p_f \eta \eta p_s$

• • • 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

 $e^+ e^- \rightarrow \pi^0 \pi^0$ ⁴¹ Coupled channel analysis of $\pi^+ \pi^- \pi^0$, $K^+ K^- \pi^0$, and $K^\pm K_S^0 \pi^\mp$.⁴² Re-evaluated by CHABAUD 83.⁴³ Includes PAWLICKI 77 data.⁴⁴ Takes into account the $f_2(1270)$ - $f_2'(1525)$ interference.NODE=M005R12
NODE=M005R12NODE=M005R;LINKAGE=BG
NODE=M005R3;LINKAGE=D
NODE=M005R3;LINKAGE=F
NODE=M005R3;LINKAGE=M

$f_2(1270)$ REFERENCES

NODE=M005

UEHARA	10A	PR D82 114031	S. Uehara <i>et al.</i>	(BELLE Collab.)
ANISOVICH	09	IJMP A24 2481	V.V. Anisovich, A.V. Sarantsev	
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	SPD 39 420	Y.D. Prokoshkin, A.A. Kondashov	(SERP)
		Translated from DANS 336 613.		

REFID=53641
REFID=52719
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REFID=46605
REFID=46914REFID=45392
REFID=45701
REFID=45566REFID=46384
REFID=44094

BEHREND	92	ZPHY C56 381	H.J. Behrend	(CELLO Collab.)	REFID=43172
BLINOV	92	ZPHY C53 33	A.E. Blinov <i>et al.</i>	(NOVO)	REFID=41858
AGUILAR-...	91	ZPHY C50 405	M. Aguilar-Benitez <i>et al.</i>	(LEBC-EHS Collab.)	REFID=41637
AKER	91	PL B260 249	E. Aker <i>et al.</i>	(Crystal Barrel Collab.)	REFID=41587
ADACHI	90D	PL B234 185	I. Adachi <i>et al.</i>	(TOPAZ Collab.)	REFID=41345
ALBRECHT	90G	ZPHY C48 183	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=41374
BOYER	90	PR D42 1350	J. Boyer <i>et al.</i>	(Mark II Collab.)	REFID=41362
BREAKSTONE	90	ZPHY C48 569	A.M. Breakstone <i>et al.</i>	(ISU, BGNA, CERN+)	REFID=41376
MARSISKE	90	PR D41 3324	H. Marsiske <i>et al.</i>	(Crystal Ball Collab.)	REFID=41351
MORGAN	90	ZPHY C48 623	D. Morgan, M.R. Pennington	(RAL, DURH)	REFID=41583
OEST	90	ZPHY C47 343	T. Oest <i>et al.</i>	(JADE Collab.)	REFID=41358
AUGUSTIN	89	NP B320 1	J.E. Augustin, G. Cosme	(DM2 Collab.)	REFID=41004
VOROBYEV	88	SJNP 48 273	P.V. Vorobiev <i>et al.</i>	(NOVO)	REFID=41023
ALDE	87	Translated from YAF 48 436 PL B198 286	D.M. Alde <i>et al.</i>	(LANL, BRUX, SERP, LAPP)	REFID=40221
AUGUSTIN	87	ZPHY C36 369	J.E. Augustin <i>et al.</i>	(LALO, CLER, FRAS+)	REFID=40268
ABACHI	86B	PRL 57 1990	S. Abachi <i>et al.</i>	(PURD, ANL, IND, MICH+)	REFID=20394
AIHARA	86B	PRL 57 404	H. Aihara <i>et al.</i>	(TPC-2 γ Collab.)	REFID=20764
ALDE	86D	NP B269 485	D.M. Alde <i>et al.</i>	(BELG, LAPP, SERP, CERN+)	REFID=20765
LANDRO	86	PL B172 445	M. Landro, K.J. Mork, H.A. Olsen	(UTRO)	REFID=20767
LONGACRE	86	PL B177 223	R.S. Longacre <i>et al.</i>	(BNL, BRAN, CUNY+)	REFID=20768
LYTH	85	JPG 11 459	D.H. Lyth		REFID=42169
BEHREND	84B	ZPHY C23 223	H.J. Behrend <i>et al.</i>	(CELLO Collab.)	REFID=20757
BERGER	84	ZPHY C26 199	C. Berger <i>et al.</i>	(PLUTO Collab.)	REFID=20760
COURAU	84	PL 147B 227	A. Courau <i>et al.</i>	(CIT, SLAC)	REFID=20758
SMITH	84C	PR D30 851	J.R. Smith <i>et al.</i>	(SLAC, LBL, HARV)	REFID=20759
BINON	83	NC 78A 313	F.G. Binon <i>et al.</i>	(BELG, LAPP, SERP+)	REFID=20750
Also		SJNP 38 561	F.G. Binon <i>et al.</i>	(BELG, LAPP, SERP+)	REFID=20751
CHABAUD	83	Translated from YAF 38 934 NP B223 1	V. Chabaud <i>et al.</i>	(CERN, CRAC, MPIM)	REFID=20131
DENNEY	83	PR D28 2726	D.L. Denney <i>et al.</i>	(IOWA, MICH)	REFID=20754
MENNESSIER	83	ZPHY C16 241	G. Mennessier	(MONP)	REFID=20393
APEL	82	NP B201 197	W.D. Apel <i>et al.</i>	(KARLK, KARLE, PISA, SERP+)	REFID=20745
CASON	82	PRL 48 1316	N.M. Cason <i>et al.</i>	(NDAM, ANL)	REFID=20746
EDWARDS	82F	PL 110B 82	C. Edwards <i>et al.</i>	(CIT, HARV, PRIN+)	REFID=20747
ETKIN	82B	PR D25 1786	A. Etkin <i>et al.</i>	(BNL, CUNY, TUFTS, VAND)	REFID=20390
BRANDELIK	81B	ZPHY C10 117	R. Brandelik <i>et al.</i>	(TASSO Collab.)	REFID=20741
CHABAUD	81	APP B12 575	V. Chabaud <i>et al.</i>	(CERN, CRAC, MPIM)	REFID=20742
GIDAL	81	PL 107B 153	G. Gidal <i>et al.</i>	(SLAC, LBL)	REFID=20386
ROUSSARIE	81	PL 105B 304	A. Roussarie <i>et al.</i>	(SLAC, LBL)	REFID=20388
BERGER	80B	PL 94B 254	C. Berger <i>et al.</i>	(PLUTO Collab.)	REFID=20736
COSTA...	80	NP B175 402	G. Costa de Beauregard <i>et al.</i>	(BARI, BONN+)	REFID=20737
LOVERRE	80	ZPHY C6 187	P.F. Loverre <i>et al.</i>	(CERN, CDEF, MADR+)	REFID=20382
CORDEN	79	NP B157 250	M.J. Corden <i>et al.</i>	(BIRM, RHEL, TELA+)	REFID=20374
MARTIN	79	NP B158 520	A.D. Martin, E.N. Ozmutlu	(DURH)	REFID=20377
POLYCHRO...	79	PR D19 1317	V.A. Polychronakos <i>et al.</i>	(NDAM, ANL)	REFID=20378
PDG	78	PL 75B 1	C. Bricman <i>et al.</i>		REFID=40124
ANTIPOV	77	NP B119 45	Y.M. Antipov <i>et al.</i>	(SERP, GEVA)	REFID=20728
PAWLICKI	77	PR D15 3196	A.J. Pawlicki <i>et al.</i>	(ANL)	REFID=20367
DEUTSCH...	76	NP B103 426	M. Deuschmann <i>et al.</i>	(AACH3, BERL, BONN+)	REFID=20119
APEL	75	PL 57B 398	W.D. Apel <i>et al.</i>	(KARLK, KARLE, PISA, SERP+)	REFID=20720
EMMS	75D	NP B96 155	M.J. Emms <i>et al.</i>	(BIRM, DURH, RHEL)	REFID=20721
EISENBERG	74	PL 52B 239	Y. Eisenberg <i>et al.</i>	(REHO)	REFID=20715
ENGLER	74	PR D10 2070	A. Engler <i>et al.</i>	(CMU, CASE)	REFID=20110
LOUIE	74	PL 48B 385	J. Louie <i>et al.</i>	(SACL, CERN)	REFID=20719
ANDERSON	73	PRL 31 562	J.C. Anderson <i>et al.</i>	(CMU, CASE)	REFID=20710
TAKAHASHI	72	PR D6 1266	K. Takahashi <i>et al.</i>	(TOHOK, PENN, NDAM+)	REFID=20103
BEAUPRE	71	NP B28 77	J.V. Beaupre <i>et al.</i>	(AACH, BERL, CERN)	REFID=20698
FLATTE	71	PL 34B 551	S.M. Flatte <i>et al.</i>	(LBL)	REFID=20700
ARMENISE	70	LNC 4 199	N. Armenise <i>et al.</i>	(BARI, BGNA, FIRZ)	REFID=20693
OH	70	PR D1 2494	B.Y. Oh <i>et al.</i>	(WISC, TINTO) JP	REFID=20335
STUNTEBECK	70	PL 32B 391	P.H. Stuntebeck <i>et al.</i>	(NDAM)	REFID=20696
ADERHOLZ	69	NP B11 259	M. Aderholz <i>et al.</i>	(AACH3, BERL, CERN+)	REFID=20687
ARMENISE	68	NC 54A 999	N. Armenise <i>et al.</i>	(BARI, BGNA, FIRZ+)	REFID=20054
ASCOLI	68D	PRL 21 1712	G. Ascoli <i>et al.</i>	(ILL)	REFID=20681
BOESEBECK	68	NP B4 501	K. Boesebeck <i>et al.</i>	(AACH, BERL, CERN)	REFID=20585
JOHNSON	68	PR 176 1651	P.B. Johnson <i>et al.</i>	(NDAM, PURD, SLAC)	REFID=20065
EISNER	67	PR 164 1699	R.L. Eisner <i>et al.</i>	(PURD)	REFID=20046
DERADO	65	PRL 14 872	I. Derado <i>et al.</i>	(NDAM)	REFID=20668
LEE	64	PRL 12 342	Y.Y. Lee <i>et al.</i>	(MICH)	REFID=20663
BONDAR	63	PL 5 153	L. Bondar <i>et al.</i>	(AACH, BIRM, BONN, DESY+)	REFID=20657

$f_1(1285)$

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

NODE=M008

 $f_1(1285)$ MASS

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. [1282.1 ± 0.6 MeV OUR 2012 AVERAGE Scale factor = 1.7]		
1281.16 ± 0.39 ± 0.45		¹ LEES	12X BABR	$\tau^- \rightarrow \pi^- f_1(1285) \nu_\tau$
1285.1 ± 1.0 $\pm \begin{smallmatrix} 1.6 \\ -0.3 \end{smallmatrix}$		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 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 $pp \rightarrow pp K_S^0 K^\pm \pi^\mp$
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 $\pi^+ p \rightarrow K \bar{K} \pi \pi p, pp \rightarrow K \bar{K} \pi pp$
1286 ± 1		CHAUVAT	84 SPEC	ISR 31.5 pp
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 $p\bar{p} \rightarrow K \bar{K} 3\pi$
1279 ± 5	210	GRASSLER	77 HBC	16 $\pi^\mp p$
1286 ± 3	180	DUBOC	72 HBC	1.2 $p\bar{p} \rightarrow 2K 4\pi$
1283 ± 5		DAHL	67 HBC	1.6-4.2 $\pi^- p$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
1281.9 ± 0.5		⁵ SOSA	99 SPEC	$pp \rightarrow p_{\text{slow}} (K_S^0 K^+ \pi^-) p_{\text{fast}}$
1282.8 ± 0.6		⁵ SOSA	99 SPEC	$pp \rightarrow p_{\text{slow}} (K_S^0 K^- \pi^+) p_{\text{fast}}$
1270 ± 10		AMELIN	95 VES	37 $\pi^- N \rightarrow \pi^- \pi^+ \pi^- \gamma N$
1280 ± 2		ABATZIS	94 OMEG	450 $pp \rightarrow pp2(\pi^+ \pi^-)$
1282 ± 4		ARMSTRONG	93C E760	$p\bar{p} \rightarrow \pi^0 \eta \eta \rightarrow 6\gamma$
1270 ± 6 ± 10		ARMSTRONG	92C OMEG	300 $pp \rightarrow pp \pi^+ \pi^- \gamma$
1281 ± 1		ARMSTRONG	89E OMEG	300 $pp \rightarrow pp2(\pi^+ \pi^-)$
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 $\pi^- p \rightarrow K^+ K^- \pi n$

NODE=M008M

NEW

OCCUR=2

1295 ±12	85	CORDEN	78	OMEG	12-15 $\pi^- p \rightarrow n5\pi$
1292 ±10	150	DEFOIX	72	HBC	0.7 $\bar{p}p \rightarrow 7\pi$
1280 ± 3	500	⁸ THUN	72	MMS	13.4 $\pi^- p$
1303 ± 8		BARDADIN...	71	HBC	8 $\pi^+ p \rightarrow p6\pi$
1283 ± 6		BOESEBECK	71	HBC	16.0 $\pi p \rightarrow p5\pi$
1270 ±10		CAMPBELL	69	DBC	2.7 $\pi^+ d$
1285 ± 7		LORSTAD	69	HBC	0.7 $\bar{p}p$, 4,5-body
1290 ± 7		D'ANDLAU	68	HBC	1.2 $\bar{p}p$, 5-6 body

OCCUR=2

¹ Using the $2\pi^+2\pi^-$ and $\pi^+\pi^-\eta$ modes of $f_1(1285)$ decay.

² The selected process is $J/\psi \rightarrow \omega a_0(980)\pi$.

³ Supersedes ABATZIS 94, ARMSTRONG 89E.

⁴ From partial wave analysis of $K^+ \bar{K}^0 \pi^-$ system.

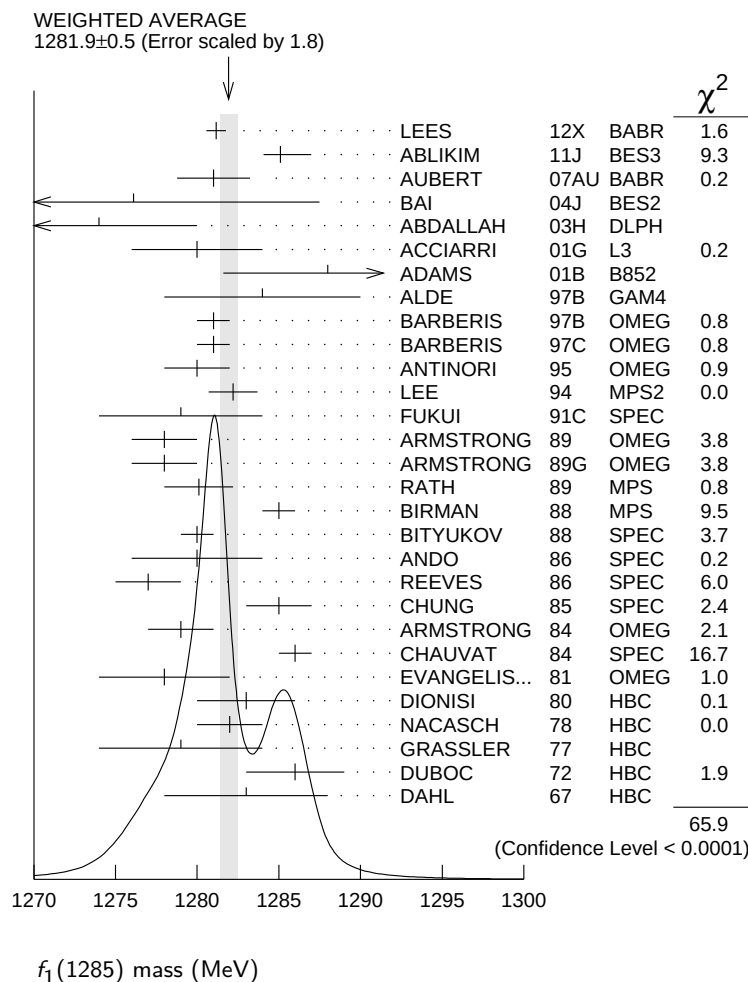
⁵ No systematic error given.

⁶ From a unitarized quark-model calculation.

⁷ From phase shift analysis of $\eta\pi^+\pi^-$ system.

⁸ Seen in the missing mass spectrum.

NODE=M008M;LINKAGE=LE
 NODE=M008M;LINKAGE=BL
 NODE=M008M;LINKAGE=B
 NODE=M008M;LINKAGE=A
 NODE=M008M;LINKAGE=N1
 NODE=M008M;LINKAGE=T
 NODE=M008M;LINKAGE=P
 NODE=M008M;LINKAGE=S



$f_1(1285)$ WIDTH

NODE=M008W

Only experiments giving width error less than 20 MeV are kept for averaging.

NODE=M008W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
24.2 ± 1.1 OUR AVERAGE		Error includes scale factor of 1.3. See the ideogram below.		
22.0 ± 3.1 ^{+2.0} _{-1.5}		⁹ 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 $e^+e^- \rightarrow K_S^0 K^\pm \pi^\mp + X$

NODE=M008W

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 $pp \rightarrow ppK_S^0 K^\pm \pi^\mp$	
36 ± 5		10 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	11 BIRMAN	88	MPS	8 $\pi^- p \rightarrow K^+ \bar{K}^0 \pi^- n$	
25 ± 4	504	BITYUKOV	88	SPEC	32.5 $\pi^- p \rightarrow K^+ K^- \pi^0 n$	
19 ± 5		ANDO	86	SPEC	8 $\pi^- p \rightarrow \eta \pi^+ \pi^- n$	
32 ± 8	420	REEVES	86	SPEC	6.6 $p\bar{p} \rightarrow K K \pi X$	
22 ± 2		CHUNG	85	SPEC	8 $\pi^- p \rightarrow N K \bar{K} \pi$	
32 ± 3	604	ARMSTRONG	84	OMEG	85 $\pi^+ p \rightarrow K \bar{K} \pi \pi p$, $pp \rightarrow K \bar{K} \pi pp$	
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. • • •						
18.2 ± 1.2		12 SOSA	99	SPEC	$pp \rightarrow p_{\text{slow}} (K_S^0 K^+ \pi^-)$	
19.4 ± 1.5		12 SOSA	99	SPEC	$pp \rightarrow p_{\text{slow}} (K_S^0 K^- \pi^+)$	OCCUR=2
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		13 STANTON	79	CNTR	8.5 $\pi^- p \rightarrow n 2\gamma 2\pi$	
24 ± 18	210	GRASSLER	77	HBC	16 $\pi^\mp p$	
28 ± 5	150	14 DEFOIX	72	HBC	0.7 $\bar{p} p \rightarrow 7\pi$	
46 ± 9	180	14 DUBOC	72	HBC	1.2 $\bar{p} p \rightarrow 2K 4\pi$	
37 ± 5	500	15 THUN	72	MMS	13.4 $\pi^- p$	
10 ± 10		BOESEBECK	71	HBC	16.0 $\pi p \rightarrow p 5\pi$	
30 ± 15		CAMPBELL	69	DBC	2.7 $\pi^+ d$	
60 ± 15		14 LORSTAD	69	HBC	0.7 $\bar{p} p$, 4,5-body	
35 ± 10		14 DAHL	67	HBC	1.6–4.2 $\pi^- p$	

⁹ The selected process is $J/\psi \rightarrow \omega a_0(980) \pi$.

¹⁰ Supersedes ABATZIS 94, ARMSTRONG 89E.

¹¹ From partial wave analysis of $K^+ \bar{K}^0 \pi^-$ system.

¹² No systematic error given.

¹³ From phase shift analysis of $\eta \pi^+ \pi^-$ system.

¹⁴ Resolution is not unfolded.

¹⁵ Seen in the missing mass spectrum.

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NODE=M008W;LINKAGE=B

NODE=M008W;LINKAGE=A

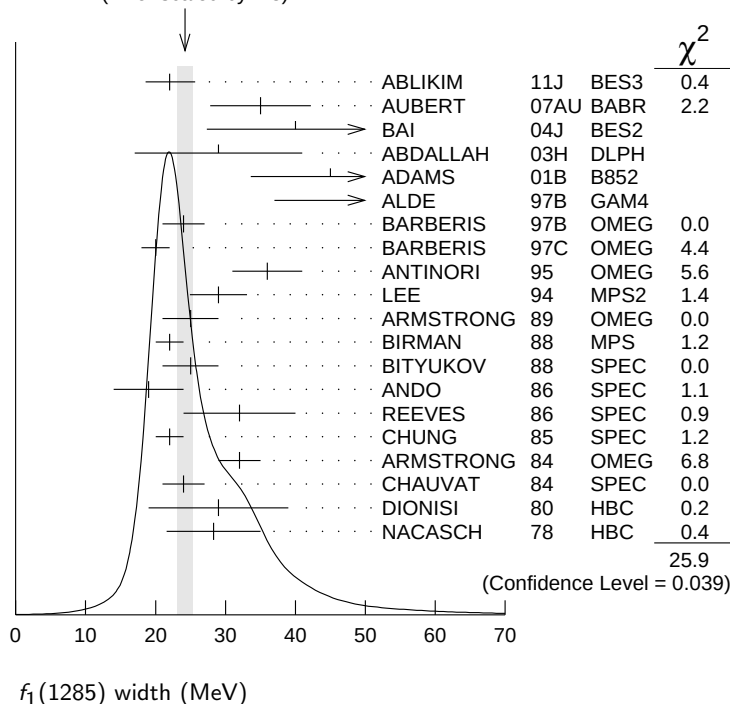
NODE=M008W;LINKAGE=N1

NODE=M008W;LINKAGE=P

NODE=M008W;LINKAGE=R

NODE=M008W;LINKAGE=S

WEIGHTED AVERAGE
24.2±1.1 (Error scaled by 1.3)



$f_1(1285)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
$\Gamma_1 \quad 4\pi$	$(33.1^{+2.1}_{-1.8}) \%$	S=1.3
$\Gamma_2 \quad \pi^0 \pi^0 \pi^+ \pi^-$	$(22.0^{+1.4}_{-1.2}) \%$	S=1.3
$\Gamma_3 \quad 2\pi^+ 2\pi^-$	$(11.0^{+0.7}_{-0.6}) \%$	S=1.3
$\Gamma_4 \quad \rho^0 \pi^+ \pi^-$	$(11.0^{+0.7}_{-0.6}) \%$	S=1.3
$\Gamma_5 \quad \rho^0 \rho^0$	seen	
$\Gamma_6 \quad 4\pi^0$	$< 7 \times 10^{-4}$	CL=90%
$\Gamma_7 \quad \eta \pi^+ \pi^-$	$(35 \pm 15) \%$	
$\Gamma_8 \quad \eta \pi \pi$	$(52.4^{+1.9}_{-2.2}) \%$	S=1.2
$\Gamma_9 \quad a_0(980) \pi$ [ignoring $a_0(980) \rightarrow K \bar{K}$]	$(36 \pm 7) \%$	
$\Gamma_{10} \quad \eta \pi \pi$ [excluding $a_0(980) \pi$]	$(16 \pm 7) \%$	
$\Gamma_{11} \quad K \bar{K} \pi$	$(9.0 \pm 0.4) \%$	S=1.1
$\Gamma_{12} \quad K \bar{K}^*(892)$	not seen	
$\Gamma_{13} \quad \pi^+ \pi^- \pi^0$	$(3.0 \pm 0.9) \times 10^{-3}$	
$\Gamma_{14} \quad \rho^\pm \pi^\mp$	$< 3.1 \times 10^{-3}$	CL=95%
$\Gamma_{15} \quad \gamma \rho^0$	$(5.5 \pm 1.3) \%$	S=2.8
$\Gamma_{16} \quad \phi \gamma$	$(7.4 \pm 2.6) \times 10^{-4}$	
$\Gamma_{17} \quad \gamma \gamma^*$		
$\Gamma_{18} \quad \gamma \gamma$		

NODE=M008215;NODE=M008

DESIG=21

DESIG=22

DESIG=20

DESIG=191

DESIG=23;OUR EST;→ UNCHECKED ←

DESIG=7

DESIG=198

DESIG=3

DESIG=4

DESIG=5

DESIG=1

DESIG=6

DESIG=197

DESIG=199

DESIG=13

DESIG=10

DESIG=9

DESIG=8

CONSTRAINED FIT INFORMATION

An overall fit to 7 branching ratios uses 16 measurements and one constraint to determine 5 parameters. The overall fit has a $\chi^2 = 24.7$ for 12 degrees of freedom.

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

x_9	-17			
x_{10}	-8	-95		
x_{11}	46	-9	-4	
x_{15}	-36	-4	-2	-34
	x_1	x_9	x_{10}	x_{11}

$f_1(1285) \Gamma(i) \Gamma(\gamma\gamma) / \Gamma(\text{total})$

NODE=M008217

$\Gamma(\eta\pi\pi) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$		$\Gamma_8 \Gamma_{18} / \Gamma = (\Gamma_9 + \Gamma_{10}) \Gamma_{18} / \Gamma$		
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

$\Gamma(\eta\pi\pi) \times \Gamma(\gamma\gamma^*) / \Gamma_{\text{total}}$		$\Gamma_8 \Gamma_{17} / \Gamma = (\Gamma_9 + \Gamma_{10}) \Gamma_{17} / \Gamma$		
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	^{16,17} AIHARA	88B	TPC $e^+ e^- \rightarrow e^+ e^- \eta \pi^+ \pi^-$
2.30 $\pm$ 0.61 $\pm$ 0.42		^{16,18} 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	¹⁹ ACHARD	02B	L3 $183\text{--}209 \text{ e}^+ e^- \rightarrow e^+ e^- \eta \pi^+ \pi^-$

NODE=M008G3
NODE=M008G3¹⁶ Assuming a ρ -pole form factor.¹⁷ Published value multiplied by $\eta\pi\pi$ branching ratio 0.49.¹⁸ Published value divided by 2 and multiplied by the $\eta\pi\pi$ branching ratio 0.49.¹⁹ 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

$f_1(1285) \text{ BRANCHING RATIOS}$

NODE=M008220

$\Gamma(K\bar{K}\pi)/\Gamma(4\pi)$					Γ_{11}/Γ_1	
VALUE	DOCUMENT ID	TECN	COMMENT			
0.271±0.016 OUR FIT	Error includes scale factor of 1.3.					
0.271±0.016 OUR AVERAGE	Error includes scale factor of 1.2.					
0.265±0.014	²⁰ BARBERIS	97C	OMEG 450	$pp \rightarrow pp K_S^0 K^\pm \pi^\mp$		
0.28 ±0.05	²¹ ARMSTRONG	89E	OMEG 300	$pp \rightarrow pp f_1(1285)$		
0.37 ±0.03 ±0.05	²² ARMSTRONG	89G	OMEG 85	$\pi p \rightarrow 4\pi X$		

NODE=M008R1
NODE=M008R1²⁰ Using $2(\pi^+ \pi^-)$ data from BARBERIS 97B.²¹ Assuming $\rho\pi\pi$ and $a_0(980)\pi$ intermediate states.²² 4π consistent with being entirely $\rho\pi\pi$.NODE=M008R1;LINKAGE=B
NODE=M008R1;LINKAGE=M
NODE=M008R1;LINKAGE=A

$\Gamma(\pi^0 \pi^0 \pi^+ \pi^-) / \Gamma_{\text{total}}$		$\Gamma_2 / \Gamma = \frac{2}{3} \Gamma_1 / \Gamma$	
VALUE	DOCUMENT ID		
$0.220^{+0.014}_{-0.012}$ OUR FIT	Error includes scale factor of 1.3.		

NODE=M008R18
NODE=M008R18

$\Gamma(2\pi^+ 2\pi^-)/\Gamma_{\text{total}}$		$\Gamma_3/\Gamma = \frac{1}{3}\Gamma_1/\Gamma$
VALUE	DOCUMENT ID	
$0.110^{+0.007}_{-0.006}$ OUR FIT	Error includes scale factor of 1.3.	

NODE=M008R17
NODE=M008R17

$\Gamma(\rho^0 \pi^+ \pi^-)/\Gamma_{\text{total}}$		$\Gamma_4/\Gamma = \frac{1}{3}\Gamma_1/\Gamma$	
VALUE	DOCUMENT ID		
$0.110^{+0.007}_{-0.006}$ OUR FIT	Error includes scale factor of 1.3.		

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
• • • We do not use the following data for averages, fits, limits, etc. • • •		
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 $\pi^- p \rightarrow 4\pi^0 n$

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	²³ DOROFEEV	11	VES $\pi^- N \rightarrow \pi^- f_1(1285) N$

NODE=M008R02
NODE=M008R02

²³ 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
0.524 ^{+0.019} _{-0.022} 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 1.2.		
0.41 ± 0.14 OUR AVERAGE			

NODE=M008R4
NODE=M008R4

0.37 ± 0.11 ± 0.11 BOLTON 92 MRK3 $J/\psi \rightarrow \gamma f_1(1285)$

0.64 ± 0.40 GURTU 79 HBC 4.2 $K^- p$

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

0.93 ± 0.30 ²⁴ GRASSLER 77 HBC 16 $\pi^\mp p$

²⁴ Assuming $\rho \pi \pi$ and $a_0(980) \pi$ intermediate states.

NODE=M008R4;LINKAGE=M

$$\Gamma(2\pi^+ 2\pi^-) / \Gamma(\eta \pi \pi)$$

$$\Gamma_3 / \Gamma_8$$

VALUE	DOCUMENT ID	TECN	COMMENT
0.28 ± 0.02 ± 0.02	²⁵ LEES	12X	BABR $\tau^- \rightarrow \pi^- f_1(1285) \nu_\tau$

NODE=M008R04
NODE=M008R04

²⁵ Assuming $B(f_1(1285) \rightarrow \pi \pi \eta) = 3/2 B(f_1(1285) \rightarrow \pi^+ \pi^- \eta)$.

NODE=M008R04;LINKAGE=LE

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

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

VALUE	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
0.69 ± 0.13 OUR FIT					
0.69 ^{+0.13} _{-0.12} OUR AVERAGE					

NODE=M008R3
NODE=M008R3

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 95 318 ACHARD 02B L3 183-209 $e^+ e^- \rightarrow e^+ e^- \eta \pi^+ \pi^-$

0.28 ± 0.07 1400 ALDE 97B GAM4 100 $\pi^- p \rightarrow \eta \pi^0 \pi^0 n$

1.0 ± 0.3 GRASSLER 77 HBC 16 $\pi^\mp p$

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

$$\Gamma_{11} / \Gamma_8 = \Gamma_{11} / (\Gamma_9 + \Gamma_{10})$$

VALUE	DOCUMENT ID	TECN	COMMENT
0.171 ± 0.013 OUR FIT	Error includes scale factor of 1.1.		
0.170 ± 0.012 OUR AVERAGE			

NODE=M008R2
NODE=M008R2

0.166 ± 0.01 ± 0.008 BARBERIS 98C OMEG 450 $pp \rightarrow p_f f_1(1285) p_s$

0.42 ± 0.15 GURTU 79 HBC 4.2 $K^- p$

0.5 ± 0.2 ²⁶ CORDEN 78 OMEG 12-15 $\pi^- p$

0.20 ± 0.08 ²⁷ DEFOIX 72 HBC 0.7 $\bar{p} p \rightarrow 7\pi$

0.16 ± 0.08 CAMPBELL 69 DBC 2.7 $\pi^+ d$

²⁶ CORDEN 78 assumes low-mass $\eta \pi \pi$ region is dominantly 1^{++} . See BARBERIS 98C and MANAK 00A for discussion.

NODE=M008R2;LINKAGE=CD

²⁷ $K \bar{K}$ system characterized by the $I = 1$ threshold enhancement. (See under $a_0(980)$).

NODE=M008R2;LINKAGE=K

$\Gamma(K\bar{K}^*(892))/\Gamma_{\text{total}}$ Γ_{12}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	NACASCH 78	HBC	$0.7, 0.76 \bar{p}p \rightarrow K\bar{K}3\pi$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
seen	²⁸ ACHARD 07	L3	$183-209 e^+e^- \rightarrow e^+e^- K_S^0 K^\pm \pi^\mp$

²⁸ A clear signal of 19.8 ± 4.4 events observed at high Q^2 .

NODE=M008R5
NODE=M008R5

NODE=M008R5;LINKAGE=CH

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

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
$0.30 \pm 0.055 \pm 0.074$	2.3k	²⁹ DOROFEEV 11	VES	$\pi^- N \rightarrow \pi^- f_1(1285) N$

²⁹ Value obtained selecting the region corresponding to $f_0(980)$ in the $\pi^+\pi^-$ mass spectrum. The systematic error includes the uncertainty on the partial width $f_1 \rightarrow \eta\pi\pi$ obtained from PDG 10 data.

NODE=M008R01
NODE=M008R01

NODE=M008R01;LINKAGE=DO

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

VALUE (%)	CL%	DOCUMENT ID	TECN	COMMENT
<0.31	95	DOROFEEV 11	VES	$\pi^- N \rightarrow \pi^- f_1(1285) N$

NODE=M008R03
NODE=M008R03

 $\Gamma(\gamma\rho^0)/\Gamma_{\text{total}}$ Γ_{15}/Γ

VALUE (units 10^{-2})	CL%	DOCUMENT ID	TECN	COMMENT
5.5 ± 1.3 OUR FIT	Error includes scale factor of 2.8.			
$2.8 \pm 0.7 \pm 0.6$		AMELIN 95	VES	$37 \pi^- N \rightarrow \pi^- \pi^+ \pi^- \gamma N$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<5	95	BITYUKOV 91B	SPEC	$32 \pi^- p \rightarrow \pi^+ \pi^- \gamma n$

NODE=M008R15
NODE=M008R15

 $\Gamma(\gamma\rho^0)/\Gamma(2\pi^+2\pi^-)$ $\Gamma_{15}/\Gamma_3 = \Gamma_{15}/\frac{1}{3}\Gamma_1$

VALUE	DOCUMENT ID	TECN	COMMENT
0.50 ± 0.13 OUR FIT	Error includes scale factor of 2.5.		
0.45 ± 0.18	³⁰ COFFMAN 90	MRK3	$J/\psi \rightarrow \gamma\gamma\pi^+\pi^-$

³⁰ 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
9.5 ± 2.0 OUR FIT	Error includes scale factor of 2.5.		
7.9 ± 0.9 OUR AVERAGE			
$10.0 \pm 1.0 \pm 2.0$	BARBERIS 98C	OMEG 450	$pp \rightarrow p_f f_1(1285) p_s$
7.5 ± 1.0	³¹ ARMSTRONG 92C	OMEG 300	$pp \rightarrow pp\pi^+\pi^-\gamma, pp\eta\pi^+\pi^-$

³¹ Published value multiplied by 1.5.

NODE=M008R16
NODE=M008R16

NODE=M008R16;LINKAGE=B

 $\Gamma(\gamma\rho^0)/\Gamma(K\bar{K}\pi)$ Γ_{15}/Γ_{11}

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
>0.035	90	³² COFFMAN 90	MRK3	$J/\psi \rightarrow \gamma\gamma\pi^+\pi^-$
³² Using $B(J/\psi \rightarrow \gamma f_1(1285) \rightarrow \gamma\gamma\rho^0) = 0.25 \times 10^{-4}$ and $B(J/\psi \rightarrow \gamma f_1(1285) \rightarrow \gamma K\bar{K}\pi) = 0.72 \times 10^{-3}$.				

NODE=M008R12
NODE=M008R12

NODE=M008R12;LINKAGE=F

 $\Gamma(\phi\gamma)/\Gamma(K\bar{K}\pi)$ Γ_{16}/Γ_{11}

VALUE (units 10^{-2})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$0.82 \pm 0.21 \pm 0.20$		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

$f_1(1285)$ REFERENCES

NODE=M008

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>	(BES III Collab.)	REFID=53931
DOROFEEV	11	EPJ A47 68	V. Dorofeev <i>et al.</i>	(SERP, MIPT)	REFID=16755
PDG	10	JPG 37 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
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
BARBERIS	97B	Translated from YAF 60 458	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=45758
BARBERIS	97C	PL B413 217	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. Bityukov <i>et al.</i>	(SERP)	REFID=41864
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. Bityukov <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. Bityukov <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 also the mini-review under $\eta(1405)$

NODE=M037

NODE=M037

NODE=M037M

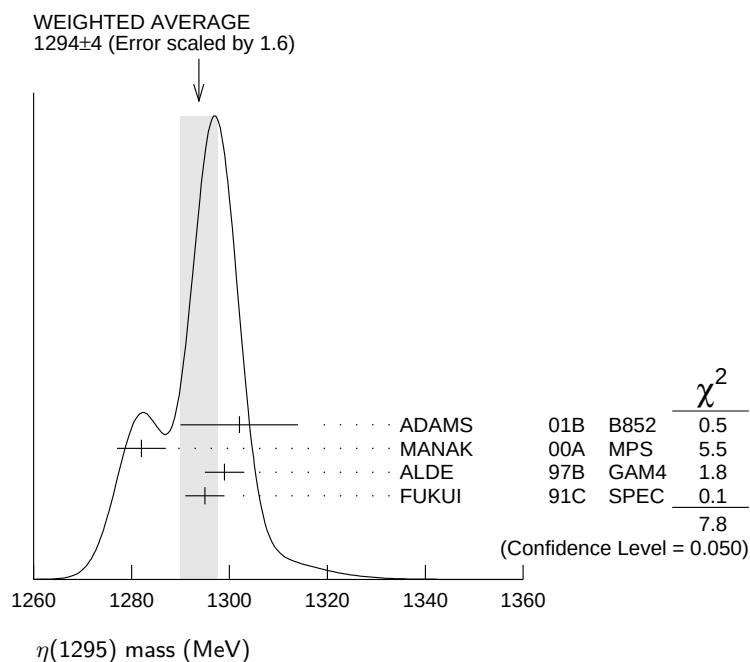
NODE=M037M

 $\eta(1295)$ 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. ● ● ●				
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	$0.0 \bar{p}d \rightarrow \pi^-4\pi^0p$
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	$200 \pi^+Z \rightarrow Z3\pi$
1240± 30		BELLINI 82	SPEC	$40 \pi^-A \rightarrow A3\pi$
1273± 50		² AARON 81	RVUE	
1342± 20		BONESINI 81	OMEG	$12 \pi^-p \rightarrow p3\pi$
~ 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. ● ● ●				
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	$0.0 \bar{p}d \rightarrow \pi^-4\pi^0p$
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	$200 \pi^+Z \rightarrow Z3\pi$
360±120		BELLINI 82	SPEC	$40 \pi^-A \rightarrow A3\pi$
580±100		⁴ AARON 81	RVUE	
220± 70		BONESINI 81	OMEG	$12 \pi^-p \rightarrow p3\pi$
~ 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

$\Gamma(\rho\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$					$\Gamma_1\Gamma_3/\Gamma$
VALUE (keV)	CL%	DOCUMENT ID	TECN	COMMENT	
<0.085	90	ACCIARRI	97T L3	$e^+e^- \rightarrow e^+e^-\pi^+\pi^-\pi^0$	
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
<0.8	95	⁵ SCHEGELSKY 06	RVUE	$\gamma\gamma \rightarrow \pi^+\pi^-\pi^0$	
<0.54	90	ALBRECHT	97B ARG	$e^+e^- \rightarrow e^+e^-\pi^+\pi^-\pi^0$	

⁵ From analysis of L3 data at 183–209 GeV.

NODE=M058G1

NODE=M058G1

NODE=M058G1;LINKAGE=SC

$\pi(1300)$ BRANCHING RATIOS $\Gamma(\pi\pi)_{S\text{-wave}}/\Gamma(\rho\pi)$ 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 $\pm$ 0.4		90k	SALVINI	04	OBLX $\bar{p}p \rightarrow 2\pi^+ 2\pi^-$
seen			CHUNG	02	B852 $18.3 \pi^- p \rightarrow \pi^+ 2\pi^- p$
<0.15	90		ABELE	01	CBAR $0.0 \bar{p}d \rightarrow \pi^- 4\pi^0 p$
2.12			⁶ AARON	81	RVUE

⁶ Uses multichannel Aitchison-Bowler model (BOWLER 75). Uses data from DAUM 80 and DANKOWYCH 81.

NODE=M058220

NODE=M058R1
NODE=M058R1

NODE=M058R1;LINKAGE=E

 $\pi(1300)$ REFERENCES

SCHEGELSKY 06	EPJ A27 199	V.A. Schegelsky <i>et al.</i>	
SALVINI 04	EPJ C35 21	P. Salvini <i>et al.</i>	(OBELIX Collab.)
CHUNG 02	PR D65 072001	S.U. Chung <i>et al.</i>	(BNL E852 Collab.)
ABELE 01	EPJ C19 667	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
ACCIARRI 97T	PL B413 147	M. Acciarri <i>et al.</i>	(L3 Collab.)
ALBRECHT 97B	ZPHY C74 469	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
BERTIN 97D	PL B414 220	A. Bertin <i>et al.</i>	(OBELIX Collab.)
ABELE 96	PL B380 453	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
ZIELINSKI 84	PR D30 1855	M. Zielinski <i>et al.</i>	(ROCH, MINN, FNAL)
BELLINI 82	PRL 48 1697	G. Bellini <i>et al.</i>	(MILA, BGNA, JINR)
AARON 81	PR D24 1207	R.A. Aaron, R.S. Longacre	(NEAS, BNL)
BONESINI 81	PL 103B 75	M. Bonesini <i>et al.</i>	(MILA, LIVP, DARE+)
DANKOWYCH... 81	PRL 46 580	J.A. 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+)
BOWLER 75	NP B97 227	M.G. Bowler <i>et al.</i>	(OXFTP, DARE)

NODE=M058

REFID=51186
REFID=53226
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REFID=45418
REFID=45763
REFID=45011
REFID=20881
REFID=21134
REFID=20870
REFID=21130
REFID=20572
REFID=20872
REFID=20868
REFID=20571

NODE=M012

 $a_2(1320)$

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

 $a_2(1320)$ MASS

NODE=M012205

VALUE (MeV)	DOCUMENT ID

1318.3 $^{+0.5}_{-0.6}$ OUR AVERAGE Includes data from the 4 datablocks that follow this one.
Error includes scale factor of 1.2.

NODE=M012M0

 3π MODE

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	CHG	COMMENT

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

NODE=M012M1
NODE=M012M1

1319.0 $^{+1.0}_{-1.3}$ OUR AVERAGE Error includes scale factor of 1.4. See the ideogram below.

1321 $\pm$ 1 $^{+0}_{-7}$	420k	ALEKSEEV	10	COMP	190 $\pi^- Pb \rightarrow \pi^- \pi^- \pi^+ Pb'$
1326 $\pm$ 2 $\pm$ 2		CHUNG	02	B852	18.3 $\pi^- p \rightarrow \pi^+ \pi^- \pi^- p$
1317 $\pm$ 3		BARBERIS	98B		450 $pp \rightarrow p_f \pi^+ \pi^- \pi^0 p_s$
1323 $\pm$ 4 $\pm$ 3		ACCIARRI	97T	L3	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^- \pi^0$
1320 $\pm$ 7		ALBRECHT	97B	ARG	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^- \pi^0$
1311.3 $\pm$ 1.6 $\pm$ 3.0	72.4k	AMELIN	96	VES	36 $\pi^- p \rightarrow \pi^+ \pi^- \pi^0 n$
1310 $\pm$ 5		ARMSTRONG	90	OMEG 0	300.0 $pp \rightarrow pp \pi^+ \pi^- \pi^0$
1323.8 $\pm$ 2.3	4022	AUGUSTIN	89	DM2 $\pm$	$J/\psi \rightarrow \rho^\pm a_2^\mp$
1320.6 $\pm$ 3.1	3562	AUGUSTIN	89	DM2 0	$J/\psi \rightarrow \rho^0 a_2^0$
1317 $\pm$ 2	25k	¹ DAUM	80C	SPEC $-$	63,94 $\pi^- p \rightarrow 3\pi p$
1320 $\pm$ 10	1097	¹ BALTAY	78B	HBC $+0$	15 $\pi^+ p \rightarrow p 4\pi$
1306 $\pm$ 8		FERRERSORIA	78	OMEG $-$	9 $\pi^- p \rightarrow p 3\pi$
1318 $\pm$ 7	1.6k	¹ EMMS	75	DBC 0	4 $\pi^+ n \rightarrow p(3\pi)^0$
1315 $\pm$ 5		¹ ANTIPOV	73C	CNTR $-$	25,40 $\pi^- p \rightarrow p \eta \pi^-$
1306 $\pm$ 9	1580	CHALOUPKA	73	HBC $-$	3.9 $\pi^- p$

OCCUR=2

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

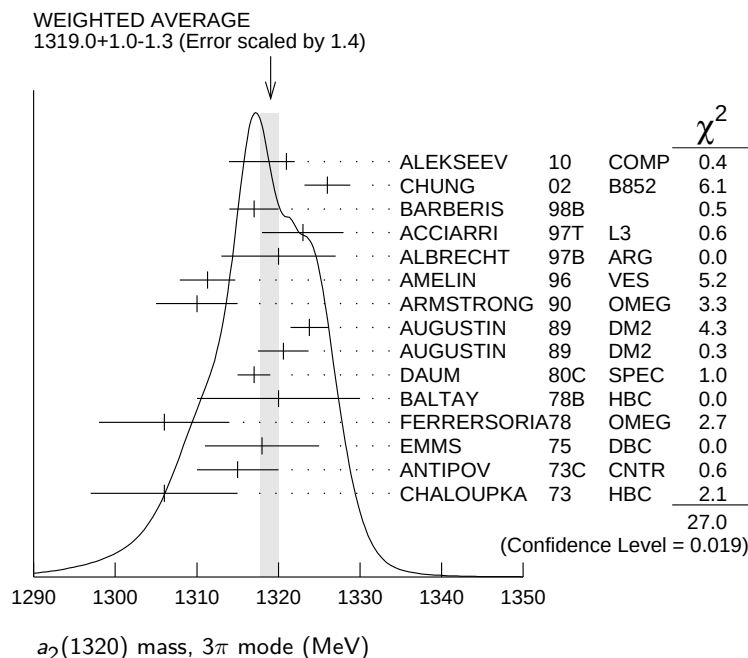
1300 ± 2 ± 4	18k	² SCHEGELSKY 06	RVUE 0	$\gamma\gamma \rightarrow \pi^+\pi^-\pi^0$	
1305 ± 14		CONDO 93	SHF	$\gamma p \rightarrow n\pi^+\pi^+\pi^-$	
1310 ± 2		¹ EVANGELIS...	81 OMEG -	$12 \pi^- p \rightarrow 3\pi p$	
1343 ± 11	490	BALTAY 78B	HBC 0	$15 \pi^+ p \rightarrow \Delta 3\pi$	OCCUR=2
1309 ± 5	5k	BINNIE 71	MMS -	$\pi^- p$ near a_2 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 +	$7.0 \pi^+ p \rightarrow 3\pi p$	

¹From a fit to $J^P = 2^+ \rho\pi$ partial wave.

²From analysis of L3 data at 183–209 GeV.

NODE=M012M1;LINKAGE=P

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 ± 0.7 OUR AVERAGE

1319 ± 5	4700	^{3,4} CLELAND	82B SPEC +	$50 \pi^+ p \rightarrow K_S^0 K^+ p$	OCCUR=2
1324 ± 6	5200	^{3,4} 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		^{3,5} 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	⁵ 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	⁶ SCHEGELSKY 06A	RVUE 0	$\gamma\gamma \rightarrow K_S^0 K_S^0$	
1330 ± 11	1000	^{3,4} CLELAND 82B	SPEC +	$30 \pi^+ p \rightarrow K_S^0 K^+ p$	
1324 ± 5	350	HYAMS 78	ASPK +	$12.7 \pi^+ p \rightarrow K^+ K_S^0 p$	

³From a fit to $J^P = 2^+$ partial wave.

⁴Number of events evaluated by us.

⁵Systematic error in mass scale subtracted.

⁶From analysis of L3 data at 91 and 183–209 GeV.

NODE=M012M2;LINKAGE=P

NODE=M012M2;LINKAGE=W

NODE=M012M2;LINKAGE=S

NODE=M012M2;LINKAGE=SC

$\eta\pi$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

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

NODE=M012M3
 NODE=M012M3

1317.7±1.4 OUR AVERAGE

1308 ±9		BARBERIS	00H		450 $p p \rightarrow p_f \eta \pi^0 p_s$
1316 ±9		BARBERIS	00H		450 $p p \rightarrow \Delta_f^{++} \eta \pi^- p_s$
1317 ±1 ±2		THOMPSON	97	MPS	18 $\pi^- p \rightarrow \eta \pi^- p$
1315 ±5 ±2		⁷ 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	⁸ KEY	73	OSPK	- 6 $\pi^- p \rightarrow p \pi^- \eta$

OCCUR=2

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

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	^{8,9} CONFORTO	73	OSPK	- 6 $\pi^- p \rightarrow p \pi^- \eta$

OCCUR=2

⁷ The systematic error of 2 MeV corresponds to the spread of solutions.⁸ Error includes 5 MeV systematic mass-scale error.⁹ Missing mass with enriched MMS = $\eta \pi^-$, $\eta = 2\gamma$.

NODE=M012M3;LINKAGE=DD
 NODE=M012M3;LINKAGE=E
 NODE=M012M3;LINKAGE=M

 $\eta'\pi$ MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

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

NODE=M012M4
 NODE=M012M4

1322 ± 7 OUR AVERAGE

1318 ± 8 $^{+3}_{-5}$		IVANOV	01	B852	18 $\pi^- p \rightarrow \eta' \pi^- p$
1327.0±10.7		BELADIDZE	93	VES	37 $\pi^- N \rightarrow \eta' \pi^- N$

 $a_2(1320)$ WIDTH

NODE=M012210

3 π MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

NODE=M012W1
 NODE=M012W1

105.0 $^{+1.6}_{-1.9}$ OUR AVERAGE

110 ± 2 $^{+2}_{-15}$	420k	ALEKSEEV	10	COMP	190 $\pi^- p \rightarrow \pi^- \pi^- \pi^+ p b'$
108 ± 3 ±15		CHUNG	02	B852	18.3 $\pi^- p \rightarrow \pi^+ \pi^- \pi^- p$
120 ±10		BARBERIS	98B		450 $p p \rightarrow p_f \pi^+ \pi^- \pi^0 p_s$
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 $p p \rightarrow p p \pi^+ \pi^- \pi^0$
107.0± 9.7	4022	AUGUSTIN	89	DM2	± $J/\psi \rightarrow \rho^\pm a_2^\mp$
118.5±12.5	3562	AUGUSTIN	89	DM2	0 $J/\psi \rightarrow \rho^0 a_2^0$
97 ± 5		¹⁰ EVANGELIS...	81	OMEG	- 12 $\pi^- p \rightarrow 3\pi p$
96 ± 9	25k	¹⁰ DAUM	80C	SPEC	- 63.94 $\pi^- p \rightarrow 3\pi p$
110 ±15	1097	¹⁰ BALTAY	78B	HBC	+0 15 $\pi^+ p \rightarrow p 4\pi$
112 ±18	1.6k	¹⁰ EMMS	75	DBC	0 4 $\pi^+ n \rightarrow p(3\pi)^0$
122 ±14	1.2k	^{10,11} WAGNER	75	HBC	0 7 $\pi^+ p \rightarrow \Delta^{++} (3\pi)^0$
115 ±15		¹⁰ ANTIPOV	73C	CNTR	- 25.40 $\pi^- p \rightarrow p \eta \pi^-$
99 ±15	1580	CHALOUPIKA	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. • • •

117 ± 6 ± 20	18k	¹² 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

¹⁰ From a fit to $J^P = 2^+ \rho\pi$ partial wave.

¹¹ Width errors enlarged by us to $4\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.

¹² From analysis of L3 data at 183–209 GeV.

NODE=M012W1;LINKAGE=P

NODE=M012W1;LINKAGE=S

NODE=M012W1;LINKAGE=SC

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

VALUE (MeV) DOCUMENT ID

107 ± 5 OUR ESTIMATE

110.4 ± 1.7 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

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

NODE=M012W2

NODE=M012W2

109.8 ± 2.4 OUR AVERAGE

112 ± 20	4700	^{13,14} CLELAND	82B	SPEC	+	$50 \pi^+ p \rightarrow K_S^0 K^+ p$
120 ± 25	5200	^{13,14} 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		^{13,15} MARTIN	78D	SPEC	—	$10 \pi^- p \rightarrow K_S^0 K^- p$
105 ± 8	2724	¹⁵ 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	¹⁵ 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	¹⁶ SCHEGELSKY	06A	RVUE	0	$\gamma\gamma \rightarrow K_S^0 K_S^0$
121 ± 51	1000	^{13,14} CLELAND	82B	SPEC	+	$30 \pi^+ p \rightarrow K_S^0 K^+ p$
110 ± 18	350	HYAMS	78	ASPK	+	$12.7 \pi^+ p \rightarrow K^+ K_S^0 p$

¹³ From a fit to $J^P = 2^+$ partial wave.

¹⁴ Number of events evaluated by us.

¹⁵ Width errors enlarged by us to $4\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.

¹⁶ From analysis of L3 data at 91 and 183–209 GeV.

NODE=M012W2;LINKAGE=P

NODE=M012W2;LINKAGE=W

NODE=M012W2;LINKAGE=S

NODE=M012W2;LINKAGE=SC

$\eta\pi$ MODE

VALUE (MeV) EVTS DOCUMENT ID TECN CHG COMMENT

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

NODE=M012W3

NODE=M012W3

111.1 ± 2.4 OUR AVERAGE

115 ± 20		BARBERIS	00H			$450 p p \rightarrow p_f \eta \pi^0 p_s$
112 ± 14		BARBERIS	00H			$450 p p \rightarrow$ $\Delta_f^{++} \eta \pi^- p_s$
112 ± 3 ± 2		¹⁷ AMSLER	94D	CBAR		$0.0 \bar{p} p \rightarrow \pi^0 \pi^0 \eta$
103 ± 6 ± 3		BELADIDZE	93	VES		$37 \pi^- N \rightarrow \eta \pi^- N$
112.2 ± 5.7	2561	DELFOSSSE	81	SPEC	+	$\pi^\pm p \rightarrow p \pi^\pm \eta$
116.6 ± 7.7	1653	DELFOSSSE	81	SPEC	—	$\pi^\pm p \rightarrow p \pi^\pm \eta$
108 ± 9	1000	KEY	73	OSPK	—	$6 \pi^- p \rightarrow p \pi^- \eta$

OCCUR=2

OCCUR=2

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

110 ± 4		ANISOVICH	09	RVUE		$\bar{p} p, \pi N$
127 ± 2 ± 2		¹⁸ THOMPSON	97	MPS		$18 \pi^- p \rightarrow \eta \pi^- p$
118 ± 10		ARMSTRONG	93C	E760	0	$\bar{p} p \rightarrow \pi^0 \eta \eta \rightarrow 6\gamma$
104 ± 9	6200	¹⁹ CONFORTO	73	OSPK	—	$6 \pi^- p \rightarrow p \pi^- \eta$

¹⁷ The systematic error of 2 MeV corresponds to the spread of solutions.

¹⁸ Resolution is not unfolded.

¹⁹ Missing mass with enriched MMS = $\eta \pi^-$, $\eta = 2\gamma$.

NODE=M012W3;LINKAGE=DD

NODE=M012W3;LINKAGE=A

NODE=M012W3;LINKAGE=M

$\eta'\pi$ MODE

VALUE (MeV) DOCUMENT ID TECN COMMENT

119 ± 25 OUR AVERAGE

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

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	DESIG=1
Γ_2 $\rho(770)\pi$			DESIG=11
Γ_3 $f_2(1270)\pi$			DESIG=12
Γ_4 $\rho(1450)\pi$			DESIG=13
Γ_5 $\eta\pi$	(14.5 $\pm$ 1.2) %		DESIG=3
Γ_6 $\omega\pi\pi$	(10.6 $\pm$ 3.2) %	S=1.3	DESIG=4
Γ_7 $K\bar{K}$	(4.9 $\pm$ 0.8) %		DESIG=2
Γ_8 $\eta'(958)\pi$	(5.3 $\pm$ 0.9) $\times 10^{-3}$		DESIG=8
Γ_9 $\pi^\pm\gamma$	(2.68 $\pm$ 0.31) $\times 10^{-3}$		DESIG=7
Γ_{10} $\gamma\gamma$	(9.4 $\pm$ 0.7) $\times 10^{-6}$		DESIG=9
Γ_{11} e^+e^-	< 5 $\times 10^{-9}$	CL=90%	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

NODE=M012220

 $\Gamma(\eta\pi)$ **Γ_5**

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

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

18.5 $\pm$ 3.0 870 ²⁰ SCHEGELSKY 06A RVUE 0 $\gamma\gamma \rightarrow K_S^0 K_S^0$

²⁰ 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=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 ²¹ SCHEGELSKY 06A RVUE 0 $\gamma\gamma \rightarrow K_S^0 K_S^0$

²¹ 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

287 $\pm$ 30 OUR AVERAGE

284 $\pm$ 25 $\pm$ 25 7100 MOLCHANOV 01 SELX 600 $\pi^- A \rightarrow \pi^+\pi^-\pi^- A$
295 $\pm$ 60 CIHANGIR 82 SPEC + 200 $\pi^+ A$

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

461 $\pm$ 110 ²² MAY 77 SPEC $\pm$ 9.7 γA

²² Assuming one-pion exchange.

NODE=M012W7
NODE=M012W7

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±0.05±0.09		ACCIARRI	97T	L3	$e^+e^- \rightarrow e^+e^-\pi^+\pi^-\pi^0$
0.96±0.03±0.13		ALBRECHT	97B	ARG	$e^+e^- \rightarrow e^+e^-\pi^+\pi^-\pi^0$
1.26±0.26±0.18	36	BARU	90	MD1	$e^+e^- \rightarrow e^+e^-\pi^+\pi^-\pi^0$
1.00±0.07±0.15	415	BEHREND	90C	CELL 0	$e^+e^- \rightarrow e^+e^-\pi^+\pi^-\pi^0$
1.03±0.13±0.21		BUTLER	90	MRK2	$e^+e^- \rightarrow e^+e^-\pi^+\pi^-\pi^0$
1.01±0.14±0.22	85	OEST	90	JADE	$e^+e^- \rightarrow e^+e^-\pi^0\eta$
0.90±0.27±0.15	56	²³ ALTHOFF	86	TASS 0	$e^+e^- \rightarrow e^+e^-3\pi$
1.14±0.20±0.26		²⁴ ANTREASYAN	86	CBAL 0	$e^+e^- \rightarrow e^+e^-\pi^0\eta$
1.06±0.18±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±0.19 ^{+0.42} _{-0.11}	35	²³ BEHREND	83B	CELL 0	$e^+e^- \rightarrow e^+e^-3\pi$
0.77±0.18±0.27	22	²⁴ EDWARDS	82F	CBAL 0	$e^+e^- \rightarrow e^+e^-\pi^0\eta$
²³ From $\rho\pi$ decay mode.					
²⁴ 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
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.65±0.02±0.02	18k	²⁵ SCHEGELSKY	06	RVUE $\gamma\gamma \rightarrow \pi^+\pi^-\pi^0$
²⁵ From analysis of L3 data at 183–209 GeV.				

NODE=M012G2
 NODE=M012G2

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
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.145 ^{+0.097} _{-0.034}	²⁶ UEHARA	09A	BELL $e^+e^- \rightarrow e^+e^-\eta\pi^0$
²⁶ From the D_2 -wave. The fraction of the D_0 -wave is $3.4^{+2.3}_{-1.1}\%$.			

NODE=M012G01
 NODE=M012G01

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
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.126±0.007±0.028	²⁷ 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	²⁸ ALBRECHT	90G	ARG $e^+e^- \rightarrow e^+e^-K^+K^-$
²⁷ Using an incoherent background.			
²⁸ Using a coherent background.			

NODE=M012G1
 NODE=M012G1

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	— $3.93 \pi^- p$

NODE=M012R9
 NODE=M012R9

$\Gamma(\eta\pi)/\Gamma(3\pi)$ 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 $\pi^- p$
0.22 ±0.05	52	ANTIPOV	73	CNTR	40 $\pi^- p$
0.211±0.044	149	CHALOUPKA	73	HBC	3.9 $\pi^- p$
0.246±0.042	167	ALSTON-...	71	HBC	7.0 $\pi^+ p$
0.25 ±0.09	15	BOECKMANN	70	HBC	5.0 $\pi^+ p$
0.23 ±0.08	22	ASCOLI	68	HBC	5 $\pi^- p$
0.12 ±0.08		CHUNG	68	HBC	3.2 $\pi^- p$
0.22 ±0.09		CONTE	67	HBC	11.0 $\pi^- p$

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 $\pi^+ n$
0.18±0.08	29	KARSHON	74	HBC	Avg. of above two
0.10±0.05	279	CHALOUPKA	73	HBC	3.9 $\pi^- p$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.29±0.08	140	29 KARSHON	74	HBC	0 4.9 $\pi^+ p$
0.10±0.04	60	29 KARSHON	74	HBC	+ 4.9 $\pi^+ p$
0.19±0.08		DEFOIX	73	HBC	0 0.7 $\bar{p} p$

NODE=M012R12
 NODE=M012R12

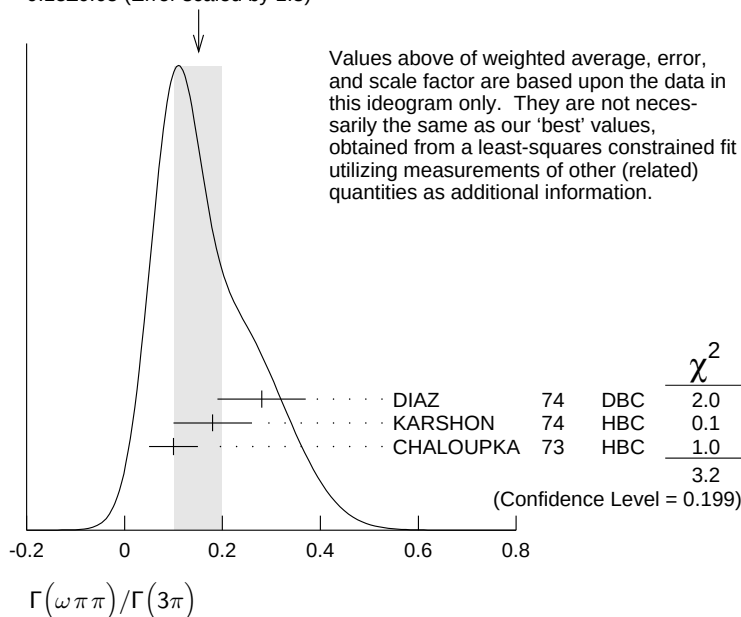
OCCUR=3

OCCUR=2

NODE=M012R12;LINKAGE=K

²⁹ KARSHON 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.

WEIGHTED AVERAGE
 0.15±0.05 (Error scaled by 1.3)

 $\Gamma(K\bar{K})/\Gamma(3\pi)$ Γ_7/Γ_1

VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
0.070±0.012 OUR FIT					
0.078±0.017		CHABAUD	78	RVUE	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.011±0.003	30	BERTIN	98B	OBLX	0.0 $\bar{p} p \rightarrow K^\pm K_s \pi^\mp$
0.056±0.014	50	31 CHALOUPKA	73	HBC	3.9 $\pi^- p$
0.097±0.018	113	31 ALSTON-...	71	HBC	+ 7.0 $\pi^+ p$
0.06 ±0.03		31 ABRAMOVI...	70B	HBC	3.93 $\pi^- p$
0.054±0.022		31 CHUNG	68	HBC	3.2 $\pi^- p$

NODE=M012R1
 NODE=M012R1

³⁰ Using 4 π data from BERTIN 97D.

³¹ Included in CHABAUD 78 review.

NODE=M012R1;LINKAGE=BE
 NODE=M012R1;LINKAGE=C

$\Gamma(K\bar{K})/\Gamma(\eta\pi)$ Γ_7/Γ_5

VALUE	DOCUMENT ID	TECN	COMMENT

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

0.08 ± 0.02	³² BERTIN	98B	OBLX 0.0 $\bar{p}p \rightarrow K^\pm K_s^\mp \pi^\mp$

³² Using $\eta\pi\pi$ data from AMSLER 94D.

NODE=M012R14
NODE=M012R14

NODE=M012R14;LINKAGE=BE

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

VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

0.162 ± 0.012 OUR FIT

0.140 ± 0.028 OUR AVERAGE

0.13 ± 0.04		ESPIGAT	72	HBC	± 0.0 $\bar{p}p$
0.15 ± 0.04	34	BARNHAM	71	HBC	+ 3.7 $\pi^+ p$

NODE=M012R2
NODE=M012R2

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

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	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	³³ ESPIGAT	72	HBC	± 0.0 $\bar{p}p$

³³ Not averaged because of discrepancy between masses from $K\bar{K}$ and $\rho\pi$ modes.

NODE=M012R8
NODE=M012R8

OCCUR=2

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		BOESEBECK	68	HBC	+ 8 $\pi^+ p$

NODE=M012R4
NODE=M012R4

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

0.037 ± 0.006 OUR AVERAGE

0.032 ± 0.009	ABELE	97C	CBAR 0.0 $\bar{p}p \rightarrow \pi^0 \pi^0 \eta'$
0.047 ± 0.010 ± 0.004	³⁴ BELADIDZE	93	VES 37 $\pi^- N \rightarrow a_2^- N$
0.034 ± 0.008 ± 0.005	BELADIDZE	92	VES 36 $\pi^- C \rightarrow a_2^- C$

³⁴ 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 $\begin{smallmatrix} +0.005 \\ -0.003 \end{smallmatrix}$	³⁵ EISENBERG	72	HBC 4.3, 5.25, 7.5 γp

³⁵ 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

a₂(1320) REFERENCES

NODE=M012

ALEKSEEV	10	PRL 104 241803	M.G. Alekseev <i>et al.</i>	(COMPASS Collab.)	REFID=53356
ANISOVICH	09	IJMP A24 2481	V.V. Anisovich, A.V. Sarantsev		REFID=52719
UEHARA	09A	PR D80 032001	S. Uehara <i>et al.</i>	(BELLE Collab.)	REFID=53002
SCHEGELSKY	06	EPJ A27 199	V.A. Schegelsky <i>et al.</i>		REFID=51186
SCHEGELSKY	06A	EPJ A27 207	V.A. Schegelsky <i>et al.</i>		REFID=51185
CHUNG	02	PR D65 072001	S.U. Chung <i>et al.</i>	(BNL E852 Collab.)	REFID=48837
IVANOV	01	PRL 86 3977	E.I. Ivanov <i>et al.</i>	(BNL E852 Collab.)	REFID=48317
MOLCHANOV	01	PL B521 171	V.V. Molchanov <i>et al.</i>	(FNAL SELEX Collab.)	REFID=48559
ACHASOV	00K	PL B492 8	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47933
BARBERIS	00H	PL B488 225	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=47964
BARBERIS	98B	PL B422 399	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=46345
BERTIN	98B	PL B434 180	A. Bertin <i>et al.</i>	(OBELIX Collab.)	REFID=46351
ABELE	97C	PL B404 179	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)	REFID=45531
ACCIARRI	97T	PL B413 147	M. Acciarri <i>et al.</i>	(L3 Collab.)	REFID=45761
ALBRECHT	97B	ZPHY C74 469	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=45418
THOMPSON	97	PRL 79 1630	D.R. Thompson <i>et al.</i>	(BNL E852 Collab.)	REFID=45584
AMELIN	96	ZPHY C70 71	D.V. Amelin <i>et al.</i>	(SERP, TBIL)	REFID=44649
AMSLER	94D	PL B333 277	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=44093
AOYAGI	93	PL B314 246	H. Aoyagi <i>et al.</i>	(BKEI Collab.)	REFID=43599
ARMSTRONG	93C	PL B307 394	T.A. Armstrong <i>et al.</i>	(FNAL, FERR, GENO+)	REFID=43587
BELADIDZE	93	PL B313 276	G.M. Beladidze <i>et al.</i>	(VES Collab.)	REFID=43598
CONDO	93	PR D48 3045	G.T. Condo <i>et al.</i>	(SLAC Hybrid Collab.)	REFID=43600
ALDE	92B	ZPHY C54 549	D.M. Alde <i>et al.</i>	(SERP, BELG, LANL, LAPP+)	REFID=41852
BELADIDZE	92	ZPHY C54 235	G.M. Beladidze <i>et al.</i>	(VES Collab.)	REFID=42171
ALBRECHT	90G	ZPHY C48 183	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=41374
ARMSTRONG	90	ZPHY C48 213	T.A. Armstrong, M. Benayoun, W. Beusch	(WA76 Coll.)	REFID=41375
BARU	90	ZPHY C48 581	S.E. Baru <i>et al.</i>	(MD-1 Collab.)	REFID=41366
BEHREND	90C	ZPHY C46 583	H.J. Behrend <i>et al.</i>	(CELLO Collab.)	REFID=41356
BUTLER	90	PR D42 1368	F. Butler <i>et al.</i>	(Mark II Collab.)	REFID=41363
OEST	90	ZPHY C47 343	T. Oest <i>et al.</i>	(JADE Collab.)	REFID=41358
AUGUSTIN	89	NP B320 1	J.E. Augustin, G. Cosme	(DM2 Collab.)	REFID=41004
VOROBYEV	88	SJNP 48 273	P.V. Vorobiev <i>et al.</i>	(NOVO)	REFID=41023
		Translated from YAF 48 436.			
ALTHOFF	86	ZPHY C31 537	M. Althoff <i>et al.</i>	(TASSO Collab.)	REFID=21287
ANTREASIAN	86	PR D33 1847	D. Antreasian <i>et al.</i>	(Crystal Ball Collab.)	REFID=20469
BERGER	84C	PL 149B 427	C. Berger <i>et al.</i>	(PLUTO Collab.)	REFID=21286
BEHREND	83B	PL 125B 518 (erratum)	H.J. Behrend <i>et al.</i>	(CELLO Collab.)	REFID=20302
CIHANGIR	82	PL 117B 123	S. Cihangir <i>et al.</i>	(FNAL, MINN, ROCH)	REFID=21280
CLELAND	82B	NP B208 228	W.E. Cleland <i>et al.</i>	(DURH, GEVA, LAUS+)	REFID=21281
EDWARDS	82F	PL 110B 82	C. Edwards <i>et al.</i>	(CIT, HARV, PRIN+)	REFID=20747
DELFOSE	81	NP B183 349	A. Delfosse <i>et al.</i>	(GEVA, LAUS)	REFID=21277
EVANGELIS...	81	NP B178 197	C. Evangelista <i>et al.</i>	(BARI, BONN, CERN+)	REFID=20462
CHABAUD	80	NP B175 189	V. Chabaud <i>et al.</i>	(CERN, MPIM, AMST)	REFID=21274
DAUM	80C	PL 89B 276	C. Daum <i>et al.</i>	(AMST, CERN, CRAC, MPIM+) JP	REFID=21275
BALTAY	78B	PR D17 62	C. Baltay <i>et al.</i>	(COLU, BING)	REFID=21265
CHABAUD	78	NP B145 349	V. Chabaud <i>et al.</i>	(CERN, MPIM)	REFID=21267
FERRERSORIA	78	PL 74B 287	A. Ferrer Soria <i>et al.</i>	(ORSAY, CERN, CDEF+)	REFID=21270
HYAMS	78	NP B146 303	B.D. Hyams <i>et al.</i>	(CERN, MPIM, ATEN)	REFID=21271
MARTIN	78D	PL 74B 417	A.D. Martin <i>et al.</i>	(DURH, GEVA) JP	REFID=21272
MAY	77	PR D16 1983	E.N. May <i>et al.</i>	(ROCH, CORN)	REFID=20450
FORINO	76	NC 35A 465	A. Forino <i>et al.</i>	(BGNA, FIRZ, GENO, MILA+)	REFID=21259
MARGULIE	76	PR D14 667	M. Margulies <i>et al.</i>	(BNL, CUNY)	REFID=21261
EMMS	75	PL 58B 117	M.J. Emms <i>et al.</i>	(BIRM, DURH, RHEL) JP	REFID=21254
WAGNER	75	PL 58B 201	F. Wagner, M. Tabak, D.M. Chew	(LBL) JP	REFID=20843
DIAZ	74	PRL 32 260	J. Diaz <i>et al.</i>	(CASE, CMU)	REFID=21248
KARSHON	74	PRL 32 852	U. Karshon <i>et al.</i>	(REHO)	REFID=21249
ANTIPOV	73	NP B63 175	Y.M. Antipov <i>et al.</i>	(CERN, SERP) JP	REFID=21238
ANTIPOV	73C	NP B63 153	Y.M. Antipov <i>et al.</i>	(CERN, SERP) JP	REFID=20817
CHALOUPKA	73	PL 44B 211	V. Chaloupka <i>et al.</i>	(CERN)	REFID=21242
CONFORTO	73	PL 45B 154	G. Conforto <i>et al.</i>	(EFI, FNAL, TNTO+)	REFID=21243
DEFOIX	73	PL 43B 141	C. Defoix <i>et al.</i>	(CDEF)	REFID=21244
EISENSTEIN	73	PR D7 278	L. Eisenstein <i>et al.</i>	(ILL)	REFID=21245
KEY	73	PRL 30 503	A.W. Key <i>et al.</i>	(TNTO, EFI, FNAL, WISC)	REFID=21246
TOET	73	NP B63 248	D.Z. Toet <i>et al.</i>	(NIJM, BONN, DURH, TORI)	REFID=20714
DAMERI	72	NC 9A 1	M. Dameri <i>et al.</i>	(GENO, MILA, SACL)	REFID=20338
EISENBERG	72	PR D5 15	Y. Eisenberg <i>et al.</i>	(REHO, SLAC, TELA)	REFID=20098
ESPIGAT	72	NP B36 93	P. Espigat <i>et al.</i>	(CERN, CDEF)	REFID=21232
FOLEY	72	PR D6 747	K.J. Foley <i>et al.</i>	(BNL, CUNY)	REFID=21233
ALSTON-...	71	PL 34B 156	M. Alston-Garnjost <i>et al.</i>	(LRL)	REFID=21214
BARNHAM	71	PRL 26 1494	K.W.J. Barnham <i>et al.</i>	(LBL)	REFID=21215
BINNIE	71	PL 36B 257	D.M. Binnie <i>et al.</i>	(LOIC, SHMP)	REFID=21217
BOWEN	71	PRL 26 1663	D.R. Bowen <i>et al.</i>	(NEAS, STON)	REFID=21219
GRAYER	71	PL 34B 333	G. Grayer <i>et al.</i>	(CERN, MPIM)	REFID=21223
ABRAMOVI...	70B	NP B23 466	M. Abramovich <i>et al.</i>	(CERN) JP	REFID=21195
ALSTON-...	70	PL 33B 607	M. Alston-Garnjost <i>et al.</i>	(LRL)	REFID=21196
BOECKMANN	70	NP B16 221	K. Boeckmann <i>et al.</i>	(BONN, DURH, NIJM+)	REFID=21202
ASCOLI	68	PRL 20 1321	G. Ascoli <i>et al.</i>	(ILL) JP	REFID=21171
BOESEBECK	68	NP B4 501	K. Boesebeck <i>et al.</i>	(AACH, BERL, CERN)	REFID=20585
CHUNG	68	PR 165 1491	S.U. Chung <i>et al.</i>	(LRL)	REFID=20059
CONTE	67	NC 51A 175	F. Conte <i>et al.</i>	(GENO, HAMB, MILA, SACL)	REFID=21166

$f_0(1370)$

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

See also the mini-reviews on scalar mesons under $f_0(500)$ (see the index for the page number) and on non- $q\bar{q}$ candidates in PDG 06, Journal of Physics, G **33** 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)–$i(150–250)$ OUR ESTIMATE			
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$(1290 \pm 50) - i(170^{+20}_{-40})$	¹ ANISOVICH	09	RVUE $0.0 \bar{p}p, \pi N$
$(1373 \pm 15) - i(137 \pm 10)$	² BARGIOTTI	03	OBLX $\bar{p}p$
$(1302 \pm 17) - i(166 \pm 18)$	³ 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 $pp \rightarrow K^+ K^-$, $\pi^+ \pi^-$
$(1406 \pm 19) - i(80 \pm 6)$	⁴ 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
$(1330 \pm 50) - i(150 \pm 40)$	⁵ AMSLER	95B	CBAR $\bar{p}p \rightarrow 3\pi^0$
$(1360 \pm 35) - i(150–300)$	⁵ AMSLER	95C	CBAR $\bar{p}p \rightarrow \pi^0 \eta\eta$
$(1390 \pm 30) - i(190 \pm 40)$	⁶ AMSLER	95D	CBAR $\bar{p}p \rightarrow 3\pi^0, \pi^0 \eta\eta$, $\pi^0 \pi^0 \eta$
1346 – $i249$	^{7,8} JANSSEN	95	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}$
1214 – $i168$	^{8,9} 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 $\bar{p}p \rightarrow 3\pi^0, \pi^0 \eta\eta$
$(1340 \pm 40) - i(127^{+30}_{-20})$	¹⁰ BUGG	94	RVUE $\bar{p}p \rightarrow 3\pi^0, \eta\eta\pi^0$, $\eta\pi^0 \pi^0$
$(1430 \pm 5) - i(73 \pm 13)$	¹¹ KAMINSKI	94	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}$
1420 – $i220$	¹² AU	87	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}$

OCCUR=2

OCCUR=2

OCCUR=2

OCCUR=2

¹ Another pole is found at $(1510 \pm 130) - i(800^{+100}_{-150})$ MeV.

² Coupled channel analysis of $\pi^+ \pi^- \pi^0$, $K^+ K^- \pi^0$, and $K^\pm K_S^0 \pi^\mp$.

³ Average between $\pi^+ \pi^- 2\pi^0$ and $2(\pi^+ \pi^-)$.

⁴ T-matrix pole on sheet – – –.

⁵ Supersedes ANISOVICH 94.

⁶ 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.

⁷ Analysis of data from FALVARD 88.

⁸ The pole is on Sheet III. Demonstrates explicitly that $f_0(500)$ and $f_0(1370)$ are two different poles.

⁹ 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.

¹⁰ Reanalysis of ANISOVICH 94 data.

¹¹ T-matrix pole on sheet III.

¹² Analysis of data from OCHS 73, GRAYER 74, BECKER 79, and CASON 83.

NODE=M147PP;LINKAGE=AO

NODE=M147PP;LINKAGE=BG

NODE=M147PP;LINKAGE=PC

NODE=M147PP;LINKAGE=TK

NODE=M147PP;LINKAGE=K

NODE=M147PP;LINKAGE=A

NODE=M147PP;LINKAGE=C

NODE=M147PP;LINKAGE=DD

NODE=M147PP;LINKAGE=BB

NODE=M147PP;LINKAGE=C1

NODE=M147PP;LINKAGE=KM

NODE=M147PP;LINKAGE=H

$f_0(1370)$ 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		¹³ AUBERT	09L BABR	$B^\pm \rightarrow \pi^\pm \pi^\pm \pi^\mp$
1470^{+6+72}_{-7-255}		¹⁴ UEHARA	08A BELL	$10.6 e^+ e^- \rightarrow e^+ e^- \pi^0 \pi^0$
1259 ± 55	2.6k	BONVICINI	07 CLEO	$D^+ \rightarrow \pi^- \pi^+ \pi^+$
$1309 \pm 1 \pm 15$		¹⁵ BUGG	07A RVUE	$0.0 p \bar{p} \rightarrow 3 \pi^0$
1449 ± 13	4.3k	¹⁶ 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	$450 p p \rightarrow p_s p_f \pi^+ \pi^-$
1315 ± 50		BELLAZZINI	99 GAM4	$450 p p \rightarrow p p \pi^0 \pi^0$
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		^{17,18} TORNQVIST	95 RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}, K\pi, \eta\pi$
1472 ± 12		ARMSTRONG	91 OMEG	$300 p p \rightarrow p p \pi\pi, p p K\bar{K}$
1275 ± 20		BREAKSTONE	90 SFM	$62 p p \rightarrow p p \pi^+ \pi^-$
1420 ± 20		AKESSON	86 SPEC	$63 p p \rightarrow p p \pi^+ \pi^-$
1256		FROGGATT	77 RVUE	$\pi^+ \pi^-$ channel

¹³ Breit-Wigner mass.¹⁴ Breit-Wigner mass. May also be the $f_0(1500)$.¹⁵ Reanalysis of ABELE 96C data.¹⁶ Also observed by GARMASH 07 in $B^0 \rightarrow K_S^0 \pi^+ \pi^-$ decays. Supersedes GARMASH 05.¹⁷ 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.¹⁸ Also observed by ASNER 00 in $\tau^- \rightarrow \pi^- \pi^0 \pi^0 \nu_\tau$ decaysNODE=M147M1
NODE=M147M1NODE=M147M1;LINKAGE=BW
NODE=M147M1;LINKAGE=UE
NODE=M147M1;LINKAGE=BU
NODE=M147M1;LINKAGE=GR
NODE=M147M1;LINKAGE=BB

NODE=M147M1;LINKAGE=FF

 $K\bar{K}$ MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
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	$7 \pi^- p \rightarrow n 2 K_S^0$

NODE=M147M2
NODE=M147M2 **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	¹⁹ BETTINI	66 DBC	$0.0 \bar{p} n \rightarrow 2 \pi^+ 3 \pi^-$

¹⁹ $\rho\rho$ 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. • • •			
$1262^{+51+82}_{-78-103}$	²⁰ 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	$100 \pi^- p \rightarrow n 2 \eta$

²⁰ Breit-Wigner mass. May also be the $f_0(1500)$.NODE=M147M4
NODE=M147M4

NODE=M147M4;LINKAGE=UE

COUPLED CHANNEL MODE

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>

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

1306 ± 20

²¹ ANISOVICH 03 RVUE

²¹ 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=M147M;LINKAGE=KM

 $f_0(1370)$ BREIT-WIGNER WIDTH

NODE=M147210

VALUE (MeV)

DOCUMENT ID

200 to 500 OUR ESTIMATE

NODE=M147W
→ UNCHECKED ←

 $\pi\pi$ MODE

<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. • • •

300 ± 80		²² AUBERT	09L	BABR	$B^\pm \rightarrow \pi^\pm \pi^\pm \pi^\mp$
90 ⁺ ₁₋ 2 ⁺ ₁₋ 50 ₂₂		²³ 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	²⁴ GARMASH	06	BELL	$B^+ \rightarrow K^+ \pi^+ \pi^-$
265 ± 40		ABLIKIM	05	BES2	$J/\psi \rightarrow \phi \pi^+ \pi^-$
350 ± 100 ⁺ ₆₀		ABLIKIM	05Q	BES2	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$
173 ± 32 ± 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		^{25,26} 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		²⁷ FROGGATT	77	RVUE	$\pi^+ \pi^-$ channel

²² The systematic errors are not reported.

²³ Breit-Wigner width. May also be the $f_0(1500)$.

²⁴ Also observed by GARMASH 07 in $B^0 \rightarrow K_S^0 \pi^+ \pi^-$ decays. Supersedes GARMASH 05.

²⁵ 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.

²⁶ Also observed by ASNER 00 in $\tau^- \rightarrow \pi^- \pi^0 \pi^0 \nu_\tau$ decays

²⁷ 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

<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. • • •

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 ⁺ ₁₆ 138 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 $\pi^- p \rightarrow n 2 K_S^0$

NODE=M147W2
NODE=M147W2

 4π MODE $2(\pi\pi)_S + \rho\rho$

<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. • • •

275 ± 55		ABELE	01	CBAR	0.0 $\bar{p} d \rightarrow \pi^- 4\pi^0 p$
375 ± 61		AMSLER	94	CBAR	0.0 $\bar{p} p \rightarrow \pi^+ \pi^- 3\pi^0$
398 ± 26		ADAMO	93	OBLX	$\bar{n} p \rightarrow 3\pi^+ 2\pi^-$
310 ± 50		GASPERO	93	DBC	0.0 $\bar{p} n \rightarrow 2\pi^+ 3\pi^-$
~ 90	5751	²⁸ BETTINI	66	DBC	0.0 $\bar{p} n \rightarrow 2\pi^+ 3\pi^-$

²⁸ $\rho\rho$ 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. • • •			
$484^{+246+246}_{-170-263}$	²⁹ UEHARA	10A BELL	$10.6 e^+ e^- \rightarrow e^+ e^- \eta\eta$
250	AMSLER	92 CBAR	$0.0 \bar{p}p \rightarrow \pi^0 \eta\eta$
320 ± 40	ALDE	86D GAM4	$100 \pi^- p \rightarrow n 2\eta$
²⁹ 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
• • • We do not use the following data for averages, fits, limits, etc. • • •		
147^{+30}_{-50}	³⁰ ANISOVICH	03 RVUE
³⁰ 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)
$\Gamma_1 \pi\pi$	seen
$\Gamma_2 4\pi$	seen
$\Gamma_3 4\pi^0$	seen
$\Gamma_4 2\pi^+ 2\pi^-$	seen
$\Gamma_5 \pi^+ \pi^- 2\pi^0$	seen
$\Gamma_6 \rho\rho$	dominant
$\Gamma_7 2(\pi\pi)_{S\text{-wave}}$	seen
$\Gamma_8 \pi(1300)\pi$	seen
$\Gamma_9 a_1(1260)\pi$	seen
$\Gamma_{10} \eta\eta$	seen
$\Gamma_{11} K\bar{K}$	seen
$\Gamma_{12} K\bar{K} n\pi$	not seen
$\Gamma_{13} 6\pi$	not seen
$\Gamma_{14} \omega\omega$	not seen
$\Gamma_{15} \gamma\gamma$	seen
$\Gamma_{16} e^+ e^-$	not seen

NODE=M147215;NODE=M147

DESIG=1;OUR EST;→ UNCHECKED ←
 DESIG=10;OUR EST;→ UNCHECKED ←
 DESIG=4;OUR EST;→ UNCHECKED ←
 DESIG=5;OUR EST;→ UNCHECKED ←
 DESIG=6;OUR EST;→ UNCHECKED ←
 DESIG=14;OUR EST;→ UNCHECKED ←
 DESIG=15;OUR EST;→ UNCHECKED ←
 DESIG=16;OUR EVAL;→ UNCHECKED ←
 DESIG=17;OUR EVAL;→ UNCHECKED ←
 DESIG=2;OUR EST;→ UNCHECKED ←
 DESIG=11;OUR EST;→ UNCHECKED ←
 DESIG=18;OUR EVAL;→ UNCHECKED ←
 DESIG=19;OUR EVAL;→ UNCHECKED ←
 DESIG=20;OUR EVAL;→ UNCHECKED ←
 DESIG=12;OUR EST;→ UNCHECKED ←
 DESIG=13;OUR EST;→ UNCHECKED ←

 $f_0(1370)$ PARTIAL WIDTHS

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

NODE=M147217

NODE=M147W11
 NODE=M147W11
 NODE=M147W11

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

 $f_0(1370) \Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

$\Gamma(\eta\eta) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$121^{+133+169}_{-53-106}$	³¹ UEHARA	10A BELL	$10.6 e^+ e^- \rightarrow e^+ e^- \eta\eta$
³¹ 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 $f_0(1500)$.			

$\Gamma_{10}\Gamma_{15}/\Gamma$

NODE=M147225

NODE=M147G01
 NODE=M147G01

NODE=M147G01;LINKAGE=UE

$f_0(1370)$ BRANCHING RATIOS

NODE=M147220

$\Gamma(\pi\pi)/\Gamma_{\text{total}}$				Γ_1/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.26 ± 0.09	BUGG	96	RVUE	
< 0.15	³² AMSLER	94	CBAR $\bar{p}p \rightarrow \pi^+ \pi^- 3\pi^0$	
< 0.06	GASPERO	93	DBC $0.0 \bar{p}n \rightarrow \text{hadrons}$	
³² 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	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
> 0.72	GASPERO	93	DBC $0.0 \bar{p}n \rightarrow \text{hadrons}$	

NODE=M147R4
NODE=M147R4

$\Gamma(4\pi^0)/\Gamma(4\pi)$				Γ_3/Γ_2
VALUE	DOCUMENT ID	TECN	COMMENT	
• • • 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	³³ GASPERO	93	DBC $0.0 \bar{p}n \rightarrow \text{hadrons}$	
³³ Model-dependent evaluation.				

NODE=M147R12
NODE=M147R12

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	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.420 ± 0.014	³⁴ GASPERO	93	DBC $0.0 \bar{p}n \rightarrow 2\pi^+ 3\pi^-$	
³⁴ Model-dependent evaluation.				

NODE=M147R5
NODE=M147R5

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	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.512 ± 0.019	³⁵ GASPERO	93	DBC $0.0 \bar{p}n \rightarrow \text{hadrons}$	
³⁵ Model-dependent evaluation.				

NODE=M147R6
NODE=M147R6

NODE=M147R6;LINKAGE=A

$\Gamma(\rho\rho)/\Gamma(4\pi)$				Γ_6/Γ_2
VALUE	DOCUMENT ID	TECN	COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.26 ± 0.07	ABELE	01B	CBAR $0.0 \bar{p}d \rightarrow 5\pi p$	

NODE=M147R17
NODE=M147R17

$\Gamma(2(\pi\pi)_{\text{S-wave}})/\Gamma(\pi\pi)$				Γ_7/Γ_1
VALUE	DOCUMENT ID	TECN	COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
5.6 ± 2.6	³⁶ ABELE	01	CBAR $0.0 \bar{p}d \rightarrow \pi^- 4\pi^0 p$	
³⁶ From the combined data of ABELE 96 and ABELE 96C.				

NODE=M147R15
NODE=M147R15

NODE=M147R;LINKAGE=KZ

$\Gamma(2(\pi\pi)_{\text{S-wave}})/\Gamma(4\pi)$				Γ_7/Γ_2
VALUE	DOCUMENT ID	TECN	COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.51 ± 0.09	ABELE	01B	CBAR $0.0 \bar{p}d \rightarrow 5\pi p$	

NODE=M147R16
NODE=M147R16

$\Gamma(\rho\rho)/\Gamma(2(\pi\pi)_{\text{S-wave}})$				Γ_6/Γ_7
VALUE	DOCUMENT ID	TECN	COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
large	BARBERIS	00C	$450 pp \rightarrow p_f 4\pi p_s$	
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. • • •

$(28 \pm 11) \times 10^{-3}$	³⁷ ANISOVICH	02D	SPEC Combined fit
$(4.7 \pm 2.0) \times 10^{-3}$	BARBERIS	00E	450 $pp \rightarrow p_f \eta \eta p_s$

³⁷ 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
NODE=M147R14

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	³⁸ BARGIOTTI	03	OBLX $\bar{p}p$
0.12±0.06	³⁹ ANISOVICH	02D	SPEC Combined fit
0.46±0.15±0.11	BARBERIS	99D	OMEG 450 $pp \rightarrow K^+K^-, \pi^+\pi^-$

³⁸ Coupled channel analysis of $\pi^+\pi^-\pi^0$, $K^+K^-\pi^0$, and $K^\pm K_S^0 \pi^\mp$.

³⁹ 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=M147R13
NODE=M147R13

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

 $f_0(1370)$ REFERENCES

NODE=M147

UEHARA	10A	PR D82 114031	S. Uehara <i>et al.</i>	(BELLE Collab.)
ANISOVICH	09	IJMP A24 2481	V.V. Anisovich, A.V. Sarantsev	
AUBERT	09L	PR D79 072006	B. Aubert <i>et al.</i>	(BABAR Collab.)
PDG	08	PL B667 1	C. Amsler <i>et al.</i>	(PDG Collab.)
UEHARA	08A	PR D78 052004	S. Uehara <i>et al.</i>	(BELLE Collab.)
BONVICINI	07	PR D76 012001	G. Bonvicini <i>et al.</i>	(CLEO Collab.)
BUGG	07A	JPG 34 151	D.V. Bugg <i>et al.</i>	
GARMASH	07	PR D75 012006	A. Garmash <i>et al.</i>	(BELLE Collab.)
GARMASH	06	PRL 96 251803	A. Garmash <i>et al.</i>	(BELLE Collab.)
PDG	06	JPG 33 1	W.-M. Yao <i>et al.</i>	(PDG Collab.)
VLADIMIRSK...	06	PAN 69 493	V.V. Vladimirovsky <i>et al.</i>	(ITEP, Moscow)
		Translated from YAF 69 515.		
ABLIKIM	05	PL B607 243	M. Ablikim <i>et al.</i>	(BES Collab.)
ABLIKIM	05Q	PR D72 092002	M. Ablikim <i>et al.</i>	(BES Collab.)
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.)
TIKHOMIROV	03	PAN 66 828	G.D. Tikhomirov <i>et al.</i>	
		Translated from YAF 66 860.		
ANISOVICH	02D	PAN 65 1545	V.V. Anisovich <i>et al.</i>	
		Translated from YAF 65 1583.		

REFID=53641
REFID=52719
REFID=52723
REFID=52166
REFID=52309
REFID=51721
REFID=53252
REFID=51594
REFID=51162
REFID=51004
REFID=51191

REFID=50450
REFID=50958
REFID=50641
REFID=49401
REFID=49217
REFID=49423

REFID=48831

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
ANISOVICH	98B	Translated from YAF 62 446 SPU 41 419	V.V. Anisovich <i>et al.</i>		REFID=46331
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	(ROMAI) JPC	REFID=43658
AMSLER	92	PL B291 347	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=43169
ARMSTRONG	91	ZPHY C51 351	T.A. Armstrong <i>et al.</i>	(ATHU, BARI, BIRM+)	REFID=41744
ARMSTRONG	91B	ZPHY C52 389	T.A. Armstrong <i>et al.</i>	(ATHU, BARI, BIRM+)	REFID=41862
BREAKSTONE	90	ZPHY C48 569	A.M. Breakstone <i>et al.</i>	(ISU, BGNA, CERN+)	REFID=41376
MORGAN	90	ZPHY C48 623	D. Morgan, M.R. Pennington	(RAL, DURH)	REFID=41583
ASTON	88	NP B296 493	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)	REFID=40262
BOLONKIN	88	NP B309 426	B.V. Bolonkin <i>et al.</i>	(ITEP, SERP)	REFID=40580
FALVARD	88	PR D38 2706	A. Falvard <i>et al.</i>	(CLER, FRAS, LALO+)	REFID=40576
VOROBYEV	88	SJNP 48 273	P.V. Vorobiev <i>et al.</i>	(NOVO)	REFID=41023
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
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
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

NODE=M109

$h_1(1380)$

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

OMITTED FROM SUMMARY TABLE

Seen in partial-wave analysis of the $K\bar{K}\pi$ system. Needs confirmation.

NODE=M109

$h_1(1380)$ MASS

NODE=M109M

NODE=M109M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
1386±19 OUR AVERAGE			
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 $K^- p \rightarrow K_S^0 K^\pm \pi^\mp \Lambda$

$h_1(1380)$ WIDTH

NODE=M109W

NODE=M109W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
91±30 OUR AVERAGE	Error includes scale factor of 1.1.		
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 $K^- p \rightarrow K_S^0 K^\pm \pi^\mp \Lambda$

$h_1(1380)$ DECAY MODES

NODE=M109215;NODE=M109

Mode
$\Gamma_1 \quad K\bar{K}^*(892) + \text{c.c.}$

DESIG=1

$h_1(1380)$ REFERENCES

NODE=M109

REFID=45765
REFID=40282

ABELE	97H	PL B415 280	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
ASTON	88C	PL B201 573	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)

NODE=M111

$\pi_1(1400)$

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

NODE=M111

See also the mini-review under non- $q\bar{q}$ candidates in PDG 06, Journal of Physics, G **33** 1 (2006).

$\pi_1(1400)$ MASS

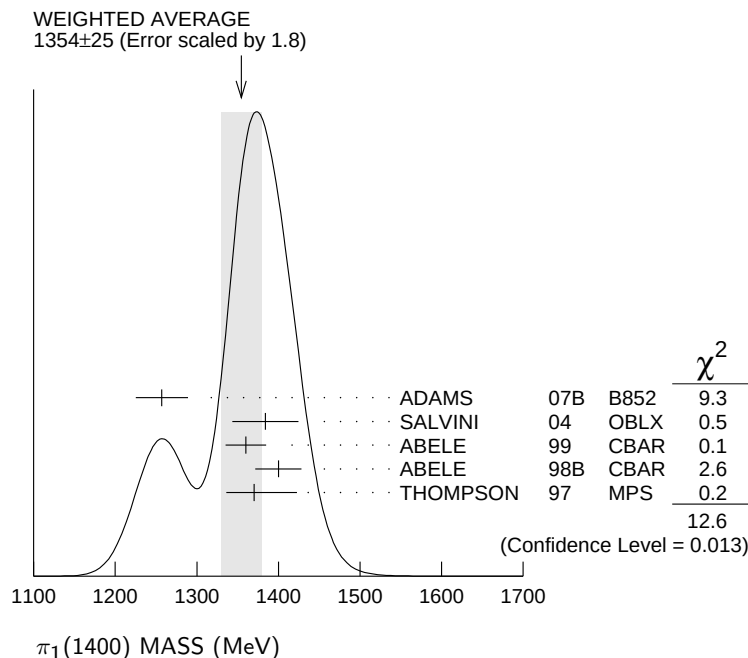
NODE=M111M

NODE=M111M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
1354 ±25 OUR AVERAGE		Error includes scale factor of 1.8. See the ideogram below.			
1257 ±20 ±25	23.5k	ADAMS	07B B852		$18 \pi^- p \rightarrow \eta \pi^0 n$
1384 ±20 ±35	90k	SALVINI	04 OBLX		$\bar{p}p \rightarrow 2\pi^+ 2\pi^-$
1360 ±25		ABELE	99 CBAR		$0.0 \bar{p}p \rightarrow \pi^0 \pi^0 \eta$
1400 ±20 ±20		ABELE	98B CBAR		$0.0 \bar{p}n \rightarrow \pi^- \pi^0 \eta$
1370 ±16 $^{+50}_{-30}$		¹ THOMPSON	97 MPS		$18 \pi^- p \rightarrow \eta \pi^- p$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
1323.1± 4.6		² AOYAGI	93 BKEI		$\pi^- p \rightarrow \eta \pi^- p$
1406 ±20		³ ALDE	88B GAM4	0	$100 \pi^- p \rightarrow \eta \pi^0 n$

¹ Natural parity exchange, questioned by DZIERBA 03.
² Unnatural parity exchange.
³ Seen in the P_0 -wave intensity of the $\eta\pi^0$ system, unnatural parity exchange.

NODE=M111M;LINKAGE=B
NODE=M111M;LINKAGE=C
NODE=M111M;LINKAGE=A



$\pi_1(1400)$ WIDTH

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		⁴ THOMPSON	97	MPS	$18 \pi^- p \rightarrow \eta \pi^- p$
143.2±12.5		⁵ AOYAGI	93	BKEI	$\pi^- p \rightarrow \eta \pi^- p$
180 ±20		⁶ ALDE	88B	GAM4 0	$100 \pi^- p \rightarrow \eta \pi^0 n$

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

⁴ Resolution is not unfolded, natural parity exchange, questioned by DZIERBA 03.

⁵ Unnatural parity exchange.

⁶ Seen in the P_0 -wave intensity of the $\eta \pi^0$ system, unnatural parity exchange.

$\pi_1(1400)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \eta \pi^0$	seen
$\Gamma_2 \quad \eta \pi^-$	seen
$\Gamma_3 \quad \eta' \pi$	

$\pi_1(1400)$ BRANCHING RATIOS

$\Gamma(\eta \pi^0)/\Gamma_{\text{total}}$				Γ_1/Γ
VALUE	DOCUMENT ID	TECN	CHG	COMMENT
not seen	PROKOSHKIN	95B	GAM4	$100 \pi^- p \rightarrow \eta \pi^0 n$
not seen	⁷ BUGG	94	RVUE	$\bar{p} p \rightarrow \eta 2\pi^0$
not seen	⁸ APEL	81	NICE 0	$40 \pi^- p \rightarrow \eta \pi^0 n$

⁷ Using Crystal Barrel data.

⁸ A general fit allowing S , D , and P waves (including $m=0$) is not done because of limited statistics.

NODE=M111W

NODE=M111W

NODE=M111W;LINKAGE=QQ

NODE=M111W;LINKAGE=C

NODE=M111W;LINKAGE=A

NODE=M111215;NODE=M111

DESIG=1;OUR EST;→ UNCHECKED ←

DESIG=4;OUR EST;→ UNCHECKED ←

DESIG=3

NODE=M111220

NODE=M111R1

NODE=M111R1

NODE=M111R1;LINKAGE=C

NODE=M111R1;LINKAGE=B

$\Gamma(\eta\pi^-)/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE	DOCUMENT ID	TECN	COMMENT

NODE=M111R4
 NODE=M111R4

• • • 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

NODE=M111R3
 NODE=M111R3

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

<0.80	95	BOUTEMEUR 90	GAM4	100 $\pi^- p \rightarrow 4\gamma n$

 $\pi_1(1400)$ REFERENCES

NODE=M111

ADAMS	07B	PL B657 27	G.S. Adams <i>et al.</i>	(BNL E852 Collab.)
PDG	06	JPG 33 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)

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

 $\eta(1405)$ $I^G(J^{PC}) = 0^+(0^-+)$

NODE=M027

A REVIEW GOES HERE – Check our WWW List of Reviews

NODE=M027

 $\eta(1405)$ MASS

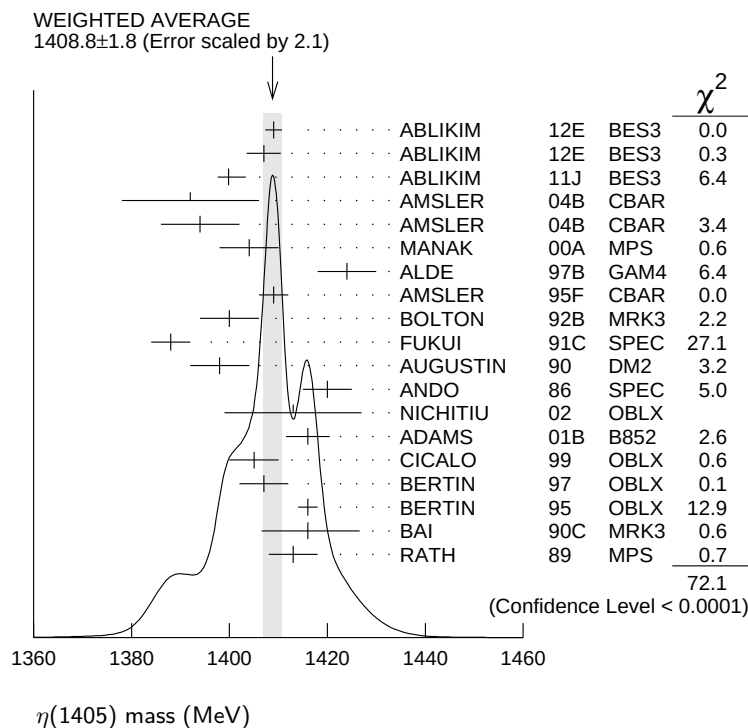
NODE=M027205

VALUE (MeV)

DOCUMENT ID

1408.8±1.8 OUR AVERAGE Includes data from the 2 datablocks that follow this one.
 Error includes scale factor of 2.1. See the ideogram below. [1408.9 ± 2.4 MeV OUR 2012
 AVERAGE Scale factor = 2.3]

NODE=M027MX
 NEW



$\eta\pi\pi$ MODE

VALUE (MeV) EVTS DOCUMENT ID TECN COMMENT

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

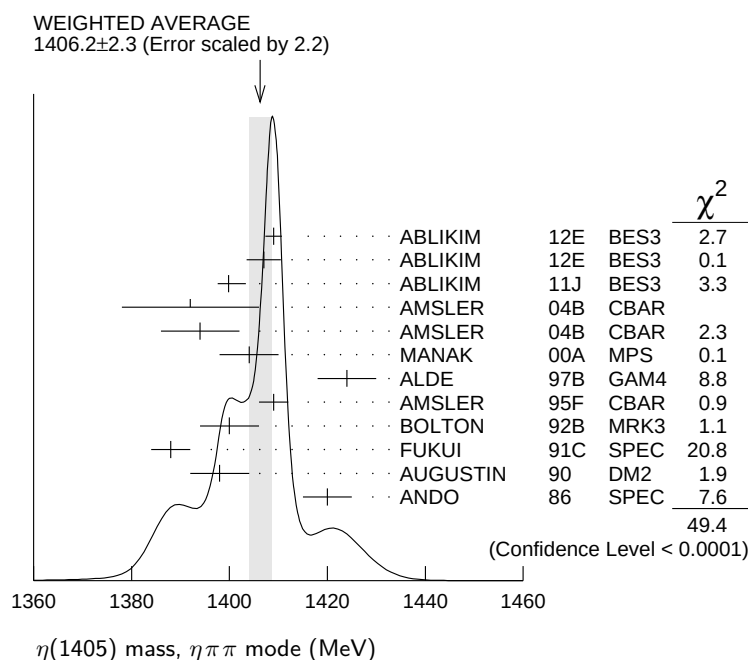
1406.2 $\pm$ 2.3 OUR AVERAGE Error includes scale factor of 2.2. See the ideogram below.
 [1403.8 $^{+3.4}_{-3.0}$ MeV OUR 2012 AVERAGE Scale factor = 2.2]

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	$J/\psi \rightarrow \gamma(\pi^0\pi^0\pi^0)$
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	$0\bar{p}p \rightarrow \pi^+\pi^-\pi^0\pi^0\eta$
1404 $\pm$ 6	9082	MANAK	00A MPS	$18\pi^-\pi^+ \rightarrow \eta\pi^+\pi^-n$
1424 $\pm$ 6	2200	ALDE	97B GAM4	$100\pi^-\pi^+ \rightarrow \eta\pi^0\pi^0n$
1409 $\pm$ 3		AMSLER	95F CBAR	$0\bar{p}p \rightarrow \pi^+\pi^-\pi^0\pi^0\eta$
1400 $\pm$ 6	2	BOLTON	92B MRK3	$J/\psi \rightarrow \gamma\eta\pi^+\pi^-$
1388 $\pm$ 4		FUKUI	91C SPEC	$8.95\pi^-\pi^+ \rightarrow \eta\pi^+\pi^-n$
1398 $\pm$ 6	261	³ AUGUSTIN	90 DM2	$J/\psi \rightarrow \gamma\eta\pi^+\pi^-$
1420 $\pm$ 5		ANDO	86 SPEC	$8\pi^-\pi^+ \rightarrow \eta\pi^+\pi^-n$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
1385 $\pm$ 7		BAI	99 BES	$J/\psi \rightarrow \gamma\eta\pi^+\pi^-$

NEW

OCCUR=2

OCCUR=2

 **$K\bar{K}\pi$ 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 $\pm$ 1.7 OUR AVERAGE Error includes scale factor of 1.1.

1413 $\pm$ 14	3651	⁴ NICHITIU	02 OBLX	
1416 $\pm$ 4 $\pm$ 2	20k	ADAMS	01B B852	$18\text{ GeV } \pi^-\pi^+ \rightarrow K^+K^-\pi^0n$
1405 $\pm$ 5		⁵ CICALO	99 OBLX	$0\bar{p}p \rightarrow K^\pm K_S^0 \pi^\mp \pi^+\pi^-$
1407 $\pm$ 5		⁵ BERTIN	97 OBLX	$0\bar{p}p \rightarrow K^\pm(K^0)\pi^\mp \pi^+\pi^-$
1416 $\pm$ 2		⁵ BERTIN	95 OBLX	$0\bar{p}p \rightarrow K\bar{K}\pi\pi\pi$
1416 $\pm$ 8 $^{+7}_{-5}$	700	⁶ BAI	90C MRK3	$J/\psi \rightarrow \gamma K_S^0 K^\pm \pi^\mp$
1413 $\pm$ 5		⁶ RATH	89 MPS	$21.4\pi^-\pi^+ \rightarrow n K_S^0 K_S^0 \pi^0$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
1459 $\pm$ 5		⁷ AUGUSTIN	92 DM2	$J/\psi \rightarrow \gamma K\bar{K}\pi$

NODE=M027M4
 NODE=M027M4

OCCUR=2

OCCUR=3

 $\pi\pi\gamma$ MODE

VALUE (MeV) EVTS DOCUMENT ID TECN COMMENT

1390$\pm$ 12	235 $\pm$ 91	AMSLER	04B CBAR	$0\bar{p}p \rightarrow \pi^+\pi^-\pi^+\pi^-\gamma$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
1424 $\pm$ 10 $\pm$ 11	547	BAI	04J BES2	$J/\psi \rightarrow \gamma\gamma\pi^+\pi^-$
1401 $\pm$ 18		^{8,9} AUGUSTIN	90 DM2	$J/\psi \rightarrow \pi^+\pi^-\gamma\gamma$
1432 $\pm$ 8		⁹ COFFMAN	90 MRK3	$J/\psi \rightarrow \pi^+\pi^-2\gamma$

NODE=M027M2
 NODE=M027M2

OCCUR=4

4 π MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1420 $\pm$ 20		BUGG	95 MRK3	$J/\psi \rightarrow \gamma \pi^+ \pi^- \pi^+ \pi^-$
1489 $\pm$ 12	3270	¹⁰ BISELLO	89B DM2	$J/\psi \rightarrow 4\pi \gamma$

NODE=M027M3
NODE=M027M3

K $\bar{K}$ π MODE (unresolved)

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1437.6 $\pm$ 3.2	249 $\pm$ 35	^{11,12} ABLIKIM	08E BES2	$J/\psi \rightarrow \omega K_S^0 K^+ \pi^- + \text{c.c.}$
1445.9 $\pm$ 5.7	62 $\pm$ 18	^{11,12} ABLIKIM	08E BES2	$J/\psi \rightarrow \omega K^+ K^- \pi^0$
1442 $\pm$ 10	410	¹¹ BAI	98C BES	$J/\psi \rightarrow \gamma K^+ K^- \pi^0$
1445 $\pm$ 8	693	¹¹ AUGUSTIN	90 DM2	$J/\psi \rightarrow \gamma K_S^0 K^\pm \pi^\mp$
1433 $\pm$ 8	296	¹¹ AUGUSTIN	90 DM2	$J/\psi \rightarrow \gamma K^+ K^- \pi^0$
1413 $\pm$ 8	500	¹¹ DUCH	89 ASTE	$\bar{p} p \rightarrow \pi^+ \pi^- K^\pm \pi^\mp K^0$
1453 $\pm$ 7	170	¹¹ RATH	89 MPS	$21.4 \pi^- p \rightarrow K_S^0 K_S^0 \pi^0 n$
1419 $\pm$ 1	8800	¹¹ BIRMAN	88 MPS	$8 \pi^- p \rightarrow K^+ \bar{K}^0 \pi^- n$
1424 $\pm$ 3	620	¹¹ REEVES	86 SPEC	$6.6 p \bar{p} \rightarrow K \bar{K} \pi X$
1421 $\pm$ 2		¹¹ CHUNG	85 SPEC	$8 \pi^- p \rightarrow K \bar{K} \pi n$
1440 $\begin{smallmatrix} +20 \\ -15 \end{smallmatrix}$	174	¹¹ EDWARDS	82E CBAL	$J/\psi \rightarrow \gamma K^+ K^- \pi^0$
1440 $\begin{smallmatrix} +10 \\ -15 \end{smallmatrix}$		¹¹ SCHARRE	80 MRK2	$J/\psi \rightarrow \gamma K_S^0 K^\pm \pi^\mp$
1425 $\pm$ 7	800	^{11,13} BAILLON	67 HBC	$0 \bar{p} p \rightarrow K \bar{K} \pi \pi \pi$

NODE=M027M6
NODE=M027M6

OCCUR=2

OCCUR=2

OCCUR=2

- 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 Decaying dominantly directly to $K^+ K^- \pi^0$.
- ⁵ Decaying into $(K \bar{K})_S \pi$, $(K \pi)_S \bar{K}$, and $a_0(980) \pi$.
- ⁶ From fit to the $a_0(980) \pi 0^- +$ partial wave. Cannot rule out a $a_0(980) \pi 1^- +$ partial wave.
- ⁷ Excluded from averaging because averaging would be meaningless.
- ⁸ Best fit with a single Breit Wigner.
- ⁹ This peak in the $\gamma \rho$ channel may not be related to the $\eta(1405)$.
- ¹⁰ Estimated by us from various fits.
- ¹¹ These experiments identify only one pseudoscalar in the 1400–1500 range. Data could also refer to $\eta(1475)$.
- ¹² Systematic uncertainty not evaluated.
- ¹³ From best fit of $0^- +$ partial wave , 50% $K^*(892) K$, 50% $a_0(980) \pi$.

NODE=M027M1;LINKAGE=BL
NODE=M027M1;LINKAGE=J1
NODE=M027M1;LINKAGE=A1
NODE=M027M;LINKAGE=NC
NODE=M027M4;LINKAGE=FX
NODE=M027M4;LINKAGE=C2

NODE=M027M4;LINKAGE=AA
NODE=M027M2;LINKAGE=E
NODE=M027M2;LINKAGE=X
NODE=M027M3;LINKAGE=E
NODE=M027M;LINKAGE=NP

NODE=M027M;LINKAGE=NS
NODE=M027M6;LINKAGE=H

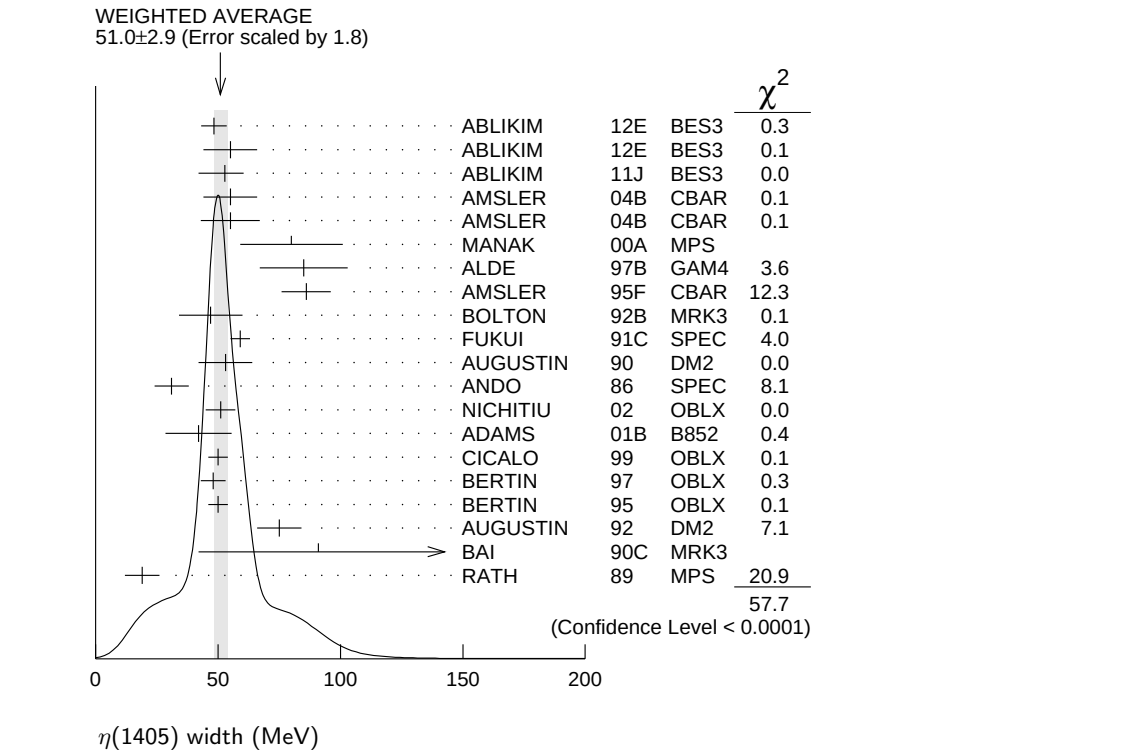
 $\eta(1405)$ WIDTH

NODE=M027210

VALUE (MeV) DOCUMENT ID

51.0 $\pm$ 2.9 OUR AVERAGE Includes data from the 2 datablocks that follow this one. Error includes scale factor of 1.8. See the ideogram below. [51.1 $\pm$ 3.2 MeV OUR 2012 AVERAGE Scale factor = 2.0]

NODE=M027WX
NEW



$\eta\pi\pi$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
The data in this block is included in the average printed for a previous datablock.				

NODE=M027W1
NODE=M027W1

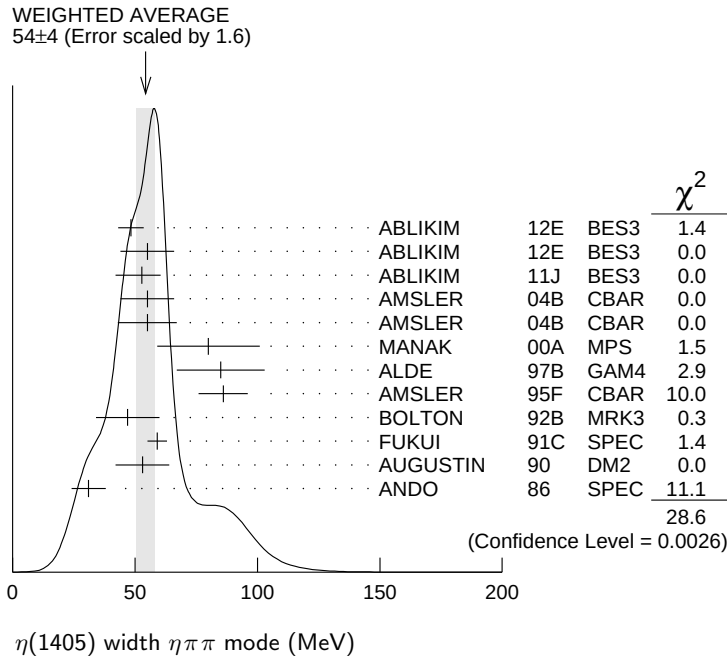
54 ± 4 OUR AVERAGE Error includes scale factor of 1.6. See the ideogram below.
[56 ± 5 MeV OUR 2012 AVERAGE Scale factor = 1.7]

NEW

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± 7.6 ^{+0.1} _{-7.6}	14	ABLIKIM	11J	BES3	$J/\psi \rightarrow \omega(\eta\pi^+\pi^-)$
55 ±11	900 ± 375	AMSLER	04B	CBAR	$0 \bar{p} p \rightarrow \pi^+\pi^-\pi^+\pi^-\eta$
55 ±12	6.6 ± 2.0k	AMSLER	04B	CBAR	$0 \bar{p} p \rightarrow \pi^+\pi^-\pi^0\pi^0\gamma$
80 ±21	9082	MANAK	00A	MPS	$18 \pi^-\bar{p} \rightarrow \eta\pi^+\pi^-n$
85 ±18	2200	ALDE	97B	GAM4	$100 \pi^-\bar{p} \rightarrow \eta\pi^0\pi^0n$
86 ±10		AMSLER	95F	CBAR	$0 \bar{p} p \rightarrow \pi^+\pi^-\pi^0\pi^0\eta$
47 ±13	15	BOLTON	92B	MRK3	$J/\psi \rightarrow \gamma\eta\pi^+\pi^-$
59 ± 4		FUKUI	91C	SPEC	$8.95 \pi^-\bar{p} \rightarrow \eta\pi^+\pi^-n$
53 ±11	16	AUGUSTIN	90	DM2	$J/\psi \rightarrow \gamma\eta\pi^+\pi^-$
31 ± 7		ANDO	86	SPEC	$8 \pi^-\bar{p} \rightarrow \eta\pi^+\pi^-n$

OCCUR=2

OCCUR=2



$K\bar{K}\pi$ 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.

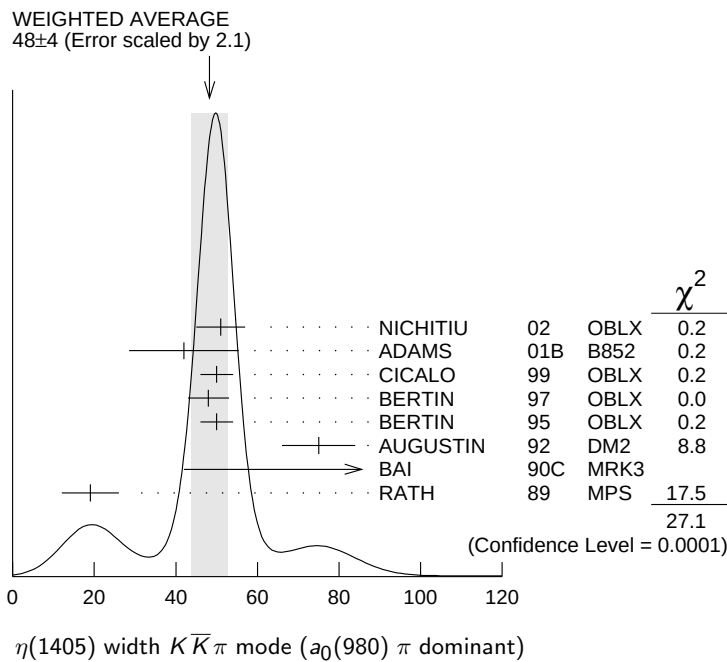
48 ± 4 OUR AVERAGE Error includes scale factor of 2.1. See the ideogram below.

51 ± 6	3651	17 NICHITIU	02 OBLX	
42 ± 10 ± 9	20k	ADAMS	01B B852	18 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	18 BERTIN	97 OBLX	0.0 $\bar{p} p \rightarrow K^\pm (K^0) \pi^\mp \pi^+ \pi^-$	
50 ± 4	18 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	19 BAI	90C MRK3	$J/\psi \rightarrow \gamma K_S^0 K^\pm \pi^\mp$	
19 ± 7	19 RATH	89 MPS	21.4 $\pi^- p \rightarrow n K_S^0 K_S^0 \pi^0$	

NODE=M027W4
NODE=M027W4

OCCUR=2

OCCUR=3



$\pi\pi\gamma$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
64 ± 18	235 ± 91	AMSLER	04B CBAR	0 $\bar{p} p \rightarrow \pi^+ \pi^- \pi^+ \pi^- \gamma$

NODE=M027W2
NODE=M027W2

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

101.0 ± 8.8 ± 8.8	547	BAI	04J	BES2	$J/\psi \rightarrow \gamma\gamma\pi^+\pi^-$
174 ± 44		AUGUSTIN	90	DM2	$J/\psi \rightarrow \pi^+\pi^-\gamma\gamma$
90 ± 26		20 COFFMAN	90	MRK3	$J/\psi \rightarrow \pi^+\pi^-2\gamma$

OCCUR=2

4 π MODE

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT

NODE=M027W3

NODE=M027W3

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

160 ± 30		BUGG	95	MRK3	$J/\psi \rightarrow \gamma\pi^+\pi^-\pi^+\pi^-$
144 ± 13	3270	21 BISELLO	89B	DM2	$J/\psi \rightarrow 4\pi\gamma$

$K\bar{K}\pi$ MODE (unresolved)

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT

NODE=M027W6

NODE=M027W6

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

48.9 ± 9.0	249 ± 35	22,23 ABLIKIM	08E	BES2	$J/\psi \rightarrow \omega K_S^0 K^+\pi^- + \text{c.c.}$
34.2 ± 18.5	62 ± 18	22,23 ABLIKIM	08E	BES2	$J/\psi \rightarrow \omega K^+ K^-\pi^0$
93 ± 14	296	22 AUGUSTIN	90	DM2	$J/\psi \rightarrow \gamma K^+ K^-\pi^0$
105 ± 10	693	22 AUGUSTIN	90	DM2	$J/\psi \rightarrow \gamma K_S^0 K^\pm\pi^\mp$
62 ± 16	500	22 DUCH	89	ASTE	$\bar{p}p \rightarrow K\bar{K}\pi\pi\pi$
100 ± 11	170	22 RATH	89	MPS	$21.4 \pi^- p \rightarrow K_S^0 K_S^0 \pi^0 n$
66 ± 2	8800	22 BIRMAN	88	MPS	$8 \pi^- p \rightarrow K^+ \bar{K}^0 \pi^- n$
60 ± 10	620	22 REEVES	86	SPEC	$6.6 p\bar{p} \rightarrow KK\pi X$
60 ± 10		22 CHUNG	85	SPEC	$8 \pi^- p \rightarrow K\bar{K}\pi n$
55 +20 -30	174	22 EDWARDS	82E	CBAL	$J/\psi \rightarrow \gamma K^+ K^-\pi^0$
50 +30 -20		22 SCHARRE	80	MRK2	$J/\psi \rightarrow \gamma K_S^0 K^\pm\pi^\mp$
80 ± 10	800	22,24 BAILLON	67	HBC	$0.0 \bar{p}p \rightarrow K\bar{K}\pi\pi\pi$

OCCUR=2

OCCUR=2

OCCUR=3

OCCUR=2

14 The selected process is $J/\psi \rightarrow \omega a_0(980)\pi$.

15 From fit to the $a_0(980)\pi 0^-+$ partial wave.

16 From $\eta\pi^+\pi^-$ mass distribution - mainly $a_0(980)\pi$ - no spin-parity determination available.

17 Decaying dominantly directly to $K^+ K^-\pi^0$.

18 Decaying into $(K\bar{K})_S\pi$, $(K\pi)_S\bar{K}$, and $a_0(980)\pi$.

19 From fit to the $a_0(980)\pi 0^-+$ partial wave, but $a_0(980)\pi 1^++$ cannot be excluded.

20 This peak in the $\gamma\rho$ channel may not be related to the $\eta(1405)$.

21 Estimated by us from various fits.

22 These experiments identify only one pseudoscalar in the 1400–1500 range. Data could also refer to $\eta(1475)$.

23 Systematic uncertainty not evaluated.

24 From best fit to 0^-+ partial wave, 50% $K^*(892)K$, 50% $a_0(980)\pi$.

NODE=M027W1;LINKAGE=BL

NODE=M027W1;LINKAGE=A1

NODE=M027W1;LINKAGE=D1

NODE=M027W;LINKAGE=NC

NODE=M027W4;LINKAGE=FX

NODE=M027W4;LINKAGE=C

NODE=M027W2;LINKAGE=X

NODE=M027W3;LINKAGE=F2

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 $\eta(\pi\pi)_S\text{-wave}$	seen	
Γ_5 $f_0(980)\eta$	seen	
Γ_6 4π	seen	
Γ_7 $\rho\rho$	<58 %	99.85%
Γ_8 $\gamma\gamma$		
Γ_9 $\rho^0\gamma$	seen	
Γ_{10} $\phi\gamma$		
Γ_{11} $K^*(892)K$	seen	

DESIG=2;OUR EST;→ UNCHECKED ←

DESIG=5;OUR EST;→ UNCHECKED ←

DESIG=4;OUR EST;→ UNCHECKED ←

DESIG=9;OUR EST;→ UNCHECKED ←

DESIG=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

$\Gamma(K\bar{K}\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$

 $\Gamma_1\Gamma_8/\Gamma$

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	25,26 AHOHE	05	CLE2	$10.6 e^+e^- \rightarrow e^+e^- K_S^0 K^\pm\pi^\mp$

$\Gamma(\eta\pi\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$
 $\Gamma_2\Gamma_8/\Gamma$

VALUE (keV)	CL%	DOCUMENT ID	TECN	COMMENT
<0.095	95	ACCIARRI	01G L3	183–202 $e^+e^- \rightarrow e^+e^-\eta\pi^+\pi^-$

NODE=M027G5
NODE=M027G5

 $\Gamma(\rho^0\gamma) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$
 $\Gamma_9\Gamma_8/\Gamma$

VALUE (keV)	CL%	DOCUMENT ID	TECN	COMMENT

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

<1.5	95	ALTHOFF	84E TASS	$e^+e^- \rightarrow e^+e^-\pi^+\pi^-\gamma$

²⁵ Using $\eta(1405)$ mass and width 1410 MeV and 51 MeV, respectively.

²⁶ Assuming three-body phase-space decay to $K_S^0 K^\pm \pi^\mp$.

NODE=M027G8
NODE=M027G8

NODE=M027G3;LINKAGE=AH

NODE=M027G3;LINKAGE=B3

$\eta(1405)$ BRANCHING RATIOS

NODE=M027225

 $\Gamma(\eta\pi\pi)/\Gamma(K\bar{K}\pi)$
 Γ_2/Γ_1

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

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

1.09 ± 0.48		²⁷ AMSLER	04B CBAR	$0 \bar{p}p \rightarrow \pi^+\pi^-\pi^+\pi^-\eta$
<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	$0.0 \bar{p}p$

NODE=M027R3
NODE=M027R3

 $\Gamma(\rho^0\gamma)/\Gamma(\eta\pi\pi)$
 Γ_9/Γ_2

VALUE	DOCUMENT ID	TECN	COMMENT

0.111 ± 0.064	AMSLER	04B CBAR	$0 \bar{p}p$

NODE=M027R12
NODE=M027R12

 $\Gamma(a_0(980)\pi)/\Gamma(K\bar{K}\pi)$
 Γ_3/Γ_1

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

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

~ 0.15		²⁸ BERTIN	95 OBLX	$0 \bar{p}p \rightarrow K\bar{K}\pi\pi\pi$
~ 0.8	500	²⁸ DUCH	89 ASTE	$\bar{p}p \rightarrow \pi^+\pi^-K^\pm\pi^\mp K^0$
~ 0.75		²⁸ REEVES	86 SPEC	$6.6 p\bar{p} \rightarrow KK\pi X$

NODE=M027R4
NODE=M027R4

 $\Gamma(a_0(980)\pi)/\Gamma(\eta\pi\pi)$
 Γ_3/Γ_2

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

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

0.29 ± 0.10		ABELE	98E CBAR	$0 p\bar{p} \rightarrow \eta\pi^0\pi^0\pi^0$
0.19 ± 0.04	2200	²⁹ ALDE	97B GAM4	$100 \pi^-p \rightarrow \eta\pi^0\pi^0 n$
$0.56 \pm 0.04 \pm 0.03$		²⁹ AMSLER	95F CBAR	$0 \bar{p}p \rightarrow \pi^+\pi^-\pi^0\pi^0\eta$

NODE=M027R2
NODE=M027R2

 $\Gamma(a_0(980)\pi)/\Gamma(\eta(\pi\pi)S\text{-wave})$
 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	³⁰ MANAK	00A MPS	$18 \pi^-p \rightarrow \eta\pi^+\pi^-n$
$0.70 \pm 0.12 \pm 0.20$		³¹ BAI	99 BES	$J/\psi \rightarrow \gamma\eta\pi^+\pi^-$

NODE=M027R9
NODE=M027R9

 $\Gamma(\rho^0\gamma)/\Gamma(K\bar{K}\pi)$
 Γ_9/Γ_1

VALUE	DOCUMENT ID	TECN	COMMENT

0.0152 ± 0.0038	³² COFFMAN	90 MRK3	$J/\psi \rightarrow \gamma\gamma\pi^+\pi^-$

NODE=M027R7
NODE=M027R7

 $\Gamma(\eta(\pi\pi)S\text{-wave})/\Gamma(\eta\pi\pi)$
 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_5/Γ_2

VALUE	DOCUMENT ID	TECN	COMMENT

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

0.32 ± 0.07	³³ ANISOVICH	00 SPEC	$0.9\text{--}1.2 \bar{p}p \rightarrow \eta 3\pi^0$

NODE=M027R10
NODE=M027R10

 $\Gamma(\rho\rho)/\Gamma_{\text{total}}$
 Γ_7/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<0.58	99.85	^{27,34} AMSLER	04B CBAR	$0 \bar{p}p$

NODE=M027R13
NODE=M027R13

$\Gamma(K^*(892)K)/\Gamma(a_0(980)\pi)$ Γ_{11}/Γ_3

VALUE	DOCUMENT ID	TECN	COMMENT

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

0.084 ± 0.024 ³⁰ ADAMS 01B B852 18 GeV $\pi^- p \rightarrow K^+ K^- \pi^0 n$ NODE=M027R11
NODE=M027R11 $\Gamma(\phi\gamma)/\Gamma(\rho^0\gamma)$ Γ_{10}/Γ_9

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

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

<0.77 95 ³⁵ BAI 04J BES2 $J/\psi \rightarrow \gamma\gamma K^+ K^-$ ²⁷ Using the data of BAILLON 67 on $\bar{p}p \rightarrow K\bar{K}\pi$.²⁸ Assuming that the $a_0(980)$ decays only into $K\bar{K}$.²⁹ Assuming that the $a_0(980)$ decays only into $\eta\pi$.³⁰ Statistical error only.³¹ Assuming that the $a_0(980)$ decays only into $\eta\pi$.³² Using $B(J/\psi \rightarrow \gamma\eta(1405) \rightarrow \gamma K\bar{K}\pi) = 4.2 \times 10^{-3}$ and $B(J/\psi \rightarrow \gamma\eta(1405) \rightarrow \gamma\gamma\rho^0) = 6.4 \times 10^{-5}$ and assuming that the $\gamma\rho^0$ signal does not come from the $f_1(1420)$.³³ Using preliminary Crystal Barrel data.³⁴ Assuming that the $\eta(1405)$ decays are saturated by the $\pi\pi\eta$, $K\bar{K}\pi$ and $\rho\rho$ modes.³⁵ 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=M027R14NODE=M027R3;LINKAGE=AM
NODE=M027R4;LINKAGE=C
NODE=M027R2;LINKAGE=A
NODE=M027R;LINKAGE=K3
NODE=M027R9;LINKAGE=BK
NODE=M027R7;LINKAGE=DNODE=M027R10;LINKAGE=D
NODE=M027R13;LINKAGE=AM
NODE=M027R14;LINKAGE=BA $\eta(1405)$ REFERENCES

NODE=M027

ABLIKIM	12E	PRL 108 182001	M. Ablikim <i>et al.</i>	(BES III Collab.)
ABLIKIM	11J	PRL 107 182001	M. Ablikim <i>et al.</i>	(BES III Collab.)
ABLIKIM	08E	PR D77 032005	M. Ablikim <i>et al.</i>	(BES Collab.)
AHOHE	05	PR D71 072001	R. Ahohe <i>et al.</i>	(CLEO Collab.)
AMSLER	04B	EPJ C33 23	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
BAI	04J	PL B594 47	J.Z. Bai <i>et al.</i>	(BES Collab.)
NICHITIU	02	PL B545 261	F. Nichitiu <i>et al.</i>	(OBELIX Collab.)
ACCIARRI	01G	PL B501 1	M. Acciarri <i>et al.</i>	(L3 Collab.)
ADAMS	01B	PL B516 264	G.S. Adams <i>et al.</i>	(BNL E852 Collab.)
ANISOVICH	01	NP A690 567	A.V. Anisovich <i>et al.</i>	
ANISOVICH	00	PL B472 168	A.V. Anisovich <i>et al.</i>	
MANAK	00A	PR D62 012003	J.J. Manak <i>et al.</i>	(BNL E852 Collab.)
BAI	99	PL B446 356	J.Z. Bai <i>et al.</i>	(BES Collab.)
CICALO	99	PL B462 453	C. Cicalo <i>et al.</i>	(OBELIX Collab.)
ABELE	98E	NP B514 45	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
BAI	98C	PL B440 217	J.Z. Bai <i>et al.</i>	(BES Collab.)
ALDE	97B	PAN 60 386	D. Alde <i>et al.</i>	(GAMS Collab.)
Translated from YAF 60 458.				
BERTIN	97	PL B400 226	A. Bertin <i>et al.</i>	(OBELIX Collab.)
AMSLER	95F	PL B358 389	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
BERTIN	95	PL B361 187	A. Bertin <i>et al.</i>	(OBELIX Collab.)
BUGG	95	PL B353 378	D.V. Bugg <i>et al.</i>	(LOQM, PNPI, WASH)
AUGUSTIN	92	PR D46 1951	J.E. Augustin, G. Cosme	(DM2 Collab.)
BOLTON	92B	PRL 69 1328	T. Bolton <i>et al.</i>	(Mark III Collab.)
FUKUI	91C	PL B267 293	S. Fukui <i>et al.</i>	(SUGI, NAGO, KEK, KYOT+)
AUGUSTIN	90	PR D42 10	J.E. Augustin <i>et al.</i>	(DM2 Collab.)
BAI	90C	PRL 65 2507	Z. Bai <i>et al.</i>	(Mark III Collab.)
COFFMAN	90	PR D41 1410	D.M. Coffman <i>et al.</i>	(Mark III Collab.)
BISELLO	89B	PR D39 701	G. Busetto <i>et al.</i>	(DM2 Collab.)
DUCH	89	ZPHY C45 223	K.D. Duch <i>et al.</i>	(ASTERIX Collab.) JP
RATH	89	PR D40 693	M.G. Rath <i>et al.</i>	(NDAM, BRAN, BNL, CUNY+)
BIRMAN	88	PRL 61 1557	A. Birman <i>et al.</i>	(BNL, FSU, IND, MASD) JP
ANDO	86	PRL 57 1296	A. Ando <i>et al.</i>	(KEK, KYOT, NIRS, SAGA+) IJP
REEVES	86	PR D34 1960	D.F. Reeves <i>et al.</i>	(FLOR, BNL, IND+) JP
CHUNG	85	PRL 55 779	S.U. Chung <i>et al.</i>	(BNL, FLOR, IND+) JP
ALTHOFF	84E	PL 147B 487	M. Althoff <i>et al.</i>	(TASSO Collab.)
EDWARDS	83B	PRL 51 859	C. Edwards <i>et al.</i>	(CIT, HARV, PRIN+)
EDWARDS	82E	PRL 49 259	C. Edwards <i>et al.</i>	(CIT, HARV, PRIN+)
Also		PRL 50 219	C. Edwards <i>et al.</i>	(CIT, HARV, PRIN+)
SCHARRE	80	PL 97B 329	D.L. Scharre <i>et al.</i>	(SLAC, LBL)
FOSTER	68B	NP B8 174	M. Foster <i>et al.</i>	(CERN, CDEF)
BAILLON	67	NC 50A 393	P.H. Baillon <i>et al.</i>	(CERN, CDEF, IRAD)

REFID=54270
REFID=53931
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REFID=21179
REFID=20407

$f_1(1420)$

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

See the minireview under $\eta(1405)$.

NODE=M006

NODE=M006

NODE=M006M2

NODE=M006M2

$f_1(1420)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1426.4 ± 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	
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 $\bar{p}p \rightarrow K^\pm (K^0) \pi^\mp \pi^+ \pi^-$
1435 ± 9		PROKOSHKIN	97B GAM4	100 $\pi^- p \rightarrow \eta \pi^0 \pi^0 n$
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 $^{+7}_{-6} \pm \frac{+3}{-2}$	1100	BAI	90C MRK3	$J/\psi \rightarrow \gamma K_S^0 K^\pm \pi^\mp$
1425 ± 10	17	BEHREND	89 CELL	$\gamma\gamma \rightarrow K_S^0 K^\pm \pi^\mp$
1442 ± 5 $^{+10}_{-17}$	111	BECKER	87 MRK3	$e^+e^-, \omega K\bar{K}\pi$
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 $\pi^- p$
• • • 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	$pp \rightarrow p_{\text{slow}} (K_S^0 K^- \pi^+) p_{\text{fast}}$
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.

OCCUR=2

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
54.9 ± 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	
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 $\bar{p}p \rightarrow K^\pm (K^0) \pi^\mp \pi^+ \pi^-$
90 ± 25		PROKOSHKIN	97B GAM4	100 $\pi^- p \rightarrow \eta \pi^0 \pi^0 n$
58 ± 10		⁶ ARMSTRONG	92E OMEG	85,300 $\pi^+ p, pp \rightarrow \pi^+ p, pp(K\bar{K}\pi)$

NODE=M006W

NODE=M006W

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 $p\bar{p}$
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	$p\bar{p} \rightarrow p_{\text{slow}} (K_S^0 K^+ \pi^-) p_{\text{fast}}$
58.8 ± 3.3		⁸ SOSA	99	SPEC	$p\bar{p} \rightarrow p_{\text{slow}} (K_S^0 K^- \pi^+) p_{\text{fast}}$
58 ± 8	389	ARMSTRONG	89	OMEG	300 $p\bar{p} \rightarrow K \bar{K} \pi p\bar{p}$
62 ± 5	1520	ARMSTRONG	84	OMEG	85 $\pi^+ p, p\bar{p} \rightarrow (\pi^+, p)(K \bar{K} \pi)p$
~ 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 $K^*(892)K 1^+ 1^+$ partial wave.

⁸ No systematic error given.

OCCUR=2

NODE=M006W;LINKAGE=C
 NODE=M006W;LINKAGE=B
 NODE=M006W;LINKAGE=N1

NODE=M006215;NODE=M006

$f_1(1420)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $K \bar{K} \pi$	dominant
Γ_2 $K \bar{K}^*(892) + \text{c.c.}$	dominant
Γ_3 $\eta \pi \pi$	possibly seen
Γ_4 $a_0(980) \pi$	
Γ_5 $\pi \pi \rho$	
Γ_6 4π	
Γ_7 $\rho^0 \gamma$	
Γ_8 $\phi \gamma$	seen

DESIG=2;OUR EST;→ UNCHECKED ←
 DESIG=1;OUR EST;→ UNCHECKED ←
 DESIG=5;OUR EST;→ UNCHECKED ←
 DESIG=4
 DESIG=3
 DESIG=6
 DESIG=8
 DESIG=9;OUR EST;→ UNCHECKED ←

$f_1(1420) \Gamma(i) \Gamma(\gamma\gamma) / \Gamma(\text{total})$

NODE=M006220

$\Gamma(K \bar{K} \pi) \times \Gamma(\gamma\gamma^*) / \Gamma_{\text{total}}$

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

$\Gamma(K \bar{K}^*(892) + \text{c.c.}) / \Gamma(K \bar{K} \pi)$

 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

$\Gamma(\pi\pi\rho)/\Gamma(K\bar{K}\pi)$ Γ_5/Γ_1

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.3	95	CORDEN	78	OMEG 12-15 $\pi^- p$
<2.0		DAHL	67	HBC 1.6-4.2 $\pi^- p$

NODE=M006R2
 NODE=M006R2

 $\Gamma(\eta\pi\pi)/\Gamma(K\bar{K}\pi)$ Γ_3/Γ_1

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.1	95	ARMSTRONG	91B	OMEG 300 $p p \rightarrow p p \eta \pi^+ \pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1.35 ± 0.75		KOPKE	89	MRK3 $J/\psi \rightarrow \omega \eta \pi \pi (K\bar{K}\pi)$
<0.6	90	GIDAL	87	MRK2 $e^+ e^- \rightarrow e^+ e^- \eta \pi^+ \pi^-$
<0.5	95	CORDEN	78	OMEG 12-15 $\pi^- p$
1.5 ± 0.8		DEFOIX	72	HBC 0.7 $\bar{p} p$

NODE=M006R3
 NODE=M006R3

 $\Gamma(a_0(980)\pi)/\Gamma(\eta\pi\pi)$ Γ_4/Γ_3

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
>0.1	90	PROKOSHKIN	97B	GAM4 100 $\pi^- p \rightarrow \eta \pi^0 \pi^0 n$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
not seen in either mode		ANDO	86	SPEC 8 $\pi^- p$
not seen in either mode		CORDEN	78	OMEG 12-15 $\pi^- p$
0.4 ± 0.2		DEFOIX	72	HBC 0.7 $\bar{p} p \rightarrow 7\pi$

NODE=M006R4
 NODE=M006R4

 $\Gamma(4\pi)/\Gamma(K\bar{K}^*(892)+c.c.)$ Γ_6/Γ_2

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.90	95	DIONISI	80	HBC 4 $\pi^- p$

NODE=M006R5
 NODE=M006R5

 $\Gamma(K\bar{K}\pi)/[\Gamma(K\bar{K}^*(892)+c.c.)+\Gamma(a_0(980)\pi)]$ $\Gamma_1/(\Gamma_2+\Gamma_4)$

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.65 ± 0.27	¹⁴ DIONISI	80	HBC 4 $\pi^- p$
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
0.04 ± 0.01 ± 0.01		BARBERIS	98C	OMEG 450 $p p \rightarrow \rho_f f_1(1420) p_S$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.04	68	ARMSTRONG	84	OMEG 85 $\pi^+ p$

NODE=M006R7
 NODE=M006R7

 $\Gamma(4\pi)/\Gamma(K\bar{K}\pi)$ Γ_6/Γ_1

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.62	95	ARMSTRONG	89G	OMEG 85 $\pi p \rightarrow 4\pi X$

NODE=M006R8
 NODE=M006R8

 $\Gamma(\rho^0\gamma)/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.08	95	¹⁵ ARMSTRONG	92C	SPEC 300 $p p \rightarrow p p \pi^+ \pi^- \gamma$
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
<0.02	95	BARBERIS	98C	OMEG 450 $p p \rightarrow \rho_f f_1(1420) p_S$

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 $p p \rightarrow \rho_f f_1(1420) p_S$

NODE=M006R11
 NODE=M006R11

$\phi_1(1420)$ REFERENCES

ACHARD	07	JHEP 0703 018	P. Achard <i>et al.</i>	(L3 Collab.)
ABDALLAH	03H	PL B569 129	J. Abdallah <i>et al.</i>	(DELPHI Collab.)
NICHITIUI	02	PL B545 261	F. Nichitiui <i>et al.</i>	(OBELIX Collab.)
ADAMS	01B	PL B516 264	G.S. Adams <i>et al.</i>	(BNL E852 Collab.)
SOSA	99	PRL 83 913	M. Sosa <i>et al.</i>	
BARBERIS	98C	PL B440 225	D. Barberis <i>et al.</i>	(WA 102 Collab.)
BARBERIS	97C	PL B413 225	D. Barberis <i>et al.</i>	(WA 102 Collab.)
BERTIN	97	PL B400 226	A. Bertin <i>et al.</i>	(OBELIX Collab.)
PROKOSHKIN	97B	SPD 42 298	Yu.D. Prokoshkin, S.A. Sadovsky	
		Translated from DANS 354 751.		
ARMSTRONG	92C	ZPHY C54 371	T.A. Armstrong <i>et al.</i>	(ATHU, BARI, BIRM+)
ARMSTRONG	92E	ZPHY C56 29	T.A. Armstrong <i>et al.</i>	(ATHU, BARI, BIRM+) JPC
AUGUSTIN	92	PR D46 1951	J.E. Augustin, G. Cosme	(DM2 Collab.)
ARMSTRONG	91B	ZPHY C52 389	T.A. Armstrong <i>et al.</i>	(ATHU, BARI, BIRM+)
BAI	90C	PRL 65 2507	Z. Bai <i>et al.</i>	(Mark III Collab.)
ARMSTRONG	89	PL B221 216	T.A. Armstrong <i>et al.</i>	(CERN, CDEF, BIRM+) JPC
ARMSTRONG	89G	ZPHY C43 55	T.A. Armstrong <i>et al.</i>	(CERN, BIRM, BARI+)
BEHREND	89	ZPHY C42 367	H.J. Behrend <i>et al.</i>	(CELLO Collab.)
HILL	89	ZPHY C42 355	P. Hill <i>et al.</i>	(JADE Collab.) JP
KOPKE	89	PRPL 174 67	L. Kopke <i>et al.</i>	(CERN)
AIHARA	88B	PL B209 107	H. Aihara <i>et al.</i>	(TPC-2 γ Collab.)
BECKER	87	PRL 59 186	J.J. Becker <i>et al.</i>	(Mark III Collab.) JP
GIDAL	87	PRL 59 2012	G. Gidal <i>et al.</i>	(LBL, SLAC, HARV)
GIDAL	87B	PRL 59 2016	G. Gidal <i>et al.</i>	(LBL, SLAC, HARV)
AIHARA	86C	PRL 57 2500	H. Aihara <i>et al.</i>	(TPC-2 γ Collab.) JP
ANDO	86	PRL 57 1296	A. Ando <i>et al.</i>	(KEK, KYOT, NIRS, SAGA+)
ARMSTRONG	84	PL 146B 273	T.A. Armstrong <i>et al.</i>	(ATHU, BARI, BIRM+) JP
BITYUKOV	84	SJNP 39 735	S. Bityukov <i>et al.</i>	(SERP)
		Translated from YAF 39 1165.		
CHAUVAT	84	PL 148B 382	P. Chauvat <i>et al.</i>	(CERN, CLER, UCLA+)
JENNI	83	PR D27 1031	P. Jenni <i>et al.</i>	(SLAC, LBL)
BROMBERG	80	PR D22 1513	C.M. Bromberg <i>et al.</i>	(CIT, FNAL, ILLC+)
DIONISI	80	NP B169 1	C. Dionisi <i>et al.</i>	(CERN, MADR, CDEF+) IJP
CORDEN	78	NP B144 253	M.J. Corden <i>et al.</i>	(BIRM, RHEL, TELA+)
DEFOIX	72	NP B44 125	C. Defoix <i>et al.</i>	(CDEF, CERN)
DAHL	67	PR 163 1377	O.I. Dahl <i>et al.</i>	(LRL) IJP
Also		PRL 14 1074	D.H. Miller <i>et al.</i>	(LRL, UCB)

NODE=M006

REFID=51698
REFID=49548
REFID=48848
REFID=49649
REFID=46937
REFID=46346
REFID=45759
REFID=45417
REFID=45549

REFID=42097
REFID=43173
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REFID=41862
REFID=41578
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REFID=40732
REFID=40741
REFID=41863
REFID=40572
REFID=40015
REFID=40223
REFID=40224
REFID=21326
REFID=20891
REFID=20929
REFID=45856

REFID=20932
REFID=20304
REFID=20922
REFID=20924
REFID=20452
REFID=20435
REFID=20321
REFID=21291

NODE=M125

 $\omega(1420)$

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

 $\omega(1420)$ MASS

NODE=M125M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

(1400–1450) OUR ESTIMATE

NODE=M125M

→ UNCHECKED ←

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

1382 $\pm$ 23 $\pm$ 70		AUBERT	07AU BABR	10.6 e ⁺ e ⁻ → $\omega\pi^+\pi^-\gamma$
1350 $\pm$ 20 $\pm$ 20		AUBERT,B	04N BABR	10.6 e ⁺ e ⁻ → $\pi^+\pi^-\pi^0\gamma$
1400 $\pm$ 50 $\pm$ 130	1.2M	¹ ACHASOV	03D RVUE	0.44–2.00 e ⁺ e ⁻ → $\pi^+\pi^-\pi^0$
1450 $\pm$ 10		² HENNER	02 RVUE	1.2–2.0 e ⁺ e ⁻ → $\rho\pi, \omega\pi\pi$
1373 $\pm$ 70	177	³ AKHMETSHIN	00D CMD2	1.2–1.38 e ⁺ e ⁻ → $\omega\pi^+\pi^-$
1370 $\pm$ 25	5095	ANISOVICH	00H SPEC	0.0 $p\bar{p}$ → $\omega\pi^0\pi^0\pi^0$
1400 ⁺¹⁰⁰ ₋₂₀₀		⁴ ACHASOV	98H RVUE	e ⁺ e ⁻ → $\pi^+\pi^-\pi^0$
~ 1400		⁵ ACHASOV	98H RVUE	e ⁺ e ⁻ → $\omega\pi^+\pi^-$
~ 1460		⁶ ACHASOV	98H RVUE	e ⁺ e ⁻ → K^+K^-
1440 $\pm$ 70		⁷ CLEGG	94 RVUE	
1419 $\pm$ 31	315	⁸ ANTONELLI	92 DM2	1.34–2.4e ⁺ e ⁻ → $\rho\pi$

OCCUR=2

OCCUR=3

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.

NODE=M125M;LINKAGE=VH

² Using results of CORDIER 81 and preliminary data of DOLINSKY 91 and ANTONELLI 92.

NODE=M125M;LINKAGE=AB

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.

NODE=M125M;LINKAGE=KL

⁴ Using data from BARKOV 87, DOLINSKY 91, and ANTONELLI 92.

NODE=M125M;LINKAGE=L1

⁵ Using the data from ANTONELLI 92.

NODE=M125M;LINKAGE=L2

⁶ Using the data from IVANOV 81 and BISELLO 88B.

NODE=M125M;LINKAGE=L3

⁷ From a fit to two Breit-Wigner functions and using the data of DOLINSKY 91 and ANTONELLI 92.

NODE=M125M;LINKAGE=AD

⁸ From a fit to two Breit-Wigner functions interfering between them and with the ω, ϕ tails with fixed (+, -, +) phases.

NODE=M125M;LINKAGE=B

 $\omega(1420)$ WIDTH

NODE=M125W

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT

(180-250) OUR ESTIMATE

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

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	⁹ ACHASOV	03D	RVUE	0.44-2.00	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
199± 15		¹⁰ HENNER	02	RVUE	1.2-2.0	$e^+e^- \rightarrow \rho\pi, \omega\pi\pi$
188± 45	177	¹¹ 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		¹² CLEGG	94	RVUE		
174± 59	315	¹³ ANTONELLI	92	DM2	1.34-2.4	$e^+e^- \rightarrow \rho\pi$

⁹ 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.

¹⁰ Using results of CORDIER 81 and preliminary data of DOLINSKY 91 and ANTONELLI 92.

¹¹ 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.

¹² From a fit to two Breit-Wigner functions and using the data of DOLINSKY 91 and ANTONELLI 92.

¹³ From a fit to two Breit-Wigner functions interfering between them and with the ω, ϕ tails with fixed (+, -, +) phases.

NODE=M125W

→ UNCHECKED ←

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 $\rho\pi$	dominant
Γ_2 $\omega\pi\pi$	seen
Γ_3 $b_1(1235)\pi$	seen
Γ_4 e^+e^-	seen
Γ_5 $\pi^0\gamma$	

NODE=M125215;NODE=M125

DESIG=1;OUR EST;→ UNCHECKED ←

DESIG=4;OUR EST;→ UNCHECKED ←

DESIG=5;OUR EST;→ UNCHECKED ←

DESIG=3;OUR EST;→ UNCHECKED ←

DESIG=6

 $\omega(1420) \Gamma(i)\Gamma(e^+e^-)/\Gamma^2(\text{total})$

$\Gamma(\rho\pi)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_1/\Gamma \times \Gamma_4/\Gamma$

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

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

0.82 ±0.05 ±0.06		AUBERT,B	04N	BABR	10.6	$e^+e^- \rightarrow \pi^+\pi^-\pi^0\gamma$
0.65 ±0.13 ±0.21	1.2M	^{14,15} ACHASOV	03D	RVUE	0.44-2.00	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
0.625±0.160		^{16,17} CLEGG	94	RVUE		
0.466±0.178		^{18,19} ANTONELLI	92	DM2	1.34-2.4	$e^+e^- \rightarrow \rho\pi$

¹⁴ Calculated by us from the cross section at the peak.

¹⁵ 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.

¹⁶ From a fit to two Breit-Wigner functions and using the data of DOLINSKY 91 and ANTONELLI 92.

¹⁷ From the partial and leptonic width given by the authors.

¹⁸ From a fit to two Breit-Wigner functions interfering between them and with the ω, ϕ tails with fixed (+, -, +) phases.

¹⁹ From the product of the leptonic width and partial branching ratio given by the authors.

NODE=M125G;LINKAGE=AW

NODE=M125G;LINKAGE=VH

NODE=M125G;LINKAGE=AD

NODE=M125G;LINKAGE=SE

NODE=M125G;LINKAGE=A

NODE=M125G;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^{-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		²⁰ AKHMETSHIN	00D	CMD2	1.2-2.4	$e^+e^- \rightarrow \omega\pi^+\pi^-$

²⁰ 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=M125G4

NODE=M125G4

NODE=M125G;LINKAGE=KL

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

$$\Gamma_5/\Gamma \times \Gamma_4/\Gamma$$

VALUE (units 10^{-8})

DOCUMENT ID

TECN

COMMENT

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

 $2.03^{+0.70}_{-0.75}$
 ^{21} AKHMETSHIN 05 CMD2 $0.60\text{--}1.38\ e^+e^- \rightarrow \pi^0\gamma$
 ^{21} Using 1420 MeV and 220 MeV for the $\omega(1420)$ mass and width.

NODE=M125G5
NODE=M125G5

NODE=M125G5;LINKAGE=AK

$\omega(1420)$ BRANCHING RATIOS

NODE=M125225

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

$$\Gamma_2/\Gamma$$

VALUE

DOCUMENT ID

TECN

COMMENT

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

 0.301 ± 0.029
 ^{22} HENNER 02 RVUE $1.2\text{--}2.0\ e^+e^- \rightarrow \rho\pi, \omega\pi\pi$

possibly seen

 ^{22} AKHMETSHIN 00D CMD2 $e^+e^- \rightarrow \omega\pi^+\pi^-$

NODE=M125R2
NODE=M125R2

$$\Gamma(\omega\pi\pi)/\Gamma(b_1(1235)\pi)$$

$$\Gamma_2/\Gamma_3$$

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 $0.0\ \rho\bar{\rho} \rightarrow \omega\pi^0\pi^0\pi^0$

NODE=M125R1
NODE=M125R1

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

$$\Gamma_1/\Gamma$$

VALUE

DOCUMENT ID

TECN

COMMENT

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

 0.699 ± 0.029
 ^{22} HENNER 02 RVUE $1.2\text{--}2.0\ e^+e^- \rightarrow \rho\pi, \omega\pi\pi$

NODE=M125R3
NODE=M125R3

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

$$\Gamma_4/\Gamma$$

VALUE (units 10^{-7})

EVTS

DOCUMENT ID

TECN

COMMENT

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

 ~ 6.6
 $1.2M$ ^{23,24} ACHASOV 03D RVUE $0.44\text{--}2.00\ e^+e^- \rightarrow \pi^+\pi^-\pi^0$
 $^{23} \pm 1$
 ^{22} HENNER 02 RVUE $1.2\text{--}2.0\ e^+e^- \rightarrow \rho\pi, \omega\pi\pi$
 ^{22} Assuming that the $\omega(1420)$ decays into $\rho\pi$ and $\omega\pi\pi$ only.

 ^{23} Calculated by us from the cross section at the peak.

 ^{24} 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

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=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

$f_2(1430)$

$I^G(J^{PC}) = 0^+(2^{++})$

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

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 minireview on scalar mesons under $f_0(500)$.

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. • • •				
1515 ±30		² ANISOVICH	09	RVUE 0.0 $\bar{p}p, \pi N$
1316.8 ⁺ _{-1.0} 0.7 ⁺ _{-4.6} 24.7		³ UEHARA	09A	BELL $\gamma\gamma \rightarrow \pi^0 \eta$
1432 ±13 ±25		⁴ BUGG	08A	RVUE $\bar{p}p$
1477 ±10	80k	⁵ UMAN	06	E835 5.2 $\bar{p}p \rightarrow \eta \eta \pi^0$
1441 ⁺ ₋₁₅ 40	35280	² BAKER	03	SPEC $\bar{p}p \rightarrow \omega \pi^+ \pi^- \pi^0$
1303 ±16		⁶ BARGIOTTI	03	OBLX $\bar{p}p$
1296 ±10		⁷ AMSLER	02	CBAR 0.9 $\bar{p}p \rightarrow \pi^0 \pi^0 \eta$
1565 ±30		⁷ ANISOVICH	98B	RVUE Compilation
1290 ±10		⁸ BERTIN	98B	OBLX 0.0 $\bar{p}p \rightarrow K^\pm K_S^\mp \pi^\mp$
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		⁹ CASON	76	

¹ Coupled-channel analysis of AMSLER 95B, AMSLER 95C, and AMSLER 94D.² From the pole position.³ May be a different state.⁴ Using data from AMSLER 94D, ABELE 98, and BAKER 03. Supersedes BUGG 94.⁵ Statistical error only.⁶ Coupled channel analysis of $\pi^+ \pi^- \pi^0$, $K^+ K^- \pi^0$, and $K^\pm K_S^0 \pi^\mp$.⁷ T-matrix pole.⁸ Not confirmed by BUGG 08A.⁹ Isospin 0 not excluded.

NODE=M149M;LINKAGE=AB

NODE=M149M;LINKAGE=PP

NODE=M149M;LINKAGE=UE

NODE=M149M;LINKAGE=BU

NODE=M149M;LINKAGE=ST

NODE=M149M;LINKAGE=BG

NODE=M149M;LINKAGE=AN

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		¹⁰ 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. • • •				
230 ±36		¹¹ ANISOVICH	09	RVUE 0.0 $\bar{p}p, \pi N$
65.0 ⁺ _{-5.4} 2.1 ⁺ _{-32.6} 99.1		¹² UEHARA	09A	BELL $\gamma\gamma \rightarrow \pi^0 \eta$
196 ±10 ±10		¹³ BUGG	08A	RVUE $\bar{p}p$
267 ±11	80k	¹⁴ UMAN	06	E835 5.2 $\bar{p}p \rightarrow \eta \eta \pi^0$
110 ±14	35280	¹¹ BAKER	03	SPEC $\bar{p}p \rightarrow \omega \pi^+ \pi^- \pi^0$
92 ±16		¹⁵ BARGIOTTI	03	OBLX $\bar{p}p$
81 ±21		¹⁶ AMSLER	02	CBAR 0.9 $\bar{p}p \rightarrow \pi^0 \pi^0 \eta$
292 ±40		¹⁶ ANISOVICH	98B	RVUE Compilation
80 ± 5		¹⁷ BERTIN	98B	OBLX 0.0 $\bar{p}p \rightarrow K^\pm K_S^\mp \pi^\mp$
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		¹⁸ CASON	76	

NODE=M149W

NODE=M149W

- 10 Coupled-channel analysis of AMSLER 95B, AMSLER 95C, and AMSLER 94D.
 11 From the pole position.
 12 May be a different state.
 13 Using data from AMSLER 94D, ABELE 98, and BAKER 03. Supersedes BUGG 94.
 14 Statistical error only.
 15 Coupled channel analysis of $\pi^+\pi^-\pi^0$, $K^+K^-\pi^0$, and $K^\pm K_S^0\pi^\mp$.
 16 T-matrix pole.
 17 Not confirmed by BUGG 08A.
 18 Isospin 0 not excluded.

NODE=M149W;LINKAGE=AB
 NODE=M149W;LINKAGE=PP
 NODE=M149W;LINKAGE=UE
 NODE=M149W;LINKAGE=BU
 NODE=M149W;LINKAGE=ST
 NODE=M149W;LINKAGE=BG
 NODE=M149W;LINKAGE=AN
 NODE=M149W;LINKAGE=BE
 NODE=M149W;LINKAGE=CC

$a_0(1450)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $\pi\eta$	seen
Γ_2 $\pi\eta'(958)$	seen
Γ_3 $K\bar{K}$	seen
Γ_4 $\omega\pi\pi$	seen
Γ_5 $a_0(980)\pi\pi$	seen
Γ_6 $\gamma\gamma$	seen

NODE=M149215;NODE=M149

DESIG=1;OUR EST;→ UNCHECKED ←
 DESIG=2;OUR EST;→ UNCHECKED ←
 DESIG=3;OUR EST;→ UNCHECKED ←
 DESIG=4;OUR EST;→ UNCHECKED ←
 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. • • •	
$432 \pm 6^{+1073}_{-256}$	¹⁹ UEHARA 09A BELL $\gamma\gamma \rightarrow \pi^0\eta$
¹⁹ 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	²⁰ 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 $0.0 \bar{p}p \rightarrow \pi^0 \pi^0 \eta'$
²⁰ 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	²¹ ABELE 98 CBAR $0.0 \bar{p}p \rightarrow K_L^0 K^\pm \pi^\mp$
²¹ Using $\pi^0\eta$ from AMSLER 94D.	

NODE=M149R2
 NODE=M149R2

NODE=M149R2;LINKAGE=A

$\Gamma(\omega\pi\pi)/\Gamma(\pi\eta)$	Γ_4/Γ_1
VALUE	DOCUMENT ID TECN COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •	
10.7 ± 2.3	35280 ²² BAKER 03 SPEC $\bar{p}p \rightarrow \omega\pi^+\pi^-\pi^0$
²² 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	²³ UEHARA 09A BELL $\gamma\gamma \rightarrow \pi^0\eta$
²³ May be a different state.	

NODE=M149R03
 NODE=M149R03

NODE=M149R03;LINKAGE=UE

$\rho(1450)$ REFERENCES

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)

NODE=M149

REFID=52719
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REFID=45076
REFID=44377
REFID=44440
REFID=44441
REFID=44093
REFID=44078
REFID=20391
REFID=22446
REFID=21064

NODE=M105

 $\rho(1450)$

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

See our mini-review under the $\rho(1700)$.

NODE=M105

 $\rho(1450)$ MASS

NODE=M105205

VALUE (MeV)

DOCUMENT ID

1465 ± 25 OUR ESTIMATE This is only an educated guess; the error given is larger than the error on the average of the published values.

NODE=M105M0

→ UNCHECKED ←

 $\eta\rho^0$ MODE

VALUE (MeV)

DOCUMENT ID

TECN

COMMENT

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

1497 ± 14	¹ AKHMETSHIN 01B	CMD2	$e^+e^- \rightarrow \eta\gamma$
1421 ± 15	² 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 Using the data of AKHMETSHIN 01B on $e^+e^- \rightarrow \eta\gamma$, AKHMETSHIN 00D and ANTONELLI 88 on $e^+e^- \rightarrow \eta\pi^+\pi^-$.

² 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=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. • • •

1582 ± 17 ± 25	2382	³ AKHMETSHIN 03B	CMD2	$e^+e^- \rightarrow \pi^0\pi^0\gamma$
1349 ± 25 $^{+10}_{-5}$	341	⁴ ALEXANDER 01B	CLE2	$B \rightarrow D^{(*)}\omega\pi^-$
1523 ± 10		⁵ EDWARDS 00A	CLE2	$\tau^- \rightarrow \omega\pi^- \nu_\tau$
1463 ± 25		⁶ CLEGG 94	RVUE	
1250		⁷ ASTON 80C	OMEG	20-70 $\gamma p \rightarrow \omega\pi^0 p$
1290 ± 40		⁷ BARBER 80C	SPEC	3-5 $\gamma p \rightarrow \omega\pi^0 p$

³ Using the data of AKHMETSHIN 03B and BISELLO 91B assuming the $\omega\pi^0$ and $\pi^+\pi^-$ mass dependence of the total width. $\rho(1700)$ mass and width fixed at 1700 MeV and 240 MeV, respectively.

⁴ Using Breit-Wigner parameterization of the $\rho(1450)$ and assuming the $\omega\pi^-$ mass dependence for the total width.

⁵ Mass-independent width parameterization. $\rho(1700)$ mass and width fixed at 1700 MeV and 235 MeV respectively.

⁶ Using data from BISELLO 91B, DOLINSKY 86 and ALBRECHT 87L.

⁷ Not separated from $b_1(1235)$, not pure $J^P = 1^-$ effect.

NODE=M105M3;LINKAGE=HK

NODE=M105M3;LINKAGE=3Z

NODE=M105M;LINKAGE=E1

NODE=M105M3;LINKAGE=B

NODE=M105M3;LINKAGE=A

 4π MODE

VALUE (MeV)

DOCUMENT ID

TECN

COMMENT

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

1435 ± 40	ABELE 01B	CBAR	0.0 $\bar{p}n \rightarrow 2\pi^- 2\pi^0 \pi^+$
1350 ± 50	ACHASOV 97	RVUE	$e^+e^- \rightarrow 2(\pi^+\pi^-)$
1449 ± 4	⁸ ARMSTRONG 89E	OMEG	300 $pp \rightarrow pp2(\pi^+\pi^-)$

⁸ 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. ● ● ●				
1350 ± 20 $^{+20}_{-30}$ 63.5k	9	ABRAMOWICZ12	ZEUS	$e p \rightarrow e \pi^+ \pi^- p$
1493 ± 15	10	LEES	12G	$BABR \ e^+ e^- \rightarrow \pi^+ \pi^- \gamma$
1446 ± 7 ± 28 5.4M	11,12	FUJIKAWA	08	$BELL \ \tau^- \rightarrow \pi^- \pi^0 \nu_\tau$
1328 ± 15	13	SCHAEEL	05C	$ALEP \ \tau^- \rightarrow \pi^- \pi^0 \nu_\tau$
1406 ± 15	11,14	ANDERSON	00A	$CLE2 \ \tau^- \rightarrow \pi^- \pi^0 \nu_\tau$
~ 1368	15	ABELE	99C	$CBAR \ 0.0 \ \bar{p} d \rightarrow \pi^+ \pi^- \pi^- p$
1348 ± 33		BERTIN	98	$OBLX \ 0.05-0.405 \ \bar{n} p \rightarrow 2\pi^+ \pi^-$
1411 ± 14	16	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	14	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	17	KURDADZE	83	$OLYA \ 0.64-1.4 \ e^+ e^- \rightarrow \pi^+ \pi^-$

⁹ Using the KUHN 90 parametrization of the pion form factor, neglecting $\rho-\omega$ interference.

¹⁰ Using the GOUNARIS 68 parametrization of the pion form factor leaving the masses and widths of the $\rho(1450)$, $\rho(1700)$, and $\rho(2150)$ resonances as free parameters of the fit.

¹¹ From the GOUNARIS 68 parametrization of the pion form factor.

¹² $|F_\pi(0)|^2$ fixed to 1.

¹³ 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.

¹⁴ $\rho(1700)$ mass and width fixed at 1700 MeV and 235 MeV, respectively.

¹⁵ $\rho(1700)$ mass and width fixed at 1780 MeV and 275 MeV respectively.

¹⁶ T-matrix pole.

¹⁷ Using for $\rho(1700)$ mass and width 1600 ± 20 and 300 ± 10 MeV respectively.

NODE=M105M5
NODE=M105M5

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

 $K\bar{K}$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
1422.8 ± 6.5 27k	18	ABELE	99D	CBAR $\pm$	$0.0 \ \bar{p} p \rightarrow K^+ K^- \pi^0$

¹⁸ K-matrix pole. Isospin not determined, could be $\omega(1420)$.

NODE=M105M7
NODE=M105M7

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 $\pm 19 \pm 7$	AUBERT	08S	$BABR \ 10.6 \ e^+ e^- \rightarrow K\bar{K}^*(892) \gamma$

NODE=M105M8
NODE=M105M8

 $\rho(1450)$ WIDTH

NODE=M105210

VALUE (MeV)	DOCUMENT ID

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
→ UNCHECKED ←

 $\eta\rho^0$ MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
226 ± 44	19	AKHMETSHIN 01B	$CMD2 \ e^+ e^- \rightarrow \eta \gamma$
211 ± 31	20	AKHMETSHIN 00D	$CMD2 \ e^+ e^- \rightarrow \eta \pi^+ \pi^-$
230 ± 30	ANTONELLI	88	$DM2 \ e^+ e^- \rightarrow \eta \pi^+ \pi^-$
60 ± 15	FUKUI	88	$SPEC \ 8.95 \ \pi^- p \rightarrow \eta \pi^+ \pi^- n$

¹⁹ Using the data of AKHMETSHIN 01B on $e^+ e^- \rightarrow \eta \gamma$, AKHMETSHIN 00D and ANTONELLI 88 on $e^+ e^- \rightarrow \eta \pi^+ \pi^-$.

²⁰ Using the data of ANTONELLI 88, DOLINSKY 91, and AKHMETSHIN 00D. The energy-independent width of the $\rho(1450)$ and $\rho(1700)$ mesons assumed.

NODE=M105W1
NODE=M105W1

NODE=M105W;LINKAGE=SW

NODE=M105W1;LINKAGE=KL

$\omega\pi$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$429 \pm 42 \pm 10$	2382	²¹ AKHMETSHIN 03B	CMD2	$e^+e^- \rightarrow \pi^0\pi^0\gamma$
$547 \pm 86^{+46}_{-45}$	341	²² ALEXANDER 01B	CLE2	$B \rightarrow D(*)\omega\pi^-$
400 ± 35		²³ EDWARDS 00A	CLE2	$\tau^- \rightarrow \omega\pi^- \nu_\tau$
311 ± 62		²⁴ CLEGG 94	RVUE	
300		²⁵ ASTON 80C	OMEG	$20-70 \gamma p \rightarrow \omega\pi^0 p$
320 ± 100		²⁵ BARBER 80C	SPEC	$3-5 \gamma p \rightarrow \omega\pi^0 p$

²¹ 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.

²² Using Breit-Wigner parameterization of the $\rho(1450)$ and assuming the $\omega\pi^-$ mass dependence for the total width.

²³ Mass-independent width parameterization. $\rho(1700)$ mass and width fixed at 1700 MeV and 235 MeV respectively.

²⁴ Using data from BISELLO 91B, DOLINSKY 86 and ALBRECHT 87L.

²⁵ Not separated from $b_1(1235)$, not pure $J^P = 1^-$ effect.

NODE=M105W3
NODE=M105W3

NODE=M105W3;LINKAGE=HK

NODE=M105W3;LINKAGE=3Z

NODE=M105W;LINKAGE=E1

NODE=M105W3;LINKAGE=B

NODE=M105W3;LINKAGE=A

 4π MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
325 ± 100	ABELE 01B	CBAR	$0.0 \bar{p}n \rightarrow 2\pi^- 2\pi^0 \pi^+$

NODE=M105W66
NODE=M105W66

 $\pi\pi$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$460 \pm 30^{+40}_{-45}$	63.5k	²⁶ ABRAMOWICZ12	ZEUS	$ep \rightarrow e\pi^+\pi^-p$
427 ± 31		²⁷ LEES 12G	BABR	$e^+e^- \rightarrow \pi^+\pi^-\gamma$
$434 \pm 16 \pm 60$	5.4M	^{28,29} FUJIKAWA 08	BELL	$\tau^- \rightarrow \pi^-\pi^0\nu_\tau$
468 ± 41		³⁰ SCHAEEL 05C	ALEP	$\tau^- \rightarrow \pi^-\pi^0\nu_\tau$
455 ± 41	87k	^{28,31} ANDERSON 00A	CLE2	$\tau^- \rightarrow \pi^-\pi^0\nu_\tau$
~ 374		³² 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		³³ ABELE 97	CBAR	$\bar{p}n \rightarrow \pi^-\pi^0\pi^0$
310 ± 40		³¹ 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		³⁴ KURDADZE 83	OLYA	$0.64-1.4 e^+e^- \rightarrow \pi^+\pi^-$

²⁶ Using the KUHN 90 parametrization of the pion form factor, neglecting $\rho-\omega$ interference.

²⁷ 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.

²⁸ From the GOUNARIS 68 parametrization of the pion form factor.

²⁹ $|F_\pi(0)|^2$ fixed to 1.

³⁰ 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.

³¹ $\rho(1700)$ mass and width fixed at 1700 MeV and 235 MeV, respectively.

³² $\rho(1700)$ mass and width fixed at 1780 MeV and 275 MeV respectively.

³³ T-matrix pole.

³⁴ Using for $\rho(1700)$ mass and width 1600 ± 20 and 300 ± 10 MeV respectively.

NODE=M105W5
NODE=M105W5

NODE=M105W5;LINKAGE=AB
NODE=M105W5;LINKAGE=LE

NODE=M105W;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. • • •					
146.5 ± 10.5	27k	³⁵ ABELE 99D	CBAR	$\pm$	$0.0 \bar{p}p \rightarrow K^+K^-\pi^0$

³⁵ K-matrix pole. Isospin not determined, could be $\omega(1420)$.

NODE=M105W7
NODE=M105W7

NODE=M105W7;LINKAGE=AN

 $K\bar{K}^*(892) + \text{c.c.}$ MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$418 \pm 25 \pm 4$	AUBERT 08S	BABR	$10.6 e^+e^- \rightarrow K\bar{K}^*(892)\gamma$

NODE=M105W8
NODE=M105W8

$\rho(1450)$ DECAY MODES

NODE=M105215;NODE=M105

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \pi\pi$	seen
$\Gamma_2 \quad 4\pi$	seen
$\Gamma_3 \quad \omega\pi$	
$\Gamma_4 \quad a_1(1260)\pi$	
$\Gamma_5 \quad h_1(1170)\pi$	
$\Gamma_6 \quad \pi(1300)\pi$	
$\Gamma_7 \quad \rho\rho$	
$\Gamma_8 \quad \rho(\pi\pi)S\text{-wave}$	
$\Gamma_9 \quad e^+e^-$	seen
$\Gamma_{10} \quad \eta\rho$	possibly seen
$\Gamma_{11} \quad a_2(1320)\pi$	not seen
$\Gamma_{12} \quad K\bar{K}$	not seen
$\Gamma_{13} \quad K\bar{K}^*(892) + \text{c.c.}$	possibly seen
$\Gamma_{14} \quad \eta\gamma$	possibly seen
$\Gamma_{15} \quad f_0(500)\gamma$	not seen
$\Gamma_{16} \quad f_0(980)\gamma$	not seen
$\Gamma_{17} \quad f_0(1370)\gamma$	not seen
$\Gamma_{18} \quad f_2(1270)\gamma$	not seen

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DESIG=2;OUR EST;→ UNCHECKED ←
DESIG=6
DESIG=10
DESIG=11
DESIG=12
DESIG=13
DESIG=14
DESIG=4;OUR EST;→ UNCHECKED ←
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DESIG=8;OUR EST;→ UNCHECKED ←
DESIG=7;OUR EVAL;→ UNCHECKED ←
DESIG=15;OUR EST;→ UNCHECKED ←
DESIG=9;OUR EST;→ UNCHECKED ←
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

$\Gamma(\pi\pi) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$	$\Gamma_1\Gamma_9/\Gamma$
VALUE (keV)	DOCUMENT ID TECN COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •	
0.12	³⁶ DIEKMAN 88 RVUE $e^+e^- \rightarrow \pi^+\pi^-$
$0.027^{+0.015}_{-0.010}$	³⁷ KURDADZE 83 OLYA $0.64\text{--}1.4 e^+e^- \rightarrow \pi^+\pi^-$

NODE=M105G3
NODE=M105G3

$\Gamma(\eta\rho) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$	$\Gamma_{10}\Gamma_9/\Gamma$
VALUE (eV)	DOCUMENT ID TECN COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •	
74 ± 20	³⁸ AKHMETSHIN 00D CMD2 $e^+e^- \rightarrow \eta\pi^+\pi^-$
91 ± 19	ANTONELLI 88 DM2 $e^+e^- \rightarrow \eta\pi^+\pi^-$

NODE=M105G4
NODE=M105G4

$\Gamma(\eta\gamma) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$	$\Gamma_{14}\Gamma_9/\Gamma$
VALUE (eV)	DOCUMENT ID TECN COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •	
<16.4	³⁹ AKHMETSHIN 05 CMD2 $0.60\text{--}1.38 e^+e^- \rightarrow \eta\gamma$
$2.2 \pm 0.5 \pm 0.3$	⁴⁰ AKHMETSHIN 01B CMD2 $e^+e^- \rightarrow \eta\gamma$

NODE=M105G6
NODE=M105G6

$\Gamma(K\bar{K}^*(892) + \text{c.c.}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$	$\Gamma_{13}\Gamma_9/\Gamma$
VALUE (eV)	DOCUMENT ID TECN COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •	
$127 \pm 15 \pm 6$	AUBERT 08S BABR $10.6 e^+e^- \rightarrow K\bar{K}^*(892)\gamma$

NODE=M105G8
NODE=M105G8

- ³⁶ Using total width = 235 MeV.
³⁷ Using for $\rho(1700)$ mass and width 1600 ± 20 and 300 ± 10 MeV respectively.
³⁸ Using the data of ANTONELLI 88, DOLINSKY 91, and AKHMETSHIN 00D. The energy-independent width of the $\rho(1450)$ and $\rho(1700)$ mesons assumed.
³⁹ From 2γ decay mode of η using 1465 MeV and 310 MeV for the $\rho(1450)$ mass and width. Recalculated by us.
⁴⁰ 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=M105G3;LINKAGE=B
NODE=M105G3;LINKAGE=KD
NODE=M105G4;LINKAGE=KL

NODE=M105G6;LINKAGE=AK

NODE=M105G;LINKAGE=SW

 $\rho(1450) \Gamma(i)/\Gamma(\text{total}) \times \Gamma(e^+e^-)/\Gamma(\text{total})$

NODE=M105230

$\Gamma(f_0(500)\gamma)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$	$\Gamma_{15}/\Gamma \times \Gamma_9/\Gamma$
VALUE (units 10^{-9})	CL% DOCUMENT ID TECN COMMENT
<4.0	90 ACHASOV 11 SND $e^+e^- \rightarrow \pi^0\pi^0\gamma$

NODE=M105R01
NODE=M105R01

$$\Gamma(f_0(980)\gamma)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{16}/\Gamma \times \Gamma_9/\Gamma$$

VALUE (units 10^{-9})	CL%	DOCUMENT ID	TECN	COMMENT
<2.6	90	ACHASOV	11	SND $e^+e^- \rightarrow \pi^0\pi^0\gamma$

NODE=M105R02
NODE=M105R02

$$\Gamma(f_0(1370)\gamma)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{17}/\Gamma \times \Gamma_9/\Gamma$$

VALUE (units 10^{-9})	CL%	DOCUMENT ID	TECN	COMMENT
<3.5	90	ACHASOV	11	SND $e^+e^- \rightarrow \pi^0\pi^0\gamma$

NODE=M105R03
NODE=M105R03

$$\Gamma(f_2(1270)\gamma)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{18}/\Gamma \times \Gamma_9/\Gamma$$

VALUE (units 10^{-9})	CL%	DOCUMENT ID	TECN	COMMENT
<0.8	90	⁴¹ ACHASOV	11	SND $e^+e^- \rightarrow \pi^0\pi^0\gamma$

NODE=M105R04
NODE=M105R04

⁴¹ Using Breit-Wigner parametrization of the $\rho(1450)$ with mass and width of 1465 MeV and 400 MeV, respectively.

NODE=M105R01;LINKAGE=AC

$\rho(1450)$ BRANCHING RATIOS

NODE=M105225

$$\Gamma(\pi\pi)/\Gamma(4\pi) \quad \Gamma_1/\Gamma_2$$

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.37 ± 0.10	^{42,43} ABELE	01B	CBAR $0.0 \bar{p}n \rightarrow 5\pi$

NODE=M105R15
NODE=M105R15

$$\Gamma(\omega\pi)/\Gamma_{\text{total}} \quad \Gamma_3/\Gamma$$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
seen	1.6k	ACHASOV	12	SND $e^+e^- \rightarrow \pi^0\pi^0\gamma$
~ 0.21		CLEGG	94	RVUE

NODE=M105R5
NODE=M105R5

$$\Gamma(\pi\pi)/\Gamma(\omega\pi) \quad \Gamma_1/\Gamma_3$$

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
~ 0.32	CLEGG	94	RVUE

NODE=M105R6
NODE=M105R6

$$\Gamma(\omega\pi)/\Gamma(4\pi) \quad \Gamma_3/\Gamma_2$$

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
<0.14	CLEGG	88	RVUE

NODE=M105R3
NODE=M105R3

$$\Gamma(a_1(1260)\pi)/\Gamma(4\pi) \quad \Gamma_4/\Gamma_2$$

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.27 ± 0.08	⁴² ABELE	01B	CBAR $0.0 \bar{p}n \rightarrow 5\pi$

NODE=M105R10
NODE=M105R10

$$\Gamma(h_1(1170)\pi)/\Gamma(4\pi) \quad \Gamma_5/\Gamma_2$$

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.08 ± 0.04	⁴² ABELE	01B	CBAR $0.0 \bar{p}n \rightarrow 5\pi$

NODE=M105R11
NODE=M105R11

$$\Gamma(\pi(1300)\pi)/\Gamma(4\pi) \quad \Gamma_6/\Gamma_2$$

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.37 ± 0.13	⁴² ABELE	01B	CBAR $0.0 \bar{p}n \rightarrow 5\pi$

NODE=M105R12
NODE=M105R12

$$\Gamma(\rho\rho)/\Gamma(4\pi) \quad \Gamma_7/\Gamma_2$$

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.11 ± 0.05	⁴² ABELE	01B	CBAR $0.0 \bar{p}n \rightarrow 5\pi$

NODE=M105R13
NODE=M105R13

$$\Gamma(\rho(\pi\pi)\text{S-wave})/\Gamma(4\pi) \quad \Gamma_8/\Gamma_2$$

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.17 ± 0.09	⁴² ABELE	01B	CBAR $0.0 \bar{p}n \rightarrow 5\pi$

NODE=M105R14
NODE=M105R14

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

VALUE

DOCUMENT ID TECN

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

<0.04

DONNACHIE 87B RVUE

 Γ_{10}/Γ NODE=M105R2
NODE=M105R2 $\Gamma(\eta\rho)/\Gamma(\omega\pi)$

VALUE

DOCUMENT ID TECN COMMENT

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

~ 0.24

⁴⁴ DONNACHIE 91 RVUE

>2

FUKUI 91 SPEC 8.95 $\pi^- p \rightarrow \omega \pi^0 n$ Γ_{10}/Γ_3 NODE=M105R4
NODE=M105R4 $\Gamma(a_2(1320)\pi)/\Gamma_{\text{total}}$

VALUE

DOCUMENT ID TECN COMMENT

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

not seen

AMELIN 00 VES 37 $\pi^- p \rightarrow \eta \pi^+ \pi^- n$ Γ_{11}/Γ NODE=M105R9
NODE=M105R9 $\Gamma(K\bar{K})/\Gamma(\omega\pi)$

VALUE

DOCUMENT ID TECN

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

<0.08

⁴⁴ DONNACHIE 91 RVUE Γ_{12}/Γ_3 NODE=M105R8
NODE=M105R8 $\Gamma(K\bar{K}^*(892)+\text{c.c.})/\Gamma_{\text{total}}$

VALUE

DOCUMENT ID TECN COMMENT

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

possibly seen

COAN 04 CLEO $\tau^- \rightarrow K^- \pi^- K^+ \nu_\tau$ Γ_{13}/Γ NODE=M105R16
NODE=M105R16⁴² $\omega\pi$ not included.⁴³ Using ABELE 97.⁴⁴ Using data from BISELLO 91B, DOLINSKY 86 and ALBRECHT 87L.NODE=M105R;LINKAGE=BL
NODE=M105R;LINKAGE=LK
NODE=M105R;LINKAGE=A

$\rho(1450)$ REFERENCES

NODE=M105

ABRAMOWICZ 12	EPJ C72 1869	H. Abramowicz <i>et al.</i>	(ZEUS Collab.)
ACHASOV 12	JETPL 94 734	M.N. Achasov <i>et al.</i>	
	Translated from ZETFP 94 796.		
LEES 12G	PR D86 032013	J.P. Lees <i>et al.</i>	(BABAR Collab.)
ACHASOV 11	JETP 113 75	M.N. Achasov <i>et al.</i>	(SND Collab.)
	Translated from ZETF 140 87.		
AUBERT 08S	PR D77 092002	B. Aubert <i>et al.</i>	(BABAR Collab.)
FUJIKAWA 08	PR D78 072006	M. Fujikawa <i>et al.</i>	(BELLE Collab.)
AKHMETSHIN 05	PL B605 26	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)
ALOISIO 05	PL B606 12	A. Aloisio <i>et al.</i>	(KLOE Collab.)
SCHAEEL 05C	PRPL 421 191	S. Schaeel <i>et al.</i>	(ALEPH Collab.)
AKHMETSHIN 04	PL B578 285	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)
COAN 04	PRL 92 232001	T.E. Coan <i>et al.</i>	(CLEO Collab.)
AKHMETSHIN 03B	PL B562 173	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)
ABELE 01B	EPJ C21 261	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
AKHMETSHIN 01B	PL B509 217	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)
ALEXANDER 01B	PR D64 092001	J.P. Alexander <i>et al.</i>	(CLEO Collab.)
AKHMETSHIN 00D	PL B489 125	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)
AMELIN 00	NP A668 83	D. Amelin <i>et al.</i>	(VES Collab.)
ANDERSON 00A	PR D61 112002	S. Anderson <i>et al.</i>	(CLEO Collab.)
EDWARDS 00A	PR D61 072003	K.W. Edwards <i>et al.</i>	(CLEO Collab.)
ABELE 99C	PL B450 275	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
ABELE 99D	PL B468 178	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
BERTIN 98	PR D57 55	A. Bertin <i>et al.</i>	(OBELIX Collab.)
ABELE 97	PL B391 191	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
ACHASOV 97	PR D55 2663	N.N. Achasov <i>et al.</i>	(NOVM)
BARATE 97M	ZPHY C76 15	R. Barate <i>et al.</i>	(ALEPH Collab.)
BERTIN 97C	PL B408 476	A. Bertin <i>et al.</i>	(OBELIX Collab.)
BERTIN 97D	PL B414 220	A. Bertin <i>et al.</i>	(OBELIX Collab.)
CLEGG 94	ZPHY C62 455	A.B. Clegg, A. Donnachie	(LANC, MCHS)
BISELLO 91B	NPBPS B21 111	D. Bisello	(DM2 Collab.)
DOLINSKY 91	PRPL 202 99	S.I. Dolinsky <i>et al.</i>	(NOVO)
DONNACHIE 91	ZPHY C51 689	A. Donnachie, A.B. Clegg	(MCHS, LANC)
FUKUI 91	PL B257 241	S. Fukui <i>et al.</i>	(SUGI, NAGO, KEK, KYOT+)
KUHN 90	ZPHY C48 445	J.H. Kuhn <i>et al.</i>	(MPIM)
ARMSTRONG 89E	PL B228 536	T.A. Armstrong, M. Benayoun	(ATHU, BARI, BIRM+)
BISELLO 89	PL B220 321	D. Bisello <i>et al.</i>	(DM2 Collab.)
DUBNICKA 89	JPG 15 1349	S. Dubnicka <i>et al.</i>	(JINR, SLOV)
ANTONELLI 88	PL B212 133	A. Antonelli <i>et al.</i>	(DM2 Collab.)
CLEGG 88	ZPHY C40 313	A.B. Clegg, A. Donnachie	(MCHS, LANC)
DIEKMAN 88	PRPL 159 99	B. Diekmann	(BONN)
FUKUI 88	PL B202 441	S. Fukui <i>et al.</i>	(SUGI, NAGO, KEK, KYOT+)
ALBRECHT 87L	PL B185 223	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
DONNACHIE 87B	ZPHY C34 257	A. Donnachie, A.B. Clegg	(MCHS, LANC)
DOLINSKY 86	PL B174 453	S.I. Dolinsky <i>et al.</i>	(NOVO)
BARKOV 85	NP B256 365	L.M. Barkov <i>et al.</i>	(NOVO)
KURDADZE 83	JETPL 37 733	L.M. Kurdadze <i>et al.</i>	(NOVO)
	Translated from ZETFP 37 613.		
ASTON 80C	PL 92B 211	D. Aston	(BONN, CERN, EPOL, GLAS, LANC+)
BARBER 80C	ZPHY C4 169	D.P. Barber <i>et al.</i>	(DARE, LANC, SHEF)
GOUNARIS 68	PRL 21 244	G.J. Gounaris, J.J. Sakurai	

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REFID=48054

$\eta(1475)$

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

See also the $\eta(1405)$.

NODE=M175

NODE=M175

NODE=M175205

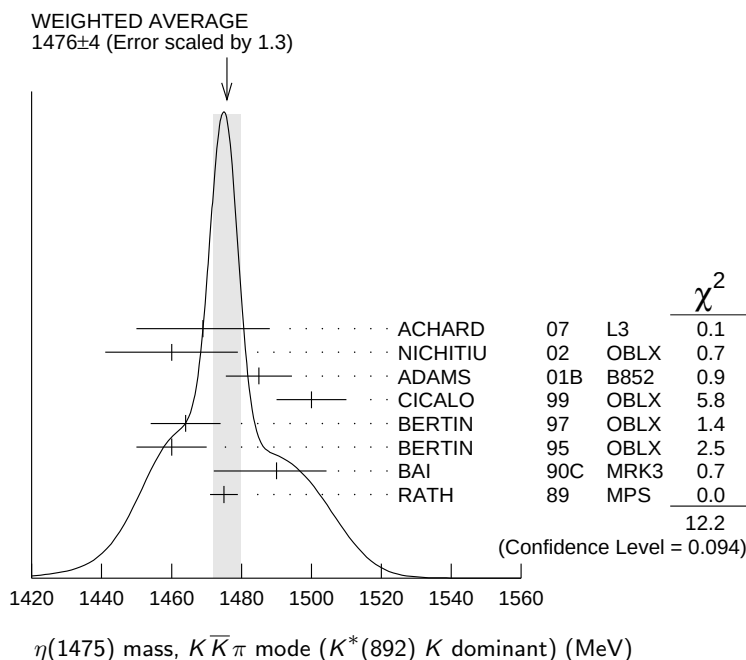
NODE=M175M5
NODE=M175M5 $\eta(1475)$ MASS $K\bar{K}\pi$ MODE ($K^*(892)$ K dominant)

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1476 ± 4 OUR AVERAGE		Error includes scale factor of 1.3. See the ideogram below.		
1469 ± 14 ± 13	74	ACHARD	07 L3	183-209 $e^+e^- \rightarrow K_S^0 K^\pm \pi^\mp$
1460 ± 19	3651	NICHITIU	02 OBLX	
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 $^{+14}_{-8} \pm 3_{-16}$	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. • • •				
1421 ± 14		AUGUSTIN	92 DM2	$J/\psi \rightarrow \gamma K\bar{K}\pi$

OCCUR=2

OCCUR=2

OCCUR=2

 $\eta(1475)$ WIDTH

NODE=M175210

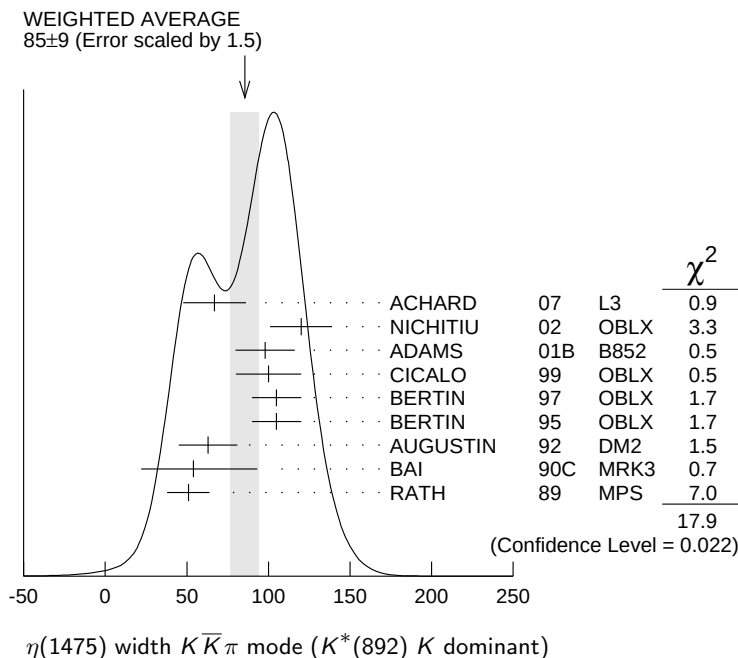
 $K\bar{K}\pi$ MODE ($K^*(892)$ K dominant)NODE=M175W5
NODE=M175W5

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
85 ± 9 OUR AVERAGE		Error includes scale factor of 1.5. See the ideogram below.		
67 ± 18 ± 7	74	ACHARD	07 L3	183-209 $e^+e^- \rightarrow K_S^0 K^\pm \pi^\mp$
120 ± 19	3651	NICHITIU	02 OBLX	
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 $\bar{p} p \rightarrow K\bar{K}\pi\pi\pi$
63 ± 18		AUGUSTIN	92 DM2	$J/\psi \rightarrow \gamma K\bar{K}\pi$
54 $^{+37}_{-21} \pm 13_{-24}$		BAI	90C MRK3	$J/\psi \rightarrow \gamma K_S^0 K^\pm \pi^\mp$
51 ± 13		RATH	89 MPS	21.4 $\pi^- p \rightarrow n K_S^0 K_S^0 \pi^0$

OCCUR=2

OCCUR=2

OCCUR=2



$\eta(1475)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $K \bar{K} \pi$	dominant
Γ_2 $K \bar{K}^*(892) + \text{c.c.}$	seen
Γ_3 $a_0(980) \pi$	seen
Γ_4 $\gamma \gamma$	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 ←

$\eta(1475) \Gamma(i) \Gamma(\gamma \gamma) / \Gamma(\text{total})$

$\Gamma(K \bar{K} \pi) \times \Gamma(\gamma \gamma) / \Gamma_{\text{total}}$	$\Gamma_1 \Gamma_4 / \Gamma$
VALUE (keV)	CL% EVTS DOCUMENT ID TECN COMMENT
0.23±0.05±0.05	74 ¹ ACHARD 07 L3 183-209 $e^+ e^- \rightarrow e^+ e^- K_S^0 K^\pm \pi^\mp$

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 $e^+ e^- \rightarrow e^+ e^- K_S^0 K^\pm \pi^\mp$

¹ Supersedes ACCIARRI 01G. Compatible with $K^* K$ decay. Using $B(K_S^0 \rightarrow \pi^+ \pi^-) = 0.6895$.

² Using $\eta(1475)$ mass of 1481 MeV and width of 48 MeV. The upper limit increases to 0.140 keV if the world average value, 87 MeV, of the width is used.

³ Assuming three-body phase-space decay to $K_S^0 K^\pm \pi^\mp$.

NODE=M175G2;LINKAGE=CH

NODE=M175G2;LINKAGE=AH

NODE=M175G2;LINKAGE=B3

$\eta(1475)$ BRANCHING RATIOS

$\Gamma(K \bar{K}^*(892) + \text{c.c.}) / \Gamma(K \bar{K} \pi)$	Γ_2 / Γ_1
VALUE DOCUMENT ID TECN COMMENT	
0.50±0.10 ⁴ BAILLON 67 HBC 0.0 $\bar{p} p \rightarrow K \bar{K} \pi \pi \pi$	

NODE=M175225

NODE=M175R1
 NODE=M175R1

$\Gamma(K \bar{K}^*(892) + \text{c.c.}) / [\Gamma(K \bar{K}^*(892) + \text{c.c.}) + \Gamma(a_0(980) \pi)]$	$\Gamma_2 / (\Gamma_2 + \Gamma_3)$
VALUE CL% DOCUMENT ID TECN COMMENT	

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

< 0.25 90 EDWARDS 82E CBAL $J/\psi \rightarrow K^+ K^- \pi^0 \gamma$

⁴ Data could also refer to $\eta(1405)$.

NODE=M175R6
 NODE=M175R6

NODE=M175R;LINKAGE=BL

$\eta(1475)$ REFERENCES

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.)
CICALO	99	PL B462 453	C. Cicalo <i>et al.</i>	(OBELIX Collab.)
BERTIN	97	PL B400 226	A. Bertin <i>et al.</i>	(OBELIX Collab.)
BERTIN	95	PL B361 187	A. Bertin <i>et al.</i>	(OBELIX Collab.)
AUGUSTIN	92	PR D46 1951	J.E. Augustin, G. Cosme	(DM2 Collab.)
BAI	90C	PRL 65 2507	Z. Bai <i>et al.</i>	(Mark III Collab.)
RATH	89	PR D40 693	M.G. Rath <i>et al.</i>	(NDAM, BRAN, BNL, CUNY+)
EDWARDS	82E	PRL 49 259	C. Edwards <i>et al.</i>	(CIT, HARV, PRIN+)
BAILLON	67	NC 50A 393	P.H. Baillon <i>et al.</i>	(CERN, CDEF, IRAD)

NODE=M175

REFID=51698
REFID=50764
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REFID=48319
REFID=49649
REFID=47394
REFID=45417
REFID=44614
REFID=41584
REFID=41578
REFID=40924
REFID=21314
REFID=20407

 $f_0(1500)$

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

See also the mini-reviews on scalar mesons under $f_0(500)$ (see the index for the page number) and on non- $q\bar{q}$ candidates in PDG 06, Journal of Physics, G **33** 1 (2006).

NODE=M152

NODE=M152

 $f_0(1500)$ MASS

NODE=M152M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1505 ± 6 OUR AVERAGE		Error includes scale factor of 1.3. See the ideogram below.		
1466 ± 6 ± 20		ABLIKIM	06V BES2	$e^+e^- \rightarrow J/\psi \rightarrow \gamma\pi^+\pi^-$
1515 ± 12		1 BARBERIS	00A	450 $pp \rightarrow p_f\eta\eta p_s$
1511 ± 9		1,2 BARBERIS	00C	450 $pp \rightarrow p_f4\pi p_s$
1510 ± 8		1 BARBERIS	00E	450 $pp \rightarrow p_f\eta\eta p_s$
1522 ± 25		BERTIN	98 OBLX	0.05–0.405 $\bar{n}p \rightarrow \pi^+\pi^+\pi^-$
1449 ± 20		1 BERTIN	97C OBLX	0.0 $\bar{p}p \rightarrow \pi^+\pi^-\pi^0$
1515 ± 20		ABELE	96B CBAR	0.0 $\bar{p}p \rightarrow \pi^0 K_L^0 K_L^0$
1500 ± 15		3 AMSLER	95B CBAR	0.0 $\bar{p}p \rightarrow 3\pi^0$
1505 ± 15		4 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. • • •				
1486 ± 10		1 ANISOVICH	09 RVUE	0.0 $\bar{p}p, \pi N$
1470 ± 60	568	5 KLEMP	08 E791	$D_s^+ \rightarrow \pi^-\pi^+\pi^+$
1470 $^{+6}_{-7} \pm 25$		6 UEHARA	08A BELL	10.6 $e^+e^- \rightarrow e^+e^-\pi^0\pi^0$
1495 ± 4		AMSLER	06 CBAR	0.9 $\bar{p}p \rightarrow K^+K^-\pi^0$
1539 ± 20	9.9k	AUBERT	06O BABR	$B^+ \rightarrow K^+K^+K^-$
1473 ± 5	80k	7,8 UMAN	06 E835	5.2 $\bar{p}p \rightarrow \eta\eta\pi^0$
1478 ± 6		VLADIMIRSK...	06 SPEC	40 $\pi^-p \rightarrow K_S^0 K_S^0 n$
1493 ± 7		7 BINON	05 GAMS	33 $\pi^-p \rightarrow \eta\eta n$
1524 ± 14	1400	9 GARMASH	05 BELL	$B^+ \rightarrow K^+K^+K^-$
1489 $^{+8}_{-4}$		10 ANISOVICH	03 RVUE	
1490 ± 30		7 ABELE	01 CBAR	0.0 $\bar{p}d \rightarrow \pi^-4\pi^0 p$
1497 ± 10		7 BARBERIS	99 OMEG	450 $pp \rightarrow p_s p_f K^+K^-$
1502 ± 10		7 BARBERIS	99B OMEG	450 $pp \rightarrow p_s p_f \pi^+\pi^-$
1502 ± 12 ± 10		11 BARBERIS	99D OMEG	450 $pp \rightarrow K^+K^-, \pi^+\pi^-$
1530 ± 45		7 BELLAZZINI	99 GAM4	450 $pp \rightarrow pp\pi^0\pi^0$
1505 ± 18		7 FRENCH	99	300 $pp \rightarrow p_f(K^+K^-)p_s$
1447 ± 27		12 KAMINSKI	99 RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}, \sigma\sigma$
1580 ± 80		7 ALDE	98 GAM4	100 $\pi^-p \rightarrow \pi^0\pi^0 n$
1499 ± 8		1 ANISOVICH	98B RVUE	Compilation
~ 1520		REYES	98 SPEC	800 $pp \rightarrow p_s p_f K_S^0 K_S^0$
1510 ± 20		1 BARBERIS	97B OMEG	450 $pp \rightarrow pp2(\pi^+\pi^-)$
~ 1475		FRABETTI	97D E687	$D_s^\pm \rightarrow \pi^\mp \pi^\pm \pi^\pm$
~ 1505		ABELE	96 CBAR	0.0 $\bar{p}p \rightarrow 5\pi^0$
1500 ± 8		1 ABELE	96C RVUE	Compilation
1460 ± 20	120	7 AMELIN	96B VES	37 $\pi^-A \rightarrow \eta\eta\pi^- A$
1500 ± 8		BUGG	96 RVUE	
1500 ± 10		13 AMSLER	95D CBAR	0.0 $\bar{p}p \rightarrow \pi^0\pi^0\pi^0, \pi^0\eta\eta, \pi^0\pi^0\eta$
1445 ± 5		14 ANTINORI	95 OMEG	300,450 $pp \rightarrow pp2(\pi^+\pi^-)$

NODE=M152M

OCCUR=2

1497±30		⁷ ANTINORI	95	OMEG	300,450	$pp \rightarrow pp\pi^+\pi^-$
~ 1505		BUGG	95	MRK3	$J/\psi \rightarrow \gamma\pi^+\pi^-\pi^+\pi^-$	
1446± 5		⁷ ABATZIS	94	OMEG	450	$pp \rightarrow pp2(\pi^+\pi^-)$
1545±25		⁷ AMSLER	94E	CBAR	0.0	$\bar{p}p \rightarrow \pi^0\eta\eta'$
1520±25		^{1,15} ANISOVICH	94	CBAR	0.0	$\bar{p}p \rightarrow 3\pi^0, \pi^0\eta\eta$
1505±20		^{1,16} BUGG	94	RVUE	$\bar{p}p \rightarrow 3\pi^0, \eta\eta\pi^0, \eta\pi^0\pi^0$	
1560±25		⁷ AMSLER	92	CBAR	0.0	$\bar{p}p \rightarrow \pi^0\eta\eta$
1550±45± 30		⁷ BELADIDZE	92C	VES	36	$\pi^-\text{Be} \rightarrow \pi^-\eta'\eta\text{Be}$
1449± 4		⁷ ARMSTRONG	89E	OMEG	300	$pp \rightarrow pp2(\pi^+\pi^-)$
1610±20		⁷ ALDE	88	GAM4	300	$\pi^-N \rightarrow \pi^-N2\eta$
~ 1525		ASTON	88D	LASS	11	$K^-p \rightarrow K_S^0K_S^0\Lambda$
1570±20	600	⁷ ALDE	87	GAM4	100	$\pi^-p \rightarrow 4\pi^0n$
1575±45		¹⁷ ALDE	86D	GAM4	100	$\pi^-p \rightarrow 2\eta n$
1568±33		⁷ BINON	84C	GAM2	38	$\pi^-p \rightarrow \eta\eta'n$
1592±25		⁷ BINON	83	GAM2	38	$\pi^-p \rightarrow 2\eta n$
1525± 5		⁷ GRAY	83	DBC	0.0	$\bar{p}N \rightarrow 3\pi$

OCCUR=2

¹ T-matrix pole.² Average between $\pi^+\pi^-2\pi^0$ and $2(\pi^+\pi^-)$.³ T-matrix pole, supersedes ANISOVICH 94.⁴ T-matrix pole, supersedes ANISOVICH 94 and AMSLER 92.⁵ Reanalysis of AITALA 01A data. This state could also be $f_0(1370)$.⁶ Breit-Wigner mass. May also be the $f_0(1370)$.⁷ Breit-Wigner mass.⁸ Statistical error only.⁹ Breit-Wigner, solution 1, PWA ambiguous.

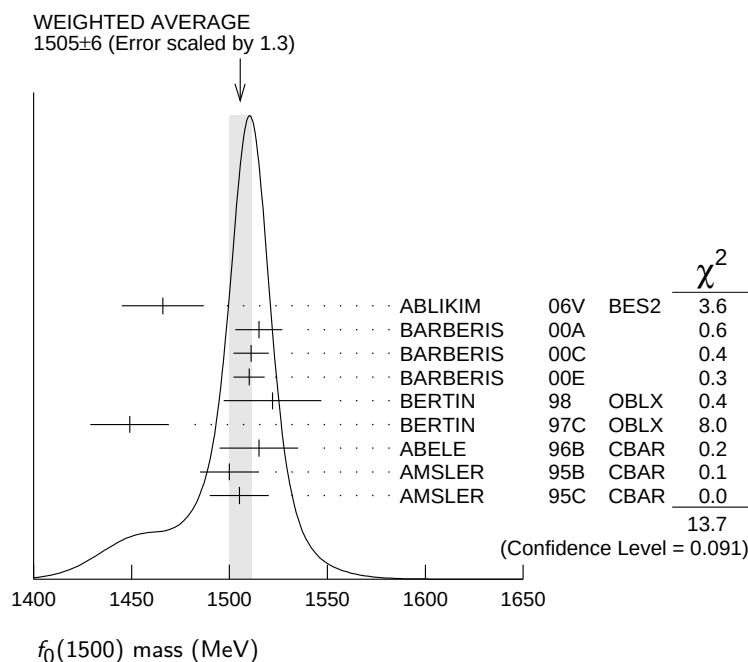
¹⁰ K-matrix pole from combined analysis of $\pi^- p \rightarrow \pi^0\pi^0 n$, $\pi^- p \rightarrow K\bar{K}n$, $\pi^+\pi^- \rightarrow \pi^+\pi^-$, $\bar{p}p \rightarrow \pi^0\pi^0\pi^0$, $\pi^0\eta\eta$, $\pi^0\pi^0\eta$, $\pi^+\pi^-\pi^0$, $K^+K^-\pi^0$, $K_S^0 K_S^0\pi^0$, $K^+K_S^0\pi^-$ at rest, $\bar{p}n \rightarrow \pi^-\pi^-\pi^+$, $K_S^0 K^-\pi^0$, $K_S^0 K_S^0\pi^-$ at rest.

¹¹ Supersedes BARBERIS 99 and BARBERIS 99B.¹² T-matrix pole on sheet $--+$.¹³ T-matrix pole. Coupled-channel analysis of AMSLER 95B, AMSLER 95C, and AMSLER 94D.¹⁴ Supersedes ABATZIS 94, ARMSTRONG 89E. Breit-Wigner mass.¹⁵ From a simultaneous analysis of the annihilations $\bar{p}p \rightarrow 3\pi^0, \pi^0\eta\eta$.¹⁶ Reanalysis of ANISOVICH 94 data.¹⁷ From central value and spread of two solutions. Breit-Wigner mass.

NODE=M152M;LINKAGE=PP
 NODE=M152M;LINKAGE=PC
 NODE=M152M;LINKAGE=D
 NODE=M152M;LINKAGE=D1
 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=AB

NODE=M152M;LINKAGE=B
 NODE=M152M;LINKAGE=A
 NODE=M152M;LINKAGE=C1
 NODE=M152M;LINKAGE=AZ

 **$f_0(1500)$ WIDTH**

NODE=M152W

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
109± 7 OUR AVERAGE				
108 ⁺ ₋₁₁ ± 25		ABLIKIM	06V BES2	$e^+e^- \rightarrow J/\psi \rightarrow \gamma\pi^+\pi^-$
110± 24		18 BARBERIS	00A	450 $pp \rightarrow p_f\eta\eta p_s$
102± 18		18,19 BARBERIS	00C	450 $pp \rightarrow p_f4\pi p_s$
110± 16		18 BARBERIS	00E	450 $pp \rightarrow p_f\eta\eta p_s$
108± 33		BERTIN	98 OBLX	0.05–0.405 $\bar{n}p \rightarrow \pi^+\pi^+\pi^-$
114± 30		18 BERTIN	97C OBLX	0.0 $\bar{p}p \rightarrow \pi^+\pi^-\pi^0$
105± 15		ABELE	96B CBAR	0.0 $\bar{p}p \rightarrow \pi^0 K_L^0 K_L^0$
120± 25		20 AMSLER	95B CBAR	0.0 $\bar{p}p \rightarrow 3\pi^0$
120± 30		21 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. • • •				
114± 10		18 ANISOVICH	09 RVUE	0.0 $\bar{p}p, \pi N$
90 ⁺ ₋₁ ²⁺⁵⁰ ₋₂₂		22 UEHARA	08A BELL	10.6 $e^+e^- \rightarrow e^+e^-\pi^0\pi^0$
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	23,24 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		23 BINON	05 GAMS	33 $\pi^-p \rightarrow \eta\eta n$
136± 23	1400	25 GARMASH	05 BELL	$B^+ \rightarrow K^+K^+K^-$
102± 10		26 ANISOVICH	03 RVUE	
140± 40		23 ABELE	01 CBAR	0.0 $\bar{p}d \rightarrow \pi^-4\pi^0 p$
104± 25		23 BARBERIS	99 OMEG	450 $pp \rightarrow p_s p_f K^+K^-$
131± 15		23 BARBERIS	99B OMEG	450 $pp \rightarrow p_s p_f \pi^+\pi^-$
98± 18±16		27 BARBERIS	99D OMEG	450 $pp \rightarrow K^+K^-, \pi^+\pi^-$
160± 50		23 BELLAZZINI	99 GAM4	450 $pp \rightarrow pp\pi^0\pi^0$
100± 33		23 FRENCH	99	300 $pp \rightarrow p_f(K^+K^-)p_s$
108± 46		28 KAMINSKI	99 RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}, \sigma\sigma$
280±100		23 ALDE	98 GAM4	100 $\pi^-p \rightarrow \pi^0\pi^0 n$
130± 20		18 ANISOVICH	98B RVUE	Compilation
120± 35		18 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 $\bar{p}p \rightarrow 5\pi^0$
100± 30	120	23 AMELIN	96B VES	37 $\pi^-A \rightarrow \eta\eta\pi^-A$
132± 15		BUGG	96 RVUE	
154± 30		29 AMSLER	95D CBAR	0.0 $\bar{p}p \rightarrow \pi^0\pi^0\pi^0, \pi^0\eta\eta, \pi^0\pi^0\eta$
65± 10		30 ANTINORI	95 OMEG	300,450 $pp \rightarrow pp2(\pi^+\pi^-)$
199± 30		23 ANTINORI	95 OMEG	300,450 $pp \rightarrow pp\pi^+\pi^-$
56± 12		23 ABATZIS	94 OMEG	450 $pp \rightarrow pp2(\pi^+\pi^-)$
100± 40		23 AMSLER	94E CBAR	0.0 $\bar{p}p \rightarrow \pi^0\eta\eta'$
148 ⁺ ₋₂₅		18,31 ANISOVICH	94 CBAR	0.0 $\bar{p}p \rightarrow 3\pi^0, \pi^0\eta\eta$
150± 20		18,32 BUGG	94 RVUE	$\bar{p}p \rightarrow 3\pi^0, \eta\eta\pi^0, \eta\pi^0\pi^0$
245± 50		23 AMSLER	92 CBAR	0.0 $\bar{p}p \rightarrow \pi^0\eta\eta$
153± 67±50		23 BELADIDZE	92C VES	36 $\pi^-Be \rightarrow \pi^-\eta'\eta Be$
78± 18		23 ARMSTRONG	89E OMEG	300 $pp \rightarrow pp2(\pi^+\pi^-)$
170± 40		23 ALDE	88 GAM4	300 $\pi^-N \rightarrow \pi^-N2\eta$
150± 20	600	23 ALDE	87 GAM4	100 $\pi^-p \rightarrow 4\pi^0 n$
265± 65		33 ALDE	86D GAM4	100 $\pi^-p \rightarrow 2\eta n$
260± 60		23 BINON	84C GAM2	38 $\pi^-p \rightarrow \eta\eta' n$
210± 40		23 BINON	83 GAM2	38 $\pi^-p \rightarrow 2\eta n$
101± 13		23 GRAY	83 DBC	0.0 $\bar{p}N \rightarrow 3\pi$

NODE=M152W

OCCUR=2

OCCUR=2

NODE=M152W;LINKAGE=PP
 NODE=M152W;LINKAGE=PC
 NODE=M152W;LINKAGE=D
 NODE=M152W;LINKAGE=D1
 NODE=M152W;LINKAGE=UE
 NODE=M152W;LINKAGE=E
 NODE=M152W;LINKAGE=ST
 NODE=M152W;LINKAGE=GA
 NODE=M152W;LINKAGE=KM

18 T-matrix pole.

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

20 T-matrix pole, supersedes ANISOVICH 94.

21 T-matrix pole, supersedes ANISOVICH 94 and AMSLER 92.

22 Breit-Wigner width. May also be the $f_0(1370)$.

23 Breit-Wigner width.

24 Statistical error only.

25 Breit-Wigner, solution 1, PWA ambiguous.

26 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.

- 27 Supersedes BARBERIS 99 and BARBERIS 99B.
 28 T-matrix pole on sheet $-\ - +$.
 29 T-matrix pole. Coupled-channel analysis of AMSLER 95B, AMSLER 95C, and AMSLER 94D.
 30 Supersedes ABATZIS 94, ARMSTRONG 89E. Breit-Wigner mass.
 31 From a simultaneous analysis of the annihilations $\bar{p}p \rightarrow 3\pi^0, \pi^0\eta\eta$.
 32 Reanalysis of ANISOVICH 94 data.
 33 From central value and spread of two solutions. Breit-Wigner mass.

NODE=M152W;LINKAGE=BD
 NODE=M152W;LINKAGE=TK
 NODE=M152W;LINKAGE=AB

 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	$\pi\pi$	$(34.9 \pm 2.3) \%$	1.2
Γ_2	$\pi^+\pi^-$	seen	
Γ_3	$2\pi^0$	seen	
Γ_4	4π	$(49.5 \pm 3.3) \%$	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}	$\eta\eta$	$(5.1 \pm 0.9) \%$	1.4
Γ_{12}	$\eta\eta'(958)$	$(1.9 \pm 0.8) \%$	1.7
Γ_{13}	$K\bar{K}$	$(8.6 \pm 1.0) \%$	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 ←
 DESIG=6;OUR EST;→ UNCHECKED ←
 DESIG=11;OUR EST;→ UNCHECKED ←
 DESIG=12;OUR EST;→ UNCHECKED ←
 DESIG=13;OUR EST;→ UNCHECKED ←
 DESIG=14;OUR EST;→ UNCHECKED ←
 DESIG=1
 DESIG=2
 DESIG=4
 DESIG=10;OUR EST;→ UNCHECKED ←

CONSTRAINED FIT INFORMATION

An overall fit to 6 branching ratios uses 10 measurements and one constraint to determine 5 parameters. The overall fit has a $\chi^2 = 11.4$ for 6 degrees of freedom.

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

x_4	−83			
x_{11}	11	−52		
x_{12}	−5	−31	29	
x_{13}	39	−67	33	6
	x_1	x_4	x_{11}	x_{12}

$f_0(1500) \Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

$\Gamma(\pi\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$					$\Gamma_1\Gamma_{14}/\Gamma$
VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$33^{+12}_{-6} + 1809_{-21}$		34 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	$\gamma\gamma \rightarrow \pi^+\pi^-$	
34 May also be the $f_0(1370)$. Multiplied by us by 3 to obtain the $\pi\pi$ value.					

NODE=M152217

NODE=M152G1
 NODE=M152G1

NODE=M152G1;LINKAGE=UE

$f_0(1500)$ BRANCHING RATIOS

$\Gamma(\pi\pi)/\Gamma_{\text{total}}$				Γ_1/Γ
VALUE		DOCUMENT ID	TECN	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.454 ± 0.104		BUGG	96 RVUE	

NODE=M152220

NODE=M152R8
 NODE=M152R8

$\Gamma(\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_2/Γ

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	$D_s^\pm \rightarrow \pi^\mp \pi^\pm \pi^\pm$

NODE=M152R10
 NODE=M152R10

 $\Gamma(4\pi)/\Gamma(\pi\pi)$ Γ_4/Γ_1

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 $pp \rightarrow p_f 4\pi p_s$
2.1 ±0.6	35 AMSLER	98	RVUE
• • • We do not use the following data for averages, fits, limits, etc. • • •			
2.1 ±0.2	36 ANISOVICH	02D	SPEC Combined fit
3.4 ±0.8	35 ABELE	96	CBAR 0.0 $\bar{p}p \rightarrow 5\pi^0$

NODE=M152R6
 NODE=M152R6

 $\Gamma(2(\pi\pi)_{\text{S-wave}})/\Gamma(\pi\pi)$ Γ_7/Γ_1

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.42±0.26	37 ABELE	01	CBAR 0.0 $\bar{p}d \rightarrow \pi^- 4\pi^0 p$

NODE=M152R14
 NODE=M152R14

 $\Gamma(2(\pi\pi)_{\text{S-wave}})/\Gamma(4\pi)$ Γ_7/Γ_4

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

NODE=M152R15
 NODE=M152R15

 $\Gamma(\rho\rho)/\Gamma(4\pi)$ Γ_8/Γ_4

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

NODE=M152R16
 NODE=M152R16

 $\Gamma(\rho\rho)/\Gamma(2(\pi\pi)_{\text{S-wave}})$ Γ_8/Γ_7

VALUE	DOCUMENT ID	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •		
3.3±0.5	BARBERIS	00C 450 $pp \rightarrow p_f \pi^+ \pi^- 2\pi^0 p_s$
2.6±0.4	BARBERIS	00C 450 $pp \rightarrow p_f 2(\pi^+ \pi^-) p_s$

NODE=M152R11
 NODE=M152R11

OCCUR=2

 $\Gamma(\pi(1300)\pi)/\Gamma(4\pi)$ Γ_9/Γ_4

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

NODE=M152R17
 NODE=M152R17

 $\Gamma(a_1(1260)\pi)/\Gamma(4\pi)$ Γ_{10}/Γ_4

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.12±0.05	ABELE	01B	CBAR 0.0 $\bar{p}d \rightarrow 5\pi p$

NODE=M152R18
 NODE=M152R18

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

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
large	ALDE	88	GAM4 300 $\pi^- N \rightarrow \eta\eta\pi^- N$
large	BINON	83	GAM2 38 $\pi^- p \rightarrow 2\eta n$

NODE=M152R1
 NODE=M152R1

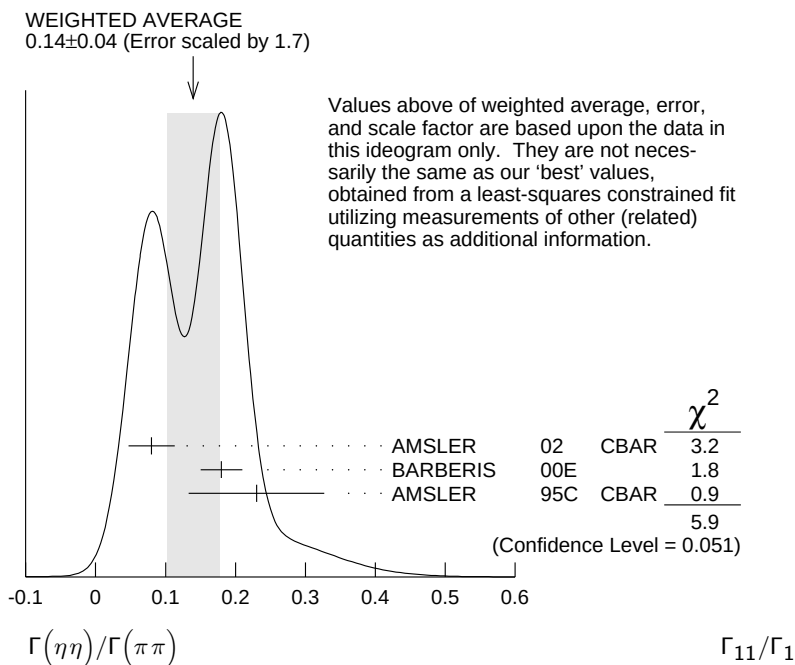
 $\Gamma(\eta\eta)/\Gamma(\pi\pi)$ Γ_{11}/Γ_1

VALUE	DOCUMENT ID	TECN	COMMENT
0.145±0.027 OUR FIT	Error includes scale factor of 1.5.		
0.14 ±0.04 OUR AVERAGE	Error includes scale factor of 1.7. See the ideogram below.		
0.080±0.033	AMSLER	02	CBAR 0.9 $\bar{p}p \rightarrow \pi^0 \eta\eta, \pi^0 \pi^0 \pi^0$
0.18 ±0.03	BARBERIS	00E	450 $pp \rightarrow p_f \eta\eta p_s$
0.230±0.097	38 AMSLER	95C	CBAR 0.0 $\bar{p}p \rightarrow \eta\eta\pi^0$

NODE=M152R13
 NODE=M152R13

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

0.11 ±0.03	³⁶ ANISOVICH	02D	SPEC	Combined fit
0.078±0.013	³⁹ ABELE	96C	RVUE	Compilation
0.157±0.060	⁴⁰ AMSLER	95D	CBAR	0.0 $\bar{p}p \rightarrow \pi^0 \pi^0 \pi^0, \pi^0 \eta \eta, \pi^0 \pi^0 \eta$



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

Γ_5/Γ_{11}

VALUE DOCUMENT ID TECN COMMENT

NODE=M152R5
NODE=M152R5

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

0.8±0.3	ALDE	87	GAM4	100 $\pi^- p \rightarrow 4\pi^0 n$

$\Gamma(\eta\eta'(958))/\Gamma(\pi\pi)$

Γ_{12}/Γ_1

VALUE DOCUMENT ID TECN COMMENT

NODE=M152R12
NODE=M152R12

0.055±0.024 OUR FIT Error includes scale factor of 1.8.

0.095±0.026 BARBERIS 00A 450 $pp \rightarrow p_f \eta \eta p_s$

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

0.005±0.003	³⁶ ANISOVICH	02D	SPEC	Combined fit

$\Gamma(\eta\eta'(958))/\Gamma(\eta\eta)$

Γ_{12}/Γ_{11}

VALUE DOCUMENT ID TECN COMMENT

NODE=M152R2
NODE=M152R2

0.38±0.16 OUR FIT Error includes scale factor of 1.9.

0.29±0.10 ⁴¹ 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	³⁶ ANISOVICH	02D	SPEC	Combined fit
0.84±0.23	ABELE	96C	RVUE	Compilation
2.7 ±0.8	BINON	84C	GAM2	38 $\pi^- p \rightarrow \eta \eta' n$

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

Γ_{13}/Γ

VALUE DOCUMENT ID TECN

NODE=M152R9
NODE=M152R9

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

0.044±0.021	BUGG	96	RVUE	

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

Γ_{13}/Γ_1

VALUE DOCUMENT ID TECN COMMENT

NODE=M152R7
NODE=M152R7

0.246±0.026 OUR FIT

0.241±0.028 OUR AVERAGE

0.25 ±0.03	⁴² BARGIOTTI	03	OBLX	$\bar{p}p$
0.19 ±0.07	⁴³ 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. • • •				
0.16 ±0.05	³⁶ ANISOVICH	02D	SPEC	Combined fit
0.33 ±0.03 ±0.07	BARBERIS	99D	OMEG	450 $pp \rightarrow K^+ K^-, \pi^+ \pi^-$
0.20 ±0.08	⁴⁴ ABELE	96B	CBAR	0.0 $\bar{p}p \rightarrow \pi^0 K_L^0 K_L^0$

$\Gamma(K\bar{K})/\Gamma(\eta\eta)$ Γ_{13}/Γ_{11}

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
1.69±0.33 OUR FIT	Error includes scale factor of 1.4.			
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		36 ANISOVICH 02D	SPEC	Combined fit
<0.4	90	45 PROKOSHKIN 91	GAM4	300 $\pi^- p \rightarrow \pi^- p \eta \eta$
<0.6		46 BINON 83	GAM2	38 $\pi^- p \rightarrow 2\eta n$
35 Excluding $\rho\rho$ contribution to 4π .				
36 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.				
37 From the combined data of ABELE 96 and ABELE 96C.				
38 Using AMSLER 95B ($3\pi^0$).				
39 2π width determined to be 60 ± 12 MeV.				
40 Coupled-channel analysis of AMSLER 95B, AMSLER 95C, and AMSLER 94D.				
41 Using AMSLER 94E ($\eta \eta' \pi^0$).				
42 Coupled channel analysis of $\pi^+ \pi^- \pi^0$, $K^+ K^- \pi^0$, and $K^\pm K_S^0 \pi^\mp$.				
43 Using $\pi^0 \pi^0$ from AMSLER 95B.				
44 Using AMSLER 95B ($3\pi^0$), AMSLER 94C ($2\pi^0 \eta$) and SU(3).				
45 Combining results of GAM4 with those of WA76 on $K\bar{K}$ central production.				
46 Using ETKIN 82B and COHEN 80.				

NODE=M152R4
 NODE=M152R4

NODE=M152R6;LINKAGE=C
 NODE=M152R;LINKAGE=CH

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 NODE=M152R3;LINKAGE=A
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 NODE=M152R2;LINKAGE=A
 NODE=M152R;LINKAGE=BG
 NODE=M152R7;LINKAGE=A
 NODE=M152R7;LINKAGE=D
 NODE=M152R4;LINKAGE=BZ
 NODE=M152R4;LINKAGE=A

 $f_0(1500)$ REFERENCES

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>	(CBAR Collab.)
AUBERT 06O	PR D74 032003	B. Aubert <i>et al.</i>	(BABAR Collab.)
PDG 06	JPG 33 1	W.-M. Yao <i>et al.</i>	(PDG 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, GAM4 Collab.)
Translated from DANS 316 900			
ARMSTRONG 89E	PL B228 536	T.A. Armstrong, M. Benayoun	(ATHU, BARI, BIRM+)
ALDE 88	PL B201 160	D.M. Alde <i>et al.</i>	(SERP, BELG, LANL, LAPP+)
ASTON 88D	NP B301 525	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)
ALDE 87	PL B198 286	D.M. Alde <i>et al.</i>	(LANL, BRUX, SERP, LAPP)
ALDE 86D	NP B269 485	D.M. Alde <i>et al.</i>	(BELG, LAPP, SERP, CERN+)
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)

NODE=M152

REFID=52719
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NODE=M084

$f_1(1510)$

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

OMITTED FROM SUMMARY TABLE
See the minireview under $\eta(1405)$.

NODE=M084

NODE=M084M

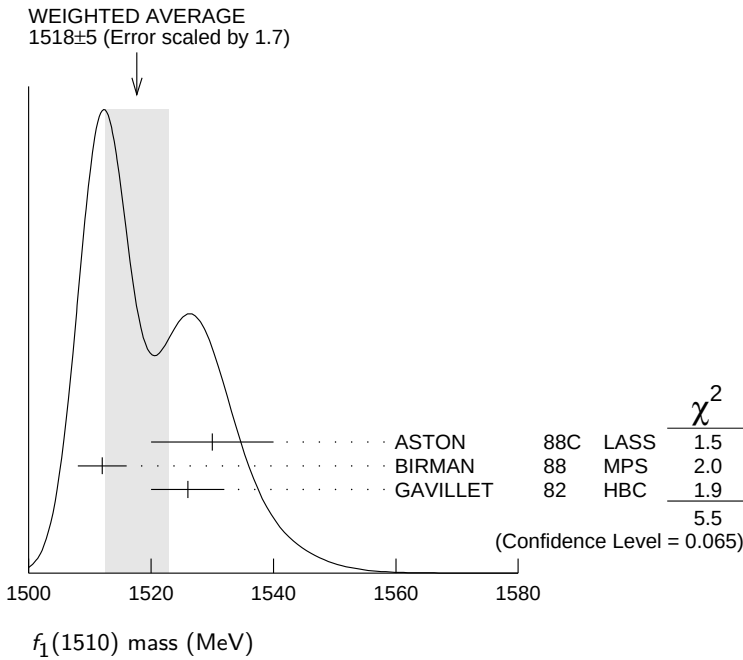
NODE=M084M

$f_1(1510)$ 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



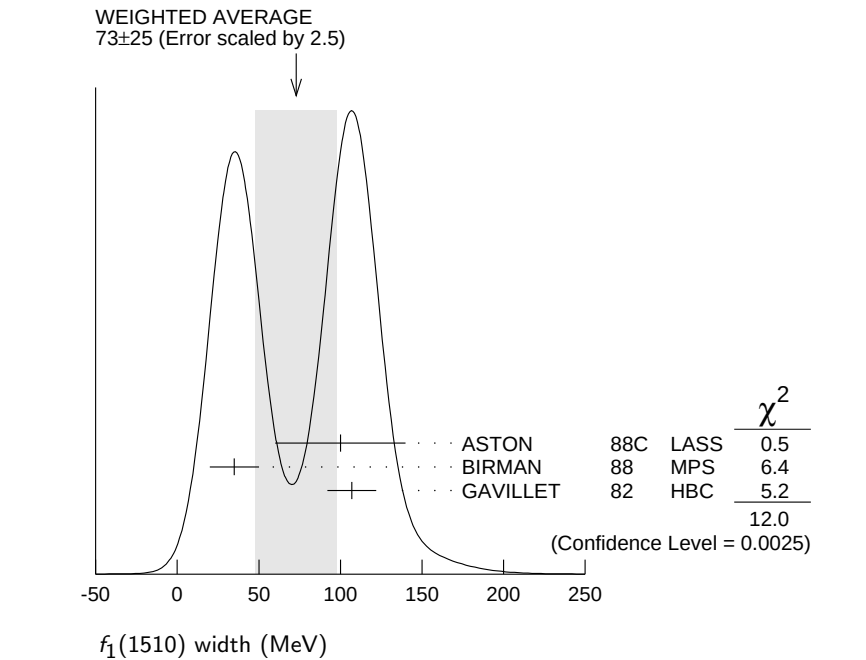
$f_1(1510)$ WIDTH

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>	(BES III 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=M013205

VALUE (MeV)

DOCUMENT ID

1525±5 OUR ESTIMATE This is only an educated guess; the error given is larger than the error on the average of the published values.

NODE=M013MX

→ UNCHECKED ←

PRODUCED BY PION BEAM

VALUE (MeV)

EVTS

DOCUMENT ID

TECN

COMMENT

• • • 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 $\pi^- p \rightarrow K_S^0 K_S^0 n$

NODE=M013M1

NODE=M013M1

OCCUR=2

PRODUCED BY $K^\pm$ BEAM

VALUE (MeV)

EVTS

DOCUMENT ID

TECN

COMMENT

1523.4± 1.3 OUR AVERAGE Includes data from the datablock that follows this one. Error includes scale factor of 1.1.

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		⁴ BARKOV 99	SPEC	40 $K^- p \rightarrow K_S^0 K_S^0 y$

NODE=M013M2

NODE=M013M2

PRODUCED IN e^+e^- ANNIHILATION

VALUE (MeV)

EVTS

DOCUMENT ID

TECN

COMMENT

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

1520.7± 2.0 OUR AVERAGE

1521 ± 5		ABLIKIM 05	BES2	$J/\psi \rightarrow \phi K^+ K^-$
1518 ± 1 ± 3		ABE 04	BELL	10.6 $e^+ e^- \rightarrow e^+ e^- K^+ K^-$
1519 ± 2 ⁺¹⁵ ₋₅		BAI 03G	BES	$J/\psi \rightarrow \gamma K \bar{K}$
1523 ± 6	331	⁵ 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	$J/\psi \rightarrow \gamma K^+ K^-$
1515 ± 5		⁶ FALVARD 88	DM2	$J/\psi \rightarrow \phi K^+ K^-$
1525 ±10 ±10		BALTRUSAIT..87	MRK3	$J/\psi \rightarrow \gamma K^+ K^-$

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

1523 ± 5	870	⁷ SCHEGELSKY 06A	RVUE	$\gamma \gamma \rightarrow K_S^0 K_S^0$
1496 ± 2		⁸ FALVARD 88	DM2	$J/\psi \rightarrow \phi K^+ K^-$

NODE=M013M3

NODE=M013M3

OCCUR=2

PRODUCED IN $\bar{p}p$ ANNIHILATION

VALUE (MeV)

DOCUMENT ID

TECN

COMMENT

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

1530±12		⁹ ANISOVICH 09	RVUE	0.0 $\bar{p}p, \pi N$
1513± 4		AMSLER 06	CBAR	0.9 $\bar{p}p \rightarrow K^+ K^- \pi^0$
1508± 9		¹⁰ AMSLER 02	CBAR	0.9 $\bar{p}p \rightarrow \pi^0 \eta \eta, \pi^0 \pi^0 \pi^0$

NODE=M013M9

NODE=M013M9

CENTRAL PRODUCTION

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
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
1512±3^{+1.4}_{-0.5}	11	CHEKANOV	08	ZEUS $ep \rightarrow K_S^0 K_S^0 X$

NODE=M013M10
NODE=M013M10

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

1537 ⁺⁹ ₋₈	84	12 CHEKANOV	04	ZEUS $ep \rightarrow K_S^0 K_S^0 X$

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 Systematic errors not estimated.

⁵ Supersedes ACCIARRI 95J.

⁶ From an analysis ignoring interference with $f_0(1710)$.

⁷ From analysis of L3 data at 91 and 183–209 GeV.

⁸ From an analysis including interference with $f_0(1710)$.

⁹ 4-poles, 5-channel K matrix fit.

¹⁰ T-matrix pole.

¹¹ 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.

¹² Systematic errors not estimated.

NODE=M013M;LINKAGE=L

NODE=M013M;LINKAGE=D

NODE=M013M;LINKAGE=N

NODE=M013M2;LINKAGE=SK

NODE=M013M;LINKAGE=HA

NODE=M013M;LINKAGE=F1

NODE=M013M3;LINKAGE=SC

NODE=M013M;LINKAGE=F2

NODE=M013M9;LINKAGE=AN

NODE=M013M;LINKAGE=TT

NODE=M013M10;LINKAGE=HE

NODE=M013M10;LINKAGE=CH

 $f_2'(1525)$ WIDTH

NODE=M013210

VALUE (MeV)	DOCUMENT ID	COMMENT

NODE=M013WX

73⁺⁶₋₅ OUR FIT

76±10	PDG	90	For fitting

PRODUCED BY PION BEAM

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

NODE=M013W1
NODE=M013W1

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

102±42	TIKHOMIROV	03	SPEC 40.0 $\pi^- C \rightarrow K_S^0 K_S^0 K_L^0 X$

108 ⁺⁵ ₋₂	13 LONGACRE	86	MPS 22 $\pi^- p \rightarrow K_S^0 K_S^0 n$

69 ⁺²² ₋₁₆	14 CHABAUD	81	ASPK 6 $\pi^- p \rightarrow K^+ K^- n$

137 ⁺²³ ₋₂₁	CHABAUD	81	ASPK 18.4 $\pi^- p \rightarrow K^+ K^- n$

OCCUR=2

150 ⁺⁸³ ₋₅₀	GORLICH	80	ASPK 17 $\pi^- p$ polarized $\rightarrow K^+ K^- n$

165±42	15 CORDEN	79	OMEG 12–15 $\pi^- p \rightarrow \pi^+ \pi^- n$

92 ⁺³⁹ ₋₂₂	16 POLYCHRO...	79	STRC 7 $\pi^- p \rightarrow n K_S^0 K_S^0$

PRODUCED BY $K^\pm$ BEAM

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT

NODE=M013W2
NODE=M013W2

80.2± 2.6 OUR AVERAGE Includes data from the datablock that follows this one.

90 ±12	ASTON	88D	LASS 11 $K^- p \rightarrow K_S^0 K_S^0 \Lambda$

73 ±18	BOLONKIN	86	SPEC 40 $K^- p \rightarrow K_S^0 K_S^0 \gamma$

83 ±15	ARMSTRONG	83B	OMEG 18.5 $K^- p \rightarrow K^- K^+ \Lambda$

85 ±16	650 AGUILAR-...	81B	HBC 4.2 $K^- p \rightarrow \Lambda K^+ K^-$

80 ⁺¹⁴ ₋₁₁	572 ALHARRAN	81	HBC 8.25 $K^- p \rightarrow \Lambda K \bar{K}$

72 ±25	166 EVANGELIS...	77	OMEG 10 $K^- p \rightarrow K^+ K^- (\Lambda, \Sigma)$

69 ±22	100 AGUILAR-...	72B	HBC 3.9,4.6 $K^- p \rightarrow K \bar{K} (\Lambda, \Sigma)$

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

92 ⁺²⁵ ₋₁₆	61 BINON	07	GAMS 32.5 $K^- p \rightarrow \eta \eta (\Lambda / \Sigma^0)$

75 ±20	17 BARKOV	99	SPEC 40 $K^- p \rightarrow K_S^0 K_S^0 \gamma$

62 ⁺¹⁹ ₋₁₄	123 BARREIRO	77	HBC 4.15 $K^- p \rightarrow \Lambda K_S^0 K_S^0$

61 ± 8	120 BRANDENB...	76C	ASPK 13 $K^- p \rightarrow K^+ K^- (\Lambda, \Sigma)$

PRODUCED IN e^+e^- ANNIHILATION

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

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

79.9$\pm$ 3.3 OUR AVERAGE Error includes scale factor of 1.1.				
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 $\pm$ 15	331	18 ACCIARRI	01H L3	91, 183–209 $e^+e^- \rightarrow e^+e^- K_S^0 K_S^0$
60 $\pm$ 20 $\pm$ 19		ABREU	96C DLPH	$Z^0 \rightarrow K^+ K^- + X$
60 $\pm$ 23 $\pm$ 13 -20		BAI	96C BES	$J/\psi \rightarrow \gamma K^+ K^-$
103 $\pm$ 30		AUGUSTIN	88 DM2	$J/\psi \rightarrow \gamma K^+ K^-$
62 $\pm$ 10	19	FALVARD	88 DM2	$J/\psi \rightarrow \phi K^+ K^-$
85 $\pm$ 35		BALTRUSAIT..87	MRK3	$J/\psi \rightarrow \gamma K^+ K^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
104 $\pm$ 10	870	20 SCHEGELSKY	06A RVUE	$\gamma\gamma \rightarrow K_S^0 K_S^0$
100 $\pm$ 3	21	FALVARD	88 DM2	$J/\psi \rightarrow \phi K^+ K^-$

NODE=M013W3
NODE=M013W3

OCCUR=2

PRODUCED IN $\bar{p}p$ ANNIHILATION

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

79$\pm$ 8	22 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. • • •			
128 $\pm$ 20	23 ANISOVICH	09 RVUE	0.0 $\bar{p}p, \pi N$
76 $\pm$ 6	AMSLER	06 CBAR	0.9 $\bar{p}p \rightarrow K^+ K^- \pi^0$

NODE=M013W9
NODE=M013W9

CENTRAL PRODUCTION

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

70$\pm$ 25	BARBERIS	99 OMEG	450 $pp \rightarrow p_S p_f K^+ K^-$

NODE=M013W4
NODE=M013W4

PRODUCED IN $e p$ COLLISIONS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

83$\pm$ 9$\pm$ 5 -4	24	CHEKANOV	08 ZEUS	$e p \rightarrow K_S^0 K_S^0 X$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
50 $\pm$ 34 -22	84	25 CHEKANOV	04 ZEUS	$e p \rightarrow K_S^0 K_S^0 X$

NODE=M013W10
NODE=M013W10

- 13 From a partial-wave analysis of data using a K-matrix formalism with 5 poles.
14 CHABAUD 81 is a reanalysis of PAWLICKI 77 data.
15 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.
16 From a fit to the D with $f_2(1270)$ - $f_2'(1525)$ interference. Mass fixed at 1516 MeV.
17 Systematic errors not estimated.
18 Supersedes ACCIARRI 95J.
19 From an analysis ignoring interference with $f_0(1710)$.
20 From analysis of L3 data at 91 and 183–209 GeV.
21 From an analysis including interference with $f_0(1710)$.
22 T-matrix pole.
23 4-poles, 5-channel K matrix fit.
24 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.
25 Systematic errors not estimated.

NODE=M013W;LINKAGE=L
NODE=M013W;LINKAGE=D
NODE=M013W;LINKAGE=N

NODE=M013W;LINKAGE=M
NODE=M013W2;LINKAGE=SK
NODE=M013W;LINKAGE=HA
NODE=M013W;LINKAGE=F1
NODE=M013W3;LINKAGE=SC
NODE=M013W;LINKAGE=F2
NODE=M013W;LINKAGE=TT
NODE=M013W9;LINKAGE=AN
NODE=M013W10;LINKAGE=HE

NODE=M013W10;LINKAGE=CH

 $f_2'(1525)$ DECAY MODES

NODE=M013215;NODE=M013

Mode	Fraction (Γ_i/Γ)

Γ_1 $K \bar{K}$	(88.7 $\pm$ 2.2) %
Γ_2 $\eta \eta$	(10.4 $\pm$ 2.2) %
Γ_3 $\pi \pi$	(8.2 $\pm$ 1.5) $\times 10^{-3}$
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 $\gamma \gamma$	(1.11 $\pm$ 0.14) $\times 10^{-6}$

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 16 measurements and one constraint to determine 5 parameters. The overall fit has a $\chi^2 = 14.0$ for 12 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta p_i \delta p_j \rangle / (\delta p_i \cdot \delta p_j)$, 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_2	-100			
x_3	-6	-1		
x_8	-6	6	1	
Γ	-23	23	-1	-55
	x_1	x_2	x_3	x_8

Mode	Rate (MeV)
Γ_1 $K\bar{K}$	65 $^{+5}_{-4}$
Γ_2 $\eta\eta$	7.6 ± 1.8
Γ_3 $\pi\pi$	0.60 ± 0.12
Γ_8 $\gamma\gamma$	(8.1 ± 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			

NODE=M013W6
NODE=M013W6**65 $^{+5}_{-4}$ OUR FIT**

63 $^{+6}_{-5}$ ²⁶ LONGACRE 86 MPS 22 $\pi^- p \rightarrow K_S^0 K_S^0 n$

$\Gamma(\eta\eta)$						Γ_2
VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT		

NODE=M013W7
NODE=M013W7**7.6 ± 1.8 OUR FIT**

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

5.0 ± 0.8 870 ²⁷ SCHEGELSKY 06A RVUE $\gamma\gamma \rightarrow K_S^0 K_S^0$
 24 $^{+3}_{-1}$ ²⁶ LONGACRE 86 MPS 22 $\pi^- p \rightarrow K_S^0 K_S^0 n$

$\Gamma(\pi\pi)$						Γ_3
VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT		

NODE=M013W5
NODE=M013W5**0.60 ± 0.12 OUR FIT**

1.4 $^{+1.0}_{-0.5}$ ²⁶ 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 $^{+1.0}_{-0.2}$ 870 ²⁷ SCHEGELSKY 06A RVUE $\gamma\gamma \rightarrow K_S^0 K_S^0$

$\Gamma(\gamma\gamma)$						Γ_8
VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT		

NODE=M013W8
NODE=M013W8**0.081 ± 0.009 OUR FIT**

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

0.13 ± 0.03 870 ²⁷ SCHEGELSKY 06A RVUE $\gamma\gamma \rightarrow K_S^0 K_S^0$

²⁶ From a partial-wave analysis of data using a K-matrix formalism with 5 poles.

²⁷ 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=M013PW;LINKAGE=L

NODE=M013W8;LINKAGE=SC

$f'_2(1525) \Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

NODE=M013223

 $\Gamma(K\bar{K}) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_1\Gamma_8/\Gamma$ NODE=M013G1
NODE=M013G1

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
0.072 ± 0.007 OUR FIT				
0.072 ± 0.007 OUR AVERAGE				
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	28 ACCIARRI	01H L3	$e^+e^- \rightarrow e^+e^- K_S^0 K_S^0$
0.067 ± 0.008 ± 0.015		29 ALBRECHT	90G ARG	$e^+e^- \rightarrow e^+e^- K^+K^-$
0.11 $^{+0.03}_{-0.02}$ ± 0.02		BEHREND	89c CELL	$e^+e^- \rightarrow e^+e^- K_S^0 K_S^0$
0.10 $^{+0.04}_{-0.03}$ ± 0.03		BERGER	88 PLUT	$e^+e^- \rightarrow e^+e^- K_S^0 K_S^0$
0.12 ± 0.07 ± 0.04		29 AIHARA	86B TPC	$e^+e^- \rightarrow e^+e^- K^+K^-$
0.11 ± 0.02 ± 0.04		29 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		30 ALBRECHT	90G ARG	$e^+e^- \rightarrow e^+e^- K^+K^-$
28 Supersedes ACCIARRI 95J. From analysis of L3 data at 91 and 183–209 GeV,				
29 Using an incoherent background.				
30 Using a coherent background.				

OCCUR=2

NODE=M013G;LINKAGE=HA
NODE=M013G1;LINKAGE=A
NODE=M013G1;LINKAGE=B $f'_2(1525) \text{ BRANCHING RATIOS}$

NODE=M013225

 $\Gamma(\eta\eta)/\Gamma_{\text{total}}$ Γ_2/Γ NODE=M013R8
NODE=M013R8

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
seen	UEHARA	10A BELL	10.6 $e^+e^- \rightarrow e^+e^- \eta\eta$
0.10 ± 0.03	31 PROKOSHKIN	91 GAM4	300 $\pi^- p \rightarrow \pi^- p \eta\eta$
31 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=B

 $\Gamma(\eta\eta)/\Gamma(K\bar{K})$ Γ_2/Γ_1 NODE=M013R3
NODE=M013R3

VALUE	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
0.118 ± 0.028 OUR FIT					
0.115 ± 0.028 OUR AVERAGE					
0.119 ± 0.015 ± 0.036		61	32 BINON	07 GAMS	32.5 $K^- p \rightarrow \eta\eta(\Lambda/\Sigma^0)$
0.11 ± 0.04			33 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 $pp \rightarrow p_f \eta\eta p_s$
< 0.50			BARNES	67 HBC	4.6, 5.0 $K^- p$
32 Using the compilation of the cross sections for $f'_2(1525)$ production in $K^- p$ collisions from ASTON 88D.					
33 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 NODE=M013R1
NODE=M013R1

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
0.0082 ± 0.0016 OUR FIT				
0.0075 ± 0.0016 OUR AVERAGE				
0.007 ± 0.002		COSTA...	80 OMEG	10 $\pi^- p \rightarrow K^+ K^- n$
0.027 $^{+0.071}_{-0.013}$		34 GORLICH	80 ASPK	17, 18 $\pi^- p$
0.0075 ± 0.0025		34, 35 MARTIN	79 RVUE	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
< 0.06		95 AGUILAR...	81B HBC	4.2 $K^- p \rightarrow \Lambda K^+ K^-$
0.19 ± 0.03		CORDEN	79 OMEG	12–15 $\pi^- p \rightarrow \pi^+ \pi^- n$
< 0.045		95 BARREIRO	77 HBC	4.15 $K^- p \rightarrow \Lambda K_S^0 K_S^0$
0.012 ± 0.004		34 PAWLICKI	77 SPEC	6 $\pi N \rightarrow K^+ K^- N$
< 0.063		90 BRANDENB...	76C ASPK	13 $K^- p \rightarrow K^+ K^- (\Lambda, \Sigma)$
< 0.0086		34 BEUSCH	75B OSPK	8.9 $\pi^- p \rightarrow K^0 \bar{K}^0 n$
34 Assuming that the $f'_2(1525)$ is produced by an one-pion exchange production mechanism.				
35 MARTIN 79 uses the PAWLICKI 77 data with different input value of the $f'_2(1525) \rightarrow K\bar{K}$ branching ratio.				

NODE=M013R1;LINKAGE=C

NODE=M013R1;LINKAGE=D

$\Gamma(\pi\pi)/\Gamma(K\bar{K})$ Γ_3/Γ_1

VALUE	DOCUMENT ID	TECN	COMMENT

0.0092±0.0018 OUR FIT**0.075 ±0.035**AUGUSTIN 87 DM2 $J/\psi \rightarrow \gamma\pi^+\pi^-$ NODE=M013R7
NODE=M013R7 $[\Gamma(K\bar{K}^*(892)+c.c.)+\Gamma(\pi K\bar{K})]/\Gamma(K\bar{K})$ $(\Gamma_4+\Gamma_5)/\Gamma_1$

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

UEHARA	10A	PR D82 114031	S. Uehara <i>et al.</i>	(BELLE Collab.)
ANISOVICH	09	IJMP A24 2481	V.V. Anisovich, A.V. Sarantsev	
CHEKANOV	08	PRL 101 112003	S. Chekanov <i>et al.</i>	(ZEUS Collab.)
BINON	07	PAN 70 1713	F. Binon <i>et al.</i>	(GAMS Collab.)
AMSLER	06	PL B639 165	C. Amsler <i>et al.</i>	(CBAR 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.)
ABE	04	EPJ C32 323	K. Abe <i>et al.</i>	(BELLE Collab.)
CHEKANOV	04	PL B578 33	S. Chekanov <i>et al.</i>	(ZEUS Collab.)
BAI	03G	PR D68 052003	J.Z. Bai <i>et al.</i>	(BES Collab.)
TIKHOMIROV	03	PAN 66 828	G.D. Tikhomirov <i>et al.</i>	
AMSLER	02	EPJ C23 29	C. Amsler <i>et al.</i>	
ACCIARRI	01H	PL B501 173	M. Acciarri <i>et al.</i>	(L3 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.)
BARKOV	99	JETPL 70 248	B.P. Barkov <i>et al.</i>	
ABREU	96C	PL B379 309	P. Abreu <i>et al.</i>	(DELPHI Collab.)
BAI	96C	PRL 77 3959	J.Z. Bai <i>et al.</i>	(BES Collab.)
ACCIARRI	95J	PL B363 118	M. Acciarri <i>et al.</i>	(L3 Collab.)
PROKOSHKIN	91	SPD 36 155	Y.D. Prokoshkin	(GAM2, GAM4 Collab.)
ALBRECHT	90G	ZPHY C48 183	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
PDG	90	PL B239 1	J.J. Hernandez <i>et al.</i>	(IFIC, BOST, CIT+)
BEHREND	89C	ZPHY C43 91	H.J. Behrend <i>et al.</i>	(CELLO Collab.)
ASTON	88D	NP B301 525	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)
AUGUSTIN	88	PRL 60 2238	J.E. Augustin <i>et al.</i>	(DM2 Collab.)
BERGER	88	ZPHY C37 329	C. Berger <i>et al.</i>	(PLUTO Collab.)
FALVARD	88	PR D38 2706	A. Falvard <i>et al.</i>	(CLER, FRAS, LALO+)
AUGUSTIN	87	ZPHY C36 369	J.E. Augustin <i>et al.</i>	(LALO, CLER, FRAS+)
BALTRUSAITIS	87	PR D35 2077	R.M. Baltrusaitis <i>et al.</i>	(Mark III Collab.)
AIHARA	86B	PRL 57 404	H. Aihara <i>et al.</i>	(TPC-2 γ Collab.)
BOLONKIN	86	SJNP 43 776	B.V. Bolonkin <i>et al.</i>	(ITEP) JP
LONGACRE	86	PL B177 223	R.S. Longacre <i>et al.</i>	(BNL, BRAN, CUNY+)
ALTHOFF	83	PL 121B 216	M. Althoff <i>et al.</i>	(TASSO Collab.)
ARMSTRONG	83B	NP B224 193	T.A. Armstrong <i>et al.</i>	(BARI, BIRM, CERN+)
AGUILAR-...	81B	ZPHY C8 313	M. Aguilar-Benitez <i>et al.</i>	(CERN, CDEF+)
ALHARRAN	81	NP B191 26	S. Al-Harran <i>et al.</i>	(BIRM, CERN, GLAS+)
CHABAUD	81	APP B12 575	V. Chabaud <i>et al.</i>	(CERN, CRAC, MPIM)
COSTA...	80	NP B175 402	G. Costa de Beauregard <i>et al.</i>	(BARI, BONN+)
GORLICH	80	NP B174 16	L. Gorlich <i>et al.</i>	(CRAC, MPIM, CERN+)
CORDEN	79	NP B157 250	M.J. Corden <i>et al.</i>	(BIRM, RHEL, TELA+) JP
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)
BARREIRO	77	NP B121 237	F. Barreiro <i>et al.</i>	(CERN, AMST, NIJ+)
EVANGELIS...	77	NP B127 384	C. Evangelista <i>et al.</i>	(BARI, BONN, CERN+)
PAWLICKI	77	PR D15 3196	A.J. Pawlicki <i>et al.</i>	(ANL) IJP
BRANDENB...	76C	NP B104 413	G.W. Brandenburg <i>et al.</i>	(SLAC)
BEUSCH	75B	PL 60B 101	W. Beusch <i>et al.</i>	(CERN, ETH)
AGUILAR-...	72B	PR D6 29	M. Aguilar-Benitez <i>et al.</i>	(BNL)
AMMAR	67	PRL 19 1071	R. Ammar <i>et al.</i>	(NWES, ANL) JP
BARNES	67	PRL 19 964	V.E. Barnes <i>et al.</i>	(BNL, SYRA) IJPC
CRENNELL	66	PRL 16 1025	D.J. Crennell <i>et al.</i>	(BNL) I

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$f_2(1565)$

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

OMITTED FROM SUMMARY TABLE

Seen mostly in antinucleon-nucleon annihilation. Needs confirmation in other channels.

NODE=M123

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NODE=M123M

NODE=M123M

 $f_2(1565)$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
1562±13 OUR AVERAGE	Error includes scale factor of 2.1. See the ideogram below.		
1590±10	¹ AMELIN	06 VES	$36 \pi^- p \rightarrow \omega \omega n$
1552±13	² AMSLER	02 CBAR	$0.9 \bar{p} p \rightarrow \pi^0 \eta \eta, \pi^0 \pi^0 \pi^0$
1550±10±20	AMELIN	00 VES	$37 \pi^- p \rightarrow \eta \pi^+ \pi^- n$
1575±18	BERTIN	98 OBLX	$0.05-0.405 \bar{n} p \rightarrow \pi^+ \pi^+ \pi^-$
1507±15	² BERTIN	97C OBLX	$0.0 \bar{p} p \rightarrow \pi^+ \pi^- \pi^0$
1565±20	MAY	90 ASTE	$0.0 \bar{p} p \rightarrow \pi^+ \pi^- \pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
1560±15	³ ANISOVICH	09 RVUE	$0.0 \bar{p} p, \pi N$
1598±11±9	BAKER	99B SPEC	$0 \bar{p} p \rightarrow \omega \omega \pi^0$
1534±20	⁴ ABELE	96C RVUE	Compilation
~ 1552	⁵ AMSLER	95D CBAR	$0.0 \bar{p} p \rightarrow \pi^0 \pi^0 \pi^0, \pi^0 \eta \eta, \pi^0 \pi^0 \eta$
1598±72	BALOSHIN	95 SPEC	$40 \pi^- C \rightarrow K_S^0 K_S^0 X$
1566 ⁺⁸⁰ ₋₅₀	⁶ 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	⁷ ARMSTRONG	93C E760	$\bar{p} p \rightarrow \pi^0 \eta \eta \rightarrow 6\gamma$
1508±10	⁷ ARMSTRONG	93D E760	$\bar{p} p \rightarrow 3\pi^0 \rightarrow 6\gamma$
1525±10	⁷ ARMSTRONG	93D E760	$\bar{p} p \rightarrow \eta \pi^0 \pi^0 \rightarrow 6\gamma$
~ 1504	⁸ WEIDENAUER	93 ASTE	$0.0 \bar{p} N \rightarrow 3\pi^- 2\pi^+$
1540±15	⁷ ADAMO	92 OBLX	$\bar{n} p \rightarrow \pi^+ \pi^+ \pi^-$
1515±10	⁹ AKER	91 CBAR	$0.0 \bar{p} p \rightarrow 3\pi^0$
1477±5	BRIDGES	86C DBC	$0.0 \bar{p} N \rightarrow 3\pi^- 2\pi^+$

¹ Supersedes the $\omega \omega$ state of BELADIDZE 92B earlier assigned to the $f_2(1640)$.

² T-matrix pole.

³ On sheet II in a two-pole solution.

⁴ T-matrix pole, large coupling to $\rho \rho$ and $\omega \omega$, could be $f_2(1640)$.

⁵ Coupled-channel analysis of AMSLER 95B, AMSLER 95C, and AMSLER 94D.

⁶ From a simultaneous analysis of the annihilations $\bar{p} p \rightarrow 3\pi^0, \pi^0 \eta \eta$ including AKER 91 data.

⁷ J^P not determined, could be partly $f_0(1500)$.

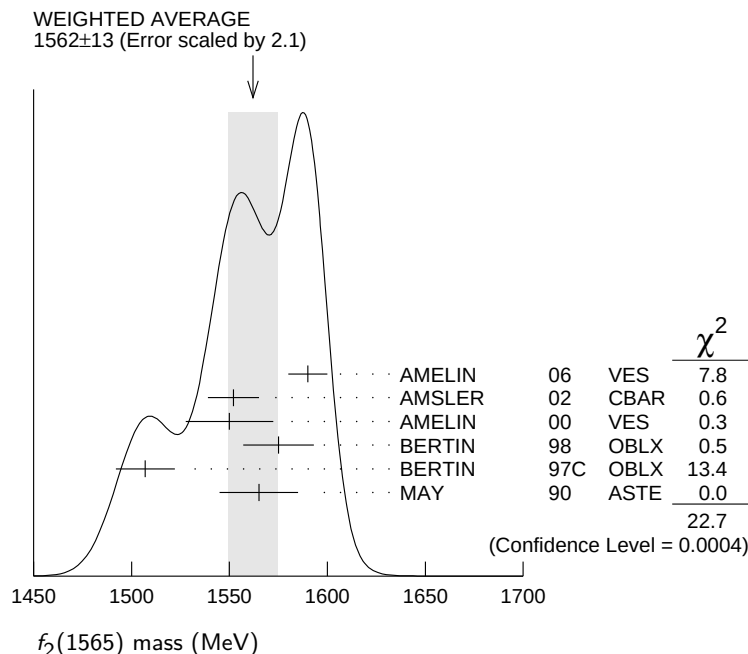
⁸ J^P not determined.

⁹ Superseded by AMSLER 95B.

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 NODE=M123M;LINKAGE=AN
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 NODE=M123M;LINKAGE=AB
 NODE=M123M;LINKAGE=C

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 NODE=M123M;LINKAGE=F
 NODE=M123M;LINKAGE=BA



$f_2(1565)$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
134± 8 OUR AVERAGE			
140± 11	¹⁰ AMELIN	06 VES	$36 \pi^- p \rightarrow \omega \omega n$
113± 23	¹¹ AMSLER	02 CBAR	$0.9 \bar{p} p \rightarrow \pi^0 \eta \eta, \pi^0 \pi^0 \pi^0$
130± 20±40	AMELIN	00 VES	$37 \pi^- p \rightarrow \eta \pi^+ \pi^- n$
119± 24	BERTIN	98 OBLX	$0.05-0.405 \bar{n} p \rightarrow \pi^+ \pi^+ \pi^-$
130± 20	¹¹ BERTIN	97C OBLX	$0.0 \bar{p} p \rightarrow \pi^+ \pi^- \pi^0$
170± 40	MAY	90 ASTE	$0.0 \bar{p} p \rightarrow \pi^+ \pi^- \pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
280± 40	¹² ANISOVICH	09 RVUE	$0.0 \bar{p} p, \pi N$
180± 60	¹³ ABELE	96C RVUE	Compilation
~ 142	¹⁴ 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 ⁺ ₋₂₀	¹⁵ ANISOVICH	94 CBAR	$0.0 \bar{p} p \rightarrow 3\pi^0, \eta \eta \pi^0$
130± 10	¹⁶ ADAMO	93 OBLX	$\bar{n} p \rightarrow \pi^+ \pi^+ \pi^-$
148± 27	¹⁷ ARMSTRONG	93C E760	$\bar{p} p \rightarrow \pi^0 \eta \eta \rightarrow 6\gamma$
103± 15	¹⁷ ARMSTRONG	93D E760	$\bar{p} p \rightarrow 3\pi^0 \rightarrow 6\gamma$
111± 10	¹⁷ ARMSTRONG	93D E760	$\bar{p} p \rightarrow \eta \pi^0 \pi^0 \rightarrow 6\gamma$
~ 206	¹⁸ WEIDENAUER	93 ASTE	$0.0 \bar{p} N \rightarrow 3\pi^- 2\pi^+$
132± 37	¹⁷ ADAMO	92 OBLX	$\bar{n} p \rightarrow \pi^+ \pi^+ \pi^-$
120± 10	¹⁹ AKER	91 CBAR	$0.0 \bar{p} p \rightarrow 3\pi^0$
116± 9	BRIDGES	86C DBC	$0.0 \bar{p} N \rightarrow 3\pi^- 2\pi^+$
¹⁰ Supersedes the $\omega \omega$ state of BELADIDZE 92B earlier assigned to the $f_2(1640)$.			
¹¹ T-matrix pole.			
¹² On sheet II in a two-pole solution.			
¹³ T-matrix pole, large coupling to $\rho \rho$ and $\omega \omega$, could be $f_2(1640)$.			
¹⁴ Coupled-channel analysis of AMSLER 95B, AMSLER 95C, and AMSLER 94D.			
¹⁵ From a simultaneous analysis of the annihilations $\bar{p} p \rightarrow 3\pi^0, \pi^0 \eta \eta$ including AKER 91 data.			
¹⁶ Supersedes ADAMO 92.			
¹⁷ J^P not determined, could be partly $f_0(1500)$.			
¹⁸ J^P not determined.			
¹⁹ Superseded by AMSLER 95B.			

NODE=M123W

NODE=M123W

OCCUR=2

NODE=M123W;LINKAGE=AM
 NODE=M123W;LINKAGE=G
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 NODE=M123W;LINKAGE=D

NODE=M123W;LINKAGE=C
 NODE=M123W;LINKAGE=E
 NODE=M123W;LINKAGE=F
 NODE=M123W;LINKAGE=BA

 $f_2(1565)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \pi \pi$	seen
$\Gamma_2 \pi^+ \pi^-$	seen
$\Gamma_3 \pi^0 \pi^0$	seen
$\Gamma_4 \rho^0 \rho^0$	seen
$\Gamma_5 2\pi^+ 2\pi^-$	seen
$\Gamma_6 \eta \eta$	seen
$\Gamma_7 a_2(1320) \pi$	
$\Gamma_8 \omega \omega$	seen
$\Gamma_9 K \bar{K}$	
$\Gamma_{10} \gamma \gamma$	

NODE=M123215;NODE=M123

DESIG=6;OUR EST;→ UNCHECKED ←
 DESIG=1;OUR EST;→ UNCHECKED ←
 DESIG=3;OUR EST;→ UNCHECKED ←
 DESIG=2;OUR EST;→ UNCHECKED ←
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 DESIG=4;OUR EST;→ UNCHECKED ←
 DESIG=8
 DESIG=7;OUR EST;→ UNCHECKED ←
 DESIG=9
 DESIG=10

 $f_2(1565)$ PARTIAL WIDTHS

$\Gamma(\eta \eta)$					Γ_6
VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1.2±0.3	870	²⁰ SCHEGELSKY 06A	RVUE	$\gamma \gamma \rightarrow K_S^0 K_S^0$	
$\Gamma(K \bar{K})$					Γ_9
VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
2.0±1.0	870	²⁰ SCHEGELSKY 06A	RVUE	$\gamma \gamma \rightarrow K_S^0 K_S^0$	

NODE=M123225

NODE=M123W3
 NODE=M123W3

NODE=M123W1
 NODE=M123W1

$\Gamma(\gamma\gamma)$ Γ_{10}

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT

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

0.70±0.14	870	20 SCHEGELSKY 06A	RVUE	$\gamma\gamma \rightarrow K_S^0 K_S^0$

²⁰ 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=M123W2
NODE=M123W2

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	²¹ ANISOVICH	94B	RVUE	$\bar{p}p \rightarrow \pi^+\pi^-\pi^0$

seen	MAY	89	ASTE	$\bar{p}p \rightarrow \pi^+\pi^-\pi^0$

²¹ ANISOVICH 94B is from a reanalysis of MAY 90.

NODE=M123R1
NODE=M123R1

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±0.005±0.012	²² ARMSTRONG	93C	E760	$\bar{p}p \rightarrow \pi^0\eta\eta \rightarrow 6\gamma$

²² J^P not determined, could be partly $f_0(1500)$.

NODE=M123R4
NODE=M123R4

NODE=M123R4;LINKAGE=E

 $\Gamma(\omega\omega)/\Gamma_{\text{total}}$ Γ_8/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.)
SCHEGELSKY	06A	Translated from YAF 69 715.	V.A. Schegelsky <i>et al.</i>	
AMSLER	02	EPJ A27 207	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)
AMSLER	94D	Translated from YAF 58 50.	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=21377

$\rho(1570)$

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

OMITTED FROM SUMMARY TABLE

May be an OZI-violating decay mode of $\rho(1700)$. See our mini-review under the $\rho(1700)$.

 $\rho(1570)$ MASS

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.				

 $\rho(1570)$ WIDTH

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.				

 $\rho(1570)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $e^+ e^-$	
Γ_2 $\phi \pi$	not seen
Γ_3 $\omega \pi$	

 $\rho(1570)$ $\Gamma(i)\Gamma(e^+ e^-)/\Gamma(\text{total})$

VALUE (eV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT	$\Gamma_2 \Gamma_1 / \Gamma$
$3.5 \pm 0.9 \pm 0.3$		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.						

 $\rho(1570)$ BRANCHING RATIOS

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_2/Γ
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.				

VALUE	CL%	DOCUMENT ID	TECN	COMMENT	Γ_2/Γ_3
> 0.5	95	BITYUKOV	87 SPEC	$32.5 \pi^- p \rightarrow \phi \pi^0 n$	

 $\rho(1570)$ REFERENCES

AUBERT	08S	PR D77 092002	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52242
ABELE	97H	PL B415 280	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)	REFID=45765
BISELLO	91B	NPBPS B21 111	D. Bisello	(DM2 Collab.)	REFID=41752
DONNACHIE	91	ZPHY C51 689	A. Donnachie, A.B. Clegg	(MCHS, LANC)	REFID=41632
ALBRECHT	87L	PL B185 223	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=40418
AULCHENKO	87B	JETPL 45 145	V.M. Aulchenko <i>et al.</i>	(NOVO)	REFID=41373
		Translated from ZETFP 45 118.			
BITYUKOV	87	PL B188 383	S.I. Bitjukov <i>et al.</i>	(SERP)	REFID=40011
DOLINSKY	86	PL B174 453	S.I. Dolinsky <i>et al.</i>	(NOVO)	REFID=20246

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NODE=M188M

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NODE=M188M;LINKAGE=BI

NODE=M188W

NODE=M188W

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NODE=M188W;LINKAGE=BI

NODE=M188215;NODE=M188

DESIG=1

DESIG=2

DESIG=3

NODE=M188225

NODE=M188G01
NODE=M188G01

NODE=M188G01;LINKAGE=AU
NODE=M188G01;LINKAGE=AL

NODE=M188220

NODE=M188R01
NODE=M188R01

NODE=M188R01;LINKAGE=DO

NODE=M188R02
NODE=M188R02

NODE=M188

$h_1(1595)$

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

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. **$h_1(1595)$ MASS**

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$1594 \pm 15^{+10}_{-60}$	EUGENIO	01	SPEC 18 $\pi^- p \rightarrow \omega\eta n$

 $h_1(1595)$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$384 \pm 60^{+70}_{-100}$	EUGENIO	01	SPEC 18 $\pi^- p \rightarrow \omega\eta n$

 $h_1(1595)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \omega\eta$	seen

 $h_1(1595)$ REFERENCESEUGENIO 01 PL B497 190 P. Eugenio *et al.* **$\pi_1(1600)$**

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

 $\pi_1(1600)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1662 ± 8	9	OUR AVERAGE		

$1660 \pm 10^{+0}_{-64}$	420k	ALEKSEEV	10	COMP	190 $\pi^- Pb \rightarrow \pi^- \pi^- \pi^+ Pb'$
$1664 \pm 8 \pm 10$	145k	¹ LU	05	B852	18 $\pi^- p \rightarrow \omega \pi^- \pi^0 p$
$1709 \pm 24 \pm 41$	69k	² KUHN	04	B852	18 $\pi^- p \rightarrow \eta \pi^+ \pi^- \pi^- p$
$1597 \pm 10^{+45}_{-10}$		² IVANOV	01	B852	18 $\pi^- p \rightarrow \eta' \pi^- p$

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

$1593 \pm 8^{+29}_{-47}$	^{2,3} ADAMS	98B	B852	18.3 $\pi^- p \rightarrow \pi^+ \pi^- \pi^- p$

¹ May be a different state: natural and unnatural parity exchanges.² Natural parity exchange.³ Superseded by DZIERBA 06 excluding this state in a more refined PWA analysis, with 2.6 M events of $\pi^- p \rightarrow \pi^- \pi^- \pi^+ p$ and 3 M events of $\pi^- p \rightarrow \pi^- \pi^0 \pi^0 p$ of E852 data. **$\pi_1(1600)$ WIDTH**

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
241 ± 40	OUR AVERAGE	Error includes scale factor of 1.4. See the ideogram below.		
$269 \pm 21^{+42}_{-64}$	420k	ALEKSEEV	10	COMP 190 $\pi^- Pb \rightarrow \pi^- \pi^- \pi^+ Pb'$
$185 \pm 25 \pm 28$	145k	⁴ LU	05	B852 18 $\pi^- p \rightarrow \omega \pi^- \pi^0 p$
$403 \pm 80 \pm 115$	69k	⁵ KUHN	04	B852 18 $\pi^- p \rightarrow \eta \pi^+ \pi^- \pi^- p$
$340 \pm 40 \pm 50$		⁵ IVANOV	01	B852 18 $\pi^- p \rightarrow \eta' \pi^- p$

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

$168 \pm 20^{+150}_{-12}$	^{5,6} ADAMS	98B	B852	18.3 $\pi^- p \rightarrow \pi^+ \pi^- \pi^- p$

NODE=M166

NODE=M166

NODE=M166M

NODE=M166M

NODE=M166W

NODE=M166W

NODE=M166215;NODE=M166

DESIG=1;OUR EST;→ UNCHECKED ←

NODE=M166

REFID=48010

NODE=M164

NODE=M164M

NODE=M164M

NODE=M164M;LINKAGE=LU

NODE=M164M;LINKAGE=A

NODE=M164M;LINKAGE=DZ

NODE=M164W

NODE=M164W

⁴ May be a different state: natural and unnatural parity exchanges.

⁵ Natural parity exchange.

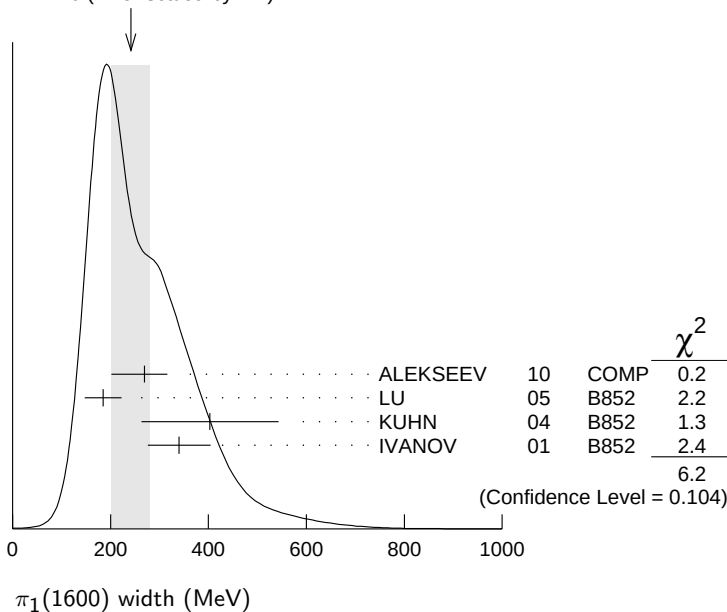
⁶ Superseded by DZIERBA 06 excluding this state in a more refined PWA analysis, with 2.6 M events of $\pi^- p \rightarrow \pi^- \pi^- \pi^+ p$ and 3 M events of $\pi^- p \rightarrow \pi^- \pi^0 \pi^0 p$ of E852 data.

NODE=M164W;LINKAGE=LU

NODE=M164W;LINKAGE=A

NODE=M164W;LINKAGE=DZ

WEIGHTED AVERAGE
241±40 (Error scaled by 1.4)



$\pi_1(1600)$ DECAY MODES

NODE=M164215;NODE=M164

Mode	Fraction (Γ_i/Γ)
Γ_1 $\pi \pi \pi$	not seen
Γ_2 $\rho^0 \pi^-$	not 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

DESIG=1;OUR EST;→ UNCHECKED ←

DESIG=2

DESIG=4

DESIG=5

DESIG=3

DESIG=6;OUR EST;→ UNCHECKED ←

$\pi_1(1600)$ BRANCHING RATIOS

NODE=M164220

$\Gamma(\rho^0 \pi^-)/\Gamma_{\text{total}}$				Γ_2/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
not seen	NOZAR	09	CLAS $\gamma p \rightarrow 2\pi^+ \pi^- n$	
not seen	⁷ DZIERBA	06	B852 $18 \pi^- p$	

NODE=M164R1

NODE=M164R1

⁷ From the PWA analysis of 2.6 M $\pi^- p \rightarrow \pi^- \pi^- \pi^+ p$ and 3 M events of $\pi^- p \rightarrow \pi^- \pi^0 \pi^0 p$ of E852 data. Supersedes ADAMS 98B.

NODE=M164R1;LINKAGE=DZ

$\Gamma(f_2(1270) \pi^-)/\Gamma_{\text{total}}$				Γ_3/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
not seen	⁸ DZIERBA	06	B852 $18 \pi^- p$	

NODE=M164R3

NODE=M164R3

⁸ 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;LINKAGE=DZ

$\Gamma(b_1(1235) \pi)/\Gamma_{\text{total}}$				Γ_4/Γ
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
seen	35280	⁹ 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 $18 \pi^- p \rightarrow \omega \pi^- \pi^0 p$

NODE=M164R4

NODE=M164R4

⁹ $B((b_1 \pi)_{D\text{-wave}})/B((b_1 \pi)_{S\text{-wave}}) = 0.3 \pm 0.1$.

NODE=M164R;LINKAGE=RB

$\Gamma(\eta'(958) \pi^-)/\Gamma_{\text{total}}$				Γ_5/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
seen	IVANOV	01	B852 $18 \pi^- p \rightarrow \eta' \pi^- p$	

NODE=M164R2

NODE=M164R2

$\Gamma(f_1(1285)\pi)/\Gamma(\eta'(958)\pi^-)$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
3.80±0.78	69k	¹⁰ KUHN	04 B852	18 $\pi^- p \rightarrow \eta \pi^+ \pi^- \pi^- p$
¹⁰ Using $\eta'(958)\pi$ data from IVANOV 01.				

NODE=M164R5
 NODE=M164R5

NODE=M164R;LINKAGE=KU

 $\pi_1(1600)$ REFERENCES

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>	(CLAS Collab.)
DZIERBA	06	PR D73 072001	A.R. Dzierba <i>et al.</i>	(BNL E852 Collab.)
LU	05	PRL 94 032002	M. Lu <i>et al.</i>	(BNL E852 Collab.)
KUHN	04	PL B595 109	J. Kuhn <i>et al.</i>	(BNL E852 Collab.)
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

REFID=53356
 REFID=52758
 REFID=51077
 REFID=50459
 REFID=49773
 REFID=49414
 REFID=48837
 REFID=48317
 REFID=46610

NODE=M161

 $a_1(1640)$

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

OMITTED FROM SUMMARY TABLE

Seen in the amplitude analysis of the $3\pi^0$ system produced in $\bar{p}p \rightarrow 4\pi^0$. Possibly seen in the study of the hadronic structure in decay $\tau \rightarrow 3\pi\nu_\tau$ (ABREU 98G and ASNER 00). Needs confirmation.

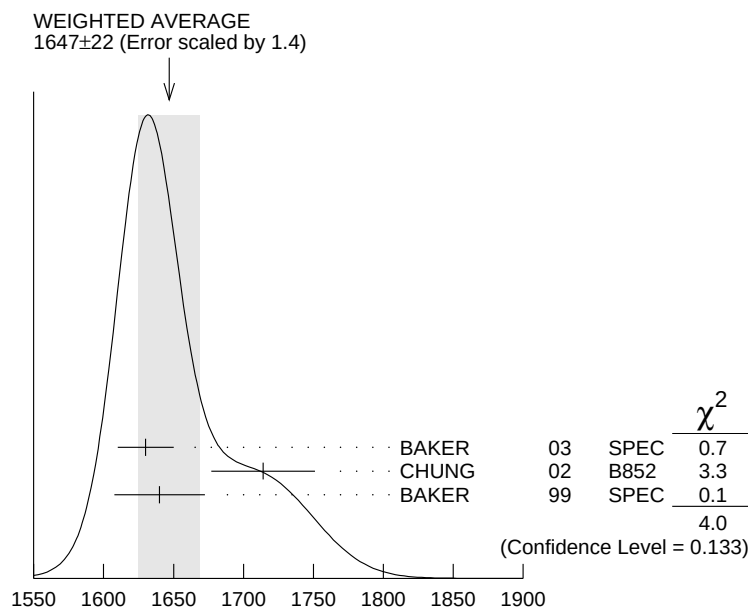
NODE=M161

 $a_1(1640)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1647±22 OUR AVERAGE		Error includes scale factor of 1.4. See the ideogram below.		
1630±20	35280	¹ 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 $\pi^- A \rightarrow \pi^- \pi^+ \pi^- A$

NODE=M161M

NODE=M161M



$a_1(1640)$ mass (MeV)

¹ Using the $a_1(1260)$ mass and width results of BOWLER 88.

NODE=M161M;LINKAGE=KB

 $a_1(1640)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
254± 27 OUR AVERAGE		Error includes scale factor of 1.1.		
225± 30	35280	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 $\pi^- A \rightarrow \pi^- \pi^+ \pi^- A$

NODE=M161W

NODE=M161W

² Using the $a_1(1260)$ mass and width results of BOWLER 88.

NODE=M161W;LINKAGE=KB

$a_1(1640)$ DECAY MODES

NODE=M161215;NODE=M161

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \pi\pi\pi$	seen
$\Gamma_2 \quad f_2(1270)\pi$	seen
$\Gamma_3 \quad \sigma\pi$	seen
$\Gamma_4 \quad \rho\pi S\text{-wave}$	seen
$\Gamma_5 \quad \rho\pi D\text{-wave}$	seen
$\Gamma_6 \quad \omega\pi\pi$	seen
$\Gamma_7 \quad f_1(1285)\pi$	seen
$\Gamma_8 \quad a_1(1260)\eta$	not seen

DESIG=3;OUR EST;→ UNCHECKED ←
 DESIG=1;OUR EST;→ UNCHECKED ←
 DESIG=2;OUR EST;→ UNCHECKED ←
 DESIG=7;OUR EST;→ UNCHECKED ←
 DESIG=4;OUR EST;→ UNCHECKED ←
 DESIG=5;OUR EST;→ UNCHECKED ←
 DESIG=6;OUR EST;→ UNCHECKED ←
 DESIG=8

$a_1(1640)$ BRANCHING RATIOS

NODE=M161220

$\Gamma(f_2(1270)\pi)/\Gamma(\sigma\pi)$ Γ_2/Γ_3

VALUE DOCUMENT ID TECN COMMENT

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

0.24 ± 0.07 BAKER 99 SPEC $1.94 \bar{p}p \rightarrow 4\pi^0$

$\Gamma(\rho\pi D\text{-wave})/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE DOCUMENT ID TECN COMMENT

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

seen CHUNG 02 B852 $18.3 \pi^- p \rightarrow \pi^+ \pi^- \pi^- p$

seen AMELIN 95B VES $36 \pi^- A \rightarrow \pi^+ \pi^- \pi^- A$

NODE=M161R2
 NODE=M161R2

$\Gamma(\omega\pi\pi)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE EVTS DOCUMENT ID TECN COMMENT

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

seen 35280 ³ BAKER 03 SPEC $\bar{p}p \rightarrow \omega\pi^+ \pi^- \pi^0$

NODE=M161R3
 NODE=M161R3

$\Gamma(f_1(1285)\pi)/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE DOCUMENT ID TECN COMMENT

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

not seen KUHN 04 B852 $18 \pi^- p \rightarrow \eta\pi^+ \pi^- \pi^- p$

seen LEE 94 MPS2 $18 \pi^- p \rightarrow K^+ \bar{K}^0 \pi^- \pi^- p$

NODE=M161R4
 NODE=M161R4

$\Gamma(a_1(1260)\eta)/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE DOCUMENT ID TECN COMMENT

not seen KUHN 04 B852 $18 \pi^- p \rightarrow \eta\pi^+ \pi^- \pi^- p$

NODE=M161R5
 NODE=M161R5

³ Assuming the $\omega\rho$ mechanism for the $\omega\pi\pi$ state.

NODE=M161R;LINKAGE=KB

$a_1(1640)$ REFERENCES

NODE=M161

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.				

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

NODE=M117M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
1639± 6 OUR AVERAGE	Error includes scale factor of 1.2.		
1620±16	BUGG	95	MRK3 $J/\psi \rightarrow \gamma \pi^+ \pi^- \pi^+ \pi^-$
1647± 7	ADAMO	92	OBLX $\bar{n} p \rightarrow 3 \pi^+ 2 \pi^-$
1635± 7	ALDE	90	GAM2 $38 \pi^- p \rightarrow \omega \omega n$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
1640± 5	AMSLER	06	CBAR $0.9 \bar{p} p \rightarrow K^+ K^- \pi^0$
1659± 6	VLADIMIRSK...	06	SPEC $40 \pi^- p \rightarrow K_S^0 K_S^0 n$
1643± 7	¹ ALDE	89B	GAM2 $38 \pi^- p \rightarrow \omega \omega n$
¹ Superseded by ALDE 90.			

NODE=M117M;LINKAGE=BB

$f_2(1640)$ WIDTH

NODE=M117W

NODE=M117W

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 $38 \pi^- p \rightarrow \omega \omega n$

$f_2(1640)$ DECAY MODES

NODE=M117215;NODE=M117

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \omega \omega$	seen
$\Gamma_2 \quad 4 \pi$	seen
$\Gamma_3 \quad K \bar{K}$	seen

DESIG=1;OUR EST;→ UNCHECKED ←
DESIG=2;OUR EST;→ UNCHECKED ←
DESIG=3

$f_2(1640)$ BRANCHING RATIOS

NODE=M117220

NODE=M117R2
NODE=M117R2

$\Gamma(K\bar{K})/\Gamma_{\text{total}}$	DOCUMENT ID	TECN	COMMENT	Γ_3/Γ
seen	AMSLER	06	CBAR $0.9 \bar{p} p \rightarrow K^+ K^- \pi^0$	

$f_2(1640)$ REFERENCES

NODE=M117

REFID=51136
REFID=51191

REFID=44438
REFID=42177
REFID=40935
REFID=40735

AMSLER	06	PL B639 165	C. Amsler <i>et al.</i>	(CBAR Collab.)
VLADIMIRSK...	06	PAN 69 493	V.V. Vladimirsky <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

$\eta_2(1645)$

$$I^G(J^{PC}) = 0^+(2^-+)$$

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

$\omega(1650)$

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

NODE=M126

 $\omega(1650)$ MASS

NODE=M126M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

1670± 30 OUR ESTIMATE

NODE=M126M

→ UNCHECKED ←

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

1667± 13± 6		AUBERT	07AU BABR	10.6 e ⁺ e ⁻ → ωπ ⁺ π ⁻ γ
1645± 8	13	AUBERT	06D BABR	10.6 e ⁺ e ⁻ → ωηγ
1660± 10± 2		AUBERT,B	04N BABR	10.6 e ⁺ e ⁻ → π ⁺ π ⁻ π ⁰ γ
1770± 50±60	1.2M	¹ ACHASOV	03D RVUE	0.44-2.00 e ⁺ e ⁻ → π ⁺ π ⁻ π ⁰
1619± 5		² HENNER	02 RVUE	1.2-2.0 e ⁺ e ⁻ → ρπ,
				ωππ
1700± 20		EUGENIO	01 SPEC	18 π ⁻ p → ωηη
1705± 26	612	³ AKHMETSHIN	00D CMD2	e ⁺ e ⁻ → ωπ ⁺ π ⁻
1820 ⁺¹⁹⁰ ₋₁₅₀		⁴ ACHASOV	98H RVUE	e ⁺ e ⁻ → π ⁺ π ⁻ π ⁰
1840 ⁺¹⁰⁰ ₋₇₀		⁵ ACHASOV	98H RVUE	e ⁺ e ⁻ → ωπ ⁺ π ⁻
1780 ⁺¹⁷⁰ ₋₃₀₀		⁶ ACHASOV	98H RVUE	e ⁺ e ⁻ → K ⁺ K ⁻
~ 2100		⁷ ACHASOV	98H RVUE	e ⁺ e ⁻ → K _S ⁰ K [±] π [∓]
1606± 9		⁸ CLEGG	94 RVUE	
1662± 13	750	⁹ ANTONELLI	92 DM2	1.34-2.4e ⁺ e ⁻ → ρπ,
				ωππ
1670± 20		ATKINSON	83B OMEG	20-70 γp → 3πX
1657± 13		CORDIER	81 DM1	e ⁺ e ⁻ → ω2π
1679± 34	21	ESPOSITO	80 FRAM	e ⁺ e ⁻ → 3π
1652± 17		COSME	79 OSPK	e ⁺ e ⁻ → 3π

OCCUR=2

OCCUR=2

OCCUR=3

OCCUR=4

OCCUR=5

OCCUR=4

¹ From the combined fit of ANTONELLI 92, ACHASOV 01E, ACHASOV 02E, and ACHASOV 03D data on the π⁺π⁻π⁰ and ANTONELLI 92 on the ωπ⁺π⁻ final states. Supersedes ACHASOV 99E and ACHASOV 02E.

NODE=M126M;LINKAGE=VH

² Using results of CORDIER 81 and preliminary data of DOLINSKY 91 and ANTONELLI 92.

NODE=M126M;LINKAGE=AB

³ Using the data of AKHMETSHIN 00D and ANTONELLI 92. The ρπ dominance for the energy dependence of the ω(1420) and ω(1650) width assumed.

NODE=M126M;LINKAGE=KI

⁴ Using data from BARKOV 87, DOLINSKY 91, and ANTONELLI 92.

NODE=M126M;LINKAGE=L1

⁵ Using the data from ANTONELLI 92.

NODE=M126M;LINKAGE=L2

⁶ Using the data from IVANOV 81 and BISELLO 88B.

NODE=M126M;LINKAGE=L3

⁷ Using the data from BISELLO 91C.

NODE=M126M;LINKAGE=L4

⁸ From a fit to two Breit-Wigner functions and using the data of DOLINSKY 91 and ANTONELLI 92.

NODE=M126M;LINKAGE=AD

⁹ From the combined fit of the ρπ and ωππ final states.

NODE=M126M;LINKAGE=AE

 $\omega(1650)$ WIDTH

NODE=M126W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

315± 35 OUR ESTIMATE

NODE=M126W

→ UNCHECKED ←

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

222± 25± 20		AUBERT	07AU BABR	10.6 e ⁺ e ⁻ → ωπ ⁺ π ⁻ γ
114± 14	13	AUBERT	06D BABR	10.6 e ⁺ e ⁻ → ωηγ
230± 30± 20		AUBERT,B	04N BABR	10.6 e ⁺ e ⁻ → π ⁺ π ⁻ π ⁰ γ
490 ⁺²⁰⁰ ₋₁₅₀ ±130	1.2M	¹⁰ ACHASOV	03D RVUE	0.44-2.00 e ⁺ e ⁻ → π ⁺ π ⁻ π ⁰
250± 14		¹¹ HENNER	02 RVUE	1.2-2.0 e ⁺ e ⁻ → ρπ, ωππ
250± 50		EUGENIO	01 SPEC	18 π ⁻ p → ωηη
370± 25	612	¹² AKHMETSHIN	00D CMD2	e ⁺ e ⁻ → ωπ ⁺ π ⁻
113± 20		¹³ CLEGG	94 RVUE	
280± 24	750	¹⁴ ANTONELLI	92 DM2	1.34-2.4e ⁺ e ⁻ → ρπ, ωππ
160± 20		ATKINSON	83B OMEG	20-70 γp → 3πX
136± 46		CORDIER	81 DM1	e ⁺ e ⁻ → ω2π
99± 49	21	ESPOSITO	80 FRAM	e ⁺ e ⁻ → 3π
42± 17		COSME	79 OSPK	e ⁺ e ⁻ → 3π

OCCUR=2

OCCUR=5

OCCUR=4

- ¹⁰ 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.
- ¹¹ Using results of CORDIER 81 and preliminary data of DOLINSKY 91 and ANTONELLI 92.
- ¹² 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.
- ¹³ From a fit to two Breit-Wigner functions and using the data of DOLINSKY 91 and ANTONELLI 92.
- ¹⁴ From the combined fit of the $\rho\pi$ and $\omega\pi\pi$ final states.

NODE=M126W;LINKAGE=VH

NODE=M126W;LINKAGE=AB

NODE=M126W;LINKAGE=KI

NODE=M126W;LINKAGE=AD

NODE=M126W;LINKAGE=AE

NODE=M126215;NODE=M126

DESIG=1;OUR EST;→ UNCHECKED ←

DESIG=2;OUR EST;→ UNCHECKED ←

DESIG=4;OUR EST;→ UNCHECKED ←

DESIG=3;OUR EST;→ UNCHECKED ←

NODE=M126230

NODE=M126G3
NODE=M126G3NODE=M126G4
NODE=M126G4NODE=M126G5
NODE=M126G5NODE=M126G;LINKAGE=AW
NODE=M126G;LINKAGE=VH

NODE=M126G;LINKAGE=AD

NODE=M126G;LINKAGE=SE
NODE=M126G;LINKAGE=AE
NODE=M126G;LINKAGE=ES
NODE=M126G;LINKAGE=KL

NODE=M126G5;LINKAGE=KH

NODE=M126225

NODE=M126R2
NODE=M126R2 **$\omega(1650)$ DECAY MODES**

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

 $\omega(1650) \Gamma(i)\Gamma(e^+e^-)/\Gamma^2(\text{total})$

$$\Gamma(\rho\pi)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_1/\Gamma \times \Gamma_4/\Gamma$$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
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	15,16	ACHASOV	03D RVUE	0.44–2.00 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
0.921 ± 0.230	17,18	CLEGG	94 RVUE	
0.479 ± 0.050	750 19,20	ANTONELLI	92 DM2	1.34–2.4 $e^+e^- \rightarrow \rho\pi, \omega\pi\pi$

$$\Gamma(\omega\pi\pi)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_2/\Gamma \times \Gamma_4/\Gamma$$

VALUE (units 10^{-7})	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
7.0 ± 0.5		AUBERT	07AU BABR	10.6 $e^+e^- \rightarrow \omega\pi^+\pi^-\gamma$
4.1 ± 0.9 ± 1.3 1.2M	15,16	ACHASOV	03D RVUE	0.44–2.00 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
5.40 ± 0.95	21	AKHMETSHIN 00D	CMD2	1.2–1.38 $e^+e^- \rightarrow \omega\pi^+\pi^-$
3.18 ± 0.80	17,18	CLEGG	94 RVUE	
6.07 ± 0.61	750 19,20	ANTONELLI	92 DM2	1.34–2.4 $e^+e^- \rightarrow \rho\pi, \omega\pi\pi$

$$\Gamma(\omega\eta)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_3/\Gamma \times \Gamma_4/\Gamma$$

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.57 ± 0.06		13	AUBERT	06D BABR	10.6 $e^+e^- \rightarrow \omega\eta\gamma$
<6		90	22 AKHMETSHIN 03B	CMD2	$e^+e^- \rightarrow \eta\pi^0\gamma$

¹⁵ Calculated by us from the cross section at the peak.¹⁶ 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.¹⁷ From a fit to two Breit-Wigner functions and using the data of DOLINSKY 91 and ANTONELLI 92.¹⁸ From the partial and leptonic width given by the authors.¹⁹ From the combined fit of the $\rho\pi$ and $\omega\pi\pi$ final states.²⁰ From the product of the leptonic width and partial branching ratio given by the authors.²¹ 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.²² $\omega(1650)$ mass and width fixed at 1700 MeV and 250 MeV, respectively. **$\omega(1650)$ BRANCHING RATIOS**

$$\Gamma(\omega\pi\pi)/\Gamma_{\text{total}} \quad \Gamma_2/\Gamma$$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
~ 0.35	1.2M	23 ACHASOV	03D RVUE	0.44–2.00 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
0.620 ± 0.014		24 HENNER	02 RVUE	1.2–2.0 $e^+e^- \rightarrow \rho\pi, \omega\pi\pi$

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

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT

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

~ 0.65	1.2M	²³ ACHASOV	03D	RVUE $0.44\text{--}2.00 e^+e^- \rightarrow \pi^+\pi^-\pi^0$
0.380 ± 0.014		²⁴ HENNER	02	RVUE $1.2\text{--}2.0 e^+e^- \rightarrow \rho\pi, \omega\pi\pi$

NODE=M126R3
 NODE=M126R3

 $\Gamma(e^+e^-)/\Gamma_{\text{total}}$ Γ_4/Γ

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

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

~ 18	1.2M	^{24,25} ACHASOV	03D	RVUE $0.44\text{--}2.00 e^+e^- \rightarrow \pi^+\pi^-\pi^0$
32 ± 1		²⁴ HENNER	02	RVUE $1.2\text{--}2.0 e^+e^- \rightarrow \rho\pi, \omega\pi\pi$

NODE=M126R4
 NODE=M126R4

²³ 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.

NODE=M126R;LINKAGE=VH

²⁴ Assuming that the $\omega(1650)$ decays into $\rho\pi$ and $\omega\pi\pi$ only.

NODE=M126R;LINKAGE=AC
 NODE=M126R;LINKAGE=AW

²⁵ Calculated by us from the cross section at the peak.

 $\omega(1650)$ REFERENCES

NODE=M126

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)
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)

REFID=52049
 REFID=51047
 REFID=50184
 REFID=49577
 REFID=49406
 REFID=48815
 REFID=49177
 REFID=48311
 REFID=48010
 REFID=47935
 REFID=47391
 REFID=46323
 REFID=44081
 REFID=43168
 REFID=41867
 REFID=41369
 REFID=40581
 REFID=40280
 REFID=21502
 REFID=21586
 REFID=20553
 REFID=21584
 REFID=21475

$\omega_3(1670)$

$$I^G(J^{PC}) = 0^-(3^{--})$$

NODE=M045

 $\omega_3(1670)$ MASS

NODE=M045M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1667 ± 4 OUR AVERAGE				
1665.3 ± 5.2 ± 4.5	23400	AMELIN	96 VES	$36 \pi^- p \rightarrow \pi^+ \pi^- \pi^0 n$
1685 ± 20	60	BAUBILLIER	79 HBC	8.2 $K^- p$ backward
1673 ± 12	430	^{1,2} BALTAY	78E HBC	$15 \pi^+ p \rightarrow \Delta 3\pi$
1650 ± 12		CORDEN	78B OMEG	$8-12 \pi^- p \rightarrow N 3\pi$
1669 ± 11	600	² WAGNER	75 HBC	$7 \pi^+ p \rightarrow \Delta^{++} 3\pi$
1678 ± 14	500	DIAZ	74 DBC	$6 \pi^+ n \rightarrow p 3\pi^0$
1660 ± 13	200	DIAZ	74 DBC	$6 \pi^+ n \rightarrow p \omega \pi^0 \pi^0$
1679 ± 17	200	MATTHEWS	71D DBC	$7.0 \pi^+ n \rightarrow p 3\pi^0$
1670 ± 20		KENYON	69 DBC	$8 \pi^+ n \rightarrow p 3\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
~ 1700	110	¹ CERRADA	77B HBC	$4.2 K^- p \rightarrow \Lambda 3\pi$
1695 ± 20		BARNES	69B HBC	$4.6 K^- p \rightarrow \omega 2\pi X$
1636 ± 20		ARMENISE	68B DBC	$5.1 \pi^+ n \rightarrow p 3\pi^0$
¹ Phase rotation seen for $J^P = 3^- \rho\pi$ wave.				
² From a fit to $I(J^P) = 0(3^-) \rho\pi$ partial wave.				

NODE=M045M

OCCUR=2

NODE=M045M;LINKAGE=E
NODE=M045M;LINKAGE=P $\omega_3(1670)$ WIDTH

NODE=M045W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
168 ± 10 OUR AVERAGE				
149 ± 19 ± 7	23400	AMELIN	96 VES	$36 \pi^- p \rightarrow \pi^+ \pi^- \pi^0 n$
160 ± 80	60	³ BAUBILLIER	79 HBC	8.2 $K^- p$ backward
173 ± 16	430	^{4,5} BALTAY	78E HBC	$15 \pi^+ p \rightarrow \Delta 3\pi$
253 ± 39		CORDEN	78B OMEG	$8-12 \pi^- p \rightarrow N 3\pi$
173 ± 28	600	^{3,5} WAGNER	75 HBC	$7 \pi^+ p \rightarrow \Delta^{++} 3\pi$
167 ± 40	500	DIAZ	74 DBC	$6 \pi^+ n \rightarrow p 3\pi^0$
122 ± 39	200	DIAZ	74 DBC	$6 \pi^+ n \rightarrow p \omega \pi^0 \pi^0$
155 ± 40	200	³ MATTHEWS	71D DBC	$7.0 \pi^+ n \rightarrow p 3\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
90 ± 20		BARNES	69B HBC	$4.6 K^- p \rightarrow \omega 2\pi$
100 ± 40		KENYON	69 DBC	$8 \pi^+ n \rightarrow p 3\pi^0$
112 ± 60		ARMENISE	68B DBC	$5.1 \pi^+ n \rightarrow p 3\pi^0$
³ Width errors enlarged by us to $4\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.				
⁴ Phase rotation seen for $J^P = 3^- \rho\pi$ wave.				
⁵ From a fit to $I(J^P) = 0(3^-) \rho\pi$ partial wave.				

NODE=M045W

OCCUR=2

NODE=M045W;LINKAGE=S
NODE=M045W;LINKAGE=E
NODE=M045W;LINKAGE=P $\omega_3(1670)$ DECAY MODES

NODE=M045215;NODE=M045

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \rho\pi$	seen
$\Gamma_2 \quad \omega\pi\pi$	seen
$\Gamma_3 \quad b_1(1235)\pi$	possibly seen

DESIG=1;OUR EST;→ UNCHECKED ←
DESIG=2;OUR EST;→ UNCHECKED ←
DESIG=3;OUR EST;→ UNCHECKED ← $\omega_3(1670)$ BRANCHING RATIOS

NODE=M045220

$\Gamma(\omega\pi\pi)/\Gamma(\rho\pi)$					Γ_2/Γ_1
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.71 ± 0.27	100	DIAZ	74 DBC	$6 \pi^+ n \rightarrow p 5\pi^0$	
$\Gamma(b_1(1235)\pi)/\Gamma(\rho\pi)$					Γ_3/Γ_1
VALUE		DOCUMENT ID	TECN	COMMENT	
possibly seen		DIAZ	74 DBC	$6 \pi^+ n \rightarrow p 5\pi^0$	

NODE=M045R3
NODE=M045R3NODE=M045R4
NODE=M045R4

$\Gamma(b_1(1235)\pi)/\Gamma(\omega\pi\pi)$ Γ_3/Γ_2

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

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

>0.75	68	BAUBILLIER	79	HBC	8.2 $K^- p$ backward

NODE=M045R5
NODE=M045R5

 $\omega_3(1670)$ REFERENCES

AMELIN	96	ZPHY C70 71	D.V. Amelin <i>et al.</i>	(SERP, TBIL)
BAUBILLIER	79	PL 89B 131	M. Baubillier <i>et al.</i>	(BIRM, CERN, GLAS+)
BALTAY	78E	PRL 40 87	C. Baltay, C.V. Cautis, M. Kalelkar	(COLU) JP
CORDEN	78B	NP B138 235	M.J. Corden <i>et al.</i>	(BIRM, RHEL, TELA+)
CERRADA	77B	NP B126 241	M. Cerrada <i>et al.</i>	(AMST, CERN, NIJM+) JP
WAGNER	75	PL 58B 201	F. Wagner, M. Tabak, D.M. Chew	(LBL) JP
DIAZ	74	PRL 32 260	J. Diaz <i>et al.</i>	(CASE, CMU)
MATTHEWS	71D	PR D3 2561	J.A.J. Matthews <i>et al.</i>	(TNTD, WISC)
BARNES	69B	PRL 23 142	V.E. Barnes <i>et al.</i>	(BNL)
KENYON	69	PRL 23 146	I.R. Kenyon <i>et al.</i>	(BNL, UCND, ORNL)
ARMENISE	68B	PL 26B 336	N. Armenise <i>et al.</i>	(BARI, BGNA, FIRZ+)

NODE=M045

REFID=44649
REFID=21522
REFID=21520
REFID=21269
REFID=20537
REFID=20843
REFID=21248
REFID=21515
REFID=21512
REFID=20800
REFID=20783

NODE=M034

 $\pi_2(1670)$

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

 $\pi_2(1670)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

1672.2 ± 3.0 OUR AVERAGE Error includes scale factor of 1.4. See the ideogram below.

1658 ± 3	$^{+24}_{-8}$	420k	ALEKSEEV	10	COMP	190 $\pi^- Pb \rightarrow \pi^- \pi^- \pi^+ Pb'$
1749 ± 10	± 100	145k	LU	05	B852	18 $\pi^- p \rightarrow \omega \pi^- \pi^0 p$
1676 ± 3	± 8		¹ CHUNG	02	B852	18.3 $\pi^- p \rightarrow \pi^+ \pi^- \pi^- p$
1685 ± 10	± 30		² BARBERIS	01		450 $pp \rightarrow p_f 3\pi^0 p_s$
1687 ± 9	± 15		AMELIN	99	VES	37 $\pi^- A \rightarrow \omega \pi^- \pi^0 A^*$
1669 ± 4			BARBERIS	98B		450 $pp \rightarrow p_f \rho \pi p_s$
1670 ± 4			BARBERIS	98B		450 $pp \rightarrow p_f f_2(1270) \pi p_s$
1730 ± 20			³ AMELIN	95B	VES	36 $\pi^- A \rightarrow \pi^+ \pi^- \pi^- A$
1690 ± 14			⁴ BERDNIKOV	94	VES	37 $\pi^- A \rightarrow K^+ K^- \pi^- A$
1710 ± 20	700		ANTIPOV	87	SIGM	50 $\pi^- Cu \rightarrow \mu^+ \mu^- \pi^- Cu$
1676 ± 6			⁴ EVANGELIS...	81	OMEG	12 $\pi^- p \rightarrow 3\pi p$
1657 ± 14			^{4,5} DAUM	80D	SPEC	63-94 $\pi p \rightarrow 3\pi X$
1662 ± 10	2000		⁴ BALTAY	77	HBC	15 $\pi^+ p \rightarrow p 3\pi$

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

1742 ± 31	± 49		ANTREASYAN	90	CBAL	$e^+ e^- \rightarrow e^+ e^- \pi^0 \pi^0 \pi^0$
1624 ± 21			¹ BELLINI	85	SPEC	40 $\pi^- A \rightarrow \pi^- \pi^+ \pi^- A$
1622 ± 35			⁶ BELLINI	85	SPEC	40 $\pi^- A \rightarrow \pi^- \pi^+ \pi^- A$
1693 ± 28			⁷ BELLINI	85	SPEC	40 $\pi^- A \rightarrow \pi^- \pi^+ \pi^- A$
1710 ± 20			⁸ DAUM	81B	SPEC	63,94 $\pi^- p$
1660 ± 10			⁴ ASCOLI	73	HBC	5-25 $\pi^- p \rightarrow p \pi_2$

¹ From $f_2(1270)\pi$ decay.

² From a fit to the invariant mass distribution.

³ From a fit to $J^{PC} = 2^-+ f_2(1270)\pi, f_0(1370)\pi$ waves.

⁴ From a fit to $J^P = 2^- S$ -wave $f_2(1270)\pi$ partial wave.

⁵ 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.

⁶ From $\rho\pi$ decay.

⁷ From $\sigma\pi$ decay.

⁸ From a two-resonance fit to four $2^- 0^+$ waves. This should not be averaged with all the single resonance fits.

NODE=M034M

NODE=M034M

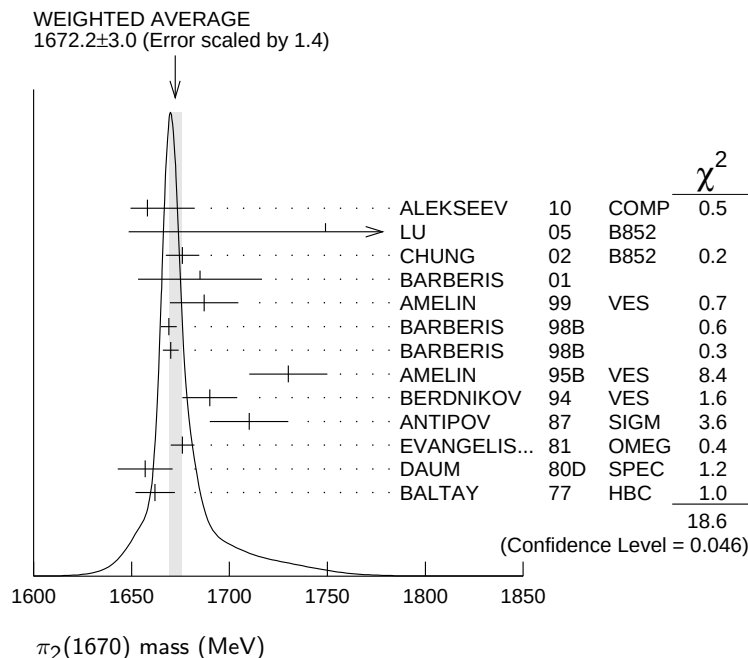
OCCUR=2

OCCUR=2

OCCUR=3

NODE=M034M;LINKAGE=F2
NODE=M034M;LINKAGE=BR
NODE=M034M;LINKAGE=AX
NODE=M034M;LINKAGE=P
NODE=M034M;LINKAGE=D

NODE=M034M;LINKAGE=R2
NODE=M034M;LINKAGE=S2
NODE=M034M;LINKAGE=L



$\pi_2(1670)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
260± 9 OUR AVERAGE		Error includes scale factor of 1.2.			
271± 9 ⁺ ₂₄	420k	ALEKSEEV	10	COMP	190 $\pi^- Pb \rightarrow \pi^- \pi^- \pi^+ Pb'$
408± 60±250	145k	LU	05	B852	18 $\pi^- p \rightarrow \omega \pi^- \pi^0 p$
254± 3± 31		⁹ CHUNG	02	B852	18.3 $\pi^- p \rightarrow \pi^+ \pi^- \pi^- p$
265± 30± 40		¹⁰ BARBERIS	01		450 $pp \rightarrow p_f 3\pi^0 p_s$
168± 43± 53		AMELIN	99	VES	37 $\pi^- A \rightarrow \omega \pi^- \pi^0 A^*$
268± 15		BARBERIS	98B		450 $pp \rightarrow p_f \rho \pi p_s$
256± 15		BARBERIS	98B		450 $pp \rightarrow p_f f_2(1270) \pi p_s$
310± 20		¹¹ AMELIN	95B	VES	36 $\pi^- A \rightarrow \pi^+ \pi^- \pi^- A$
190± 50		¹² BERDNIKOV	94	VES	37 $\pi^- A \rightarrow K^+ K^- \pi^- A$
170± 80	700	ANTIPOV	87	SIGM	50 $\pi^- Cu \rightarrow \mu^+ \mu^- \pi^- Cu$
260± 20		¹² EVANGELIS...	81	OMEG	12 $\pi^- p \rightarrow 3\pi p$
219± 20		^{12,13} DAUM	80D	SPEC	63-94 $\pi p \rightarrow 3\pi X$
285± 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. ● ● ●					
236± 49± 36		ANTREASYAN	90	CBAL	$e^+ e^- \rightarrow e^+ e^- \pi^0 \pi^0 \pi^0$
304± 22		⁹ BELLINI	85	SPEC	40 $\pi^- A \rightarrow \pi^- \pi^+ \pi^- A$
404±108		¹⁴ BELLINI	85	SPEC	40 $\pi^- A \rightarrow \pi^- \pi^+ \pi^- A$
330± 90		¹⁵ BELLINI	85	SPEC	40 $\pi^- A \rightarrow \pi^- \pi^+ \pi^- A$
312± 50		¹⁶ DAUM	81B	SPEC	63,94 $\pi^- p$
270± 60		¹² ASCOLI	73	HBC	5-25 $\pi^- p \rightarrow p \pi_2$

⁹ From $f_2(1270)\pi$ decay.

¹⁰ From a fit to the invariant mass distribution.

¹¹ From a fit to $J^{PC} = 2^- + f_2(1270)\pi, f_0(1370)\pi$ waves.

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 From $\rho\pi$ decay.

¹⁵ From $\sigma\pi$ decay.

¹⁶ From a two-resonance fit to four $2^- 0^+$ waves. This should not be averaged with all the single resonance fits.

NODE=M034W

NODE=M034W

OCCUR=2

OCCUR=2

OCCUR=3

NODE=M034W;LINKAGE=F2
 NODE=M034W;LINKAGE=BR
 NODE=M034W;LINKAGE=AX
 NODE=M034W;LINKAGE=P
 NODE=M034W;LINKAGE=D

NODE=M034W;LINKAGE=R2
 NODE=M034W;LINKAGE=S2
 NODE=M034W;LINKAGE=L

$\pi_2(1670)$ DECAY MODES

NODE=M034215;NODE=M034

	Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1	3π	$(95.8 \pm 1.4) \%$	
Γ_2	$\pi^+ \pi^- \pi^0$		
Γ_3	$\pi^0 \pi^0 \pi^0$		
Γ_4	$f_2(1270)\pi$	$(56.3 \pm 3.2) \%$	
Γ_5	$\rho\pi$	$(31 \pm 4) \%$	
Γ_6	$\sigma\pi$	$(10.9 \pm 3.4) \%$	
Γ_7	$(\pi\pi)_{S\text{-wave}}$	$(8.7 \pm 3.4) \%$	
Γ_8	$K\bar{K}^*(892) + \text{c.c.}$	$(4.2 \pm 1.4) \%$	
Γ_9	$\omega\rho$	$(2.7 \pm 1.1) \%$	
Γ_{10}	$\gamma\gamma$	$< 2.8 \times 10^{-7}$	90%
Γ_{11}	$\eta\pi$		
Γ_{12}	$\pi^\pm 2\pi^+ 2\pi^-$		
Γ_{13}	$\rho(1450)\pi$	$< 3.6 \times 10^{-3}$	97.7%
Γ_{14}	$b_1(1235)\pi$	$< 1.9 \times 10^{-3}$	97.7%
Γ_{15}	$\eta 3\pi$		
Γ_{16}	$f_1(1285)\pi$	possibly seen	
Γ_{17}	$a_2(1320)\pi$	not seen	

DESIG=20
DESIG=22
DESIG=23
DESIG=8
DESIG=2
DESIG=13
DESIG=11
DESIG=5
DESIG=14
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_8	-8	-21	-9
	x_4	x_5	x_7

 $\pi_2(1670)$ PARTIAL WIDTHS

NODE=M034217

$\Gamma(\gamma\gamma)$					Γ_{10}
VALUE (keV)	CL%	DOCUMENT ID	TECN	CHG	COMMENT
<0.072	90	17 ACCIARRI	97T L3		$e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.19	90	17 ALBRECHT	97B ARG		$e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
1.41 $\pm 0.23 \pm 0.28$		ANTREASYAN 90	CBAL 0		$e^+ e^- \rightarrow \pi^0 \pi^0 \pi^0$
0.8 $\pm 0.3 \pm 0.12$		18 BEHREND	90C CELL 0		$e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
1.3 $\pm 0.3 \pm 0.2$		19 BEHREND	90C CELL 0		$e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$

OCCUR=2

¹⁷Decaying into $f_2(1270)\pi$ and $\rho\pi$.

¹⁸Constructive interference between $f_2(1270)\pi, \rho\pi$ and background.

¹⁹Incoherent 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

$\Gamma(\pi^+ \pi^- \pi^0) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$					$\Gamma_2 \Gamma_{10}/\Gamma$
VALUE (keV)	CL%	DOCUMENT ID	TECN	COMMENT	
<0.1	95	²⁰ SCHEGELSKY 06	RVUE	$\gamma\gamma \rightarrow \pi^+ \pi^- \pi^0$	

²⁰From analysis of L3 data at 183–209 GeV.

NODE=M034G01
NODE=M034G01

NODE=M034G01;LINKAGE=SC

$\pi_2(1670)$ BRANCHING RATIOS

NODE=M034220

 $\Gamma(3\pi)/\Gamma_{\text{total}}$ $\Gamma_1/\Gamma = (\Gamma_4 + \Gamma_5 + \Gamma_7)/\Gamma$ NODE=M034R20
NODE=M034R20

VALUE

DOCUMENT ID

0.958±0.014 OUR FIT $\Gamma(\pi^0\pi^0\pi^0)/\Gamma(\pi^+\pi^-\pi^0)$ Γ_3/Γ_2 NODE=M034R21
NODE=M034R21

VALUE

DOCUMENT ID

COMMENT

0.29±0.03±0.05²¹ BARBERIS 01 450 $p p \rightarrow p_f 3\pi^0 p_s$ $\Gamma(\rho\pi)/0.565\Gamma(f_2(1270)\pi)$ $\Gamma_5/0.565\Gamma_4$

NODE=M034R16

(With $f_2(1270) \rightarrow \pi^+\pi^-$.)NODE=M034R16
NODE=M034R16

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 $p p \rightarrow p_f \pi^+\pi^-\pi^0 p_s$ $\Gamma(\sigma\pi)/\Gamma(f_2(1270)\pi)$ Γ_6/Γ_4 NODE=M034R15
NODE=M034R15

VALUE

DOCUMENT ID

TECN

COMMENT

0.19±0.06 OUR AVERAGE

0.17±0.02±0.07

CHUNG

02

B852

18.3 $\pi^- p \rightarrow \pi^+\pi^-\pi^- p$

0.24±0.10

22,23 BAKER

99

SPEC

1.94 $\bar{p} p \rightarrow 4\pi^0$ $\frac{1}{2}\Gamma(\rho\pi)/\Gamma(\pi^\pm\pi^+\pi^-)$ $\frac{1}{2}\Gamma_5/(0.565\Gamma_4 + \frac{1}{2}\Gamma_5 + 0.624\Gamma_7)$ NODE=M034R2
NODE=M034R2

VALUE

DOCUMENT ID

TECN

CHG

COMMENT

0.29±0.04 OUR FIT**0.29±0.05**²⁴ 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 $\pi^+ p \rightarrow 3\pi p$ $0.565\Gamma(f_2(1270)\pi)/\Gamma(\pi^\pm\pi^+\pi^-)$ $0.565\Gamma_4/(0.565\Gamma_4 + \frac{1}{2}\Gamma_5 + 0.624\Gamma_7)$

NODE=M034R3

(With $f_2(1270) \rightarrow \pi^+\pi^-$.)NODE=M034R3
NODE=M034R3

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

²⁴ DAUM

81B

SPEC

63,94 $\pi^- p$

0.76 +0.24

ARMENISE

69

DBC

+

5.1 $\pi^+ d \rightarrow d 3\pi$

-0.34

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 $\pi^+ p \rightarrow 3\pi p$ $0.624\Gamma((\pi\pi)_{S\text{-wave}})/\Gamma(\pi^\pm\pi^+\pi^-)$ $0.624\Gamma_7/(0.565\Gamma_4 + \frac{1}{2}\Gamma_5 + 0.624\Gamma_7)$

NODE=M034R11

(With $(\pi\pi)_{S\text{-wave}} \rightarrow \pi^+\pi^-$.)NODE=M034R11
NODE=M034R11

VALUE

DOCUMENT ID

TECN

COMMENT

0.10±0.04 OUR FIT**0.10±0.05**²⁴ DAUM

81B

SPEC

63,94 $\pi^- p$ $\Gamma(K\bar{K}^*(892)+c.c.)/\Gamma(f_2(1270)\pi)$ Γ_8/Γ_4 NODE=M034R13
NODE=M034R13

VALUE

DOCUMENT ID

TECN

CHG

COMMENT

0.075±0.025 OUR FIT**0.075±0.025**²⁵ ARMSTRONG

82B

OMEG

-

16 $\pi^- p \rightarrow K^+ K^- \pi^- p$ $\Gamma(\omega\rho)/\Gamma_{\text{total}}$ Γ_9/Γ NODE=M034R17
NODE=M034R17

VALUE

DOCUMENT ID

TECN

COMMENT

0.027±0.004±0.010²⁶ AMELIN

99

VES

37 $\pi^- A \rightarrow \omega \pi^- \pi^0 A^*$ $\Gamma(\eta\pi)/\Gamma(\pi^\pm\pi^+\pi^-)$ $\Gamma_{11}/(0.565\Gamma_4 + \frac{1}{2}\Gamma_5 + 0.624\Gamma_7)$

NODE=M034R5

(All η decays.)NODE=M034R5
NODE=M034R5

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 $\pi^- p \rightarrow f_2 \pi^- N$

$$\Gamma(\pi^{\pm}2\pi^{+}2\pi^{-})/\Gamma(\pi^{\pm}\pi^{+}\pi^{-})$$

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
<0.10	CRENNELL	70	HBC	— $6\pi^{-}p \rightarrow f_2\pi^{-}N$
<0.1	BALTAY	68	HBC	+ $7,8.5\pi^{+}p$

NODE=M034R6
NODE=M034R6;CHECK LIMITS

$$\Gamma(\rho(1450)\pi)/\Gamma_{\text{total}}$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.0036	97.7	AMELIN	99	VES $37\pi^{-}A \rightarrow \omega\pi^{-}\pi^0A^{*}$

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

NODE=M034R18
NODE=M034R18

$$\Gamma(b_1(1235)\pi)/\Gamma_{\text{total}}$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.0019	97.7	AMELIN	99	VES $37\pi^{-}A \rightarrow \omega\pi^{-}\pi^0A^{*}$

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

NODE=M034R19
NODE=M034R19

$$\Gamma(f_1(1285)\pi)/\Gamma_{\text{total}}$$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
possibly seen	69k	KUHN	04	B852 $18\pi^{-}p \rightarrow \eta\pi^{+}\pi^{-}\pi^{-}p$

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

NODE=M034R23
NODE=M034R23

$$\Gamma(a_2(1320)\pi)/\Gamma_{\text{total}}$$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
not seen	69k	KUHN	04	B852 $18\pi^{-}p \rightarrow \eta\pi^{+}\pi^{-}\pi^{-}p$

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

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	²² 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	²⁴ DAUM	81B	SPEC $63,94\pi^{-}p$

NODE=M034R14
NODE=M034R14

$$F\text{-wave}/P\text{-wave RATIO FOR } \pi_2(1670) \rightarrow \rho\pi$$

VALUE	DOCUMENT ID	TECN	COMMENT
$-0.72 \pm 0.07 \pm 0.14$	CHUNG	02	B852 $18.3\pi^{-}p \rightarrow \pi^{+}\pi^{-}\pi^{-}p$

NODE=M034R22
NODE=M034R22

²¹ Using BARBERIS 98B.

²² Using preliminary CBAR data.

²³ With the $\sigma\pi$ in $L=2$ and the $f_2(1270)\pi$ in $L=0$.

²⁴ From a two-resonance fit to four $2^{-}0^{+}$ waves.

²⁵ From a partial-wave analysis of $K^{+}K^{-}\pi^{-}$ system.

²⁶ Normalized to the $B(\pi_2(1670) \rightarrow f_2\pi)$.

NODE=M034R;LINKAGE=RB
NODE=M034R;LINKAGE=BK
NODE=M034R15;LINKAGE=A
NODE=M034R;LINKAGE=L
NODE=M034R13;LINKAGE=M
NODE=M034R;LINKAGE=DM

$\pi_2(1670)$ REFERENCES

ALEKSEEV	10	PRL 104 241803	M.G. Alekseev <i>et al.</i>	(COMPASS Collab.)
SCHEGELSKY	06	EPJ A27 199	V.A. Schegelsky <i>et al.</i>	
LU	05	PRL 94 032002	M. Lu <i>et al.</i>	(BNL E852 Collab.)
KUHN	04	PL B595 109	J. Kuhn <i>et al.</i>	(BNL E852 Collab.)
CHUNG	02	PR D65 072001	S.U. Chung <i>et al.</i>	(BNL E852 Collab.)
BARBERIS	01	PL B507 14	D. Barberis <i>et al.</i>	
AMELIN	99	PAN 62 445	D.V. Amelin <i>et al.</i>	(VES Collab.)
		Translated from YAF 62 487.		
BAKER	99	PL B449 114	C.A. Baker <i>et al.</i>	
BARBERIS	98B	PL B422 399	D. Barberis <i>et al.</i>	(WA 102 Collab.)
ACCIARRI	97T	PL B413 147	M. Acciarri <i>et al.</i>	(L3 Collab.)
ALBRECHT	97B	ZPHY C74 469	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
AMELIN	95B	PL B356 595	D.V. Amelin <i>et al.</i>	(SERP, TBIL)
BERDNIKOV	94	PL B337 219	E.B. Berdnikov <i>et al.</i>	(SERP, TBIL)
ANTREASYAN	90	ZPHY C48 561	D. Antreasyan <i>et al.</i>	(Crystal Ball Collab.)
BEHREND	90C	ZPHY C46 583	H.J. Behrend <i>et al.</i>	(CELLO Collab.)
ANTIPOV	87	EPL 4 403	Y.M. Antipov <i>et al.</i>	(SERP, JINR, INRM+)
BELLINI	85	SJNP 41 781	D. Bellini <i>et al.</i>	
		Translated from YAF 41 1223.		
ARMSTRONG	82B	NP B202 1	T.A. Armstrong, B. Baccari	(AACH3, BARI, BONN+)
DAUM	81B	NP B182 269	C. Daum <i>et al.</i>	(AMST, CERN, CRAC, MPIM+)
EVANGELIS...	81	NP B178 197	C. Evangelista <i>et al.</i>	(BARI, BONN, CERN+)
Also		NP B186 594	C. Evangelista	
DAUM	80D	PL 89B 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, TATO, GENO, HAMB, MILA+) JP
CRENNELL	70	PRL 24 781	D.J. Crennell <i>et al.</i>	(BNL)
ARMENISE	69	LNC 2 501	N. Armenise <i>et al.</i>	(BARI, BGNA, FIRZ)
BALTAY	68	PRL 20 887	C. Baltay <i>et al.</i>	(COLU, ROCH, RUTG, YALE) I
BARTSCH	68	NP B7 345	J. Bartsch <i>et al.</i>	(AACH, BERL, CERN) JP

NODE=M034

REFID=53356
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$\phi(1680)$

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

NODE=M067

 $\phi(1680)$ MASS

NODE=M067205

 e^+e^- PRODUCTION

NODE=M067M1

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT

NODE=M067M1

1680±20 OUR ESTIMATE

→ UNCHECKED ←

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

1689±7±10	4.8k	¹ SHEN	09	BELL	10.6 $e^+e^- \rightarrow K^+K^-\pi^+\pi^-\gamma$
1709±20±43		² AUBERT	08s	BABR	10.6 $e^+e^- \rightarrow$ hadrons
1623±20	948	³ AKHMETSHIN	03	CMD2	1.05–1.38 $e^+e^- \rightarrow K_L^0 K_S^0$
~1500		⁴ ACHASOV	98H	RVUE	$e^+e^- \rightarrow \pi^+\pi^-\pi^0, \omega\pi^+\pi^-,$ K^+K^-
~1900		⁵ ACHASOV	98H	RVUE	$e^+e^- \rightarrow K_S^0 K^\pm \pi^\mp$
1700±20		⁶ CLEGG	94	RVUE	$e^+e^- \rightarrow K^+K^-, K_S^0 K\pi$
1657±27	367	⁷ BISELLO	91C	DM2	$e^+e^- \rightarrow K_S^0 K^\pm \pi^\mp$
1655±17		⁷ BISELLO	88B	DM2	$e^+e^- \rightarrow K^+K^-$
1680±10		⁸ BUON	82	DM1	$e^+e^- \rightarrow$ hadrons
1677±12		⁹ MANE	82	DM1	$e^+e^- \rightarrow K_S^0 K\pi$

OCCUR=4

¹ From a fit with two incoherent Breit-Wigners.² From the simultaneous fit to the $K\bar{K}^*(892)+$ c.c. and $\phi\eta$ data from AUBERT 08s using the results of AUBERT 07AK.³ From the combined fit of AKHMETSHIN 03 and MANE 81 also including ρ, ω , and ϕ . Neither isospin nor flavor structure known.⁴ Using data from IVANOV 81, BARKOV 87, BISELLO 88B, DOLINSKY 91, and ANTONELLI 92.⁵ Using the data from BISELLO 91C.⁶ Using BISELLO 88B and MANE 82 data.⁷ From global fit including ρ, ω, ϕ and $\rho(1700)$ assume mass 1570 MeV and width 510 MeV for ρ radial excitation.⁸ 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.⁹ Fit to one channel only, neglecting interference with $\omega, \rho(1700)$.

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

PHOTOPRODUCTION

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

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

1753±3	¹⁰ LINK	02K	FOCS	20–160 $\gamma p \rightarrow K^+K^-p$
1726±22	¹⁰ BUSENITZ	89	TPS	$\gamma p \rightarrow K^+K^-X$
1760±20	¹⁰ ATKINSON	85C	OMEG	20–70 $\gamma p \rightarrow K\bar{K}X$
1690±10	¹⁰ ASTON	81F	OMEG	25–70 $\gamma p \rightarrow K^+K^-X$

¹⁰ 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	¹¹ AMSLER	06	CBAR	0.9 $\bar{p}p \rightarrow K^+K^-\pi^0$

¹¹ Could also be $\rho(1700)$.

NODE=M067M3

NODE=M067M3

NODE=M067M3;LINKAGE=AM

 $\phi(1680)$ WIDTH

NODE=M067210

 e^+e^- PRODUCTION

NODE=M067W1

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT

NODE=M067W1

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.

→ UNCHECKED ←

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

211±14±19	4.8k	¹² SHEN	09	BELL	10.6 $e^+e^- \rightarrow K^+K^-\pi^+\pi^-\gamma$
322±77±160		¹³ AUBERT	08s	BABR	10.6 $e^+e^- \rightarrow$ hadrons
139±60	948	¹⁴ AKHMETSHIN	03	CMD2	1.05–1.38 $e^+e^- \rightarrow K_L^0 K_S^0$
300±60		¹⁵ CLEGG	94	RVUE	$e^+e^- \rightarrow K^+K^-, K_S^0 K\pi$
146±55	367	¹⁵ BISELLO	91C	DM2	$e^+e^- \rightarrow K_S^0 K^\pm \pi^\mp$
207±45		¹⁶ BISELLO	88B	DM2	$e^+e^- \rightarrow K^+K^-$
185±22		¹⁷ BUON	82	DM1	$e^+e^- \rightarrow$ hadrons
102±36		¹⁸ MANE	82	DM1	$e^+e^- \rightarrow K_S^0 K\pi$

- ¹² From a fit with two incoherent Breit-Wigners.
¹³ 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.
¹⁴ From the combined fit of AKHMETSHIN 03 and MANE 81 also including ρ , ω , and ϕ . Neither isospin nor flavor structure known.
¹⁵ Using BISELLO 88B and MANE 82 data.
¹⁶ From global fit including ρ , ω , ϕ and $\rho(1700)$.
¹⁷ From global fit of ρ , ω , ϕ and their radial excitations to channels $\omega\pi^+\pi^-$, K^+K^- , $K_S^0K_L^0$, $K_S^0K^\pm\pi^\mp$. Assume mass 1570 MeV and width 510 MeV for ρ radial excitations, mass 1570 and width 500 MeV for ω radial excitation.
¹⁸ Fit to one channel only, neglecting interference with ω , $\rho(1700)$.

NODE=M067W1;LINKAGE=SH
 NODE=M067W1;LINKAGE=AU

NODE=M067W;LINKAGE=HK

NODE=M067W;LINKAGE=A
 NODE=M067W;LINKAGE=E
 NODE=M067W;LINKAGE=C

NODE=M067W;LINKAGE=D

NODE=M067W2
 NODE=M067W2

PHOTOPRODUCTION

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

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

122±63	¹⁹ LINK	02K	FOCS	20–160	$\gamma p \rightarrow K^+ K^- p$
121±47	¹⁹ BUSENITZ	89	TPS		$\gamma p \rightarrow K^+ K^- X$
80±40	¹⁹ ATKINSON	85C	OMEG	20–70	$\gamma p \rightarrow K\bar{K}X$
100±40	¹⁹ ASTON	81F	OMEG	25–70	$\gamma p \rightarrow K^+ K^- X$

¹⁹ 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	²⁰ AMSLER	06	CBAR	0.9	$\bar{p}p \rightarrow K^+ K^- \pi^0$

²⁰ Could also be $\rho(1700)$.

NODE=M067W3
 NODE=M067W3

NODE=M067W3;LINKAGE=AM

$\phi(1680)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $K\bar{K}^*(892) + \text{c.c.}$	dominant
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 $\phi \eta$	
Γ_{10} $K^+ K^- \pi^0$	

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=2

NODE=M067215;NODE=M067

$\phi(1680) \Gamma(i)\Gamma(e^+e^-)/\Gamma^2(\text{total})$

This combination of a branching ratio into channel (i) and branching ratio into e^+e^- is directly measured and obtained from the cross section at the peak. We list only data that have not been used to determine the branching ratio into (i) or e^+e^- .

NODE=M067223

NODE=M067223

$$\Gamma(K_L^0 K_S^0)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_4/\Gamma \times \Gamma_5/\Gamma$$

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	²¹ AKHMETSHIN 03	CMD2	1.05–1.38	$e^+e^- \rightarrow K_L^0 K_S^0$

²¹ From the combined fit of AKHMETSHIN 03 and MANE 81 also including ρ , ω , and ϕ . Neither isospin nor flavor structure known. Recalculated by us.

NODE=M067G5
 NODE=M067G5

NODE=M067G;LINKAGE=GK

$$\Gamma(K\bar{K}^*(892) + \text{c.c.})/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_1/\Gamma \times \Gamma_5/\Gamma$$

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

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

1.15±0.16±0.01	²² AUBERT	08S	BABR	10.6	$e^+e^- \rightarrow K\bar{K}^*(892)\gamma + \text{c.c.}$
3.29±1.57	²³ BISELLO	91C	DM2	1.35–2.40	$e^+e^- \rightarrow K_S^0 K^\pm \pi^\mp$

²² 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.

²³ Recalculated by us with the published value of $B(K\bar{K}^*(892) + \text{c.c.}) \times \Gamma(e^+e^-)$.

NODE=M067G6
 NODE=M067G6

NODE=M067G6;LINKAGE=AU

NODE=M067G;LINKAGE=GL

$$\Gamma(\phi\pi\pi)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_7/\Gamma \times \Gamma_5/\Gamma$$

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

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

$1.86 \pm 0.14 \pm 0.21$ 4.8k ²⁴ SHEN 09 BELL $10.6 e^+e^- \rightarrow K^+K^-\pi^+\pi^-\gamma$
²⁴ 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

$$\Gamma(\phi\eta)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_9/\Gamma \times \Gamma_5/\Gamma$$

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

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

$0.43 \pm 0.10 \pm 0.09$ ²⁵ AUBERT 08S BABR $10.6 e^+e^- \rightarrow \phi\eta\gamma$
²⁵ 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=AU

$\phi(1680)$ BRANCHING RATIOS

NODE=M067225

$$\Gamma(K\bar{K}^*(892) + \text{c.c.})/\Gamma(K_S^0 K\pi) \quad \Gamma_1/\Gamma_2$$

VALUE DOCUMENT ID TECN COMMENT

dominant MANE 82 DM1 $e^+e^- \rightarrow K_S^0 K^\pm \pi^\mp$

NODE=M067R3
 NODE=M067R3

$$\Gamma(K\bar{K})/\Gamma(K\bar{K}^*(892) + \text{c.c.}) \quad \Gamma_3/\Gamma_1$$

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

$$\Gamma(\omega\pi\pi)/\Gamma(K\bar{K}^*(892) + \text{c.c.}) \quad \Gamma_6/\Gamma_1$$

VALUE DOCUMENT ID TECN COMMENT

<0.10 BUON 82 DM1 e^+e^-

NODE=M067R1
 NODE=M067R1

$$\Gamma(\phi\eta)/\Gamma(K\bar{K}^*(892) + \text{c.c.}) \quad \Gamma_9/\Gamma_1$$

VALUE DOCUMENT ID TECN COMMENT

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

≈ 0.37 ²⁶ AUBERT 08S BABR $10.6 e^+e^- \rightarrow \text{hadrons}$

²⁶ From the fit including data from AUBERT 07AK.

NODE=M067R5
 NODE=M067R5

NODE=M067R5;LINKAGE=AU

$\phi(1680)$ REFERENCES

NODE=M067

SHEN	09	PR D80 031101	C.P. Shen <i>et al.</i>	(BELLE Collab.)
AUBERT	08S	PR D77 092002	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT	07AK	PR D76 012008	B. Aubert <i>et al.</i>	(BABAR Collab.)
AMSLER	06	PL B639 165	C. Amsler <i>et al.</i>	(CBAR Collab.)
AKHMETSHIN	03	PL B551 27	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)
Also		PAN 65 1222	E.V. Anashkin, V.M. Aulchenko, R.R. Akhmetshin	
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)
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=53000
 REFID=52242
 REFID=51908
 REFID=51136
 REFID=49172
 REFID=48827

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

$\rho_3(1690)$

$$I^G(J^{PC}) = 1^+(3^{--})$$

NODE=M015

 $\rho_3(1690)$ 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± 5 OUR AVERAGE Error includes scale factor of 1.1.

1694± 6		⁸ EVANGELIS...	81	OMEG	—	12 $\pi^- p \rightarrow p 4\pi$
1665±15	177	BALTAY	78B	HBC	+	15 $\pi^+ p \rightarrow p 4\pi$
1670±10		THOMPSON	74	HBC	+	13 $\pi^+ p$
1687±20		CASON	73	HBC	—	8,18.5 $\pi^- p$
1685±14		⁹ CASON	73	HBC	—	8,18.5 $\pi^- p$
1680±40	144	BARTSCH	70B	HBC	+	8 $\pi^+ p \rightarrow N 4\pi$
1689±20	102	⁹ BARTSCH	70B	HBC	+	8 $\pi^+ p \rightarrow N 2\rho$
1705±21		CASO	70	HBC	—	11.2 $\pi^- p \rightarrow$ $n \rho 2\pi$

OCCUR=2

OCCUR=3

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

1718±10		¹⁰ EVANGELIS...	81	OMEG	—	12 $\pi^- p \rightarrow p4\pi$
1673± 9		¹¹ EVANGELIS...	81	OMEG	—	12 $\pi^- p \rightarrow p4\pi$
1733± 9	66	⁹ KLIGER	74	HBC	—	4.5 $\pi^- p \rightarrow p4\pi$
1630±15		HOLMES	72	HBC	+	10–12 $K^+ p$
1720±15		BALTAY	68	HBC	+	7, 8.5 $\pi^+ p$

OCCUR=2

OCCUR=3

⁸ From $\rho^- \rho^0$ mode, not independent of the other two EVANGELISTA 81 entries.

⁹ From $\rho^\pm \rho^0$ mode.

¹⁰ From $a_2(1320)^- \pi^0$ mode, not independent of the other two EVANGELISTA 81 entries.

¹¹ From $a_2(1320)^0 \pi^-$ mode, not independent of the other two EVANGELISTA 81 entries.

NODE=M015M3;LINKAGE=A

NODE=M015M3;LINKAGE=F

NODE=M015M3;LINKAGE=B

NODE=M015M3;LINKAGE=C

$\omega\pi$ MODE

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT

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

NODE=M015M5

NODE=M015M5

1681± 7 OUR AVERAGE

1670±25		¹² ALDE	95	GAM2		38 $\pi^- p \rightarrow \omega\pi^0 n$
1690±15		EVANGELIS...	81	OMEG	—	12 $\pi^- p \rightarrow \omega\pi p$
1666±14		GESSAROLI	77	HBC		11 $\pi^- p \rightarrow \omega\pi p$
1686± 9		THOMPSON	74	HBC	+	13 $\pi^+ p$

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

1654±24		BARNHAM	70	HBC	+	10 $K^+ p \rightarrow \omega\pi X$

¹² Supersedes ALDE 92C.

NODE=M015M5;LINKAGE=A

$\eta\pi^+\pi^-$ MODE

(For difficulties with MMS experiments, see the $a_2(1320)$ mini-review in the 1973 edition.)

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT

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

NODE=M015M6

NODE=M015M6

NODE=M015M6

1682±12 OUR AVERAGE

1685±10±20		AMELIN	00	VES		37 $\pi^- p \rightarrow \eta\pi^+\pi^- n$
1680±15		FUKUI	88	SPEC	0	8.95 $\pi^- p \rightarrow \eta\pi^+\pi^- n$

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

1700±47		¹³ ANDERSON	69	MMS	—	16 $\pi^- p$ backward
1632±15		^{13,14} FOCACCI	66	MMS	—	7–12 $\pi^- p \rightarrow pMM$
1700±15		^{13,14} FOCACCI	66	MMS	—	7–12 $\pi^- p \rightarrow pMM$
1748±15		^{13,14} FOCACCI	66	MMS	—	7–12 $\pi^- p \rightarrow pMM$

OCCUR=2

OCCUR=3

¹³ Seen in 2.5–3 GeV/c $\bar{p}p$. $2\pi^+2\pi^-$, with 0, 1, 2 $\pi^+\pi^-$ pairs in ρ band not seen by OREN 74 (2.3 GeV/c $\bar{p}p$) with more statistics. (Jan. 1976)

¹⁴ Not seen by BOWEN 72.

NODE=M015M6;LINKAGE=R

NODE=M015M6;LINKAGE=N

$\rho_3(1690)$ WIDTH

NODE=M015210

2 π , $K\bar{K}$, AND $K\bar{K}\pi$ MODES

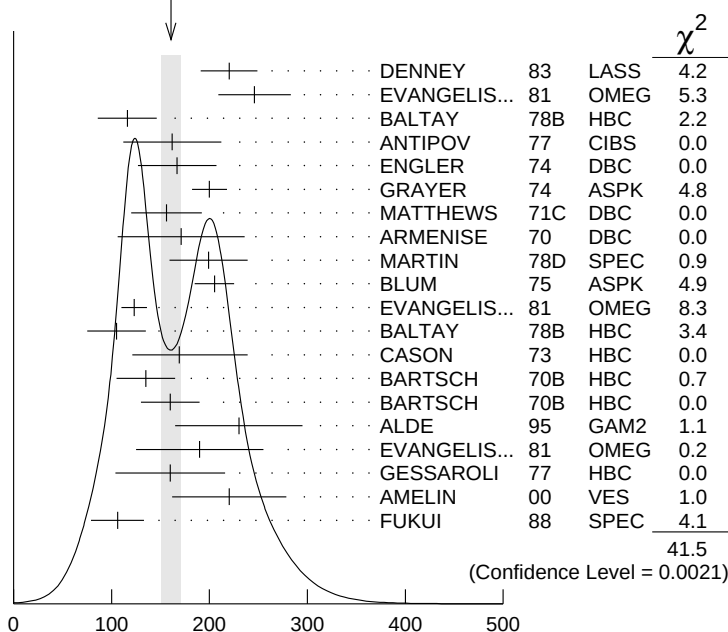
VALUE (MeV)	DOCUMENT ID

161±10 OUR AVERAGE Includes data from the 5 datablocks that follow this one. Error includes scale factor of 1.5. See the ideogram below.

NODE=M015W

NODE=M015W

WEIGHTED AVERAGE
161±10 (Error scaled by 1.5)



$\rho_3(1690)$ width, 2π , $K\bar{K}$, and $K\bar{K}\pi$ modes (MeV)

2 π MODE

VALUE (MeV) EVTS DOCUMENT ID TECN CHG COMMENT

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

NODE=M015W1
NODE=M015W1

186±14 OUR AVERAGE Error includes scale factor of 1.3. See the ideogram below.

220±29		DENNEY	83	LASS		10 $\pi^+ N$
246±37		EVANGELIS...	81	OMEG	—	12 $\pi^- p \rightarrow 2\pi p$
116±30	476	BALTAY	78B	HBC	0	15 $\pi^+ p \rightarrow$ $\pi^+ \pi^- n$
162±50	175	¹⁵ ANTIPOV	77	CIBS	0	25 $\pi^- p \rightarrow p 3\pi$
167±40	600	ENGLER	74	DBC	0	6 $\pi^+ n \rightarrow$ $\pi^+ \pi^- p$
200±18		¹⁶ GRAYER	74	ASPK	0	17 $\pi^- p \rightarrow$ $\pi^+ \pi^- n$
156±36		MATTHEWS	71C	DBC	0	7 $\pi^+ N$
171±65		ARMENISE	70	DBC	0	9 $\pi^+ d$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
322±35		¹⁷ CORDEN	79	OMEG		12–15 $\pi^- p \rightarrow$ $n 2\pi$
240±30		^{16,18} ESTABROOKS	75	RVUE		17 $\pi^- p \rightarrow$ $\pi^+ \pi^- n$
180±30	122	BARTSCH	70B	HBC	+	8 $\pi^+ p \rightarrow N 2\pi$
267 ⁺⁷² –46		STUNTEBECK	70	HDBC	0	8 $\pi^- p, 5.4 \pi^+ d$
188±49		ARMENISE	68	DBC	0	5.1 $\pi^+ d$
180±40		GOLDBERG	65	HBC	0	6 $\pi^+ d, 8 \pi^- p$

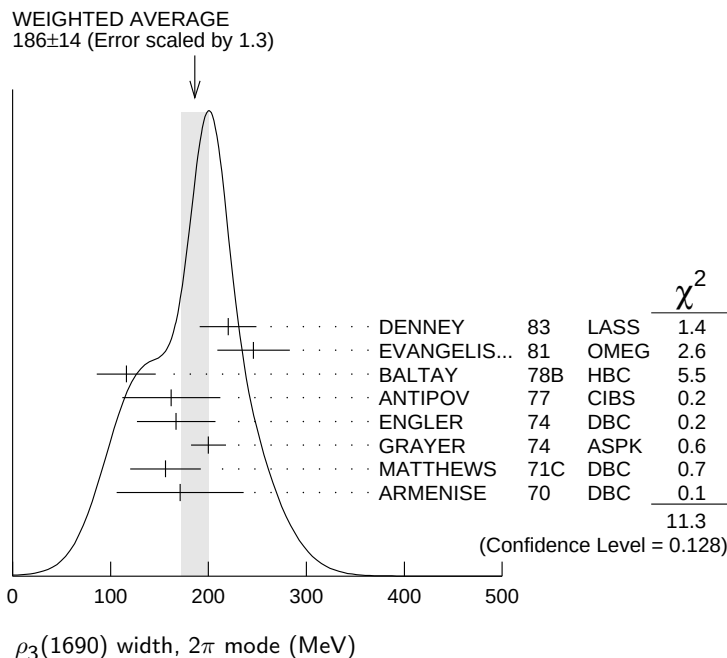
¹⁵ Width errors enlarged by us to $4\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.

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 $\pi^- p \rightarrow n K^+ K^-$
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 $\pi^+ p \rightarrow N 2\rho$

OCCUR=3

• • • 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=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	—	$16 \pi^- p \text{ backward}$
< 21	^{26,27} FOCACCI	66	MMS	—	$7-12 \pi^- p \rightarrow \rho\text{MM}$
< 30	^{26,27} FOCACCI	66	MMS	—	$7-12 \pi^- p \rightarrow \rho\text{MM}$
< 38	^{26,27} FOCACCI	66	MMS	—	$7-12 \pi^- p \rightarrow \rho\text{MM}$

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.

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

 $\rho_3(1690)$ DECAY MODES

NODE=M015215;NODE=M015

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	
Excluding 2ρ and $a_2(1320)\pi$.		
Γ_{10} $a_2(1320)\pi$	seen	
Γ_{11} $\rho\rho$	seen	
Γ_{12} $\phi\pi$		
Γ_{13} $\eta\pi$		
Γ_{14} $\pi^\pm 2\pi^+ 2\pi^- \pi^0$		

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

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

$\rho_3(1690)$ 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 $\pi^- p$ polarized
0.23 $\pm$ 0.02	CORDEN	79	OMEG		12-15 $\pi^- p \rightarrow n^2\pi$
0.22 $\pm$ 0.04	²⁸ MATTHEWS	71C	HDBC	0	7 $\pi^+ n \rightarrow \pi^- p$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.245 $\pm$ 0.006	²⁹ ESTABROOKS	75	RVUE		17 $\pi^- p \rightarrow \pi^+ \pi^- n$

NODE=M015R1
NODE=M015R1²⁸ 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

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

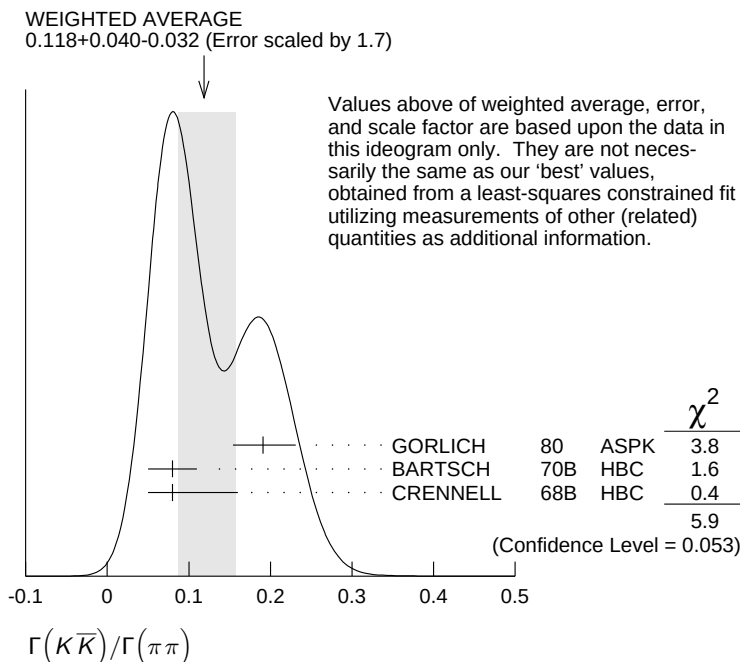
NODE=M015R2
NODE=M015R2

$\Gamma(\pi\pi)/\Gamma(4\pi)$					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 $\pi^- p$ polarized
0.08 $\pm$ 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



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

VALUE	DOCUMENT ID	TECN	CHG	COMMENT	Γ_5/Γ_4
0.16±0.05 OUR FIT					
0.16±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

$[\Gamma(\pi\pi\rho) + \Gamma(a_2(1320)\pi) + \Gamma(\rho\rho)]/\Gamma(\pi^\pm\pi^+\pi^-\pi^0)$ ($\Gamma_9+\Gamma_{10}+\Gamma_{11})/\Gamma_2$

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

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

VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT	Γ_{11}/Γ_2
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 $\pi^+ p$

³¹ $\rho\rho$ and $a_2(1320)\pi$ modes are indistinguishable.

NODE=M015R7
NODE=M015R7

NODE=M015R7;LINKAGE=T

$\Gamma(\rho\rho)/[\Gamma(\pi\pi\rho) + \Gamma(a_2(1320)\pi) + \Gamma(\rho\rho)]$ ($\Gamma_{11}/(\Gamma_9+\Gamma_{10}+\Gamma_{11})$)

VALUE	DOCUMENT ID	TECN	CHG	COMMENT	
0.48±0.16	CASO	68	HBC	-	11 $\pi^- p$

NODE=M015R8
NODE=M015R8

$\Gamma(a_2(1320)\pi)/\Gamma(\pi^\pm\pi^+\pi^-\pi^0)$

VALUE	DOCUMENT ID	TECN	CHG	COMMENT	Γ_{10}/Γ_2
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 $\pi^+ p$

³² $\rho\rho$ and $a_2(1320)\pi$ modes are indistinguishable.

NODE=M015R9
NODE=M015R9

NODE=M015R9;LINKAGE=T

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

$$\Gamma_3/\Gamma_2$$

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

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

$$\Gamma_{12}/\Gamma_2$$

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

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

$$\Gamma_{14}/\Gamma_2$$

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

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

$$\Gamma_{13}/\Gamma_2$$

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

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

$$\Gamma_6/\Gamma$$

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 $\pi p \rightarrow K_S^0 K^- p$

³³From $(\Gamma_4\Gamma_6)^{1/2} = 0.056 \pm 0.034$ assuming $B(\rho_3(1690) \rightarrow \pi\pi) = 0.24$.

NODE=M015R14
NODE=M015R14

NODE=M015R14;LINKAGE=B

$$\Gamma(\omega\pi)/[\Gamma(\omega\pi) + \Gamma(\rho\rho)]$$

$$\Gamma_3/(\Gamma_3+\Gamma_{11})$$

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.22±0.08	CASON	73	HBC	- 8,18.5 $\pi^- p$

NODE=M015R16
NODE=M015R16

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

$$\Gamma_7/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
seen	FUKUI	88	SPEC 8.95 $\pi^- p \rightarrow \eta\pi^+\pi^- n$

NODE=M015R17
NODE=M015R17

$$\Gamma(a_2(1320)\pi)/\Gamma(\rho(770)\eta)$$

$$\Gamma_{10}/\Gamma_8$$

VALUE	DOCUMENT ID	TECN	COMMENT
5.5±2.0	AMELIN	00	VES 37 $\pi^- p \rightarrow \eta\pi^+\pi^- n$

NODE=M015R18
NODE=M015R18

$\rho_3(1690)$ REFERENCES

NODE=M015

AMELIN	00	NP A668 83	D. Amelin <i>et al.</i>	(VES Collab.)	REFID=47432
ALDE	95	ZPHY C66 379	D.M. Alde <i>et al.</i>	(GAMS Collab.) JP	REFID=44371
ALDE	92C	ZPHY C54 553	D.M. Alde <i>et al.</i>	(BELG, SERP, KEK, LANL+)	REFID=41859
FUKUI	88	PL B202 441	S. Fukui <i>et al.</i>	(SUGI, NAGO, KEK, KYOT+)	REFID=40273
DENNEY	83	PR D28 2726	D.L. Denney <i>et al.</i>	(IOWA, MICH)	REFID=20754
EVANGELIS...	81	NP B178 197	C. Evangelista <i>et al.</i>	(BARI, BONN, CERN+)	REFID=20462
ALPER	80	PL 94B 422	B. Alper <i>et al.</i>	(AMST, CERN, CRAC, MPIM+)	REFID=21665
COSTA...	80	NP B175 402	G. Costa de Beauregard <i>et al.</i>	(BARI, BONN+)	REFID=20737
GORLICH	80	NP B174 16	L. Gorlich <i>et al.</i>	(CRAC, MPIM, CERN+)	REFID=20738
BECKER	79	NP B151 46	H. Becker <i>et al.</i>	(MPIM, CERN, ZEEM, CRAC)	REFID=21084
CORDEN	79	NP B157 250	M.J. Corden <i>et al.</i>	(BIRM, RHEL, TELA+)	REFID=20374
BALTAY	78B	PR D17 62	C. Baltay <i>et al.</i>	(COLU, BING)	REFID=21265
MARTIN	78B	NP B140 158	A.D. Martin <i>et al.</i>	(DURH, GEVA)	REFID=21273
MARTIN	78D	PL 74B 417	A.D. Martin <i>et al.</i>	(DURH, GEVA)	REFID=21272
ANTIPOV	77	NP B119 45	Y.M. Antipov <i>et al.</i>	(SERP, GEVA)	REFID=20728
GESSAROLI	77	NP B126 382	R. Gessaroli <i>et al.</i>	(BGNA, FIRZ, GENO+)	REFID=20230
BLUM	75	PL 57B 403	W. Blum <i>et al.</i>	(CERN, MPIM) JP	REFID=21651
ESTABROOKS	75	NP B95 322	P.G. Estabrooks, A.D. Martin	(DURH)	REFID=20642
HYAMS	75	NP B100 205	B.D. Hyams <i>et al.</i>	(CERN, MPIM)	REFID=20355
ENGLER	74	PR D10 2070	A. Engler <i>et al.</i>	(CMU, CASE)	REFID=20110

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+)

REFID=20113
REFID=21648REFID=20221
REFID=21650
REFID=20606
REFID=21711
REFID=21639
REFID=21630
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REFID=20586
REFID=21616
REFID=21617
REFID=20402
REFID=21601

NODE=M065

 $\rho(1700)$

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

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NODE=M065

 $\rho(1700)$ MASS

NODE=M065205

 $\eta\rho^0$ AND $\pi^+\pi^-$ MODES

VALUE (MeV)

DOCUMENT ID

1720±20 OUR ESTIMATE

NODE=M065M0

NODE=M065M0

→ UNCHECKED ←

 $\eta\rho^0$ MODE

VALUE (MeV)

DOCUMENT ID

TECN

COMMENT

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

NODE=M065M6

NODE=M065M6

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

1740±20	ANTONELLI	88	DM2	$e^+e^- \rightarrow \eta\pi^+\pi^-$
1701±15	¹ FUKUI	88	SPEC	$8.95 \pi^- p \rightarrow \eta\pi^+\pi^- n$

¹ Assuming $\rho^+ f_0(1370)$ decay mode interferes with $a_1(1260)^+ \pi$ background. From a two Breit-Wigner fit.

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.

NODE=M065M1

NODE=M065M1

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

1780 ±20 ⁺¹⁵ ₋₂₀	63.5k	² ABRAMOWICZ12	ZEUS	$e p \rightarrow e \pi^+ \pi^- p$
1861 ±17		³ LEES	12G	$BABR \ e^+ e^- \rightarrow \pi^+ \pi^- \gamma$
1728 ±17 ±89	5.4M	^{4,5} FUJIKAWA	08	$BELL \ \tau^- \rightarrow \pi^- \pi^0 \nu_\tau$
1780 ⁺³⁷ ₋₂₉		⁶ ABELE	97	$CBAR \ \bar{p} n \rightarrow \pi^- \pi^0 \pi^0$
1719 ±15		⁶ 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		⁷ ERKAL	85	$RVUE \ 20-70 \ \gamma p \rightarrow \gamma \pi$
1550 ±70		ABE	84B	$HYBR \ 20 \ \gamma p \rightarrow \pi^+ \pi^- p$
1590 ±20		⁸ ASTON	80	$OMEG \ 20-70 \ \gamma p \rightarrow p 2\pi$
1600 ±10		⁹ ATIYA	79B	$SPEC \ 50 \ \gamma C \rightarrow C 2\pi$
1598 ⁺²⁴ ₋₂₂		BECKER	79	$ASPK \ 17 \ \pi^- p \text{ polarized}$
1659 ±25		⁷ LANG	79	$RVUE$
1575		⁷ MARTIN	78C	$RVUE \ 17 \ \pi^- p \rightarrow \pi^+ \pi^- n$
1610 ±30		⁷ FROGGATT	77	$RVUE \ 17 \ \pi^- p \rightarrow \pi^+ \pi^- n$
1590 ±20		¹⁰ HYAMS	73	$ASPK \ 17 \ \pi^- p \rightarrow \pi^+ \pi^- n$

- ² Using the KUHN 90 parametrization of the pion form factor, neglecting $\rho-\omega$ interference.
- ³ 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.
- ⁴ $|F_\pi(0)|^2$ fixed to 1.
- ⁵ From the GOUNARIS 68 parametrization of the pion form factor.
- ⁶ T-matrix pole.
- ⁷ From phase shift analysis of HYAMS 73 data.
- ⁸ Simple relativistic Breit-Wigner fit with constant width.
- ⁹ An additional 40 MeV uncertainty in both the mass and width is present due to the choice of the background shape.
- ¹⁰ Included in BECKER 79 analysis.

 $\pi\omega$ MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

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

1550 to 1620	¹¹ ACHASOV	00I	SND $e^+e^- \rightarrow \pi^0\pi^0\gamma$
1580 to 1710	¹² ACHASOV	00I	SND $e^+e^- \rightarrow \pi^0\pi^0\gamma$
1710 $\pm$ 90	ACHASOV	97	RVUE $e^+e^- \rightarrow \omega\pi^0$

¹¹ 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.

¹² Taking into account the $\rho(1700)$ contribution only. Using the data of ACHASOV 00I on $e^+e^- \rightarrow \omega\pi^0$ and of EDWARDS 00A on $\tau^- \rightarrow \omega\pi^- \nu_\tau$.

 $K\bar{K}$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

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

1740.8 $\pm$ 22.2	27k	¹³ ABELE	99D	CBAR $\pm$	0.0 $\bar{p}p \rightarrow K^+K^-\pi^0$
1582 $\pm$ 36	1600	CLELAND	82B	SPEC $\pm$	50 $\pi p \rightarrow K_S^0 K^\pm p$

¹³ K-matrix pole. Isospin not determined, could be $\omega(1650)$ or $\phi(1680)$.

 $2(\pi^+\pi^-)$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

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

1851 $^{+27}_{-24}$		ACHASOV	97	RVUE	$e^+e^- \rightarrow 2(\pi^+\pi^-)$
1570 $\pm$ 20		¹⁴ CORDIER	82	DM1	$e^+e^- \rightarrow 2(\pi^+\pi^-)$
1520 $\pm$ 30		¹⁵ ASTON	81E	OMEG	20-70 $\gamma p \rightarrow p4\pi$
1654 $\pm$ 25		¹⁶ DIBIANCA	81	DBC	$\pi^+d \rightarrow p p2(\pi^+\pi^-)$
1666 $\pm$ 39		¹⁴ BACCI	80	FRAG	$e^+e^- \rightarrow 2(\pi^+\pi^-)$
1780	34	KILLIAN	80	SPEC	11 $e^-p \rightarrow 2(\pi^+\pi^-)$
1500		¹⁷ ATIYA	79B	SPEC	50 $\gamma C \rightarrow C4\pi^\pm$
1570 $\pm$ 60	65	¹⁸ ALEXANDER	75	HBC	7.5 $\gamma p \rightarrow p4\pi$
1550 $\pm$ 60		¹⁵ CONVERSI	74	OSPK	$e^+e^- \rightarrow 2(\pi^+\pi^-)$
1550 $\pm$ 50	160	SCHACHT	74	STRC	5.5-9 $\gamma p \rightarrow p4\pi$
1450 $\pm$ 100	340	SCHACHT	74	STRC	9-18 $\gamma p \rightarrow p4\pi$
1430 $\pm$ 50	400	BINGHAM	72B	HBC	9.3 $\gamma p \rightarrow p4\pi$

¹⁴ Simple relativistic Breit-Wigner fit with model dependent width.

¹⁵ Simple relativistic Breit-Wigner fit with constant width.

¹⁶ One peak fit result.

¹⁷ Parameters roughly estimated, not from a fit.

¹⁸ Skew mass distribution compensated by Ross-Stodolsky factor.

 $\pi^+\pi^-\pi^0\pi^0$ MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

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

1660 $\pm$ 30	ATKINSON	85B	OMEG 20-70 γp

 $3(\pi^+\pi^-)$ 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 $\pm$ 34	¹⁹ FRABETTI	04	E687 $\gamma p \rightarrow 3\pi^+3\pi^-p$
1783 $\pm$ 15	CLEGG	90	RVUE $e^+e^- \rightarrow 3(\pi^+\pi^-)2(\pi^+\pi^-\pi^0)$

¹⁹ From a fit with two resonances with the JACOB 72 continuum.

NODE=M065M1;LINKAGE=AB
NODE=M065M1;LINKAGE=LE

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

OCCUR=2

NODE=M065M;LINKAGE=I1

NODE=M065M;LINKAGE=I2

NODE=M065M2
NODE=M065M2

NODE=M065M2;LINKAGE=AN

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

NODE=M065M5
NODE=M065M5

NODE=M065M7
NODE=M065M7

NODE=M065M;LINKAGE=PI

$\rho(1700)$ WIDTH **$\eta\rho^0$ AND $\pi^+\pi^-$ MODES**

VALUE (MeV)

DOCUMENT ID

250 $\pm$ 100 OUR ESTIMATE

NODE=M065210

NODE=M065W0

NODE=M065W0

→ UNCHECKED ←

 $\eta\rho^0$ MODE

VALUE (MeV)

DOCUMENT ID

TECN

COMMENT

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

NODE=M065W6

NODE=M065W6

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

150 $\pm$ 30

ANTONELLI

88

DM2

 $e^+e^- \rightarrow \eta\pi^+\pi^-$ 282 $\pm$ 44

20 FUKUI

88

SPEC

 $8.95 \pi^- p \rightarrow \eta\pi^+\pi^- n$ ²⁰ Assuming $\rho^+ f_0(1370)$ decay mode interferes with $a_1(1260)^+ \pi$ background. From a two Breit-Wigner fit.

NODE=M065W;LINKAGE=B

 $\pi\pi$ MODE

VALUE (MeV)

EVTS

DOCUMENT ID

TECN

COMMENT

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

NODE=M065W1

NODE=M065W1

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

310 $\pm$ 30	$^{+25}_{-35}$	63.5k	²¹ ABRAMOWICZ12	ZEUS	$ep \rightarrow e\pi^+\pi^- p$
316 $\pm$ 26			²² LEES	12G BABR	$e^+e^- \rightarrow \pi^+\pi^-\gamma$
164 $\pm$ 21	$^{+89}_{-26}$	5.4M	^{23,24} FUJIKAWA	08 BELL	$\tau^- \rightarrow \pi^-\pi^0\nu_\tau$
275 $\pm$ 45			²⁵ ABELE	97 CBAR	$\bar{p}n \rightarrow \pi^-\pi^0\pi^0$
310 $\pm$ 40			²⁵ BERTIN	97C OBLX	$0.0 \bar{p}p \rightarrow \pi^+\pi^-\pi^0$
400 $\pm$ 100			CLEGG	94 RVUE	$e^+e^- \rightarrow \pi^+\pi^-$
224 $\pm$ 22			BISELLO	89 DM2	$e^+e^- \rightarrow \pi^+\pi^-$
242.5 $\pm$ 163.0			DUBNICKA	89 RVUE	$e^+e^- \rightarrow \pi^+\pi^-$
620 $\pm$ 60			GESHKEN...	89 RVUE	
<315			²⁶ ERKAL	85 RVUE	20-70 $\gamma p \rightarrow \gamma\pi$
280 $^{+30}_{-80}$			ABE	84B HYBR	20 $\gamma p \rightarrow \pi^+\pi^- p$
230 $\pm$ 80			²⁷ ASTON	80 OMEG	20-70 $\gamma p \rightarrow p2\pi$
283 $\pm$ 14			²⁸ ATIYA	79B SPEC	50 $\gamma C \rightarrow C2\pi$
175 $^{+98}_{-53}$			BECKER	79 ASPK	17 $\pi^- p$ polarized
232 $\pm$ 34			²⁶ LANG	79 RVUE	
340			²⁶ MARTIN	78C RVUE	17 $\pi^- p \rightarrow \pi^+\pi^- n$
300 $\pm$ 100			²⁶ FROGGATT	77 RVUE	17 $\pi^- p \rightarrow \pi^+\pi^- n$
180 $\pm$ 50			²⁹ HYAMS	73 ASPK	17 $\pi^- p \rightarrow \pi^+\pi^- n$

²¹ Using the KUHN 90 parametrization of the pion form factor, neglecting $\rho-\omega$ interference.²² 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.²³ $|F_\pi(0)|^2$ fixed to 1.²⁴ From the GOUNARIS 68 parametrization of the pion form factor.²⁵ T-matrix pole.²⁶ From phase shift analysis of HYAMS 73 data.²⁷ Simple relativistic Breit-Wigner fit with constant width.²⁸ An additional 40 MeV uncertainty in both the mass and width is present due to the choice of the background shape.²⁹ Included in BECKER 79 analysis.

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. • • •

187.2 $\pm$ 26.7 27k ³⁰ ABELE 99D CBAR $\pm$ 0.0 $\bar{p}p \rightarrow K^+K^-\pi^0$ 265 $\pm$ 120 1600 CLELAND 82B SPEC $\pm$ 50 $\pi p \rightarrow K_S^0 K^\pm p$ ³⁰ K-matrix pole. Isospin not determined, could be $\omega(1650)$ or $\phi(1680)$.

NODE=M065W2

NODE=M065W2

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		31 CORDIER	82 DM1	$e^+e^- \rightarrow 2(\pi^+\pi^-)$
400 ± 50		32 ASTON	81E OMEG	20–70 $\gamma p \rightarrow p4\pi$
400 ± 146		33 DIBIANCA	81 DBC	$\pi^+d \rightarrow pp2(\pi^+\pi^-)$
700 ± 160		31 BACCI	80 FRAG	$e^+e^- \rightarrow 2(\pi^+\pi^-)$
100	34	KILLIAN	80 SPEC	11 $e^-p \rightarrow 2(\pi^+\pi^-)$
600		34 ATIYA	79B SPEC	50 $\gamma C \rightarrow C4\pi^\pm$
340 ± 160	65	35 ALEXANDER	75 HBC	7.5 $\gamma p \rightarrow p4\pi$
360 ± 100		32 CONVERSI	74 OSPK	$e^+e^- \rightarrow 2(\pi^+\pi^-)$
400 ± 120	160	36 SCHACHT	74 STRC	5.5–9 $\gamma p \rightarrow p4\pi$
850 ± 200	340	36 SCHACHT	74 STRC	9–18 $\gamma p \rightarrow p4\pi$
650 ± 100	400	BINGHAM	72B HBC	9.3 $\gamma p \rightarrow p4\pi$

31 Simple relativistic Breit-Wigner fit with model-dependent width.

32 Simple relativistic Breit-Wigner fit with constant width.

33 One peak fit result.

34 Parameters roughly estimated, not from a fit.

35 Skew mass distribution compensated by Ross-Stodolsky factor.

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

 $\pi^+\pi^-\pi^0\pi^0$ 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	37 ACHASOV	00I SND	$e^+e^- \rightarrow \pi^0\pi^0\gamma$
490 to 1040	38 ACHASOV	00I SND	$e^+e^- \rightarrow \pi^0\pi^0\gamma$

37 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.

38 Taking into account the $\rho(1700)$ contribution only. Using the data of ACHASOV 00I on $e^+e^- \rightarrow \omega\pi^0$ and of EDWARDS 00A on $\tau^- \rightarrow \omega\pi^- \nu_\tau$.

3($\pi^+\pi^-\pi^0$) 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	39 FRABETTI	04 E687	$\gamma p \rightarrow 3\pi^+3\pi^-p$
285 ± 20	CLEGG	90 RVUE	$e^+e^- \rightarrow 3(\pi^+\pi^-)2(\pi^+\pi^-\pi^0)$
39 From a fit with two resonances with the JACOB 72 continuum.			

 $\rho(1700)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 4π	
Γ_2 $2(\pi^+\pi^-)$	large
Γ_3 $\rho\pi\pi$	dominant
Γ_4 $\rho^0\pi^+\pi^-$	large
Γ_5 $\rho^0\pi^0\pi^0$	
Γ_6 $\rho^\pm\pi^\mp\pi^0$	large
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

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

NODE=M065W5
NODE=M065W5

NODE=M065W9
NODE=M065W9

OCCUR=2

NODE=M065W;LINKAGE=I1

NODE=M065W;LINKAGE=I2

NODE=M065W7
NODE=M065W7

NODE=M065W;LINKAGE=PI

NODE=M065215;NODE=M065

DESIG=20

DESIG=2;OUR EST;→ UNCHECKED ←

DESIG=12;OUR EST;→ UNCHECKED ←

DESIG=1;OUR EST;→ UNCHECKED ←

DESIG=7

DESIG=9;OUR EST;→ UNCHECKED ←

DESIG=15;OUR EST;→ UNCHECKED ←

DESIG=16;OUR EST;→ UNCHECKED ←

DESIG=17;OUR EST;→ UNCHECKED ←

DESIG=18;OUR EST;→ UNCHECKED ←

DESIG=4;OUR EST;→ UNCHECKED ←

DESIG=13;OUR EST;→ UNCHECKED ←

DESIG=10;OUR EST;→ UNCHECKED ←

DESIG=11;OUR EST;→ UNCHECKED ←

DESIG=14;OUR EST;→ UNCHECKED ←

DESIG=5;OUR EST;→ UNCHECKED ←

DESIG=8;OUR EST;→ UNCHECKED ←

DESIG=6;OUR EST;→ UNCHECKED ←

$\rho(1700) \Gamma(i) \Gamma(e^+ e^-) / \Gamma(\text{total})$

This combination of a partial width with the partial width into $e^+ e^-$ and with the total width is obtained from the cross-section into channel i in $e^+ e^-$ annihilation.

NODE=M065225

NODE=M065225

 $\Gamma(2(\pi^+ \pi^-)) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_2 \Gamma_{17} / \Gamma$

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 $\Gamma(\pi^+ \pi^-) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{11} \Gamma_{17} / \Gamma$

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.13	⁴⁰ 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=M065G4⁴⁰ Using total width = 220 MeV.

NODE=M065G4;LINKAGE=B

 $\Gamma(K \bar{K}^*(892) + \text{c.c.}) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{13} \Gamma_{17} / \Gamma$

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.305 ± 0.071	⁴¹ BIZOT	80 DM1	$e^+ e^-$

NODE=M065G10
NODE=M065G10⁴¹ Model dependent.

NODE=M065G;LINKAGE=M

 $\Gamma(\eta \rho) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{14} \Gamma_{17} / \Gamma$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
7 ± 3	ANTONELLI	88 DM2	$e^+ e^- \rightarrow \eta \pi^+ \pi^-$

NODE=M065G11
NODE=M065G11 $\Gamma(K \bar{K}) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{16} \Gamma_{17} / \Gamma$

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.035 ± 0.029	⁴² BIZOT	80 DM1	$e^+ e^-$

NODE=M065G5
NODE=M065G5⁴² Model dependent.

NODE=M065G5;LINKAGE=M

 $\Gamma(\rho \pi \pi) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_3 \Gamma_{17} / \Gamma$

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
3.510 ± 0.090	⁴³ BIZOT	80 DM1	$e^+ e^-$

NODE=M065G12
NODE=M065G12⁴³ Model dependent.

NODE=M065G12;LINKAGE=M

 $\rho(1700) \text{ BRANCHING RATIOS}$

NODE=M065230

 $\Gamma(\rho \pi \pi) / \Gamma(4\pi) \quad \Gamma_3 / \Gamma_1$

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.28 ± 0.06	⁴⁴ ABELE	01B CBAR	0.0 $\bar{p} n \rightarrow 5\pi$

NODE=M065R19
NODE=M065R19⁴⁴ $\omega \pi$ not included.

NODE=M065R;LINKAGE=BL

 $\Gamma(\rho^0 \pi^+ \pi^-) / \Gamma(2(\pi^+ \pi^-)) \quad \Gamma_4 / \Gamma_2$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
~ 1.0		DELCOURT	81B DM1	$e^+ e^- \rightarrow 2(\pi^+ \pi^-)$
0.7 ± 0.1	500	SCHACHT	74 STRC	5.5–18 $\gamma p \rightarrow p 4\pi$
0.80		⁴⁵ BINGHAM	72B HBC	9.3 $\gamma p \rightarrow p 4\pi$

NODE=M065R1
NODE=M065R1⁴⁵ The $\pi \pi$ system is in S-wave.

NODE=M065R1;LINKAGE=S

 $\Gamma(\rho^0 \pi^0 \pi^0) / \Gamma(\rho^\pm \pi^\mp \pi^0) \quad \Gamma_5 / \Gamma_6$

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 $\gamma p \rightarrow p 4\pi$

NODE=M065R6
NODE=M065R6

$\Gamma(a_1(1260)\pi)/\Gamma(4\pi)$ Γ_7/Γ_1

VALUE	DOCUMENT ID	TECN	COMMENT

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

0.16 ± 0.05	⁴⁶ ABELE	01B	CBAR $0.0 \bar{p} n \rightarrow 5\pi$

⁴⁶ $\omega\pi$ not included.

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	⁴⁷ ABELE	01B	CBAR $0.0 \bar{p} n \rightarrow 5\pi$

⁴⁷ $\omega\pi$ 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	⁴⁸ ABELE	01B	CBAR $0.0 \bar{p} n \rightarrow 5\pi$

⁴⁸ $\omega\pi$ 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	⁴⁹ ABELE	01B	CBAR $0.0 \bar{p} n \rightarrow 5\pi$

⁴⁹ $\omega\pi$ 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. • • •

$0.287^{+0.043}_{-0.042}$	BECKER	79	ASPK $17 \pi^- p$ polarized
0.15 to 0.30	⁵⁰ MARTIN	78C	RVUE $17 \pi^- p \rightarrow \pi^+\pi^-n$
<0.20	⁵¹ COSTA...	77B	RVUE $e^+e^- \rightarrow 2\pi, 4\pi$
0.30 ± 0.05	⁵⁰ FROGGATT	77	RVUE $17 \pi^- p \rightarrow \pi^+\pi^-n$
<0.15	⁵² EISENBERG	73	HBC $5 \pi^+ p \rightarrow \Delta^{++} 2\pi$
0.25 ± 0.05	⁵³ HYAMS	73	ASPK $17 \pi^- p \rightarrow \pi^+\pi^-n$

⁵⁰ From phase shift analysis of HYAMS 73 data.

⁵¹ Estimate using unitarity, time reversal invariance, Breit-Wigner.

⁵² Estimated using one-pion-exchange model.

⁵³ Included in BECKER 79 analysis.

NODE=M065R5;LINKAGE=P
NODE=M065R5;LINKAGE=C
NODE=M065R5;LINKAGE=E
NODE=M065R5;LINKAGE=H

 $\Gamma(\pi^+\pi^-)/\Gamma(2(\pi^+\pi^-))$ 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	⁵⁴ DAVIER	73	STRC $6-18 \gamma p \rightarrow p 4\pi$
<0.2	⁵⁵ BINGHAM	72B	HBC $9.3 \gamma p \rightarrow p 2\pi$

⁵⁴ Upper limit is estimate.

⁵⁵ 2σ upper limit.

NODE=M065R3
NODE=M065R3

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	^{56,57} ABELE	01B	CBAR $0.0 \bar{p} n \rightarrow 5\pi$

⁵⁶ Using ABELE 97.

⁵⁷ $\omega\pi$ not included.

NODE=M065R20
NODE=M065R20

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

 $\Gamma(K\bar{K}^*(892)+\text{c.c.})/\Gamma(2(\pi^+\pi^-))$ 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	⁵⁸ DELCOURT	81B	DM1 $e^+e^- \rightarrow \bar{K} K \pi$

⁵⁸ Assuming $\rho(1700)$ and ω radial excitations to be degenerate in mass.

NODE=M065R9
NODE=M065R9

NODE=M065R9;LINKAGE=D

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

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

 Γ_{14}/Γ

NODE=M065R12
NODE=M065R12

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

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.123 ± 0.027	DELCOURT 82	DM1	$e^+e^- \rightarrow \pi^+\pi^-$ MM
~ 0.1	ASTON 80	OMEG	20–70 γp

 Γ_{14}/Γ_2

NODE=M065R8
NODE=M065R8

 $\Gamma(\pi^+\pi^- \text{ neutrals})/\Gamma(2(\pi^+\pi^-))$

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
2.6 ± 0.4	⁵⁹ BALLAM 74	HBC	9.3 γp
⁵⁹ Upper limit. Background not subtracted.			

 $(\Gamma_5 + \Gamma_6 + 0.714\Gamma_{14})/\Gamma_2$

NODE=M065R7
NODE=M065R7

 $\Gamma(a_2(1320)\pi)/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
not seen	AMELIN 00	VES	$37\pi^-p \rightarrow \eta\pi^+\pi^-n$

 Γ_{15}/Γ

NODE=M065R14
NODE=M065R14

 $\Gamma(K\bar{K})/\Gamma(2(\pi^+\pi^-))$

VALUE	CL%	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.015 ± 0.010		⁶⁰ DELCOURT 81B	DM1		$e^+e^- \rightarrow \bar{K}K$
<0.04	95	BINGHAM 72B	HBC	0	9.3 γp
⁶⁰ Assuming $\rho(1700)$ and ω radial excitations to be degenerate in mass.					

 Γ_{16}/Γ_2

NODE=M065R4
NODE=M065R4

 $\Gamma(K\bar{K})/\Gamma(K\bar{K}^*(892) + \text{c.c.})$

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.052 ± 0.026	BUON 82	DM1	$e^+e^- \rightarrow \text{hadrons}$

 Γ_{16}/Γ_{13}

NODE=M065R10
NODE=M065R10

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

VALUE	EVT5	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
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	$e^+e^- \rightarrow \omega\pi^0$

 Γ_{18}/Γ

NODE=M065R13
NODE=M065R13

 $\rho(1700)$ REFERENCES

ABRAMOWICZ 12	EPJ C72 1869	H. Abramowicz <i>et al.</i>	(ZEUS Collab.)
ACHASOV 12	JETPL 94 734	M.N. Achasov <i>et al.</i>	
	Translated from ZETFP 94 796.		
LEES 12G	PR D86 032013	J.P. Lees <i>et al.</i>	(BABAR Collab.)
FUJIKAWA 08	PR D78 072006	M. Fujikawa <i>et al.</i>	(BELLE Collab.)
COAN 04	PRL 92 232001	T.E. Coan <i>et al.</i>	(CLEO Collab.)
FRABETTI 04	PL B578 290	P.L. Frabetti <i>et al.</i>	(FNAL E687 Collab.)
AKHMETSHIN 03B	PL B562 173	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)
ABELE 01B	EPJ C21 261	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
ACHASOV 00I	PL B486 29	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)
AKHMETSHIN 00D	PL B489 125	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)
AMELIN 00	NP A668 83	D. Amelin <i>et al.</i>	(VES Collab.)
EDWARDS 00A	PR D61 072003	K.W. Edwards <i>et al.</i>	(CLEO Collab.)
ABELE 99D	PL B468 178	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
ABELE 97	PL B391 191	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
ACHASOV 97	PR D55 2663	N.N. Achasov <i>et al.</i>	(NOVM)
BERTIN 97C	PL B408 476	A. Bertin <i>et al.</i>	(OBELIX Collab.)
CLEGG 94	ZPHY C62 455	A.B. Clegg, A. Donnachie	(LANC, MCHS)
CLEGG 90	ZPHY C45 677	A.B. Clegg, A. Donnachie	(LANC, MCHS)
KUHN 90	ZPHY C48 445	J.H. Kuhn <i>et al.</i>	(MPIM)
BISELLO 89	PL B220 321	D. Bisello <i>et al.</i>	(DM2 Collab.)
DUBNICKA 89	JPG 15 1349	S. Dubnicka <i>et al.</i>	(JINR, SLOV)
GESHKEN... 89	ZPHY C45 351	B.V. Geshkenbein	(ITEP)
ANTONELLI 88	PL B212 133	A. Antonelli <i>et al.</i>	(DM2 Collab.)
DIEKMAN 88	PRPL 159 99	B. Diekmann	(BONN)
FUKUI 88	PL B202 441	S. Fukui <i>et al.</i>	(SUGI, NAGO, KEK, KYOT+)
DONNACHIE 87B	ZPHY C34 257	A. Donnachie, A.B. Clegg	(MCHS, LANC)
ATKINSON 86B	ZPHY C30 531	M. Atkinson <i>et al.</i>	(BONN, CERN, GLAS+)
ATKINSON 85B	ZPHY C26 499	M. Atkinson <i>et al.</i>	(BONN, CERN, GLAS+)
ERKAL 85	ZPHY C29 485	C. Erkal, M.G. Olsson	(WISC)
ABE 84B	PRL 53 751	K. Abe <i>et al.</i>	(SLAC HFP Collab.)
KURDADZE 83	JETPL 37 733	L.M. Kurdadze <i>et al.</i>	(NOVO)
	Translated from ZETFP 37 613.		

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ATKINSON	82	PL 108B 55	M. Atkinson <i>et al.</i>	(BONN, CERN, GLAS+)
BUON	82	PL 118B 221	J. Buon <i>et al.</i>	(LALO, MONP)
CLELAND	82B	NP B208 228	W.E. Cleland <i>et al.</i>	(DURH, GEVA, LAUS+)
CORDIER	82	PL 109B 129	A. Cordier <i>et al.</i>	(LALO)
DELCOURT	82	PL 113B 93	B. Delcourt <i>et al.</i>	(LALO)
ASTON	81E	NP B189 15	D. Aston	(BONN, CERN, EPOL, GLAS, LANC+)
DELCOURT	81B	Bonn Conf. 205	B. Delcourt	(ORSAY)
Also		PL 109B 129	A. Cordier <i>et al.</i>	(LALO)
DIBIANCA	81	PR D23 595	F.A. di Bianca <i>et al.</i>	(CASE, CMU)
ASTON	80	PL 92B 215	D. Aston	(BONN, CERN, EPOL, GLAS, LANC+)
BACCI	80	PL 95B 139	C. Bacci <i>et al.</i>	(ROMA, FRAS)
BIZOT	80	Madison Conf. 546	J.C. Bizot <i>et al.</i>	(LALO, MONP)
KILLIAN	80	PR D21 3005	T.J. Killian <i>et al.</i>	(CORN)
ATIYA	79B	PRL 43 1691	M.S. Atiya <i>et al.</i>	(COLU, ILL, FNAL)
BECKER	79	NP B151 46	H. Becker <i>et al.</i>	(MPIM, CERN, ZEEM, CRAC)
LANG	79	PR D19 956	C.B. Lang, A. Mas-Parareda	(GRAZ)
MARTIN	78C	ANP 114 1	A.D. Martin, M.R. Pennington	(CERN)
COSTA...	77B	PL 71B 345	B. Costa de Beauregard, B. Pire, T.N. Truong	(EPOL)
FROGGATT	77	NP B129 89	C.D. Froggatt, J.L. Petersen	(GLAS, NORD)
ALEXANDER	75	PL 57B 487	G. Alexander <i>et al.</i>	(TELA)
BALLAM	74	NP B76 375	J. Ballam <i>et al.</i>	(SLAC, LBL, MPIM)
CONVERSI	74	PL 52B 493	M. Conversi <i>et al.</i>	(ROMA, FRAS)
SCHACHT	74	NP B81 205	P. Schacht <i>et al.</i>	(MPIM)
DAVIER	73	NP B58 31	M. Davier <i>et al.</i>	(SLAC)
EISENBERG	73	PL 43B 149	Y. Eisenberg <i>et al.</i>	(REHO)
HYAMS	73	NP B64 134	B.D. Hyams <i>et al.</i>	(CERN, MPIM)
BINGHAM	72B	PL 41B 635	H.H. Bingham <i>et al.</i>	(LBL, UCB, SLAC) IGJP
JACOB	72	PR D5 1847	M. Jacob, R. Slansky	
GOUNARIS	68	PRL 21 244	G.J. Gounaris, J.J. Sakurai	

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NODE=M162

$a_2(1700)$

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

OMITTED FROM SUMMARY TABLE

$a_2(1700)$ MASS

NODE=M162M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
1732±16 OUR AVERAGE		Error includes scale factor of 1.9.			
1737± 5± 7		ABE	04	BELL	10.6 $e^+e^- \rightarrow e^+e^-K^+K^-$
1698±44		¹ AMSLER	02	CBAR	0.9 $\bar{p}p \rightarrow \pi^0\eta\eta$
1660±40		ABELE	99B	CBAR	1.94 $\bar{p}p \rightarrow \pi^0\eta\eta$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
1675±25		ANISOVICH	09	RVUE	0.0 $\bar{p}p, \pi N$
1722± 9±15	18k	² SCHEGELSKY	06	RVUE 0	$\gamma\gamma \rightarrow \pi^+\pi^-\pi^0$
1702± 7	80k	³ UMAN	06	E835	5.2 $\bar{p}p \rightarrow \eta\eta\pi^0$
1721±13±44	145k	LU	05	B852	18 $\pi^-p \rightarrow \omega\pi^-\pi^0p$
1767±14	221	⁴ ACCIARRI	01H	L3	$\gamma\gamma \rightarrow K_S^0 K_S^0, E_{cm}^{ee} = 91, 183-209 \text{ GeV}$
~ 1775		⁵ 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 T-matrix pole. ² From analysis of L3 data at 183–209 GeV. ³ Statistical error only. ⁴ Spin 2 dominant, isospin not determined, could also be $I=1$. ⁵ Possibly two $J^P = 2^+$ resonances with isospins 0 and 1.					

NODE=M162M;LINKAGE=TT
NODE=M162M;LINKAGE=SC
NODE=M162M;LINKAGE=ST
NODE=M162M;LINKAGE=HA
NODE=M162M;LINKAGE=GR

$a_2(1700)$ WIDTH

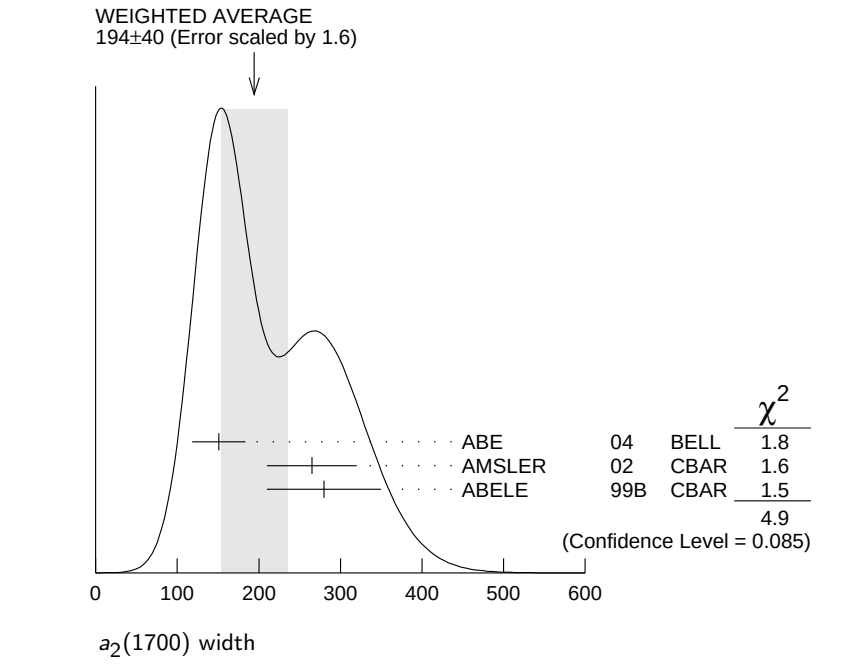
NODE=M162W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
194± 40 OUR AVERAGE		Error includes scale factor of 1.6. See the ideogram below.			
151± 22±24		ABE	04	BELL	10.6 $e^+e^- \rightarrow e^+e^-K^+K^-$
265± 55		⁶ AMSLER	02	CBAR	0.9 $\bar{p}p \rightarrow \pi^0\eta\eta$
280± 70		ABELE	99B	CBAR	1.94 $\bar{p}p \rightarrow \pi^0\eta\eta$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
270 ⁺ ₋₂₀		ANISOVICH	09	RVUE	0.0 $\bar{p}p, \pi N$
336± 20±20	18k	⁷ SCHEGELSKY	06	RVUE 0	$\gamma\gamma \rightarrow \pi^+\pi^-\pi^0$
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 $\pi^-p \rightarrow \omega\pi^-\pi^0p$
187± 60	221	⁹ ACCIARRI	01H	L3	$\gamma\gamma \rightarrow K_S^0 K_S^0, E_{cm}^{ee} = 91, 183-209 \text{ GeV}$
150±110±34		ACCIARRI	97T	L3	$\gamma\gamma \rightarrow \pi^+\pi^-\pi^0$

NODE=M162W

⁶ T-matrix pole.
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=TT
NODE=M162W;LINKAGE=SC
NODE=M162W;LINKAGE=ST
NODE=M162W;LINKAGE=HA



$a_2(1700)$ DECAY MODES

NODE=M162215;NODE=M162

Mode	Fraction (Γ_i/Γ)
Γ_1 $\eta\pi$	seen
Γ_2 $\gamma\gamma$	
Γ_3 $\rho\pi$	
Γ_4 $f_2(1270)\pi$	
Γ_5 $K\bar{K}$	seen
Γ_6 $\omega\pi^-\pi^0$	seen
Γ_7 $\omega\rho$	seen

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

$a_2(1700)$ PARTIAL WIDTHS

NODE=M162220

$\Gamma(\eta\pi)$					Γ_1
<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. • • •					
9.5 ± 2.0	870	¹⁰ SCHEGELSKY 06A	RVUE	$\gamma\gamma \rightarrow K_S^0 K_S^0$	
$\Gamma(\gamma\gamma)$					Γ_2
<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. • • •					
0.30 ± 0.05	870	¹⁰ SCHEGELSKY 06A	RVUE	$\gamma\gamma \rightarrow K_S^0 K_S^0$	
$\Gamma(K\bar{K})$					Γ_5
<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. • • •					
5.0 ± 3.0	870	¹⁰ SCHEGELSKY 06A	RVUE	$\gamma\gamma \rightarrow K_S^0 K_S^0$	
¹⁰ From analysis of L3 data at 91 and 183–209 GeV, using $a_2(1700)$ mass of 1730 MeV and width of 340 MeV, and SU(3) relations.					

NODE=M162W3
NODE=M162W3

NODE=M162W2
NODE=M162W2

NODE=M162W1
NODE=M162W1

NODE=M162W1;LINKAGE=SC

$a_2(1700)$ $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

NODE=M162225

$$\frac{[\Gamma(\rho\pi) + \Gamma(f_2(1270)\pi)] \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}}{(\Gamma_3 + \Gamma_4)\Gamma_2/\Gamma}$$

NODE=M162G1
NODE=M162G1

VALUE (keV)	EVTs	DOCUMENT ID	TECN	COMMENT

0.29±0.04±0.02		ACCIARRI	97T L3	$\gamma\gamma \rightarrow \pi^+\pi^-\pi^0$

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

$0.37^{+0.12}_{-0.08} \pm 0.10$	18k	¹¹ SCHEGELSKY 06	RVUE	$\gamma\gamma \rightarrow \pi^+\pi^-\pi^0$

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

$$\Gamma_5\Gamma_2/\Gamma$$

NODE=M162G2
NODE=M162G2

VALUE (eV)	DOCUMENT ID	TECN	COMMENT

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

$20.6 \pm 4.2 \pm 4.6$	¹² ABE	04 BELL	$10.6 e^+e^- \rightarrow e^+e^- K^+K^-$
$49 \pm 11 \pm 13$	¹³ ACCIARRI	01H L3	$\gamma\gamma \rightarrow K_S^0 K_S^0, E_{\text{cm}}^{\text{ee}} = 91, 183-209 \text{ GeV}$

¹¹ From analysis of L3 data at 183–209 GeV.¹² Assuming spin 2.¹³ Spin 2 dominant, isospin not determined, could also be $I=1$.NODE=M162G1;LINKAGE=SC
NODE=M162G2;LINKAGE=AB
NODE=M162G;LINKAGE=HA **$a_2(1700)$ BRANCHING RATIOS**

NODE=M162235

$$\Gamma(\rho\pi)/\Gamma(f_2(1270)\pi)$$

$$\Gamma_3/\Gamma_4$$

NODE=M162R01
NODE=M162R01

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT

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

$3.4 \pm 0.4 \pm 0.1$	18k	¹⁴ SCHEGELSKY 06	RVUE	$\gamma\gamma \rightarrow \pi^+\pi^-\pi^0$

¹⁴ From analysis of L3 data at 183–209 GeV.

NODE=M162R01;LINKAGE=SC

 $a_2(1700)$ REFERENCES

NODE=M162

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>
LU	05	PRL 94 032002	M. Lu <i>et al.</i>
ABE	04	EPJ C32 323	K. Abe <i>et al.</i>
AMSLER	02	EPJ C23 29	C. Amsler <i>et al.</i>
ACCIARRI	01H	PL B501 173	M. Acciarri <i>et al.</i>
ABELE	99B	EPJ C8 67	A. Abele <i>et al.</i>
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>

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$f_0(1710)$

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

See our mini-review in the 2004 edition of this *Review*, Physics Letters **B592** 1 (2004). See also the mini-review on scalar mesons under $f_0(500)$ (see the index for the page number).

NODE=M068

NODE=M068

$f_0(1710)$ MASS

NODE=M068M

NODE=M068M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1720± 6	OUR AVERAGE	Error includes scale factor of 1.6. See the ideogram below.		
1701± 5	$^{+9}_{-2}$ 4k	¹ CHEKANOV	08 ZEUS	$e p \rightarrow K_S^0 K_S^0 X$
1765 $^{+4}_{-3}$	±13	ABLIKIM	06V BES2	$e^+ e^- \rightarrow J/\psi \rightarrow \gamma \pi^+ \pi^-$
1760±15	$^{+15}_{-10}$	² ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$
1738±30		ABLIKIM	04E BES2	$J/\psi \rightarrow \omega K^+ K^-$
1740± 4	$^{+10}_{-25}$	³ BAI	03G BES	$J/\psi \rightarrow \gamma K \bar{K}$
1740 $^{+30}_{-25}$		³ BAI	00A BES	$J/\psi \rightarrow \gamma (\pi^+ \pi^- \pi^+ \pi^-)$
1698±18		⁴ BARBERIS	00E	450 $p p \rightarrow p_f \eta \eta p_S$
1710±12	±11	⁵ BARBERIS	99D OMEG	450 $p p \rightarrow K^+ K^-, \pi^+ \pi^-$
1710±25		⁶ FRENCH	99	300 $p p \rightarrow p_f (K^+ K^-) p_S$
1707±10		⁷ AUGUSTIN	88 DM2	$J/\psi \rightarrow \gamma K^+ K^-, K_S^0 K_S^0$
1698±15		⁷ AUGUSTIN	87 DM2	$J/\psi \rightarrow \gamma \pi^+ \pi^-$
1720±10	±10	⁸ BALTRUSAIT...	87 MRK3	$J/\psi \rightarrow \gamma K^+ K^-$
1742±15		⁷ WILLIAMS	84 MPSF	200 $\pi^- N \rightarrow 2 K_S^0 X$
1670±50		BLOOM	83 CBAL	$J/\psi \rightarrow \gamma 2\eta$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
1750±13		AMSLER	06 CBAR	1.64 $\bar{p} p \rightarrow K^+ K^- \pi^0$
1747± 5	80k	^{9,10} 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 $^{+40}_{-30}$		² ABLIKIM	05 BES2	$J/\psi \rightarrow \phi \pi^+ \pi^-$
1670±20		⁹ BINON	05 GAMS	33 $\pi^- p \rightarrow \eta \eta n$
1726± 7	74	¹⁰ CHEKANOV	04 ZEUS	$e p \rightarrow K_S^0 K_S^0 X$
1732±15		¹¹ ANISOVICH	03 RVUE	
1682±16		TIKHOMIROV	03 SPEC	40.0 $\pi^- C \rightarrow K_S^0 K_S^0 K_L^0 X$
1670±26	3651	^{3,12} NICHITIU	02 OBLX	
1770±12		^{13,14} ANISOVICH	99B SPEC	0.6–1.2 $p \bar{p} \rightarrow \eta \eta \pi^0$
1730±15		³ BARBERIS	99 OMEG	450 $p p \rightarrow p_S p_f K^+ K^-$
1750±20		³ BARBERIS	99B OMEG	450 $p p \rightarrow p_S p_f \pi^+ \pi^-$
1750±30		¹⁵ ANISOVICH	98B RVUE	Compilation
1720±39		BAI	98H BES	$J/\psi \rightarrow \gamma \pi^0 \pi^0$
1775± 1.5	57	¹⁶ BARKOV	98	$\pi^- p \rightarrow K_S^0 K_S^0 n$
1690±11		¹⁷ ABREU	96C DLPH	$Z^0 \rightarrow K^+ K^- + X$
1696± 5	$^{+9}_{-34}$	⁸ BAI	96C BES	$J/\psi \rightarrow \gamma K^+ K^-$
1781± 8	$^{+10}_{-31}$	³ BAI	96C BES	$J/\psi \rightarrow \gamma K^+ K^-$
1768±14		BALOSHIN	95 SPEC	40 $\pi^- C \rightarrow K_S^0 K_S^0 X$
1750±15		¹⁸ BUGG	95 MRK3	$J/\psi \rightarrow \gamma \pi^+ \pi^- \pi^+ \pi^-$
1620±16		⁸ BUGG	95 MRK3	$J/\psi \rightarrow \gamma \pi^+ \pi^- \pi^+ \pi^-$
1748±10		⁷ ARMSTRONG	93C E760	$\bar{p} p \rightarrow \pi^0 \eta \eta \rightarrow 6\gamma$
~ 1750		BREAKSTONE	93 SFM	$p p \rightarrow p p \pi^+ \pi^- \pi^+ \pi^-$
1744±15		¹⁹ ALDE	92D GAM2	38 $\pi^- p \rightarrow \eta \eta n$
1713±10		²⁰ ARMSTRONG	89D OMEG	300 $p p \rightarrow p p K^+ K^-$
1706±10		²⁰ ARMSTRONG	89D OMEG	300 $p p \rightarrow p p K_S^0 K_S^0$
1700±15		⁸ BOLONKIN	88 SPEC	40 $\pi^- p \rightarrow K_S^0 K_S^0 n$
1720±60		³ BOLONKIN	88 SPEC	40 $\pi^- p \rightarrow K_S^0 K_S^0 n$
1638±10		²¹ FALVARD	88 DM2	$J/\psi \rightarrow \phi K^+ K^-, K_S^0 K_S^0$

OCCUR=2

OCCUR=2

OCCUR=2

OCCUR=2

1690 ± 4	22 FALVARD	88 DM2	$J/\psi \rightarrow \phi K^+ K^-, K_S^0 K_S^0$
1755 ± 8	23 ALDE	86C GAM2	$38 \pi^- p \rightarrow n 2\eta$
1730 ⁺ ₋₁₀	24 LONGACRE	86 RVUE	$22 \pi^- p \rightarrow n 2K_S^0$
1650 ± 50	BURKE	82 MRK2	$J/\psi \rightarrow \gamma 2\rho$
1640 ± 50	25,26 EDWARDS	82D CBAL	$J/\psi \rightarrow \gamma 2\eta$
1730 ± 10 ± 20	27 ETKIN	82C MPS	$23 \pi^- p \rightarrow n 2K_S^0$

OCCUR=2

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 This state may be different from $f_0(1710)$, see CLOSE 05.

³ $J^P = 0^+$.

⁴ T-matrix pole.

⁵ Supersedes BARBERIS 99 and BARBERIS 99B.

⁶ $J^P = 0^+$, supersedes by ARMSTRONG 89D.

⁷ No J^{PC} determination.

⁸ $J^P = 2^+$.

⁹ Breit-Wigner mass.

¹⁰ Systematic errors not estimated.

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 $J^P = 0^+$.

¹⁴ Not seen by AMSLER 02.

¹⁵ T-matrix pole, assuming $J^P = 0^+$

¹⁶ No J^{PC} determination.

¹⁷ No J^{PC} determination, width not determined.

¹⁸ From a fit to the 0^+ partial wave.

¹⁹ ALDE 92D combines all the GAMS-2000 data.

²⁰ $J^P = 2^+$, superseded by FRENCH 99.

²¹ From an analysis ignoring interference with $f_2'(1525)$.

²² From an analysis including interference with $f_2'(1525)$.

²³ Superseded by ALDE 92D.

²⁴ 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.

²⁵ $J^P = 2^+$ preferred.

²⁶ From fit neglecting nearby $f_2'(1525)$. Replaced by BLOOM 83.

²⁷ Superseded by LONGACRE 86.

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NODE=M068M;LINKAGE=TP

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NODE=M068M;LINKAGE=NC

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NODE=M068M;LINKAGE=A4

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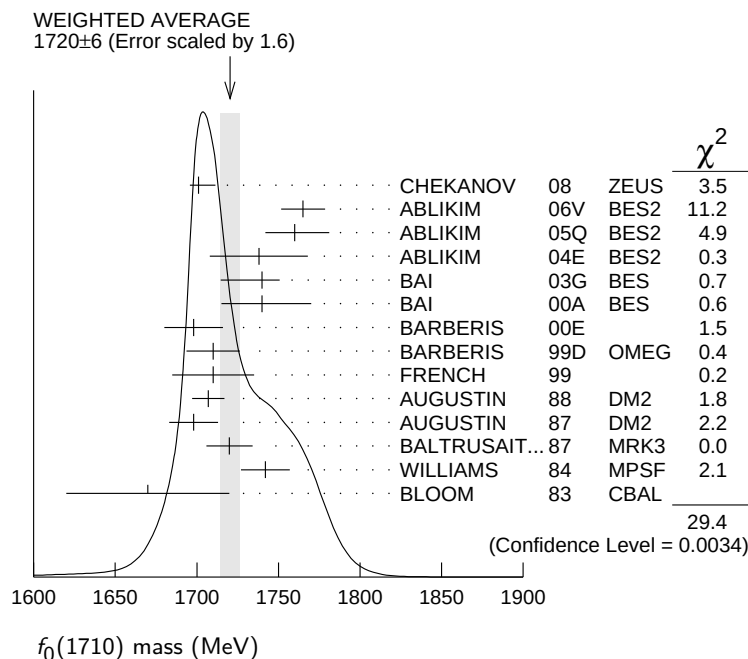
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NODE=M068M;LINKAGE=B2

NODE=M068M;LINKAGE=E

NODE=M068M;LINKAGE=B1

 **$f_0(1710)$ WIDTH**

NODE=M068W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
135 ± 8	OUR AVERAGE	Error includes scale factor of 1.1.		
100 ± 24	4k	28 CHEKANOV	08 ZEUS	$e p \rightarrow K_S^0 K_S^0 X$
145 ± 8		ABLIKIM	06V BES2	$e^+ e^- \rightarrow J/\psi \rightarrow \gamma \pi^+ \pi^-$
125 ± 25		29 ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$
125 ± 20		ABLIKIM	04E BES2	$J/\psi \rightarrow \omega K^+ K^-$
166 ± 5		30 BAI	03G BES	$J/\psi \rightarrow \gamma K \bar{K}$
120 ± 50		30 BAI	00A BES	$J/\psi \rightarrow \gamma(\pi^+ \pi^- \pi^+ \pi^-)$
120 ± 26		31 BARBERIS	00E	450 $p p \rightarrow p_f \eta \eta p_s$
126 ± 16	±18	32 BARBERIS	99D OMEG	450 $p p \rightarrow K^+ K^-, \pi^+ \pi^-$
105 ± 34		33 FRENCH	99	300 $p p \rightarrow p_f(K^+ K^-) p_s$
166.4 ± 33.2		34 AUGUSTIN	88 DM2	$J/\psi \rightarrow \gamma K^+ K^-, K_S^0 K_S^0$
136 ± 28		34 AUGUSTIN	87 DM2	$J/\psi \rightarrow \gamma \pi^+ \pi^-$
130 ± 20		35 BALTRUSAIT..	87 MRK3	$J/\psi \rightarrow \gamma K^+ K^-$
57 ± 38		36 WILLIAMS	84 MPSF	200 $\pi^- N \rightarrow 2K_S^0 X$
160 ± 80		BLOOM	83 CBAL	$J/\psi \rightarrow \gamma 2\eta$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
148 ± 40		AMSLER	06 CBAR	1.64 $\bar{p} p \rightarrow K^+ K^- \pi^0$
188 ± 13	80k	29,37 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		38 ABLIKIM	05 BES2	$J/\psi \rightarrow \phi \pi^+ \pi^-$
260 ± 50		29 BINON	05 GAMS	33 $\pi^- p \rightarrow \eta \eta n$
38 ± 20	74	37 CHEKANOV	04 ZEUS	$e p \rightarrow K_S^0 K_S^0 X$
144 ± 30		39,40 ANISOVICH	03 RVUE	
320 ± 50		40,41 ANISOVICH	03 RVUE	
102 ± 26		TIKHOMIROV	03 SPEC	40.0 $\pi^- C \rightarrow K_S^0 K_S^0 K_L^0 X$
267 ± 44	3651	30,42 NICHITIU	02 OBLX	
220 ± 40		43,44 ANISOVICH	99B SPEC	0.6–1.2 $p \bar{p} \rightarrow \eta \eta \pi^0$
100 ± 25		30 BARBERIS	99 OMEG	450 $p p \rightarrow p_s p_f K^+ K^-$
160 ± 30		30 BARBERIS	99B OMEG	450 $p p \rightarrow p_s p_f \pi^+ \pi^-$
250 ± 140		45 ANISOVICH	98B RVUE	Compilation
30 ± 7	57	46 BARKOV	98	$\pi^- p \rightarrow K_S^0 K_S^0 n$
103 ± 18		35 BAI	96C BES	$J/\psi \rightarrow \gamma K^+ K^-$
85 ± 24		30 BAI	96C BES	$J/\psi \rightarrow \gamma K^+ K^-$
56 ± 19		BALOSHIN	95 SPEC	40 $\pi^- C \rightarrow K_S^0 K_S^0 X$
160 ± 40		47 BUGG	95 MRK3	$J/\psi \rightarrow \gamma \pi^+ \pi^- \pi^+ \pi^-$
160 ± 60		35 BUGG	95 MRK3	$J/\psi \rightarrow \gamma \pi^+ \pi^- \pi^+ \pi^-$
264 ± 25		34 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		48 ALDE	92D GAM2	38 $\pi^- p \rightarrow \eta \eta N^*$
181 ± 30		49 ARMSTRONG	89D OMEG	300 $p p \rightarrow p p K^+ K^-$
104 ± 30		49 ARMSTRONG	89D OMEG	300 $p p \rightarrow p p K_S^0 K_S^0$
30 ± 20		35 BOLONKIN	88 SPEC	40 $\pi^- p \rightarrow K_S^0 K_S^0 n$
350 ± 150		30 BOLONKIN	88 SPEC	40 $\pi^- p \rightarrow K_S^0 K_S^0 n$
148 ± 17		50 FALVARD	88 DM2	$J/\psi \rightarrow \phi K^+ K^-, K_S^0 K_S^0$
184 ± 6		51 FALVARD	88 DM2	$J/\psi \rightarrow \phi K^+ K^-, K_S^0 K_S^0$
122 ± 74		52 LONGACRE	86 RVUE	22 $\pi^- p \rightarrow n 2K_S^0$
200 ± 100		BURKE	82 MRK2	$J/\psi \rightarrow \gamma 2\rho$
220 ± 100	53,54	EDWARDS	82D CBAL	$J/\psi \rightarrow \gamma 2\eta$
200 ± 156		55 ETKIN	82B MPS	23 $\pi^- p \rightarrow n 2K_S^0$

NODE=M068W

OCCUR=2

OCCUR=2

OCCUR=2

OCCUR=2

OCCUR=2

OCCUR=2

²⁸In 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.

²⁹Breit-Wigner width.

³⁰ $J^P = 0^+$.

³¹T-matrix pole.

NODE=M068W;LINKAGE=HE

NODE=M068W;LINKAGE=BW

NODE=M068W;LINKAGE=A8

NODE=M068W;LINKAGE=TP

- 32 Supersedes BARBERIS 99 and BARBERIS 99B.
 33 $J^P = 0^+$, supersedes by ARMSTRONG 89D.
 34 No J^{PC} determination.
 35 $J^P = 2^+$.
 36 No J^{PC} determination.
 37 Systematic errors not estimated.
 38 This state may be different from $f_0(1710)$, see CLOSE 05.
 39 (Solution I)
 40 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.
 41 (Solution I)
 42 Decaying to $f_0(1370) \pi \pi$.
 43 $J^P = 0^+$.
 44 Not seen by AMSLER 02.
 45 T-matrix pole, assuming $J^P = 0^+$
 46 No J^{PC} determination.
 47 From a fit to the 0^+ partial wave.
 48 ALDE 92D combines all the GAMS-2000 data.
 49 $J^P = 2^+$, (0^+ excluded).
 50 From an analysis ignoring interference with $f_2'(1525)$.
 51 From an analysis including interference with $f_2'(1525)$.
 52 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.
 53 $J^P = 2^+$ preferred.
 54 From fit neglecting nearby $f_2'(1525)$. Replaced by BLOOM 83.
 55 From an amplitude analysis of the $K_S^0 K_S^0$ system, superseded by LONGACRE 86.

NODE=M068W;LINKAGE=BD
 NODE=M068W;LINKAGE=C3
 NODE=M068W;LINKAGE=A1
 NODE=M068W;LINKAGE=A3
 NODE=M068M;LINKAGE=WI
 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=AV
 NODE=M068W;LINKAGE=NS
 NODE=M068W;LINKAGE=AN
 NODE=M068W;LINKAGE=4A
 NODE=M068W;LINKAGE=Q0
 NODE=M068W;LINKAGE=AA
 NODE=M068W;LINKAGE=B
 NODE=M068W;LINKAGE=C
 NODE=M068W;LINKAGE=D
 NODE=M068W;LINKAGE=A9

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
$\Gamma_4 \quad \gamma \gamma$	
$\Gamma_5 \quad \omega \omega$	seen

NODE=M068215;NODE=M068

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

$f_0(1710) \Gamma(i) \Gamma(\gamma\gamma) / \Gamma(\text{total})$

$\Gamma(K \bar{K}) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$					$\Gamma_1 \Gamma_4 / \Gamma$
VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT	
<110	95	⁵⁶ BEHREND	89C CELL	$\gamma\gamma \rightarrow K_S^0 K_S^0$	

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

<480	95	ALBRECHT	90G ARG	$\gamma\gamma \rightarrow K^+ K^-$
<280	95	⁵⁶ ALTHOFF	85B TASS	$\gamma\gamma \rightarrow K \bar{K} \pi$

⁵⁶ Assuming helicity 2.

$\Gamma(\pi\pi) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$					$\Gamma_3 \Gamma_4 / \Gamma$
VALUE (keV)	CL%	DOCUMENT ID	TECN	COMMENT	
<0.82	95	⁵⁷ BARATE	00E ALEP	$\gamma\gamma \rightarrow \pi^+ \pi^-$	

⁵⁷ Assuming spin 0.

NODE=M068220

NODE=M068G2
 NODE=M068G2

NODE=M068G2;LINKAGE=F

NODE=M068G3
 NODE=M068G3

NODE=M068G;LINKAGE=Z

$f_0(1710)$ BRANCHING RATIOS

$\Gamma(K \bar{K}) / \Gamma_{\text{total}}$					Γ_1 / Γ
VALUE		DOCUMENT ID	TECN	COMMENT	
0.36 ± 0.12		ALBALADEJO 08	RVUE		
0.38 ^{+0.09} _{-0.19}		^{58,59} LONGACRE	86 MPS	$22 \pi^- p \rightarrow n 2 K_S^0$	

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

NODE=M068R2
 NODE=M068R2

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

VALUE	DOCUMENT ID	TECN

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

0.22±0.12	ALBALADEJO 08	RVUE

0.18 ^{+0.03} _{-0.13}	58,59 LONGACRE 86	RVUE

 Γ_2/Γ

NODE=M068R1
NODE=M068R1

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

VALUE	DOCUMENT ID	TECN	COMMENT

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

not seen	AMSLER 02	CBAR	0.9 $\bar{p}p \rightarrow \pi^0\eta\eta, \pi^0\pi^0\pi^0$

0.039 ^{+0.002} _{-0.024}	58,59 LONGACRE 86	RVUE	

 Γ_3/Γ

NODE=M068R5
NODE=M068R5

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

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

0.41^{+0.11}_{-0.17}

ABLIKIM 06V	BES2	$e^+e^- \rightarrow J/\psi \rightarrow \gamma\pi^+\pi^-$

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

0.32±0.14	ALBALADEJO 08	RVUE

< 0.11	95 60 ABLIKIM 04E	BES2	$J/\psi \rightarrow \omega K^+ K^-$

5.8 ^{+9.1} _{-5.5}	61 ANISOVICH 02D	SPEC	Combined fit

0.2 ± 0.024±0.036	BARBERIS 99D	OMEG 450	$pp \rightarrow K^+ K^-, \pi^+\pi^-$

0.39±0.14	ARMSTRONG 91	OMEG 300	$pp \rightarrow pp\pi\pi, ppK\bar{K}$

 Γ_3/Γ_1

NODE=M068R6
NODE=M068R6

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

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}

61 ANISOVICH 02D	SPEC	Combined fit

<0.02	90 62 PROKOSHKIN 91	GA24	300 $\pi^- p \rightarrow \pi^- p\eta\eta$

 Γ_2/Γ_1

NODE=M068R7
NODE=M068R7

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

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

seen	180	ABLIKIM 06H	BES	$J/\psi \rightarrow \gamma\omega\omega$

 Γ_5/Γ

NODE=M068R3
NODE=M068R3

⁵⁸ From a partial-wave analysis of data using a K-matrix formalism with 5 poles, but assuming spin 2.

⁵⁹ Fit with constrained inelasticity.

⁶⁰ Using data from ABLIKIM 04A.

⁶¹ 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.

⁶² Combining results of GAM4 with those of ARMSTRONG 89D.

NODE=M068R;LINKAGE=L

NODE=M068R;LINKAGE=M
NODE=M068R;LINKAGE=AB
NODE=M068R;LINKAGE=CH

NODE=M068R;LINKAGE=A

 $\phi(1710)$ REFERENCES

NODE=M068

ALBALADEJO 08	PRL 101 252002	M. Albaladejo, J.A. Oller
CHEKANOV 08	PRL 101 112003	S. Chekanov <i>et al.</i>
ABLIKIM 06H	PR D73 112007	M. Ablikim <i>et al.</i>
ABLIKIM 06V	PL B642 441	M. Ablikim <i>et al.</i>
AMSLER 06	PL B639 165	C. Amsler <i>et al.</i>
UMAN 06	PR D73 052009	I. Uman <i>et al.</i>
VLADIMIRSK... 06	PAN 69 493	V.V. Vladimirovsky <i>et al.</i>
	Translated from YAF 69 515.	
ABLIKIM 05	PL B607 243	M. Ablikim <i>et al.</i>
ABLIKIM 05Q	PR D72 092002	M. Ablikim <i>et al.</i>
BINON 05	PAN 68 960	F. Binon <i>et al.</i>
	Translated from YAF 68 998.	
CLOSE 05	PR D71 094022	F.E. Close, Q. Zhao
ABLIKIM 04A	PL B598 149	M. Ablikim <i>et al.</i>
ABLIKIM 04E	PL B603 138	M. Ablikim <i>et al.</i>
CHEKANOV 04	PL B578 33	S. Chekanov <i>et al.</i>
PDG 04	PL B592 1	S. Eidelman <i>et al.</i>
ANISOVICH 03	EPJ A16 229	V.V. Anisovich <i>et al.</i>
BAI 03G	PR D68 052003	J.Z. Bai <i>et al.</i>
TIKHOMIROV 03	PAN 66 828	G.D. Tikhomirov <i>et al.</i>
	Translated from YAF 66 860.	
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.	

(ZEUS Collab.)
(BES Collab.)
(BES Collab.)
(BES Collab.)
(CBAR Collab.)
(FNAL E835)
(ITEP, Moscow)

(BES Collab.)
(BES Collab.)

(BES Collab.)
(BES Collab.)
(ZEUS Collab.)
(PDG Collab.)

(BES Collab.)

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REFID=48831

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, 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
WILLIAMS	84	PR D30 877	E.G.H. Williams <i>et al.</i>	(VAND, NDAM, TUFTS+)	REFID=21693
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

 $\eta(1760)$

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

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).

$\eta(1760)$ MASS

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
1756 ± 9 OUR AVERAGE				
1744 ± 10 ± 15	1045	¹ ABLIKIM	06H BES	$J/\psi \rightarrow \gamma\omega\omega$
1760 ± 11	320	² BISELLO	89B DM2	$J/\psi \rightarrow 4\pi\gamma$

¹ From a partial wave analysis including $\eta(1760)$, $f_0(1710)$, $f_2(1640)$, and $f_2(1910)$.

² Estimated by us from various fits.

$\eta(1760)$ WIDTH

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
96 ± 70 OUR AVERAGE				Error includes scale factor of 5.1.
244 ⁺²⁴ ₋₂₁ ± 25	1045	³ ABLIKIM	06H BES	$J/\psi \rightarrow \gamma\omega\omega$
60 ± 16	320	⁴ BISELLO	89B DM2	$J/\psi \rightarrow 4\pi\gamma$

³ From a partial wave analysis including $\eta(1760)$, $f_0(1710)$, $f_2(1640)$, and $f_2(1910)$.

⁴ Estimated by us from various fits.

$\eta(1760)$ REFERENCES

ABLIKIM	06H	PR D73 112007	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51125
BISELLO	89B	PR D39 701	G. Busetto <i>et al.</i>	(DM2 Collab.)	REFID=40575
BISELLO	87	PL B192 239	D. Bisello <i>et al.</i>	(PADO, CLER, FRAS+)	REFID=40012
BALTRUSAITIS...	86B	PR D33 1222	R.M. Baltrusaitis <i>et al.</i>	(Mark III Collab.)	REFID=22100
BALTRUSAITIS...	85C	PRL 55 1723	R.M. Baltrusaitis <i>et al.</i>	(CIT, UCSC+)	REFID=22095

NODE=M114

NODE=M114

NODE=M114M

NODE=M114M

NODE=M114M;LINKAGE=MA
NODE=M114M;LINKAGE=A

NODE=M114W

NODE=M114W

NODE=M114W;LINKAGE=MA
NODE=M114W;LINKAGE=B

NODE=M114

$\pi(1800)$

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

See also minireview under non- $q\bar{q}$ candidates in PDG 06, Journal of Physics, G **33** 1 (2006).

NODE=M075

NODE=M075

NODE=M075M

NODE=M075M

OCCUR=2

NODE=M075M;LINKAGE=SP

NODE=M075M;LINKAGE=C1

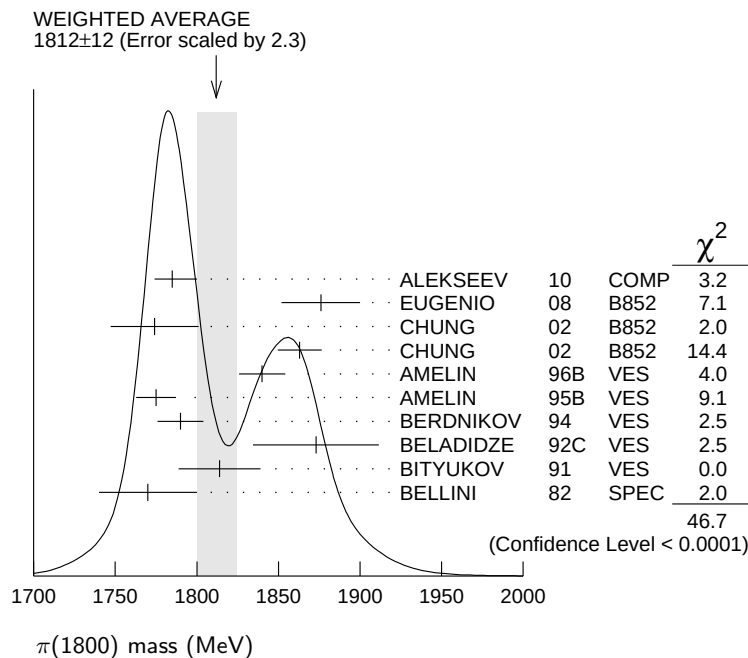
NODE=M075M;LINKAGE=C2

NODE=M075M;LINKAGE=AX

NODE=M075M;LINKAGE=A

 $\pi(1800)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
1812±12 OUR AVERAGE					
Error includes scale factor of 2.3. See the ideogram below.					
1785± 9 ⁺¹² ₋₆	420k	ALEKSEEV	10	COMP	190 $\pi^- Pb \rightarrow \pi^- \pi^- \pi^+ Pb'$
1876±18±16	4k	¹ EUGENIO	08	B852	18 $\pi^- p \rightarrow \eta \eta \pi^- p$
1774±18±20		² CHUNG	02	B852	18.3 $\pi^- p \rightarrow \pi^+ \pi^- \pi^- p$
1863± 9±10		³ CHUNG	02	B852	18.3 $\pi^- p \rightarrow \pi^+ \pi^- \pi^- p$
1840±10±10	1200	AMELIN	96B	VES	37 $\pi^- A \rightarrow \eta \eta \pi^- A$
1775± 7±10		⁴ AMELIN	95B	VES	36 $\pi^- A \rightarrow \pi^+ \pi^- \pi^- A$
1790±14		⁵ BERDNIKOV	94	VES	37 $\pi^- A \rightarrow K^+ K^- \pi^- A$
1873±33±20		BELADIDZE	92C	VES	36 $\pi^- Be \rightarrow \pi^- \eta' \eta Be$
1814±10±23	426±57	BITYUKOV	91	VES	36 $\pi^- C \rightarrow \pi^- \eta \eta C$
1770±30	1100	BELLINI	82	SPEC	40 $\pi^- A \rightarrow 3\pi A$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1737± 5±15		AMELIN	99	VES	37 $\pi^- A \rightarrow \omega \pi^- \pi^0 A^*$

¹ From a single-pole fit.² In the $f_0(980)\pi$ wave.³ In the $f_0(500)\pi$ wave.⁴ From a fit to $J^{PC} = 0^-+ f_0(980)\pi, f_0(1370)\pi$ waves.⁵ From a fit to $J^{PC} = 0^-+ K_0^*(1430)K^-$ and $f_0(980)\pi^-$ waves. **$\pi(1800)$ WIDTH**

NODE=M075W

NODE=M075W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
208±12 OUR AVERAGE					
208±22 ⁺²¹ ₋₃₇	420k	ALEKSEEV	10	COMP	190 $\pi^- Pb \rightarrow \pi^- \pi^- \pi^+ Pb'$
221±26±38	4k	⁶ EUGENIO	08	B852	18 $\pi^- p \rightarrow \eta \eta \pi^- p$
223±48±50		⁷ CHUNG	02	B852	18.3 $\pi^- p \rightarrow \pi^+ \pi^- \pi^- p$

191 ± 21 ± 20		⁸ CHUNG	02	B852	18.3 $\pi^- p \rightarrow \pi^+ \pi^- \pi^- p$	OCCUR=2
210 ± 30 ± 30	1200	AMELIN	96B	VES	37 $\pi^- A \rightarrow \eta \eta \pi^- A$	
190 ± 15 ± 15		⁹ AMELIN	95B	VES	36 $\pi^- A \rightarrow \pi^+ \pi^- \pi^- A$	
210 ± 70		¹⁰ BERDNIKOV	94	VES	37 $\pi^- A \rightarrow K^+ K^- \pi^- A$	
225 ± 35 ± 20		BELADIDZE	92C	VES	36 $\pi^- Be \rightarrow \pi^- \eta' \eta Be$	
205 ± 18 ± 32	426 ± 57	BITYUKOV	91	VES	36 $\pi^- C \rightarrow \pi^- \eta \eta C$	
310 ± 50	1100	BELLINI	82	SPEC	40 $\pi^- A \rightarrow 3\pi A$	
• • • We do not use the following data for averages, fits, limits, etc. • • •						
259 ± 19 ± 6		AMELIN	99	VES	37 $\pi^- A \rightarrow \omega \pi^- \pi^0 A^*$	
⁶ From a single-pole fit.						
⁷ In the $f_0(980)\pi$ wave.						
⁸ In the $f_0(500)\pi$ wave.						
⁹ From a fit to $J^{PC} = 0^- + f_0(980)\pi, f_0(1370)\pi$ waves.						
¹⁰ From a fit to $J^{PC} = 0^- + K_0^*(1430)K^-$ and $f_0(980)\pi^-$ waves.						

 $\pi(1800)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \pi^+ \pi^- \pi^-$	seen
$\Gamma_2 \quad f_0(500)\pi^-$	seen
$\Gamma_3 \quad f_0(980)\pi^-$	seen
$\Gamma_4 \quad f_0(1370)\pi^-$	seen
$\Gamma_5 \quad f_0(1500)\pi^-$	not seen
$\Gamma_6 \quad \rho\pi^-$	not seen
$\Gamma_7 \quad \eta\eta\pi^-$	seen
$\Gamma_8 \quad a_0(980)\eta$	seen
$\Gamma_9 \quad a_2(1320)\eta$	not seen
$\Gamma_{10} \quad f_2(1270)\pi$	not seen
$\Gamma_{11} \quad f_0(1370)\pi^-$	not seen
$\Gamma_{12} \quad f_0(1500)\pi^-$	seen
$\Gamma_{13} \quad \eta\eta'(958)\pi^-$	seen
$\Gamma_{14} \quad K_0^*(1430)K^-$	seen
$\Gamma_{15} \quad K^*(892)K^-$	not seen

NODE=M075W;LINKAGE=SP
 NODE=M075W;LINKAGE=C1
 NODE=M075W;LINKAGE=C2
 NODE=M075W;LINKAGE=AX
 NODE=M075W;LINKAGE=A

NODE=M075215;NODE=M075

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 DESIG=11;OUR EST;→ UNCHECKED ←
 DESIG=3;OUR EST;→ UNCHECKED ←
 DESIG=1
 DESIG=12
 DESIG=2
 DESIG=7;OUR EST;→ UNCHECKED ←
 DESIG=5;OUR EST;→ UNCHECKED ←
 DESIG=13
 DESIG=14
 DESIG=15
 DESIG=6;OUR EST;→ UNCHECKED ←
 DESIG=8;OUR EST;→ UNCHECKED ←
 DESIG=4
 DESIG=9

 $\pi(1800)$ BRANCHING RATIOS

$\Gamma(f_0(980)\pi^-)/\Gamma(f_0(500)\pi^-)$	Γ_3/Γ_2
VALUE	DOCUMENT ID TECN COMMENT
0.44 ± 0.08 ± 0.38	¹¹ CHUNG 02 B852 18.3 $\pi^- p \rightarrow \pi^+ \pi^- \pi^- p$

NODE=M075220

NODE=M075R11
 NODE=M075R11

$\Gamma(f_0(980)\pi^-)/\Gamma(f_0(1370)\pi^-)$	Γ_3/Γ_4
VALUE	DOCUMENT ID TECN CHG COMMENT
1.7 ± 1.3	¹² AMELIN 95B VES — 36 $\pi^- A \rightarrow \pi^+ \pi^- \pi^- A$

NODE=M075R5
 NODE=M075R5

$\Gamma(f_0(1370)\pi^-)/\Gamma_{\text{total}}$	Γ_4/Γ
VALUE	DOCUMENT ID TECN CHG COMMENT
seen	BELLINI 82 SPEC — 40 $\pi^- A \rightarrow 3\pi A$

NODE=M075R1
 NODE=M075R1

$\Gamma(f_0(1500)\pi^-)/\Gamma_{\text{total}}$	Γ_5/Γ
VALUE	DOCUMENT ID TECN COMMENT
not seen	CHUNG 02 B852 18.3 $\pi^- p \rightarrow \pi^+ \pi^- \pi^- p$

NODE=M075R12
 NODE=M075R12

$\Gamma(\rho\pi^-)/\Gamma_{\text{total}}$	Γ_6/Γ
VALUE	DOCUMENT ID TECN CHG COMMENT
not seen	BELLINI 82 SPEC — 40 $\pi^- A \rightarrow 3\pi A$

NODE=M075R2
 NODE=M075R2

$\Gamma(\rho\pi^-)/\Gamma(f_0(980)\pi^-)$ Γ_6/Γ_3

VALUE	CL%	DOCUMENT ID	TECN	CHG	COMMENT

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

<0.25		CHUNG	02	B852	18.3 $\pi^- p \rightarrow \pi^+ \pi^- \pi^- p$
<0.14	90	AMELIN	95B	VES	36 $\pi^- A \rightarrow \pi^+ \pi^- \pi^- A$

NODE=M075R6
NODE=M075R6

 $\Gamma(\eta\eta\pi^-)/\Gamma(\pi^+\pi^-\pi^-)$ Γ_7/Γ_1

VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

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

0.5±0.1	1200	¹² 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	^{12,13} EUGENIO	08	B852	18 $\pi^- p \rightarrow \eta\eta\pi^- p$
0.030 ^{+0.014} _{-0.011}		¹² ANISOVICH	01B	SPEC	0 0.6–1.94 $p\bar{p} \rightarrow \eta\eta\pi^0\pi^0$
0.08 ±0.03	1200	^{12,14} 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		¹² BELADIDZE	92C	VES	36 $\pi^- \text{Be} \rightarrow \pi^- \eta' \eta \text{Be}$
0.3 ±0.1	426 ± 57	¹² 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

¹¹ Assuming that $f_0(980)$ decays only to $\pi\pi$.¹² Systematic errors not estimated.¹³ From a single-pole fit.¹⁴ 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

NODE=M075

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.)
PDG	06	JPG 33 1	W.-M. Yao <i>et al.</i>	(PDG Collab.)
CHUNG	02	PR D65 072001	S.U. Chung <i>et al.</i>	(BNL E852 Collab.)
ANISOVICH	01B	PL B500 222	A.V. Anisovich <i>et al.</i>	
AMELIN	99	PAN 62 445	D.V. Amelin <i>et al.</i>	(VES Collab.)
		Translated from YAF 62 487.		
AMELIN	96B	PAN 59 976	D.V. Amelin <i>et al.</i>	(SERP, TBIL) IGJPC
		Translated from YAF 59 1021.		
AMELIN	95B	PL B356 595	D.V. Amelin <i>et al.</i>	(SERP, TBIL)
BERDNIKOV	94	PL B337 219	E.B. Berdnikov <i>et al.</i>	(SERP, TBIL)
BELADIDZE	92C	SJNP 55 1535	G.M. Beladidze, S.I. Bitiyukov, G.V. Borisov	(SERP+)
		Translated from YAF 55 2748.		
BITYUKOV	91	PL B268 137	S.I. Bitiyukov <i>et al.</i>	(SERP, TBIL)
BELLINI	82	PRL 48 1697	G. Bellini <i>et al.</i>	(MILA, BGNA, JINR)

REFID=53356
REFID=52160
REFID=51004
REFID=48837
REFID=48318
REFID=46910

REFID=44725

REFID=44433
REFID=44073
REFID=43175

REFID=41749
REFID=21134

$f_2(1810)$

$$I^G(J^{PC}) = 0^+(2^{++})$$

OMITTED FROM SUMMARY TABLE
Needs confirmation.

NODE=M038

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.		
1737 ± 9 ⁺¹⁹⁸ ₋₆₅		¹ 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		² ALDE	86D GAM4	100 $\pi^-p \rightarrow \eta\eta n$
1857 ⁺³⁵ ₋₂₄		³ COSTA...	80 OMEG	10 $\pi^-p \rightarrow K^+K^-n$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1858 ⁺¹⁸ ₋₇₁		⁴ LONGACRE	86 RVUE	Compilation
1799 ± 15		⁵ CASON	82 STRC	8 $\pi^+p \rightarrow \Delta^{++}\pi^0\pi^0$

¹ Breit-Wigner mass.² Seen in only one solution.³ Error increased by spread of two solutions. Included in LONGACRE 86 global analysis.⁴ From a partial-wave analysis of data using a K-matrix formalism with 5 poles. Includes compilation of several other experiments.⁵ 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.

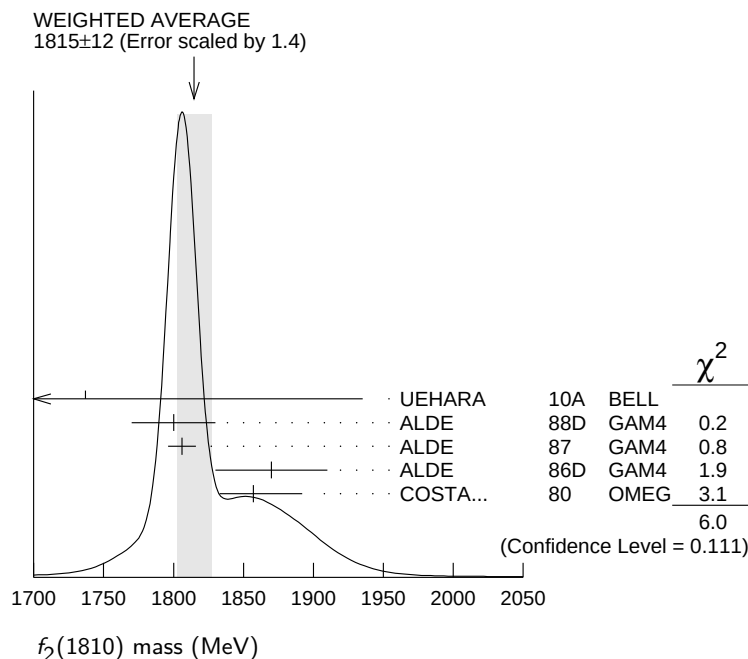
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NODE=M038M;LINKAGE=F

NODE=M038M;LINKAGE=A

NODE=M038M;LINKAGE=L

NODE=M038M;LINKAGE=P1

 **$f_2(1810)$ WIDTH**

NODE=M038W

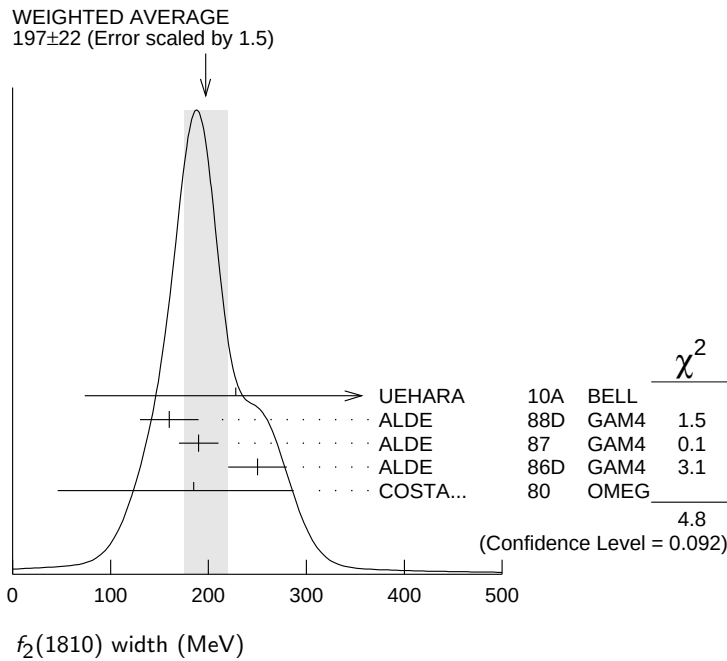
NODE=M038W

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
197 ± 22 OUR AVERAGE		Error includes scale factor of 1.5. See the ideogram below.		
228 ⁺²¹⁺²³⁴ ₋₂₀₋₁₅₃		⁶ 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		⁷ ALDE	86D GAM4	100 $\pi^-p \rightarrow \eta\eta n$
185 ⁺¹⁰² ₋₁₃₉		⁸ COSTA...	80 OMEG	10 $\pi^-p \rightarrow K^+K^-n$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
388 ⁺¹⁵ ₋₂₁		⁹ LONGACRE	86 RVUE	Compilation
280 ⁺⁴² ₋₃₅		¹⁰ CASON	82 STRC	8 $\pi^+p \rightarrow \Delta^{++}\pi^0\pi^0$

- ⁶ Breit-Wigner width.
⁷ Seen in only one solution.
⁸ Error increased by spread of two solutions. Included in LONGACRE 86 global analysis.
⁹ From a partial-wave analysis of data using a K-matrix formalism with 5 poles. Includes compilation of several other experiments.
¹⁰ From an amplitude analysis of the reaction $\pi^+\pi^-\rightarrow 2\pi^0$. The resonance in the $2\pi^0$ final state is not confirmed by PROKOSHKIN 97.

NODE=M038W;LINKAGE=UE
NODE=M038W;LINKAGE=F
NODE=M038W;LINKAGE=A
NODE=M038W;LINKAGE=L

NODE=M038W;LINKAGE=P1



$f_2(1810)$ DECAY MODES

NODE=M038215;NODE=M038

Mode		Fraction (Γ_i/Γ)
Γ_1	$\pi\pi$	
Γ_2	$\eta\eta$	
Γ_3	$4\pi^0$	seen
Γ_4	K^+K^-	
Γ_5	$\gamma\gamma$	seen

DESIG=2
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		
$5.2^{+0.9}_{-0.8} = 4.5$	¹¹ UEHARA	10A	BELL	10.6 $e^+e^- \rightarrow e^+e^-\eta\eta$	

NODE=M038G01
NODE=M038G01

- ¹¹ 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 $\pi^-\pi^+ \rightarrow \pi^0\pi^0n$	
$0.21^{+0.02}_{-0.03}$	¹² LONGACRE	86	RVUE	Compilation	
0.44 ± 0.03	¹³ CASON	82	STRC	8 $\pi^+p \rightarrow \Delta^{++}\pi^0\pi^0$	

NODE=M038R2
NODE=M038R2

- ¹² From a partial-wave analysis of data using a K-matrix formalism with 5 poles. Includes compilation of several other experiments.
¹³ Included in LONGACRE 86 global analysis.

NODE=M038R2;LINKAGE=L
NODE=M038R;LINKAGE=C

$\Gamma(\eta\eta)/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE	DOCUMENT ID	TECN	COMMENT

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

$0.008^{+0.028}_{-0.003}$	14 LONGACRE	86	RVUE Compilation

¹⁴ From a partial-wave analysis of data using a K-matrix formalism with 5 poles. Includes compilation of several other experiments.

NODE=M038R3
NODE=M038R3

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. • • •

$0.003^{+0.019}_{-0.002}$	15 LONGACRE	86	RVUE Compilation

seen	COSTA...	80	OMEG 10 $\pi^- p \rightarrow K^+ K^- n$

¹⁵ From a partial-wave analysis of data using a K-matrix formalism with 5 poles. Includes compilation of several other experiments.

NODE=M038R1
NODE=M038R1

NODE=M038R1;LINKAGE=L

$f_2(1810)$ REFERENCES

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	SPD 42 117	Y.D. Prokoshkin <i>et al.</i>	(SERP)
		Translated from DANS 353 323.		
ALDE	88D	SJNP 47 810	D.M. Alde <i>et al.</i>	(SERP, BELG, LANL, LAPP+)
		Translated from YAF 47 1273.		
ALDE	87	PL B198 286	D.M. Alde <i>et al.</i>	(LANL, BRUX, SERP, LAPP)
ALDE	86D	NP B269 485	D.M. Alde <i>et al.</i>	(BELG, LAPP, SERP, CERN+)
LONGACRE	86	PL B177 223	R.S. Longacre <i>et al.</i>	(BNL, BRAN, CUNY+)
CASON	82	PRL 48 1316	N.M. Cason <i>et al.</i>	(NDAM, ANL)
COSTA...	80	NP B175 402	G. Costa de Beauregard <i>et al.</i>	(BARI, BONN+)

NODE=M038

REFID=53641
REFID=52166
REFID=48580
REFID=45386

REFID=44652

REFID=40221
REFID=20765
REFID=20768
REFID=20746
REFID=20737

X(1835)

$$J^G(J^{PC}) = ?^?(\pi^- \pi^+)$$

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, decaying into $\pi^+\pi^-\eta'$. For the former ABLIKIM 12D determine $J^{PC} = 0(\pi^- \pi^+)$.

NODE=M085

X(1835) MASS

NODE=M085M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

NODE=M085M

1835.7^{+5.0}_{-3.2} OUR AVERAGE

1836.5 ^{±3.0} _{-2.1}	4265	¹ ABLIKIM	11C BES3	$J/\psi \rightarrow \gamma\pi^+\pi^-\eta'$

1833.7 ^{±6.1} _{±2.7}	264	ABLIKIM	05R BES2	$J/\psi \rightarrow \gamma\pi^+\pi^-\eta'$

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

1832 ⁺¹⁹ ₋₅ ±26		² ABLIKIM	12D BES3	$J/\psi \rightarrow \gamma p\bar{p}$

1877.3 ^{±6.3} _{±3.4}		³ ABLIKIM	11J BES3	$J/\psi \rightarrow \omega(\eta\pi^+\pi^-)$

1837 ⁺¹⁰ ₋₁₂ ⁺⁹ ₋₇	231	^{4,5} ALEXANDER	10 CLEO	$J/\psi \rightarrow \gamma p\bar{p}$

1831 ^{±7}		^{5,6} ABLIKIM	05R BES2	$J/\psi \rightarrow \gamma p\bar{p}$

1859 ⁺³ ₋₁₀ ⁺⁵ ₋₂₅		⁵ BAI	03F BES2	$J/\psi \rightarrow \gamma p\bar{p}$

OCCUR=2

¹ From a fit of the $\pi^+\pi^-\eta'$ mass distribution to a combination of $\gamma f_1(1510)$, $\gamma X(1835)$, and two unconfirmed states $\gamma X(2120)$, and $\gamma X(2370)$, for $M(p\bar{p}) < 2.8$ GeV, and accounting for backgrounds from non- η' events and $J/\psi \rightarrow \pi^0\pi^+\pi^-\eta'$.

NODE=M085M;LINKAGE=AI

² From the fit including final state interaction effects in isospin 0 S-wave according to SIBIRTSEV 05A.

NODE=M085M;LINKAGE=AK

³ 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

⁴ 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

⁵ 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

⁶ 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

VALUE (MeV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT

NODE=M085W

99 ±50 OUR AVERAGE Error includes scale factor of 2.8.

190 ^{±9} ⁺³⁸ ₋₃₆	4265	⁷ ABLIKIM	11C BES3	$J/\psi \rightarrow \gamma\pi^+\pi^-\eta'$

67.7 ^{±20.3} _{±7.7}	264	ABLIKIM	05R BES2	$J/\psi \rightarrow \gamma\pi^+\pi^-\eta'$

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

< 76	90	⁸ ABLIKIM	12D BES3	$J/\psi \rightarrow \gamma p\bar{p}$

57 ^{±12} ⁺¹⁹ ₋₄		⁹ ABLIKIM	11J BES3	$J/\psi \rightarrow \omega(\eta\pi^+\pi^-)$

0 ⁺⁴⁴ ₋₀	231	^{10,11} ALEXANDER	10 CLEO	$J/\psi \rightarrow \gamma p\bar{p}$

< 153	90	^{11,12} ABLIKIM	05R BES2	$J/\psi \rightarrow \gamma p\bar{p}$

OCCUR=2

< 30		¹¹ BAI	03F BES2	$J/\psi \rightarrow \gamma p\bar{p}$

⁷ From a fit of the $\pi^+\pi^-\eta'$ mass distribution to a combination of $\gamma f_1(1510)$, $\gamma X(1835)$, and two unconfirmed states $\gamma X(2120)$, and $\gamma X(2370)$, for $M(p\bar{p}) < 2.8$ GeV, and accounting for backgrounds from non- η' events and $J/\psi \rightarrow \pi^0\pi^+\pi^-\eta'$.

NODE=M085W;LINKAGE=AI

⁸ From the fit including final state interaction effects in isospin 0 S-wave according to SIBIRTSEV 05A.

NODE=M085W;LINKAGE=AK

⁹ 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=M085W;LINKAGE=BL

¹⁰ From a fit of the $p\bar{p}$ mass distribution to a combination of $\gamma X(1835)$, γR with $M(R) = 2100$ MeV and $\Gamma(R) = 160$ MeV, and $\gamma p\bar{p}$ phase space, for $M(p\bar{p}) < 2.85$ GeV.

NODE=M085W;LINKAGE=AE

- ¹¹ 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 $\Upsilon(1S) \rightarrow p\bar{p}\gamma$.
- ¹² From the fit including final state interaction effects in isospin 0 S -wave according to SIBIRTSEV 05A. Systematic errors not estimated.

NODE=M085W;LINKAGE=HF

NODE=M085W;LINKAGE=AB

NODE=M085215;NODE=M085

DESIG=1;OUR EVAL;→ UNCHECKED ←

DESIG=2;OUR EVAL;→ UNCHECKED ←

NODE=M085220

NODE=M085R01
NODE=M085R01

NODE=M085

REFID=54269
REFID=54286
REFID=53684
REFID=53931
REFID=53525
REFID=52086
REFID=50993
REFID=50985
REFID=50827
REFID=51038
REFID=50651
REFID=49473
REFID=48690
REFID=48980

NODE=M054

NODE=M054M

NODE=M054M

NODE=M054W

NODE=M054W

NODE=M054215;NODE=M054

DESIG=1;OUR EST;→ UNCHECKED ←

DESIG=2;OUR EST;→ UNCHECKED ←

X(1835) DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $p\bar{p}$	seen
Γ_2 $\pi^+\pi^-\eta'$	seen

X(1835) BRANCHING RATIOS

$\Gamma(p\bar{p})/\Gamma(\pi^+\pi^-\eta')$	Γ_1/Γ_2
VALUE	DOCUMENT ID TECN COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •	
0.333	ABLIKIM 05R BES2 $J/\psi \rightarrow \gamma\pi^+\pi^-\eta'$

X(1835) REFERENCES

ABLIKIM 12D	PRL 108 112003	M. Ablikim <i>et al.</i>	(BES III Collab.)
DEL-AMO-SA... 12	PR D85 092017	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)
ABLIKIM 11C	PRL 106 072002	M. Ablikim <i>et al.</i>	(BES III Collab.)
ABLIKIM 11J	PRL 107 182001	M. Ablikim <i>et al.</i>	(BES III 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>	(BES 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>	(BES 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>	(BES Collab.)
ABE 02W	PRL 89 151802	K. Abe <i>et al.</i>	(BES Collab.)

 $\phi_3(1850)$

$$I^G(J^{PC}) = 0^-(3^{--})$$

 $\phi_3(1850)$ MASS

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	$8.25 K^- p \rightarrow K \bar{K} \Lambda$

 $\phi_3(1850)$ WIDTH

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	$8.25 K^- p \rightarrow K \bar{K} \Lambda$

 $\phi_3(1850)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $K \bar{K}$	seen
Γ_2 $K \bar{K}^*(892) + \text{c.c.}$	seen

$\phi_3(1850)$ BRANCHING RATIOS

NODE=M054220

 $\Gamma(K\bar{K}^*(892)+c.c.)/\Gamma(K\bar{K})$ 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

OMITTED FROM SUMMARY TABLE

Needs confirmation.

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	$450 pp \rightarrow pp2(\pi^+ \pi^-)$
$1875 \pm 20 \pm 35$		ADOMEIT	96 CBAR	$1.94 \bar{p}p \rightarrow \eta 3\pi^0$
$1881 \pm 32 \pm 40$	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. • • •				
$1860 \pm 5 \pm 15$		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	$450 pp \rightarrow pp2(\pi^+ \pi^-)$
$200 \pm 25 \pm 45$		ADOMEIT	96 CBAR	$1.94 \bar{p}p \rightarrow \eta 3\pi^0$
$221 \pm 92 \pm 44$	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. • • •				
$250 \pm 25^{+50}_{-35}$		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

$\Gamma(a_2(1320)\pi)/\Gamma(f_2(1270)\eta)$

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. Γ_2/Γ_3 NODE=M101R2
NODE=M101R2

NODE=M101R2;LINKAGE=AN

 $\Gamma(a_2(1320)\pi)/\Gamma(a_0(980)\pi)$

VALUE	DOCUMENT ID	COMMENT
32.6 ± 12.6	BARBERIS	00B 450 $pp \rightarrow p_f \eta \pi^+ \pi^- p_s$

 Γ_2/Γ_4 NODE=M101R4
NODE=M101R4 $\Gamma(a_0(980)\pi)/\Gamma(f_2(1270)\eta)$

VALUE	DOCUMENT ID	TECN	COMMENT
0.48 ± 0.45	² ANISOVICH	11	SPEC 0.9–1.94 $p\bar{p}$

² Reanalysis of ADOMEIT 96 and ANISOVICH 00E. Γ_4/Γ_3 NODE=M101R01
NODE=M101R01

NODE=M101R01;LINKAGE=AN

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

VALUE	DOCUMENT ID	TECN	COMMENT
seen	KARCH	92	CBAL $e^+e^- \rightarrow e^+e^-\eta\pi^0\pi^0$

 Γ_5/Γ 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

NODE=M185

 $\pi_2(1880)$

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

 $\pi(1880)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
1895 ± 16 OUR AVERAGE					
1929 ± 24 ± 18	4k	EUGENIO	08	B852	– 18 $\pi^- p \rightarrow \eta \eta \pi^- p$
1876 ± 11 ± 67	145k	LU	05	B852	– 18 $\pi^- p \rightarrow \omega \pi^- \pi^0 p$
2003 ± 88 ± 148	69k	KUHN	04	B852	– 18 $\pi^- p \rightarrow \eta \pi^+ \pi^- \pi^- p$
1880 ± 20		ANISOVICH	01B	SPEC	0 0.6–1.94 $\bar{p}p \rightarrow \eta \eta \pi^0 \pi^0$

NODE=M185M

NODE=M185M

 $\pi(1880)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
235 ± 34 OUR AVERAGE					
323 ± 87 ± 43	4k	EUGENIO	08	B852	– 18 $\pi^- p \rightarrow \eta \eta \pi^- p$
146 ± 17 ± 62	145k	LU	05	B852	– 18 $\pi^- p \rightarrow \omega \pi^- \pi^0 p$
306 ± 132 ± 121	69k	KUHN	04	B852	– 18 $\pi^- p \rightarrow \eta \pi^+ \pi^- \pi^- p$
255 ± 45		ANISOVICH	01B	SPEC	0 0.6–1.94 $\bar{p}p \rightarrow \eta \eta \pi^0 \pi^0$

NODE=M185W

NODE=M185W

 $\pi_2(1880)$ DECAY MODES

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	$\omega \pi^- \pi^0$

NODE=M185215;NODE=M185

DESIG=1

DESIG=2

DESIG=3

DESIG=4

DESIG=5

DESIG=6

 $\Gamma(a_2(1320)\eta)/\Gamma(f_1(1285)\pi)$

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

 Γ_3/Γ_5 NODE=M185R01
NODE=M185R01

$\Gamma(f_0(1500)\pi)/\Gamma(a_0(980)\eta)$

VALUE	DOCUMENT ID	TECN	CHG	COMMENT

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

$0.28^{+0.20}_{-0.15}$	¹ ANISOVICH	01B	SPEC	0	$0.6-1.94 \bar{p}p \rightarrow \eta\eta\pi^0\pi^0$

¹ Systematic errors not estimated.

NODE=M185R02
NODE=M185R02

NODE=M185R02;LINKAGE=NS

 $\pi_2(1880)$ REFERENCES

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=52160
REFID=50459
REFID=49773
REFID=48318

NODE=M170

$\rho(1900)$

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

OMITTED FROM SUMMARY TABLE

See our mini-review under the $\rho(1700)$.

NODE=M170

 $\rho(1900)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

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

$1909 \pm 17 \pm 25$	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	$\gamma p \rightarrow 3\pi^+3\pi^-\rho$
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.

NODE=M170M;LINKAGE=AU
NODE=M170M;LINKAGE=PI
NODE=M170M;LINKAGE=RS

 $\rho(1900)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

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

$48 \pm 17 \pm 2$	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	$\gamma p \rightarrow 3\pi^+3\pi^-\rho$
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

NODE=M170W

OCCUR=2

NODE=M170W;LINKAGE=AU
NODE=M170W;LINKAGE=PI
NODE=M170W;LINKAGE=RS

 $\rho(1900) \Gamma(i)\Gamma(e^+e^-)/\Gamma^2(\text{total})$

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

$\Gamma_4/\Gamma \times \Gamma_6/\Gamma$

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

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

$4.2 \pm 1.2 \pm 0.8$	54	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

 $\rho(1900)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 6π	seen
Γ_2 $3\pi^+3\pi^-$	seen
Γ_3 $2\pi^+2\pi^-\pi^0$	
Γ_4 $\phi\pi$	
Γ_5 hadrons	seen
Γ_6 e^+e^-	seen
Γ_7 $\bar{N}N$	not seen

NODE=M170225;NODE=M170

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 ←

ρ(1900) BRANCHING RATIOS

$\Gamma(6\pi)/\Gamma_{\text{total}}$				Γ_1/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
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

ρ(1900) REFERENCES

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=52242
REFID=51047
REFID=49614
REFID=48576
REFID=48350
REFID=44633
REFID=49668

NODE=M142

$f_2(1910)$

$I^G(J^{PC}) = 0^+(2^{++})$

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

f₂(1910) MASS

NODE=M142205

NODE=M142MX

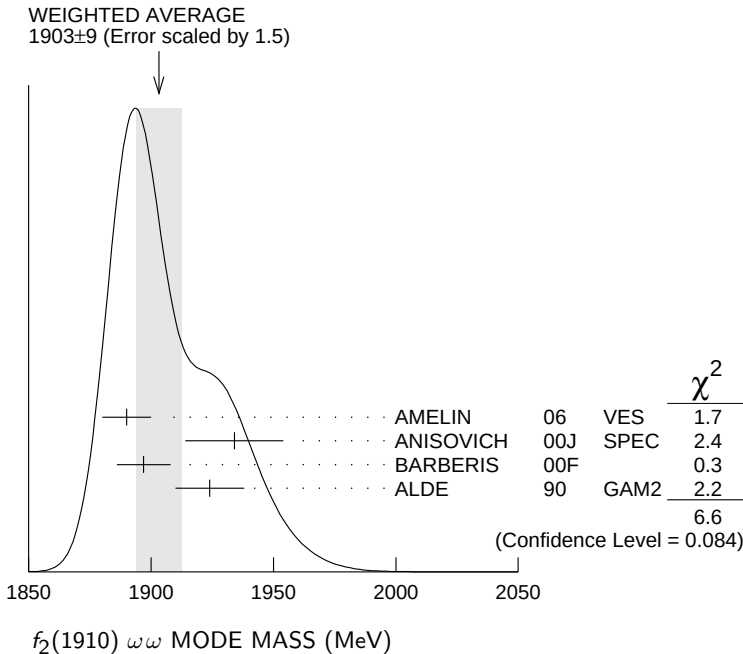
f₂(1910) ωω MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
1903± 9 OUR AVERAGE	Error includes scale factor of 1.5. See the ideogram below.		
1890±10	¹ AMELIN	06	VES 36 $\pi^- p \rightarrow \omega\omega n$
1934±20	ANISOVICH	00J	SPEC
1897±11	BARBERIS	00F	450 $pp \rightarrow p_f\omega\omega p_s$
1924±14	ALDE	90	GAM2 38 $\pi^- p \rightarrow \omega\omega n$

¹Supersedes BELADIDZE 92B.

NODE=M142M2
NODE=M142M2

NODE=M142M2;LINKAGE=AM



f₂(1910) ηη' MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
1934±16	² BARBERIS	00A	450 $pp \rightarrow p_f\eta\eta' p_s$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
1911±10	ALDE	91B	GAM2 38 $\pi^- p \rightarrow \eta\eta' n$

²Also compatible with $J^{PC}=1^{-+}$.

NODE=M142M3
NODE=M142M3

NODE=M142M3;LINKAGE=KS

$f_2(1910) K^+ K^-$ MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
1941 ± 18	AMSLER	06	CBAR 1.64 $\bar{p} p \rightarrow K^+ K^- \pi^0$

NODE=M142M4
NODE=M142M4

 $f_2(1910)$ WIDTH

NODE=M142210

NODE=M142WX

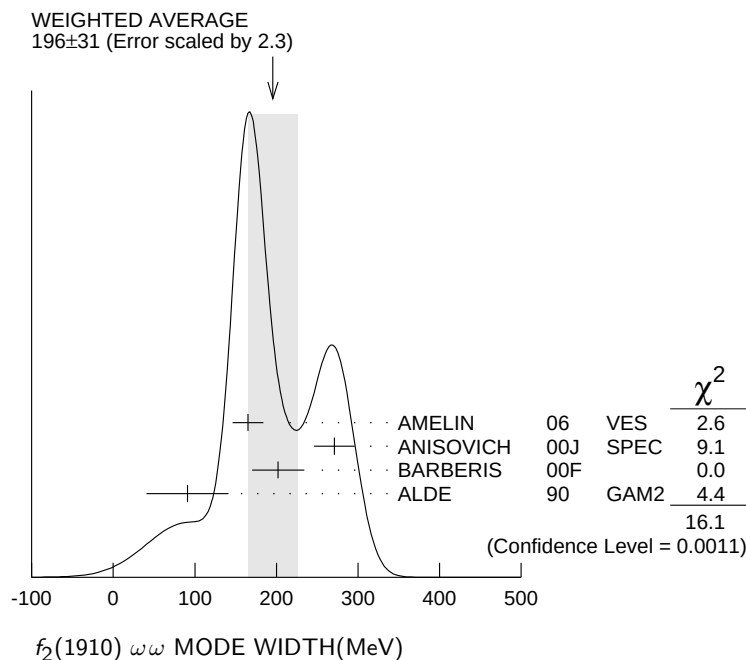
 $f_2(1910) \omega\omega$ MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
196 ± 31 OUR AVERAGE	Error includes scale factor of 2.3. See the ideogram below.		
165 ± 19	³ AMELIN	06	VES 36 $\pi^- p \rightarrow \omega\omega n$
271 ± 25	ANISOVICH	00J	SPEC
202 ± 32	BARBERIS	00F	450 $pp \rightarrow p_f \omega\omega p_s$
91 ± 50	ALDE	90	GAM2 38 $\pi^- p \rightarrow \omega\omega n$

NODE=M142W2
NODE=M142W2

³Supersedes BELADIDZE 92B.

NODE=M142W2;LINKAGE=AM

 **$f_2(1910) \eta\eta'$ MODE**

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
141 ± 41	⁴ BARBERIS	00A	450 $pp \rightarrow p_f \eta\eta' p_s$
90 ± 35	ALDE	91B	GAM2 38 $\pi^- p \rightarrow \eta\eta' n$

NODE=M142W3
NODE=M142W3

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

⁴Also compatible with $J^{PC}=1^-+$.

NODE=M142W3;LINKAGE=KS

 $f_2(1910) K^+ K^-$ 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

NODE=M142215;NODE=M142

Mode	Fraction (Γ_i/Γ)
Γ_1 $\pi^0 \pi^0$	
Γ_2 $K^+ K^-$	seen
Γ_3 $K_S^0 K_S^0$	
Γ_4 $\eta\eta$	seen
Γ_5 $\omega\omega$	seen

DESIG=6

DESIG=11

DESIG=8

DESIG=3;OUR EST;→ UNCHECKED ←

DESIG=4;OUR EST;→ UNCHECKED ←

Γ_6	$\eta\eta'$	seen
Γ_7	$\eta'\eta'$	
Γ_8	$\rho\rho$	seen
Γ_9	$a_2(1320)\pi$	seen
Γ_{10}	$f_2(1270)\eta$	seen

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	AMSLER	06	CBAR 1.64 $\bar{p}p \rightarrow K^+K^-\pi^0$

NODE=M142225

NODE=M142R11
NODE=M142R11

$\Gamma(\pi^0\pi^0)/\Gamma(\eta\eta')$ Γ_1/Γ_6

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
<0.1	ALDE	89	GAM2 38 $\pi^-p \rightarrow \eta\eta' n$

NODE=M142R4
NODE=M142R4

$\Gamma(K_S^0K_S^0)/\Gamma(\eta\eta')$ Γ_3/Γ_6

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.066	90	BALOSHIN	86	SPEC 40 $\pi p \rightarrow K_S^0K_S^0 n$

NODE=M142R7
NODE=M142R7

$\Gamma(\eta\eta)/\Gamma(\eta\eta')$ Γ_4/Γ_6

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.05	90	ALDE	91B	GAM2 38 $\pi^-p \rightarrow \eta\eta' n$

NODE=M142R6
NODE=M142R6

$\Gamma(\omega\omega)/\Gamma(\eta\eta')$ Γ_5/Γ_6

VALUE	DOCUMENT ID	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •		
2.6±0.6	BARBERIS 00F	450 $pp \rightarrow p_f\omega\omega p_s$

NODE=M142R10
NODE=M142R10

$\Gamma(\eta'\eta')/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
probably not seen	BARBERIS 00A		450 $pp \rightarrow p_f\eta'\eta' p_s$
possibly seen	BELADIDZE 92D	VES	37 $\pi^-p \rightarrow \eta'\eta' n$

NODE=M142R8
NODE=M142R8

$\Gamma(\rho\rho)/\Gamma(\omega\omega)$ Γ_8/Γ_5

VALUE	DOCUMENT ID	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •		
2.6±0.4	BARBERIS 00F	450 $pp \rightarrow p_f\omega\omega p_s$

NODE=M142R9
NODE=M142R9

$\Gamma(f_2(1270)\eta)/\Gamma(a_2(1320)\pi)$ Γ_{10}/Γ_9

VALUE	DOCUMENT ID	TECN	COMMENT
0.09±0.05	⁵ ANISOVICH 11	SPEC	0.9–1.94 $p\bar{p}$

NODE=M142R12
NODE=M142R12

⁵ 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.)
AMSLER 06	Translated from YAF 69 715.	C. Amsler <i>et al.</i>	(CBAR Collab.)
ANISOVICH 00E	PL B639 165	A.V. Anisovich <i>et al.</i>	
ANISOVICH 00J	PL B477 19	A.V. Anisovich <i>et al.</i>	
BARBERIS 00A	PL B491 47	D. Barberis <i>et al.</i>	(WA 102 Collab.)
BARBERIS 00F	PL B471 429	D. Barberis <i>et al.</i>	(WA 102 Collab.)
ADOMEIT 96	PL B484 198	J. Adomeit <i>et al.</i>	(Crystal Barrel Collab.)
BELADIDZE 92B	ZPHY C71 227	G.M. Beladidze <i>et al.</i>	(VES Collab.)
BELADIDZE 92D	ZPHY C54 367	G.M. Beladidze <i>et al.</i>	(VES Collab.)
ALDE 91B	ZPHY C57 13	D.M. Alde <i>et al.</i>	(SERP, BELG, LANL, LAPP+)
Also	SJNP 54 455	Translated from YAF 54 751.	
ALDE 90	PL B276 375	D.M. Alde <i>et al.</i>	(BELG, SERP, KEK, LANL+)
ALDE 89	PL B241 600	D.M. Alde <i>et al.</i>	(SERP, BELG, LANL, LAPP+)
Also	PL B216 447	D.M. Alde <i>et al.</i>	(SERP, BELG, LANL, LAPP)
BALOSHIN 86	SJNP 48 1035	D.M. Alde <i>et al.</i>	(BELG, SERP, LANL, LAPP)
	Translated from YAF 48 1724.		
	SJNP 43 959	O.N. Baloshin <i>et al.</i>	(ITEP)
	Translated from YAF 43 1487.		

NODE=M142

REFID=53631
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REFID=47957
REFID=47962
REFID=45202
REFID=42172
REFID=43309
REFID=41844

REFID=41911
REFID=40935
REFID=40727
REFID=44697
REFID=40734

$f_2(1950)$

$$I^G(J^{PC}) = 0^+(2^{++})$$

NODE=M135

 $f_2(1950)$ MASS

NODE=M135M

NODE=M135M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
1944±12 OUR AVERAGE	Error includes scale factor of 1.5. See the ideogram below.		
1930±25	¹ BINON	05	GAMS 33 $\pi^- p \rightarrow \eta \eta n$
2010±25	ANISOVICH	00J	SPEC
1940±50	BAI	00A	BES $J/\psi \rightarrow \gamma(\pi^+ \pi^- \pi^+ \pi^-)$
1980±22	² BARBERIS	00C	450 $pp \rightarrow pp4\pi$
1940±22	³ BARBERIS	00C	450 $pp \rightarrow pp2\pi2\pi^0$
1980±50	ANISOVICH	99B	SPEC 1.35–1.94 $p\bar{p} \rightarrow \eta \eta \pi^0$
1960±30	BARBERIS	97B	OMEG 450 $pp \rightarrow pp2(\pi^+ \pi^-)$
1918±12	ANTINORI	95	OMEG 300,450 $pp \rightarrow pp2(\pi^+ \pi^-)$

OCCUR=2

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

2038 ⁺¹³⁺¹² ₋₁₁₋₇₃	⁴ UEHARA	09	BELL 10.6 $e^+ e^- \rightarrow e^+ e^- \pi^0 \pi^0$
1980±2±14	ABE	04	BELL 10.6 $e^+ e^- \rightarrow e^+ e^- K^+ K^-$
1867±46	⁵ AMSLER	02	CBAR 0.9 $\bar{p}p \rightarrow \pi^0 \eta \eta, \pi^0 \pi^0 \pi^0$
~ 1990	⁶ OAKDEN	94	RVUE 0.36–1.55 $\bar{p}p \rightarrow \pi \pi$
1950±15	⁷ ASTON	91	LASS 11 $K^- p \rightarrow \Lambda K \bar{K} \pi \pi$

¹ First solution, PWA is ambiguous.

² Decaying into $\pi^+ \pi^- 2\pi^0$.

³ Decaying into $2(\pi^+ \pi^-)$.

⁴ Taking into account $f_4(2050)$.

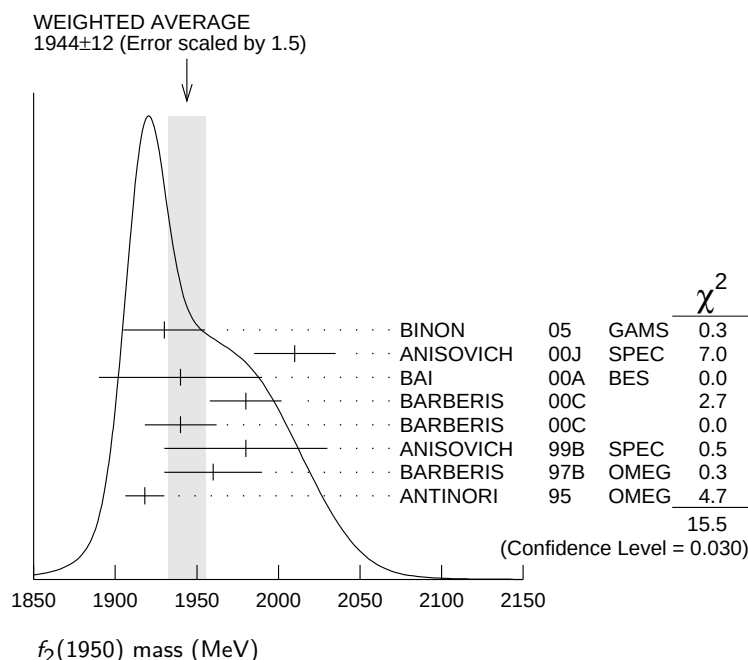
⁵ T-matrix pole.

⁶ 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.

⁷ Cannot determine spin to be 2.

NODE=M135M;LINKAGE=BI
 NODE=M135M;LINKAGE=A4
 NODE=M135M;LINKAGE=B4
 NODE=M135M;LINKAGE=UE
 NODE=M135M;LINKAGE=TT
 NODE=M135M;LINKAGE=BB

NODE=M135M;LINKAGE=A

 **$f_2(1950)$ WIDTH**

NODE=M135W

NODE=M135W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
472±18 OUR AVERAGE			
450±50	⁸ BINON	05	GAMS 33 $\pi^- p \rightarrow \eta \eta n$
495±35	ANISOVICH	00J	SPEC
380 ⁺¹²⁰ ₋₉₀	BAI	00A	BES $J/\psi \rightarrow \gamma(\pi^+ \pi^- \pi^+ \pi^-)$
520±50	⁹ BARBERIS	00C	450 $pp \rightarrow pp4\pi$

485 ± 55	10 BARBERIS	00C	450 $pp \rightarrow pp4\pi$
500 ± 100	ANISOVICH	99B SPEC	1.35–1.94 $p\bar{p} \rightarrow \eta\eta\pi^0$
460 ± 40	BARBERIS	97B OMEG	450 $pp \rightarrow pp2(\pi^+\pi^-)$
390 ± 60	ANTINORI	95 OMEG	300,450 $pp \rightarrow pp2(\pi^+\pi^-)$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
441 + 27 + 28 – 25 – 192	11 UEHARA	09 BELL	10.6 $e^+e^- \rightarrow e^+e^-\pi^0\pi^0$
297 ± 12 ± 6	ABE	04 BELL	10.6 $e^+e^- \rightarrow e^+e^-K^+K^-$
385 ± 58	12 AMSLER	02 CBAR	0.9 $\bar{p}p \rightarrow \pi^0\eta\eta, \pi^0\pi^0\pi^0$
~ 100	13 OAKDEN	94 RVUE	0.36–1.55 $\bar{p}p \rightarrow \pi\pi$
250 ± 50	14 ASTON	91 LASS	11 $K^-p \rightarrow \Lambda K\bar{K}\pi\pi$
8 First solution, PWA is ambiguous.			
9 Decaying into $\pi^+\pi^-2\pi^0$.			
10 Decaying into $2(\pi^+\pi^-)$.			
11 Taking into account $f_4(2050)$.			
12 T-matrix pole.			
13 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.			
14 Cannot determine spin to be 2.			

OCCUR=2

NODE=M135W;LINKAGE=BI
 NODE=M135W;LINKAGE=A4
 NODE=M135W;LINKAGE=B4
 NODE=M135W;LINKAGE=UE
 NODE=M135W;LINKAGE=TT
 NODE=M135W;LINKAGE=BB

NODE=M135W;LINKAGE=A

NODE=M135215;NODE=M135

 $f_2(1950)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $K^*(892)\bar{K}^*(892)$	seen
Γ_2 $\pi\pi$	
Γ_3 $\pi^+\pi^-$	seen
Γ_4 $\pi^0\pi^0$	seen
Γ_5 4π	seen
Γ_6 $\pi^+\pi^-\pi^+\pi^-$	
Γ_7 $a_2(1320)\pi$	
Γ_8 $f_2(1270)\pi\pi$	
Γ_9 $\eta\eta$	seen
Γ_{10} $K\bar{K}$	seen
Γ_{11} $\gamma\gamma$	seen
Γ_{12} $p\bar{p}$	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

 $f_2(1950) \Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

$\Gamma(K\bar{K}) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$	$\Gamma_{10}\Gamma_{11}/\Gamma$
VALUE (eV)	DOCUMENT ID TECN COMMENT

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

122 ± 4 ± 26	15 ABE	04 BELL	10.6 $e^+e^- \rightarrow e^+e^-K^+K^-$
15 Assuming spin 2.			

NODE=M135225

NODE=M135G1
 NODE=M135G1

NODE=M135G1;LINKAGE=AB

$\Gamma(\pi\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$	$\Gamma_2\Gamma_{11}/\Gamma$
VALUE	DOCUMENT ID TECN COMMENT

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

162 + 69 + 1137 – 42 – 204	16 UEHARA	09 BELL	10.6 $e^+e^- \rightarrow e^+e^-\pi^0\pi^0$
16 Taking into account $f_4(2050)$.			

NODE=M135G2
 NODE=M135G2

NODE=M135G2;LINKAGE=UE

 $f_2(1950)$ BRANCHING RATIOS

$\Gamma(K^*(892)\bar{K}^*(892))/\Gamma_{\text{total}}$	Γ_1/Γ
VALUE	DOCUMENT ID TECN CHG COMMENT
seen	ASTON 91 LASS 0 11 $K^-p \rightarrow \Lambda K\bar{K}\pi\pi$

NODE=M135220

NODE=M135R1
 NODE=M135R1

$\Gamma(a_2(1320)\pi)/\Gamma_{\text{total}}$	Γ_7/Γ
VALUE	DOCUMENT ID TECN COMMENT

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

not seen	BARBERIS	00B	450 $pp \rightarrow p_f\eta\pi^+\pi^-p_s$
not seen	BARBERIS	00C	450 $pp \rightarrow p_f4\pi p_s$
possibly seen	BARBERIS	97B OMEG	450 $pp \rightarrow pp2(\pi^+\pi^-)$

NODE=M135R3
 NODE=M135R3

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

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 $p\bar{p} \rightarrow p_f \eta \eta p_S$

 Γ_9/Γ_5

NODE=M135R5
NODE=M135R5

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

VALUE	DOCUMENT ID	TECN	COMMENT

0.14±0.05	AMSLER	02	CBAR 0.9 $\bar{p}p \rightarrow \pi^0 \eta \eta, \pi^0 \pi^0 \pi^0$

 Γ_9/Γ_3

NODE=M135R6
NODE=M135R6

 $\Gamma(p\bar{p})/\Gamma_{\text{total}}$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

seen	111	ALEXANDER	10	CLEO $\psi(2S) \rightarrow \gamma p \bar{p}$

 Γ_{12}/Γ

NODE=M135R07
NODE=M135R07

 $f_2(1950)$ REFERENCES

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>	
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.)

NODE=M135

REFID=53525
REFID=52761
REFID=50780

REFID=49650
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REFID=47958
REFID=47959
REFID=47961
REFID=46886
REFID=45758
REFID=45212
REFID=44437
REFID=45210
REFID=41746

 $\rho_3(1990)$

$$I^G(J^{PC}) = 1^+(3^--)$$

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 ± 14	¹ ANISOVICH	02	SPEC 0.6–1.9 $p\bar{p} \rightarrow \omega \pi^0, \omega \eta \pi^0, \pi^+ \pi^-$
~ 2007	HASAN	94	RVUE $\bar{p}p \rightarrow \pi\pi$

¹ From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.

NODE=M167M

NODE=M167M

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 ± 24	² ANISOVICH	02	SPEC 0.6–1.9 $p\bar{p} \rightarrow \omega \pi^0, \omega \eta \pi^0, \pi^+ \pi^-$
~ 287	HASAN	94	RVUE $\bar{p}p \rightarrow \pi\pi$

² From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.

NODE=M167W

NODE=M167W

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>	
HASAN	94	PL B334 215	A. Hasan, D.V. Bugg	(LOQM)

NODE=M167

REFID=48828
REFID=48327
REFID=48349
REFID=47950
REFID=44103

$f_2(2010)$

$I^G(J^{PC}) = 0^+(2^{++})$

NODE=M106

$f_2(2010)$ 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 ± 12	VLADIMIRSK...06	SPEC	$40 \pi^- p \rightarrow K_S^0 K_S^0 n$
1980 ± 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 ± 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 ± 32	VLADIMIRSK...06	SPEC	$40 \pi^- p \rightarrow K_S^0 K_S^0 n$
145 ± 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 ± 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
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)

$f_0(2020)$

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

OMITTED FROM SUMMARY TABLE

Needs confirmation.

NODE=M156

NODE=M156

NODE=M156M

NODE=M156M

NODE=M156M;LINKAGE=PC

NODE=M156M;LINKAGE=PP

NODE=M156M;LINKAGE=ST

NODE=M156W

NODE=M156W

NODE=M156W;LINKAGE=PC

NODE=M156W;LINKAGE=PP

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=51063

REFID=47950

REFID=47959

REFID=47962

REFID=46605

REFID=46914

REFID=45758

 $f_0(2020)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1992±16		^{1,2} BARBERIS	00C	450 $p p \rightarrow p_f 4\pi p_s$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2037±8	80k	³ UMAN	06 E835	5.2 $\bar{p} p \rightarrow \eta \eta \pi^0$
2040±38		ANISOVICH	00J SPEC	
2010±60		ALDE	98 GAM4	100 $\pi^- p \rightarrow \pi^0 \pi^0 n$
2020±35		BARBERIS	97B OMEG	450 $p p \rightarrow p p 2(\pi^+ \pi^-)$

¹ Average between $\pi^+ \pi^- 2\pi^0$ and $2(\pi^+ \pi^-)$.² T-matrix pole.³ Statistical error only. **$f_0(2020)$ WIDTH**

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
442±60		^{4,5} BARBERIS	00C	450 $p p \rightarrow p_f 4\pi p_s$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
296±17	80k	⁶ UMAN	06 E835	5.2 $\bar{p} p \rightarrow \eta \eta \pi^0$
405±40		ANISOVICH	00J SPEC	
240±100		ALDE	98 GAM4	100 $\pi^- p \rightarrow \pi^0 \pi^0 n$
410±50		BARBERIS	97B OMEG	450 $p p \rightarrow p p 2(\pi^+ \pi^-)$

⁴ Average between $\pi^+ \pi^- 2\pi^0$ and $2(\pi^+ \pi^-)$.⁵ T-matrix pole.⁶ Statistical error only. **$f_0(2020)$ DECAY MODES**

Mode	Fraction (Γ_i/Γ)
Γ_1 $\rho \pi \pi$	seen
Γ_2 $\pi^0 \pi^0$	seen
Γ_3 $\rho \rho$	seen
Γ_4 $\omega \omega$	seen
Γ_5 $\eta \eta$	seen

 $f_0(2020)$ 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 $p p \rightarrow p_f \omega \omega p_s$

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

UMAN	06	PR D73 052009	I. Uman <i>et al.</i>	(FNAL E835)
ANISOVICH	00J	PL B491 47	A.V. Anisovich <i>et al.</i>	
BARBERIS	00C	PL B471 440	D. Barberis <i>et al.</i>	(WA 102 Collab.)
BARBERIS	00F	PL B484 198	D. Barberis <i>et al.</i>	(WA 102 Collab.)
ALDE	98	EPJ A3 361	D. Alde <i>et al.</i>	(GAM4 Collab.)
Also		PAN 62 405	D. Alde <i>et al.</i>	(GAMS Collab.)
		Translated from YAF 62 446		
BARBERIS	97B	PL B413 217	D. Barberis <i>et al.</i>	(WA 102 Collab.)

$a_4(2040)$

$$I^G(J^{PC}) = 1^-(4^{++})$$

NODE=M017

 $a_4(2040)$ MASS

NODE=M017M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
1996^{+10}_{-9} OUR AVERAGE		Error includes scale factor of 1.1.			
$1885 \pm 13^{+50}_{-2}$	420k	ALEKSEEV	10	COMP	$190 \pi^- Pb \rightarrow \pi^- \pi^- \pi^+ Pb'$
$1985 \pm 10 \pm 13$	145k	LU	05	B852	$18 \pi^- p \rightarrow \omega \pi^- \pi^0 p$
$1996 \pm 25 \pm 43$		CHUNG	02	B852	$18.3 \pi^- p \rightarrow 3\pi p$
2005^{+25}_{-45}		¹ ANISOVICH	01F	SPEC	$2.0 \bar{p} p \rightarrow 3\pi^0, \pi^0 \eta, \pi^0 \eta'$
$2000 \pm 40^{+60}_{-20}$		IVANOV	01	B852	$18 \pi^- p \rightarrow \eta' \pi^- p$
$1944 \pm 8 \pm 50$		² AMELIN	99	VES	$37 \pi^- A \rightarrow \omega \pi^- \pi^0 A^*$
2010 ± 20		³ DONSKOV	96	GAM2 0	$38 \pi^- p \rightarrow \eta \pi^0 n$
2040 ± 30		⁴ CLELAND	82B	SPEC $\pm$	$50 \pi p \rightarrow K_S^0 K^\pm p$
2030 ± 50		⁵ CORDEN	78C	OMEG 0	$15 \pi^- p \rightarrow 3\pi n$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
2004 ± 6	80k	⁶ UMAN	06	E835	$5.2 \bar{p} p \rightarrow \eta \eta \pi^0$
1903 ± 10		⁷ BALDI	78	SPEC $-$	$10 \pi^- p \rightarrow p K_S^0 K^-$
¹ From the combined analysis of ANISOVICH 99C, ANISOVICH 99E, and ANISOVICH 01F. ² May be a different state. ³ From a simultaneous fit to the G_+ and G_0 wave intensities. ⁴ From an amplitude analysis. ⁵ $J^P = 4^+$ is favored, though $J^P = 2^+$ cannot be excluded. ⁶ Statistical error only. ⁷ From a fit to the Y_8^0 moment. Limited by phase space.					

NODE=M017M;LINKAGE=AN
 NODE=M017M;LINKAGE=DM
 NODE=M017M;LINKAGE=A
 NODE=M017M;LINKAGE=C
 NODE=M017M;LINKAGE=M
 NODE=M017M;LINKAGE=ST
 NODE=M017M;LINKAGE=Y

 $a_4(2040)$ WIDTH

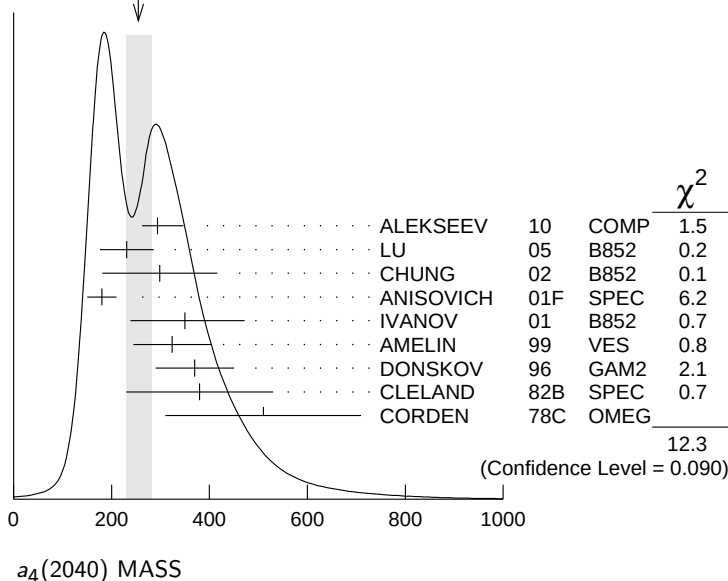
NODE=M017W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
255^{+28}_{-24} OUR AVERAGE		Error includes scale factor of 1.3. See the ideogram below.			
$294 \pm 25^{+46}_{-19}$	420k	ALEKSEEV	10	COMP	$190 \pi^- Pb \rightarrow \pi^- \pi^- \pi^+ Pb'$
$231 \pm 30 \pm 46$	145k	LU	05	B852	$18 \pi^- p \rightarrow \omega \pi^- \pi^0 p$
$298 \pm 81 \pm 85$		CHUNG	02	B852	$18.3 \pi^- p \rightarrow 3\pi p$
180 ± 30		⁸ ANISOVICH	01F	SPEC	$2.0 \bar{p} p \rightarrow 3\pi^0, \pi^0 \eta, \pi^0 \eta'$
$350 \pm 100^{+70}_{-50}$		IVANOV	01	B852	$18 \pi^- p \rightarrow \eta' \pi^- p$
$324 \pm 26 \pm 75$		⁹ AMELIN	99	VES	$37 \pi^- A \rightarrow \omega \pi^- \pi^0 A^*$
370 ± 80		¹⁰ DONSKOV	96	GAM2 0	$38 \pi^- p \rightarrow \eta \pi^0 n$
380 ± 150		¹¹ CLELAND	82B	SPEC $\pm$	$50 \pi p \rightarrow K_S^0 K^\pm p$
510 ± 200		¹² CORDEN	78C	OMEG 0	$15 \pi^- p \rightarrow 3\pi n$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
401 ± 16	80k	¹³ UMAN	06	E835	$5.2 \bar{p} p \rightarrow \eta \eta \pi^0$
166 ± 43		¹⁴ BALDI	78	SPEC $-$	$10 \pi^- p \rightarrow p K_S^0 K^-$
⁸ From the combined analysis of ANISOVICH 99C, ANISOVICH 99E, and ANISOVICH 01F. ⁹ May be a different state. ¹⁰ From a simultaneous fit to the G_+ and G_0 wave intensities. ¹¹ From an amplitude analysis. ¹² $J^P = 4^+$ is favored, though $J^P = 2^+$ cannot be excluded. ¹³ Statistical error only. ¹⁴ From a fit to the Y_8^0 moment. Limited by phase space.					

NODE=M017W

NODE=M017W;LINKAGE=AN
 NODE=M017W;LINKAGE=DM
 NODE=M017W;LINKAGE=A
 NODE=M017W;LINKAGE=C
 NODE=M017W;LINKAGE=M
 NODE=M017W;LINKAGE=ST
 NODE=M017W;LINKAGE=Y

WEIGHTED AVERAGE
255+28-24 (Error scaled by 1.3)



$a_4(2040)$ 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 $\eta\pi^0$	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 ←

$a_4(2040)$ 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 $\pi^- p \rightarrow K_S^0 K^- p$	
$\Gamma(\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$					Γ_2/Γ
VALUE	DOCUMENT ID	TECN	CHG	COMMENT	
seen	CORDEN	78C	OMEG	0 15 $\pi^- p \rightarrow 3\pi n$	
$\Gamma(\rho\pi)/\Gamma(f_2(1270)\pi)$					Γ_3/Γ_4
VALUE	DOCUMENT ID	TECN	COMMENT		
$1.1 \pm 0.2 \pm 0.2$	CHUNG	02	B852	18.3 $\pi^- p \rightarrow 3\pi p$	
$\Gamma(\eta\pi^0)/\Gamma_{\text{total}}$					Γ_7/Γ
VALUE	DOCUMENT ID	TECN	CHG	COMMENT	
seen	DONSKOV	96	GAM2	0 38 $\pi^- p \rightarrow \eta\pi^0 n$	
$\Gamma(\omega\rho)/\Gamma_{\text{total}}$					Γ_6/Γ
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
seen	145k	LU	05	B852 18 $\pi^- p \rightarrow \omega\pi^-\pi^0 p$	

NODE=M017R1
NODE=M017R1

NODE=M017R2
NODE=M017R2

NODE=M017R4
NODE=M017R4

NODE=M017R3
NODE=M017R3

NODE=M017R5
NODE=M017R5

$a_4(2040)$ REFERENCES

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=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

NODE=M016

 $f_4(2050)$

$$I^G(J^{PC}) = 0^+(4^{++})$$

 $f_4(2050)$ MASS

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	$N \bar{N} \rightarrow \pi \pi$
~ 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

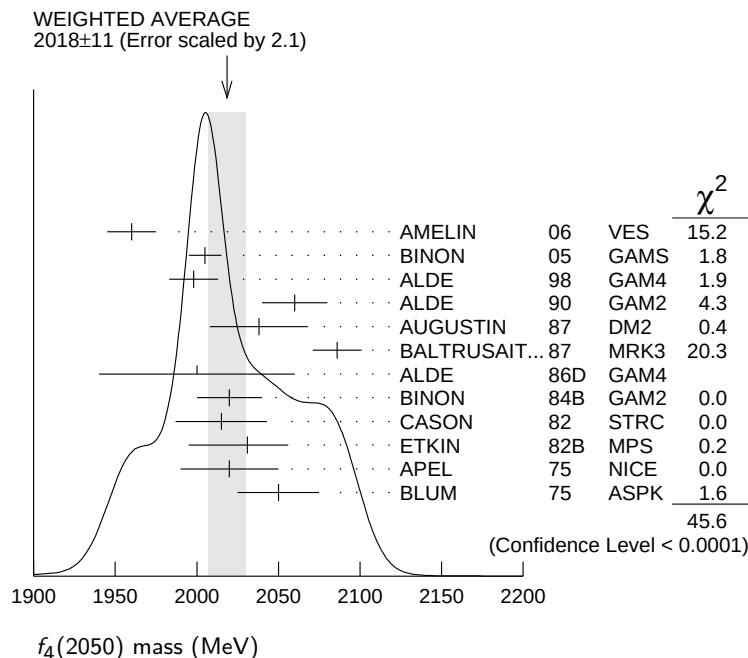
NODE=M016M

OCCUR=2

NODE=M016M;LINKAGE=BI
NODE=M016M;LINKAGE=N
NODE=M016M;LINKAGE=NN
NODE=M016M;LINKAGE=KM
NODE=M016M;LINKAGE=UE
NODE=M016M;LINKAGE=RB
NODE=M016M;LINKAGE=BR
NODE=M016M;LINKAGE=B

NODE=M016M;LINKAGE=BB

NODE=M016M;LINKAGE=M
NODE=M016M;LINKAGE=T



$f_4(2050)$ WIDTH

NODE=M016W

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 $\pi^- p \rightarrow n K^+ K^-$

NODE=M016W

• • • 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 $\pi^- p \rightarrow p 3 \pi$

OCCUR=2

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.

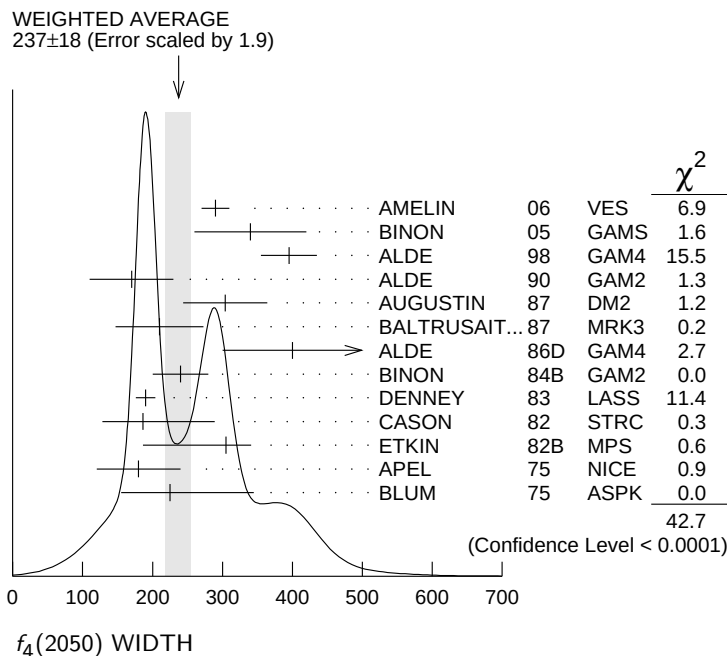
¹⁸ Single energy analysis.

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
$\Gamma_2 \quad \pi\pi$	$(17.0 \pm 1.5) \%$
$\Gamma_3 \quad K\bar{K}$	$(6.8^{+3.4}_{-1.8}) \times 10^{-3}$
$\Gamma_4 \quad \eta\eta$	$(2.1 \pm 0.8) \times 10^{-3}$
$\Gamma_5 \quad 4\pi^0$	$< 1.2 \%$
$\Gamma_6 \quad \gamma\gamma$	
$\Gamma_7 \quad a_2(1320)\pi$	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. • • •	
$23.1^{+3.6+70.5}_{-3.3-15.6}$ 23 UEHARA 09 BELL $10.6 e^+e^- \rightarrow e^+e^-\pi^0\pi^0$	
<1100 95 13 ± 4 OEST 90 JADE $e^+e^- \rightarrow e^+e^-\pi^0\pi^0$	

23 Taking into account the $f_2(1950)$. Helicity-2 production favored.

NODE=M016G3
NODE=M016G3

NODE=M016G3;LINKAGE=UE

 $f_4(2050)$ BRANCHING RATIOS

NODE=M016225

$\Gamma(\omega\omega)/\Gamma_{\text{total}}$	Γ_1/Γ
VALUE DOCUMENT ID TECN COMMENT	
seen AMELIN 06 VES $36 \pi^- p \rightarrow \omega\omega n$	
• • • We do not use the following data for averages, fits, limits, etc. • • •	
not seen BARBERIS 00F $450 pp \rightarrow pf\omega\omega p_S$	

NODE=M016R7
NODE=M016R7

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

VALUE

1.5±0.3

DOCUMENT ID

ALDE

TECN

90

COMMENT

38 $\pi^- p \rightarrow \omega\omega n$ Γ_1/Γ_2

NODE=M016R5

NODE=M016R5

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

VALUE

0.170±0.015 OUR AVERAGE

0.18 ±0.03

0.16 ±0.03

0.17 ±0.02

²⁴ Assuming one pion exchange.

DOCUMENT ID

²⁴ BINON

83C

GAM2

38 $\pi^- p \rightarrow n4\gamma$ ²⁴ CASON

82

STRC

8 $\pi^+ p \rightarrow \Delta^{++}\pi^0$ ²⁴ CORDEN

79

OMEG

12-15 $\pi^- p \rightarrow n2\pi$ Γ_2/Γ

NODE=M016R1

NODE=M016R1

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

VALUE

0.04^{+0.02}_{-0.01}

DOCUMENT ID

ETKIN

TECN

82B

MPS

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

GAM4

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

GAM4

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

VES

COMMENT

37 $\pi^- p \rightarrow \eta\pi^+\pi^- n$ Γ_7/Γ

NODE=M016R6

NODE=M016R6

f₄(2050) REFERENCES

NODE=M016

ANISOVICH	09	IJMP A24 2481	V.V. Anisovich, A.V. Sarantsev		REFID=52719
UEHARA	09	PR D79 052009	S. Uehara <i>et al.</i>	(BELLE Collab.)	REFID=52761
AMELIN	06	PAN 69 690	D.V. Amelin <i>et al.</i>	(VES Collab.)	REFID=51574
		Translated from YAF 69 715.			
BINON	05	PAN 68 960	F. Binon <i>et al.</i>		REFID=50780
		Translated from YAF 68 998.			
AMELIN	00	NP A668 83	D. Amelin <i>et al.</i>	(VES Collab.)	REFID=47432
ANISOVICH	00J	PL B491 47	A.V. Anisovich <i>et al.</i>		REFID=47950
BARBERIS	00F	PL B484 198	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=47962
ALDE	98	EPJ A3 361	D. Alde <i>et al.</i>	(GAM4 Collab.)	REFID=46605
Also		PAN 62 405	D. Alde <i>et al.</i>	(GAMS Collab.)	REFID=46914
		Translated from YAF 62 446.			
MARTIN	98	PR C57 3492	B.R. Martin <i>et al.</i>		REFID=46373
MARTIN	97	PR C56 1114	B.R. Martin, G.C. Oades	(LOUC, AARH)	REFID=45685
KLOET	96	PR D53 6120	W.M. Kloet, F. Myhrer	(RUTG, NORD)	REFID=45212
OAKDEN	94	NP A574 731	M.N. Oakden, M.R. Pennington	(DURH)	REFID=45210
ALDE	90	PL B241 600	D.M. Alde <i>et al.</i>	(SERP, BELG, LANL, LAPP+)	REFID=40935
OEST	90	ZPHY C47 343	T. Oest <i>et al.</i>	(JADE Collab.)	REFID=41358
ALDE	87	PL B198 286	D.M. Alde <i>et al.</i>	(LANL, BRUX, SERP, LAPP)	REFID=40221
AUGUSTIN	87	ZPHY C36 369	J.E. Augustin <i>et al.</i>	(LALO, CLER, FRAS+)	REFID=40268
BALTRUSAIT...	87	PR D35 2077	R.M. Baltrusaitis <i>et al.</i>	(Mark III Collab.)	REFID=40010
ALDE	86D	NP B269 485	D.M. Alde <i>et al.</i>	(BELG, LAPP, SERP, CERN+)	REFID=20765
ALTHOFF	85B	ZPHY C29 189	M. Althoff <i>et al.</i>	(TASSO Collab.)	REFID=21349
BINON	84B	LNC 39 41	F.G. Binon <i>et al.</i>	(SERP, BELG, LAPP)	REFID=21780
BINON	83C	SJNP 38 723	F.G. Binon <i>et al.</i>	(SERP, BRUX+)	REFID=40288
		Translated from YAF 38 1199.			
DENNEY	83	PR D28 2726	D.L. Denney <i>et al.</i>	(IOWA, MICH)	REFID=20754
CASON	82	PRL 48 1316	N.M. Cason <i>et al.</i>	(NDAM, ANL)	REFID=20746
ETKIN	82B	PR D25 1786	A. Etkin <i>et al.</i>	(BNL, CUNY, TUFTS, VAND)	REFID=20390
ALPER	80	PL 94B 422	B. Alper <i>et al.</i>	(AMST, CERN, CRAC, MPIM+)	REFID=21665
ROZANSKA	80	NP B162 505	M. Rozanska <i>et al.</i>	(MPIM, CERN)	REFID=21774
CORDEN	79	NP B157 250	M.J. Corden <i>et al.</i>	(BIRM, RHEL, TELA+)	REFID=20374
EVANGELIS...	79B	NP B154 381	C. Evangelista <i>et al.</i>	(BARI, BONN, CERN+)	REFID=21967
ANTIPOV	77	NP B119 45	Y.M. Antipov <i>et al.</i>	(SERP, GEVA)	REFID=20728
APEL	75	PL 57B 398	W.D. Apel <i>et al.</i>	(KARLK, KARLE, PISA, SERP+)	REFID=20720
BLUM	75	PL 57B 403	W. Blum <i>et al.</i>	(CERN, MPIM)	REFID=21651

$\pi_2(2100)$

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

OMITTED FROM SUMMARY TABLE

Needs confirmation.

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)
$\Gamma_1 \quad 3\pi$	seen
$\Gamma_2 \quad \rho\pi$	seen
$\Gamma_3 \quad f_2(1270)\pi$	seen
$\Gamma_4 \quad (\pi\pi)_S\pi$	seen

 $\pi_2(2100)$ BRANCHING RATIOS

$\Gamma(\rho\pi)/\Gamma(3\pi)$				Γ_2/Γ_1
<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
0.19±0.05	⁵ DAUM	81B	CNTR	63,94 $\pi^- p$
$\Gamma(f_2(1270)\pi)/\Gamma(3\pi)$				Γ_3/Γ_1
<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
0.36±0.09	⁵ DAUM	81B	CNTR	63,94 $\pi^- p$
$\Gamma((\pi\pi)_S\pi)/\Gamma(3\pi)$				Γ_4/Γ_1
<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
0.45±0.07	⁵ DAUM	81B	CNTR	63,94 $\pi^- p$
D-wave/S-wave RATIO FOR $\pi_2(2100) \rightarrow f_2(1270)\pi$				
<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
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+)

$f_0(2100)$

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

OMITTED FROM SUMMARY TABLE

Needs confirmation.

NODE=M168

NODE=M168

NODE=M168M

NODE=M168M

 $f_0(2100)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2103± 8 OUR AVERAGE				
2102±13		¹ ANISOVICH	00J SPEC	2.0 $\bar{p}p \rightarrow \eta\pi^0\pi^0, \pi^0\pi^0,$ $\eta\eta, \eta\eta', \pi^+\pi^-$
2090±30		BAI	00A BES	$J/\psi \rightarrow \gamma(\pi^+\pi^-\pi^+\pi^-)$
2105±10		ANISOVICH	99K SPEC	0.6–1.94 $\bar{p}p \rightarrow \eta\eta, \eta\eta'$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2105± 8	80k	² UMAN	06 E835	5.2 $\bar{p}p \rightarrow \eta\eta\pi^0$
~ 2104		BUGG	95	$J/\psi \rightarrow \gamma\pi^+\pi^-\pi^+\pi^-$
~ 2122		HASAN	94 RVUE	$\bar{p}p \rightarrow \pi\pi$

¹ Includes the data of ANISOVICH 00B indicating to exotic decay pattern.² Statistical error only.

NODE=M168M;LINKAGE=AN

NODE=M168M;LINKAGE=ST

 $f_0(2100)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
209± 19 OUR AVERAGE				
211± 29		³ ANISOVICH	00J SPEC	2.0 $\bar{p}p \rightarrow \eta\pi^0\pi^0, \pi^0\pi^0,$ $\eta\eta, \eta\eta', \pi^+\pi^-$
330±100		BAI	00A BES	$J/\psi \rightarrow \gamma(\pi^+\pi^-\pi^+\pi^-)$
200± 25		ANISOVICH	99K SPEC	0.6–1.94 $\bar{p}p \rightarrow \eta\eta, \eta\eta'$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
236± 14	80k	⁴ UMAN	06 E835	5.2 $\bar{p}p \rightarrow \eta\eta\pi^0$
~ 203		BUGG	95	$J/\psi \rightarrow \gamma\pi^+\pi^-\pi^+\pi^-$
~ 273		HASAN	94 RVUE	$\bar{p}p \rightarrow \pi\pi$

³ Includes the data of ANISOVICH 00B indicating to exotic decay pattern.⁴ Statistical error only.

NODE=M168W

NODE=M168W

NODE=M168W;LINKAGE=AN

NODE=M168W;LINKAGE=ST

 $f_0(2100)$ REFERENCES

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>	
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=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

 $f_2(2150)$ MASS **$f_2(2150)$ MASS, COMBINED MODES (MeV)**

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2157±12 OUR AVERAGE Includes data from the 2 datablocks that follow 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 $pp \rightarrow p_f\eta\eta p_s$
2175±20		PROKOSHKIN 95D	GAM4	300 $\pi^- N \rightarrow \pi^- N 2\eta$, 450 $pp \rightarrow pp2\eta$
2130±35		SINGOVSKI 94	GAM4	450 $pp \rightarrow pp2\eta$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2140±30		² ABELE 99B	CBAR	
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
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. • • •				
2135±20±45		⁴ ADOMEIT 96	CBAR 0	1.94 $\bar{p}p \rightarrow \eta3\pi^0$
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 ⁺ _{– 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 channel
⁹ 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.				

NODE=M042M;LINKAGE=ST

NODE=M042M3

NODE=M042M3

NODE=M042M3;LINKAGE=K3

NODE=M042M3;LINKAGE=A

NODE=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=L

NODE=M042M2

NODE=M042M2

NODE=M042M2;LINKAGE=I

NODE=M042M2;LINKAGE=E

NODE=M042M2;LINKAGE=M

KK̄ MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
2200±13	VLADIMIRSK...06	SPEC	40 π ⁻ p → K _S ⁰ K _S ⁰ n
2150±20	ABLIKIM	04E BES2	J/ψ → ω K ⁺ K ⁻
2130±35	BARBERIS	99 OMEG	450 p p → p _s p _f K ⁺ K ⁻

NODE=M042M5
NODE=M042M5

f₂(2150) WIDTH

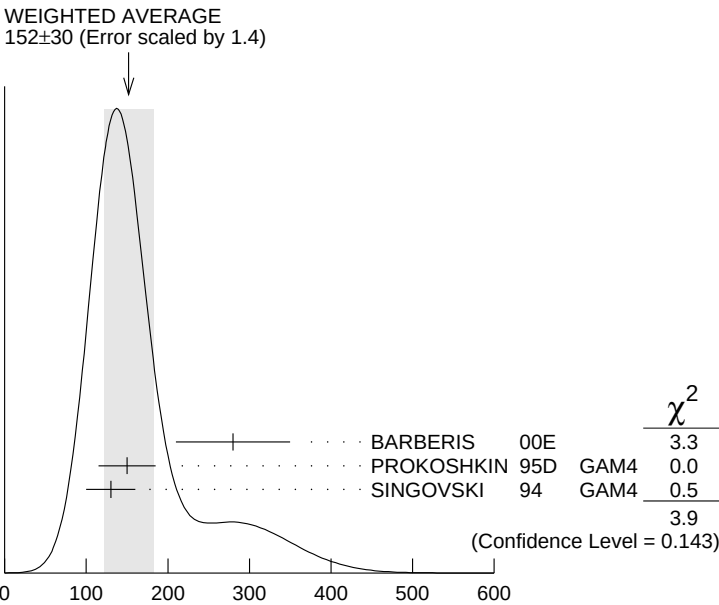
NODE=M042210

f₂(2150) WIDTH, COMBINED MODES (MeV)

NODE=M042W
NODE=M042W

VALUE (MeV)	EVS	DOCUMENT ID	TECN	COMMENT
152±30 OUR AVERAGE Includes data from the 2 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. • • •				
182±11	80k	¹² UMAN	06 E835	5.2 p̄ p → η η π ⁰
¹² Statistical error only.				

NODE=M042W;LINKAGE=ST



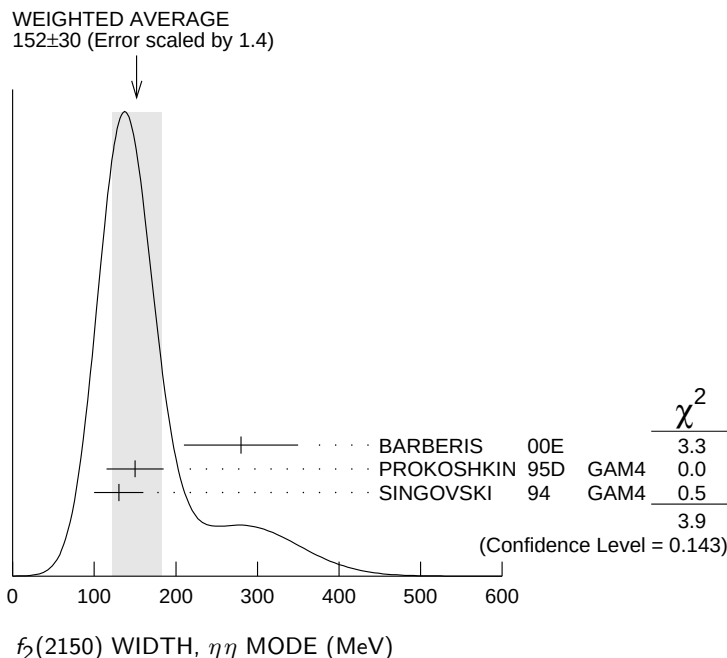
f₂(2150) WIDTH, COMBINED MODES (MeV)

ηη MODE

NODE=M042W3
NODE=M042W3

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
The data in this block is included in the average printed for a previous datablock.			
152±30 OUR AVERAGE Error includes scale factor of 1.4. See the ideogram below.			
280±70	BARBERIS	00E	450 p p → p _f η η p _s
150±35	PROKOSHKIN	95D GAM4	300 π ⁻ N → π ⁻ N 2η, 450 p p → p p 2η
130±30	SINGOVSKI	94 GAM4	450 p p → p p 2η
• • • We do not use the following data for averages, fits, limits, etc. • • •			
310±50	¹³ ABELE	99B CBAR	
203±10	¹⁴ ARMSTRONG	93C E760	p̄ p → π ⁰ η η → 6γ
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

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. • • •

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 $pp \rightarrow p_S p_f K^+ K^-$

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 $p p \rightarrow p_f \eta \eta p_s$

• • • 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 $p p \rightarrow p p 2\eta$

²² Using data from ARMSTRONG 89D.

NODE=M042220

NODE=M042R1

NODE=M042R1

NODE=M042R1;LINKAGE=A

$\Gamma(\pi\pi)/\Gamma(\eta\eta)$ **Γ_1/Γ_2**

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

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

<0.33	95	²³ PROKOSHKIN 95D	GAM4	300 $\pi^- N \rightarrow \pi^- N 2\eta$, 450 $p p \rightarrow p p 2\eta$

²³ Derived from a $\pi^0\pi^0/\eta\eta$ limit.

NODE=M042R2

NODE=M042R2

NODE=M042R2;LINKAGE=A

$\Gamma(f_2(1270)\eta)/\Gamma(a_2(1320)\pi)$ **Γ_4/Γ_5**

VALUE	DOCUMENT ID	TECN	COMMENT

0.79 ± 0.11 ²⁴ ADOMEIT 96 CBAR 1.94 $\bar{p} p \rightarrow \eta 3\pi^0$

²⁴ Using $B(a_2(1320) \rightarrow \eta\pi) = 0.145$

NODE=M042R3

NODE=M042R3

NODE=M042R3;LINKAGE=A

$\Gamma(\rho\bar{\rho})/\Gamma_{\text{total}}$ **Γ_6/Γ**

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

seen 73 ALEXANDER 10 CLEO $\psi(2S) \rightarrow \gamma p \bar{p}$

NODE=M042R04

NODE=M042R04

 $f_2(2150)$ REFERENCES

ALEXANDER 10	PR D82 092002	J.P. Alexander <i>et al.</i>	(CLEO Collab.)
UMAN 06	PR D73 052009	I. Uman <i>et al.</i>	(FNAL E835)
VLADIMIRSK... 06	PAN 69 493	V.V. Vladimirovsky <i>et al.</i>	(ITEP, Moscow)
	Translated from YAF 69 515.		
ABLIKIM 04E	PL B603 138	M. Ablikim <i>et al.</i>	(BES Collab.)
ANISOVICH 00E	PL B477 19	A.V. Anisovich <i>et al.</i>	
BARBERIS 00E	PL B479 59	D. Barberis <i>et al.</i>	(WA 102 Collab.)
ABELE 99B	EPJ C8 67	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
BARBERIS 99	PL B453 305	D. Barberis <i>et al.</i>	(Omega Expt.)
EVANGELIS... 97	PR D56 3803	C. Evangelista <i>et al.</i>	(LEAR Collab.)
MARTIN 97	PR C56 1114	B.R. Martin, G.C. Oades	(LOUC, AARH)
ADOMEIT 96	ZPHY C71 227	J. Adomeit <i>et al.</i>	(Crystal Barrel Collab.)
KLOET 96	PR D53 6120	W.M. Kloet, F. Myhrer	(RUTG, NORD)
PROKOSHKIN 95D	SPD 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 107A 1911	A.V. Singovsky	(SERP)
ARMSTRONG 93C	PL B307 394	T.A. Armstrong <i>et al.</i>	(FNAL, FERR, GENO+)
ARMSTRONG 89D	PL B227 186	T.A. Armstrong, M. Benayoun	(ATHU, BARI, BIRM+)
MARTIN 80B	NP B176 355	B.R. Martin, D. Morgan	(LOUC, RHEL) JP
MARTIN 80C	NP B169 216	A.D. Martin, M.R. Pennington	(DURH) JP
CUTTS 78B	PR D17 16	D. Cutts <i>et al.</i>	(STON, WISC)
DULUDE 78B	PL 79B 335	R.S. Dulude <i>et al.</i>	(BROW, MIT, BARI) JP
COUPLAND 77	PL 71B 460	M. Coupland <i>et al.</i>	(LOQM, RHEL)
ALSPECTOR 73	PRL 30 511	J. Alspector <i>et al.</i>	(RUTG, UPNJ)

NODE=M042

REFID=53525

REFID=51063

REFID=51191

REFID=50174

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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

NODE=M032205

 NODE=M032M3
 NODE=M032M3

OCCUR=2

 NODE=M032M1
 NODE=M032M1

 NODE=M032M2
 NODE=M032M2

 NODE=M032M4
 NODE=M032M4

NODE=M032M3;LINKAGE=LE

 NODE=M032M3;LINKAGE=A
 NODE=M032M1;LINKAGE=CC

 NODE=M032M;LINKAGE=P
 NODE=M032M;LINKAGE=AY

 NODE=M032M;LINKAGE=I
 NODE=M032M;LINKAGE=E
 NODE=M032M;LINKAGE=M
 NODE=M032M;LINKAGE=B

NODE=M032210

 NODE=M032W3
 NODE=M032W3

OCCUR=2

 $\rho(2150)$ MASS **e^+e^- PRODUCED**

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
2254 ± 22	¹ LEES	12G BABR	$e^+e^- \rightarrow \pi^+\pi^-\gamma$
$2150 \pm 40 \pm 50$	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	² CLEGG	90 RVUE	$e^+e^- \rightarrow 3(\pi^+\pi^-), 2(\pi^+\pi^-\pi^0)$

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

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
~ 2191	HASAN	94 RVUE	$\bar{p}p \rightarrow \pi\pi$
~ 2070	³ OAKDEN	94 RVUE	$0.36\text{--}1.55 \bar{p}p \rightarrow \pi\pi$
~ 2170	⁴ MARTIN	80B RVUE	
~ 2100	⁴ MARTIN	80C RVUE	

S-CHANNEL $\bar{N}N$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
2110 ± 35	⁵ ANISOVICH	02 SPEC	$0.6\text{--}1.9 \bar{p}p \rightarrow \omega\pi^0, \omega\eta\pi^0, \pi^+\pi^-$
~ 2190	⁶ CUTTS	78B CNTR	$0.97\text{--}3 \bar{p}p \rightarrow \bar{N}N$
2155 ± 15	^{6,7} COUPLAND	77 CNTR	$0.7\text{--}2.4 \bar{p}p \rightarrow \bar{p}p$
2193 ± 2	^{6,8} ALSPECTOR	73 CNTR	$\bar{p}p$ S channel
2190 ± 10	⁹ ABRAMS	70 CNTR	S channel $\bar{p}N$

 $\pi^-p \rightarrow \omega\pi^0n$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
2155 ± 21 OUR AVERAGE			
2140 ± 30	ALDE	95 GAM2	$38 \pi^-p \rightarrow \omega\pi^0n$
2170 ± 30	ALDE	92C GAM4	$100 \pi^-p \rightarrow \omega\pi^0n$

¹ 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.

² Includes ATKINSON 85.

³ See however KLOET 96 who fit $\pi^+\pi^-$ only and find waves only up to $J = 3$ to be important but not significantly resonant.

⁴ $I(J^P) = 1(1^-)$ from simultaneous analysis of $p\bar{p} \rightarrow \pi^-\pi^+$ and $\pi^0\pi^0$.

⁵ From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.

⁶ Isospins 0 and 1 not separated.

⁷ From a fit to the total elastic cross section.

⁸ Referred to as T or T region by ALSPECTOR 73.

⁹ Seen as bump in $I = 1$ state. See also COOPER 68. PEASLEE 75 confirm $\bar{p}p$ results of ABRAMS 70, no narrow structure.

 $\rho(2150)$ WIDTH **e^+e^- PRODUCED**

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
109 ± 76	¹⁰ 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	¹¹ CLEGG	90 RVUE	$e^+e^- \rightarrow 3(\pi^+\pi^-), 2(\pi^+\pi^-\pi^0)$

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

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	12 OAKDEN	94	RVUE 0.36–1.55 $\bar{p}p \rightarrow \pi\pi$
~ 250	13 MARTIN	80B	RVUE
~ 200	13 MARTIN	80C	RVUE

NODE=M032W1
NODE=M032W1

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	14 ANISOVICH	02	SPEC 0.6–1.9 $p\bar{p} \rightarrow \omega\pi^0, \omega\eta\pi^0, \pi^+\pi^-$
135±75	15,16 COUPLAND	77	CNTR 0.7–2.4 $\bar{p}p \rightarrow \bar{p}p$
98± 8	16 ALSPECTOR	73	CNTR $\bar{p}p$ S channel
~ 85	17 ABRAMS	70	CNTR S channel $\bar{p}N$

NODE=M032W2
NODE=M032W2

 $\pi^-p \rightarrow \omega\pi^0n$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
320±70	ALDE	95	GAM2 38 $\pi^-p \rightarrow \omega\pi^0n$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
~ 300	ALDE	92C	GAM4 100 $\pi^-p \rightarrow \omega\pi^0n$
¹⁰ Using the GOUNARIS 68 parametrization of the pion form factor leaving the masses and widths of the $\rho(1450)$, $\rho(1700)$, and $\rho(2150)$ resonances as free parameters of the fit. ¹¹ Includes ATKINSON 85. 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 $I(J^P) = 1(1^-)$ from simultaneous analysis of $p\bar{p} \rightarrow \pi^-\pi^+$ and $\pi^0\pi^0$. ¹⁴ From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02. ¹⁵ From a fit to the total elastic cross section. ¹⁶ Isospins 0 and 1 not separated. ¹⁷ 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=M032W4
NODE=M032W4

NODE=M032W3;LINKAGE=LE

NODE=M032W3;LINKAGE=A
NODE=M032W1;LINKAGE=CC

NODE=M032W;LINKAGE=P
NODE=M032W;LINKAGE=AY

NODE=M032W;LINKAGE=E
NODE=M032W;LINKAGE=I
NODE=M032W;LINKAGE=B

 $\rho(2150)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 e^+e^-	
Γ_2 $\pi^+\pi^-$	seen
Γ_3 K^+K^-	seen
Γ_4 $3(\pi^+\pi^-)$	seen
Γ_5 $2(\pi^+\pi^-\pi^0)$	seen
Γ_6 $\eta'\pi^+\pi^-$	seen
Γ_7 $f_1(1285)\pi^+\pi^-$	seen
Γ_8 $\omega\pi^0$	seen
Γ_9 $\omega\pi^0\eta$	seen
Γ_{10} $p\bar{p}$	

NODE=M032215;NODE=M032

DESIG=1

DESIG=2;OUR EVAL;→ UNCHECKED ←
DESIG=3;OUR EVAL;→ UNCHECKED ←
DESIG=4;OUR EVAL;→ UNCHECKED ←
DESIG=5;OUR EVAL;→ UNCHECKED ←
DESIG=6;OUR EVAL;→ UNCHECKED ←
DESIG=7;OUR EVAL;→ UNCHECKED ←
DESIG=8;OUR EVAL;→ UNCHECKED ←
DESIG=9;OUR EVAL;→ UNCHECKED ←
DESIG=10

 $\rho(2150) \Gamma(i)\Gamma(e^+e^-)/\Gamma^2(\text{total})$

$\Gamma(f_1(1285)\pi^+\pi^-)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$		$\Gamma_7/\Gamma \times \Gamma_1/\Gamma$	
VALUE (units 10^{-7})	DOCUMENT ID	TECN	COMMENT
3.1±0.6±0.5	18 AUBERT	07AU BABR	10.6 $e^+e^- \rightarrow f_1(1285)\pi^+\pi^-\gamma$
¹⁸ Calculated by us from the reported value of cross section at the peak.			

NODE=M032230

NODE=M032G01
NODE=M032G01

NODE=M032G01;LINKAGE=AU

$\Gamma(\eta'\pi^+\pi^-)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$		$\Gamma_6/\Gamma \times \Gamma_1/\Gamma$	
VALUE (units 10^{-8})	DOCUMENT ID	TECN	COMMENT
4.9±1.9	19 AUBERT	07AU BABR	10.6 $e^+e^- \rightarrow \eta'\pi^+\pi^-\gamma$
¹⁹ Calculated by us from the reported value of cross section at the peak.			

NODE=M032G02
NODE=M032G02

NODE=M032G02;LINKAGE=AU

$\rho(2150)$ REFERENCES

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>	
KLOET	96	PR D53 6120	W.M. Kloet, F. Myhrer	(RUTG, NORD)
ALDE	95	ZPHY C66 379	D.M. Alde <i>et al.</i>	(GAMS Collab.) JP
HASAN	94	PL B334 215	A. Hasan, D.V. Bugg	(LOQM)
OAKDEN	94	NP A574 731	M.N. Oakden, M.R. Pennington	(DURH)
ALDE	92C	ZPHY C54 553	D.M. Alde <i>et al.</i>	(BELG, SERP, KEK, LANL+)
BIAGINI	91	NC 104A 363	M.E. Biagini <i>et al.</i>	(FRAS, PRAG)
CLEGG	90	ZPHY C45 677	A.B. Clegg, A. Donnachie	(LANC, MCHS)
ATKINSON	85	ZPHY C29 333	M. Atkinson <i>et al.</i>	(BONN, CERN, GLAS+)
MARTIN	80B	NP B176 355	B.R. Martin, D. Morgan	(LOUC, RHEL) JP
MARTIN	80C	NP B169 216	A.D. Martin, M.R. Pennington	(DURH) JP
CUTTS	78B	PR D17 16	D. Cutts <i>et al.</i>	(STON, WISC)
COUPLAND	77	PL 71B 460	M. Coupland <i>et al.</i>	(LOQM, RHEL)
PEASLEE	75	PL 57B 189	D.C. Peaslee <i>et al.</i>	(CANB, BARI, BROW+)
ALSPECTOR	73	PRL 30 511	J. Alspector <i>et al.</i>	(RUTG, UPNJ)
ABRAMS	70	PR D1 1917	R.J. Abrams <i>et al.</i>	(BNL)
COOPER	68	PRL 20 1059	W.A. Cooper <i>et al.</i>	(ANL)
GOUNARIS	68	PRL 21 244	G.J. Gounaris, J.J. Sakurai	

NODE=M032

REFID=54299
REFID=52049
REFID=48828
REFID=48327
REFID=48349
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REFID=21824
REFID=21813
REFID=21807
REFID=21805
REFID=48054

$\phi(2170)$

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

Observed by AUBERT,BE 06D in the initial-state radiation process
 $e^+e^- \rightarrow \phi f_0(980)\gamma$.

NODE=M103

NODE=M103

$\phi(2170)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2175±15 OUR AVERAGE		Error includes scale factor of 1.6. See the ideogram below.		
2186±10± 6	52	ABLIKIM 08F	BES	$J/\psi \rightarrow \eta \phi f_0(980)$
2125±22±10	483	AUBERT 08S	BABR	$10.6 e^+e^- \rightarrow \phi \eta \gamma$
2175±10±15	201	¹ AUBERT,BE 06D	BABR	$10.6 e^+e^- \rightarrow K^+K^- \pi \pi \gamma$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
2079±13 ⁺⁷⁹ ₋₂₈	4.8k	² SHEN 09	BELL	$10.6 e^+e^- \rightarrow K^+K^- \pi^+ \pi^- \gamma$
2192±14	116 ± 95	³ AUBERT 07AK	BABR	$10.6 e^+e^- \rightarrow K^+K^- \pi^+ \pi^- \gamma$
2169±20	149 ± 36	³ AUBERT 07AK	BABR	$10.6 e^+e^- \rightarrow K^+K^- \pi^0 \pi^0 \gamma$

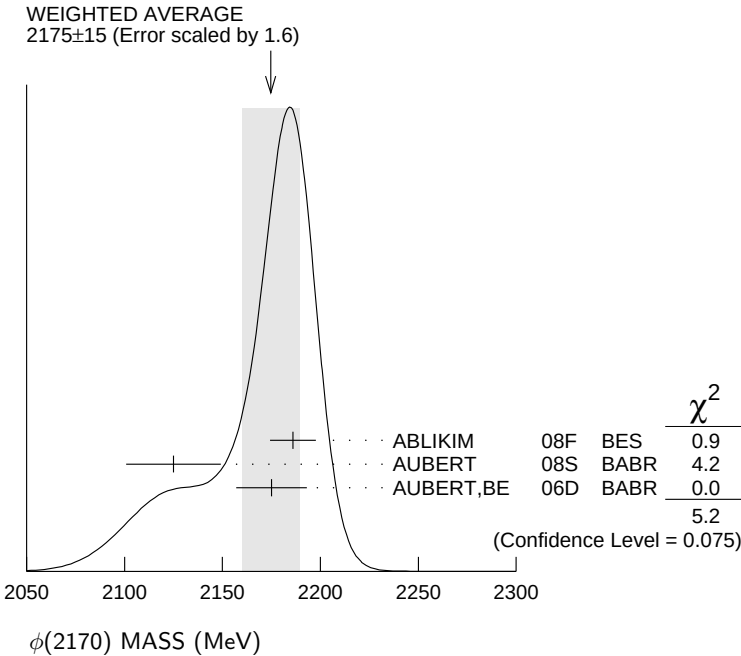
NODE=M103M

NODE=M103M

- ¹ From the $\phi f_0(980)$ component.
² From a fit with two incoherent Breit-Wigners.
³ From the $K^+K^- f_0(980)$ component.

OCCUR=2

NODE=M103M;LINKAGE=AB
NODE=M103M;LINKAGE=SH
NODE=M103M;LINKAGE=AU



$\phi(2170)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
61±18 OUR AVERAGE				
65±23±17	52	ABLIKIM	08F BES	$J/\psi \rightarrow \eta \phi f_0(980)$
61±50±13	483	AUBERT	08S BABR	$10.6 e^+ e^- \rightarrow \phi \eta \gamma$
58±16±20	201	⁴ AUBERT,BE	06D BABR	$10.6 e^+ e^- \rightarrow K^+ K^- \pi \pi \gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$192 \pm 23^{+25}_{-61}$	4.8k	⁵ SHEN	09 BELL	$10.6 e^+ e^- \rightarrow K^+ K^- \pi^+ \pi^- \gamma$
71±21	116 ± 95	⁶ AUBERT	07AK BABR	$10.6 e^+ e^- \rightarrow K^+ K^- \pi^+ \pi^- \gamma$
102±27	149 ± 36	⁶ AUBERT	07AK BABR	$10.6 e^+ e^- \rightarrow K^+ K^- \pi^0 \pi^0 \gamma$
⁴ From the $\phi f_0(980)$ component.				
⁵ From a fit with two incoherent Breit-Wigners.				
⁶ From the $K^+ K^- f_0(980)$ component.				

NODE=M103W

NODE=M103W

OCCUR=2

NODE=M103W;LINKAGE=AB
 NODE=M103W;LINKAGE=SH
 NODE=M103W;LINKAGE=AU

 $\phi(2170)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 e^+ e^-$	seen
$\Gamma_2 \phi \eta$	
$\Gamma_3 \phi \pi \pi$	
$\Gamma_4 \phi f_0(980)$	seen
$\Gamma_5 K^+ K^- \pi^+ \pi^-$	
$\Gamma_6 K^+ K^- f_0(980) \rightarrow K^+ K^- \pi^+ \pi^-$	seen
$\Gamma_7 K^+ K^- \pi^0 \pi^0$	
$\Gamma_8 K^+ K^- f_0(980) \rightarrow K^+ K^- \pi^0 \pi^0$	seen
$\Gamma_9 K^{*0} K^\pm \pi^\mp$	not seen
$\Gamma_{10} K^*(892)^0 \bar{K}^*(892)^0$	not seen

NODE=M103215;NODE=M103

DESIG=1;OUR EVAL;→ UNCHECKED ←
 DESIG=5
 DESIG=9
 DESIG=2;OUR EVAL;→ UNCHECKED ←
 DESIG=3
 DESIG=6
 DESIG=4
 DESIG=7
 DESIG=8
 DESIG=10

 $\phi(2170) \Gamma(i) \Gamma(e^+ e^-) / \Gamma(\text{total})$

$\Gamma(\phi\eta) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$					$\Gamma_2\Gamma_1/\Gamma$
<u>VALUE (eV)</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. • • •					
1.7±0.7±1.3	483	AUBERT	08S BABR	10.6 e ⁺ e ⁻ → φηγ	
$\Gamma(\phi f_0(980)) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$					$\Gamma_4\Gamma_1/\Gamma$
<u>VALUE (eV)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
2.5±0.8±0.4	201	⁷ AUBERT,BE	06D BABR	10.6 e ⁺ e ⁻ → K ⁺ K ⁻ ππγ	
⁷ From the φf ₀ (980) component.					

NODE=M103230

NODE=M103G2
 NODE=M103G2

NODE=M103G1
 NODE=M103G1

NODE=M103G1;LINKAGE=AB

 $\phi(2170) \Gamma(i) \Gamma(e^+ e^-) / \Gamma^2(\text{total})$

$\Gamma(\phi\pi\pi)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$					$\Gamma_3/\Gamma \times \Gamma_1/\Gamma$
<u>VALUE (units 10^{-7})</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. • • •					
$1.65 \pm 0.15 \pm 0.18$	4.8k	⁸ SHEN	09 BELL	$10.6 e^+ e^- \rightarrow K^+ K^- \pi^+ \pi^- \gamma$	
⁸ 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=M103220

NODE=M103G01
 NODE=M103G01

NODE=M103G01;LINKAGE=SH

 $\phi(2170)$ BRANCHING RATIOS

$\Gamma(K^+ K^- f_0(980) \rightarrow K^+ K^- \pi^+ \pi^-) / \Gamma_{\text{total}}$				Γ_6 / Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
seen	AUBERT	07AK BABR	$10.6 e^+ e^- \rightarrow K^+ K^- \pi^+ \pi^- \gamma$	
$\Gamma(K^+ K^- f_0(980) \rightarrow K^+ K^- \pi^0 \pi^0) / \Gamma_{\text{total}}$				Γ_8 / Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
seen	AUBERT	07AK BABR	$10.6 e^+ e^- \rightarrow K^+ K^- \pi^0 \pi^0 \gamma$	

NODE=M103225

NODE=M103R01
 NODE=M103R01

NODE=M103R02
 NODE=M103R02

$\Gamma(K^{*0} K^{\pm} \pi^{\mp})/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	AUBERT	07AK BABR	10.6 GeV $e^+ e^-$

NODE=M103R03
 NODE=M103R03

 $\Gamma(K^{*}(892)^0 \bar{K}^{*}(892)^0)/\Gamma_{\text{total}}$ Γ_{10}/Γ

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	10C	PL B685 27	M. Ablikim <i>et al.</i>	(BES II Collab.)
SHEN	09	PR D80 031101	C.P. Shen <i>et al.</i>	(BELLE Collab.)
ABLIKIM	08F	PRL 100 102003	M. Ablikim <i>et al.</i>	(BES Collab.)
AUBERT	08S	PR D77 092002	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT	07AK	PR D76 012008	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT,BE	06D	PR D74 091103	B. Aubert <i>et al.</i>	(BABAR Collab.)

REFID=53349
 REFID=53000
 REFID=52154
 REFID=52242
 REFID=51908
 REFID=51511

 $f_0(2200)$

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

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)	DOCUMENT ID	TECN	COMMENT
2189±13 OUR AVERAGE			
2170±20 ⁺¹⁰ ₋₁₅	ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$
2210±50	¹ BINON	05 GAMS	$33 \pi^- p \rightarrow \eta \eta n$
2197±17	² 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. • • •			
~ 2122	HASAN	94 RVUE	$\bar{p} p \rightarrow \pi \pi$
~ 2321	HASAN	94 RVUE	$\bar{p} p \rightarrow \pi \pi$

NODE=M112M

¹ First solution, PWA is ambiguous.² Cannot determine spin to be 0.

OCCUR=2

NODE=M112M;LINKAGE=BI
 NODE=M112M;LINKAGE=A

 $f_0(2200)$ WIDTH

NODE=M112W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
238±50 OUR AVERAGE	Error includes scale factor of 1.2.		
220±60 ⁺⁴⁰ ₋₄₅	ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$
380±90	³ BINON	05 GAMS	$33 \pi^- p \rightarrow \eta \eta n$
201±51	⁴ 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. • • •			
~ 273	HASAN	94 RVUE	$\bar{p} p \rightarrow \pi \pi$
~ 223	HASAN	94 RVUE	$\bar{p} p \rightarrow \pi \pi$

NODE=M112W

³ First solution, PWA is ambiguous.⁴ Cannot determine spin to be 0.

OCCUR=2

NODE=M112W;LINKAGE=BI
 NODE=M112W;LINKAGE=A

 $f_0(2200)$ REFERENCES

NODE=M112

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=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	$J/\psi \rightarrow \gamma \pi^0 \pi^0$

¹ALDE 86B uses data from both the GAMS-2000 and GAMS-4000 detectors.² $J^{PC} = 2^{++}$. Systematic uncertainties not evaluatedNODE=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			³ VLADIMIRSK...08	SPEC	$40 \pi^-p \rightarrow K_S^0 K_S^0 n + m\pi^0$
<80	90		ALDE	87C GAM2	$38 \pi^-p \rightarrow \eta'\eta n$

³ $J^{PC} = 2^{++}$. Systematic uncertainties not evaluated

NODE=M082W;LINKAGE=VL

 $f_J(2220)$ DECAY MODES

NODE=M082215;NODE=M082

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \pi\pi$	seen
$\Gamma_2 \pi^+\pi^-$	seen
$\Gamma_3 K\bar{K}$	seen
$\Gamma_4 p\bar{p}$	
$\Gamma_5 \gamma\gamma$	not seen
$\Gamma_6 \eta\eta'(958)$	seen
$\Gamma_7 \phi\phi$	not seen
$\Gamma_8 \eta\eta$	not seen

DESIG=5;OUR EST;→ UNCHECKED ←
DESIG=6;OUR EST;→ UNCHECKED ←
DESIG=1;OUR EST;→ UNCHECKED ←
DESIG=4
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	⁴ 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	⁴ GODANG	97 CLE2	$\gamma\gamma \rightarrow K_S^0 K_S^0$
< 86	95	⁴ ALBRECHT	90G ARG	$\gamma\gamma \rightarrow K^+ K^-$
< 1000	95	⁵ 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	$\gamma\gamma \rightarrow \pi^+ \pi^-$

⁴ Assuming $J^P = 2^+$.⁵ 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	⁶ AMSLER	01 CBAR	$1.4-1.5 \text{ } p\bar{p} \rightarrow \pi^0 \pi^0$

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

< (11-42)	99	⁷ HASAN	96 SPEC	$1.35-1.55 \text{ } p\bar{p} \rightarrow \pi^+ \pi^-$

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	⁸ EVANGELIS...	98 SPEC	$1.1-2.0 \text{ } p\bar{p} \rightarrow \phi\phi$

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	⁶ AMSLER	01 CBAR	$1.4-1.5 \text{ } p\bar{p} \rightarrow \eta\eta$

⁶ For $J^P = 2^+$ in the mass range 2222-2240 MeV and the total width between 10 and 20 MeV.⁷ For $J^P = 2^+$ and $J^P = 4^+$ in the mass range 2220-2245 MeV and the total width of 15 MeV.⁸ 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

 $\Gamma(p\bar{p}) / \Gamma_{\text{total}}$ 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		⁹ AUBERT	07AV BABR	$B \rightarrow p\bar{p} K^*$
not seen		WANG	05A BELL	$B^+ \rightarrow \bar{p} p K^+$
< 3.0	95	¹⁰ EVANGELIS...	97 SPEC	$1.96-2.40 \text{ } p\bar{p} \rightarrow K_S^0 K_S^0$
< 1.1	99.7	¹¹ BARNES	93 SPEC	$1.3-1.57 \text{ } p\bar{p} \rightarrow K_S^0 K_S^0$
< 2.6	99.7	¹¹ BARDIN	87 CNTR	$1.3-1.5 \text{ } p\bar{p} \rightarrow K^+ K^-$
< 3.6	99.7	¹¹ SCULLI	87 CNTR	$1.29-1.55 \text{ } p\bar{p} \rightarrow K^+ K^-$

⁹ Assuming $\Gamma < 30 \text{ MeV}$.¹⁰ Assuming $\Gamma \sim 20 \text{ MeV}$, $J^P = 2^+$ and $B(f_J(2220) \rightarrow K\bar{K}) = 100\%$.¹¹ Assuming $\Gamma = 30-35 \text{ MeV}$, $J^P = 2^+$ and $B(f_J(2220) \rightarrow K\bar{K}) = 100\%$.NODE=M082R1
NODE=M082R1

NODE=M082R1;LINKAGE=AU

NODE=M082R1;LINKAGE=C

NODE=M082R1;LINKAGE=B

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

VLADIMIRSK... 08	PAN 71 2129	V.V. Vladimirsky <i>et al.</i>	(ITEP)
AUBERT 07AV	Translated from YAF 71 2166.	B. Aubert <i>et al.</i>	(BABAR Collab.)
WANG 05A	PL D76 092004	M.-Z. Wang <i>et al.</i>	(BELLE Collab.)
PDG 04	PL B617 141	S. Eidelman <i>et al.</i>	(PDG Collab.)
ACCIARRI 01H	PL B592 1	M. Acciarri <i>et al.</i>	(L3 Collab.)
AMSLER 01	PL B501 173	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
ALAM 98C	PL B520 175	M.S. Alam <i>et al.</i>	(CLEO Collab.)
BAI 98H	PRL 81 3328	J.Z. Bai <i>et al.</i>	(BES Collab.)
EVANGELIS... 98	PRL 81 1179	C. Evangelista <i>et al.</i>	(JETSET Collab.)
EVANGELIS... 97	PR D57 5370	C. Evangelista <i>et al.</i>	(LEAR Collab.)
GODANG 97	PR D56 3803	R. Godang <i>et al.</i>	(CLEO Collab.)
BAI 96B	PRL 79 3829	J.Z. Bai <i>et al.</i>	(BES Collab.)
HASAN 96	PRL 76 3502	A. Hasan, D.V. Bugg	(BRUN, LOQM)
BARNES 93	PL B388 376	P.D. Barnes <i>et al.</i>	(PS185 Collab.)
ALBRECHT 90G	PL B309 469	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
ASTON 88F	ZPHY C48 183	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS) JP
BOLONKIN 88	PRL B215 199	B.V. Bolonkin <i>et al.</i>	(ITEP, SERP)
ALDE 87C	NP B309 426	D. Alde <i>et al.</i>	
BARDIN 87	SJNP 45 255	G. Bardin <i>et al.</i>	(SACL, FERR, CERN, PADO+)
SCULLI 87	Translated from YAF 45 405.	J. Sculli <i>et al.</i>	(NYU, BNL)
ALDE 86B	PL B195 292	D.M. Alde <i>et al.</i>	(SERP, BELG, LANL, LAPP)
BALTRUSAIT... 86D	PRL 58 1715	R.M. Baltrusaitis	(CIT, UCSC, ILL, SLAC+)
ALTHOFF 85B	PL B177 120	M. Althoff <i>et al.</i>	(TASSO Collab.)
	PRL 56 107		
	ZPHY C29 189		

NODE=M082

REFID=52681

REFID=51990
REFID=50651
REFID=49653
REFID=48321
REFID=48558
REFID=46326
REFID=46342
REFID=46365
REFID=45687
REFID=45760
REFID=44736
REFID=45197
REFID=43601
REFID=41374
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REFID=40580
REFID=47474

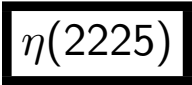
REFID=40235
REFID=40023
REFID=21864
REFID=21865
REFID=21349

OTHER RELATED PAPERS

DEL-AMO-SA... 100	PRL 105 172001	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)

REFID=53533

NODE=M115



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

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
2226±16 OUR AVERAGE				
2240 ⁺³⁰⁺³⁰ ₋₂₀₋₂₀	196 ± 19	ABLIKIM	08I BES	$J/\psi \rightarrow \gamma K^+ K^- K_S^0 K_L^0$
2230±25±15		BAI	90B MRK3	$J/\psi \rightarrow \gamma K^+ K^- K^+ K^-$
2214±20±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	$J/\psi \rightarrow \gamma K^+ K^- K^+ K^-$

OCCUR=2

$\eta(2225)$ WIDTH

NODE=M115W

NODE=M115W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
185⁺⁷⁰₋₄₀ OUR AVERAGE				
190± 30 ⁺⁶⁰ ₋₄₀	196 ± 19	ABLIKIM	08I BES	$J/\psi \rightarrow \gamma K^+ K^- K_S^0 K_L^0$
150 ⁺³⁰⁰ ₋₆₀ ±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	$J/\psi \rightarrow \gamma K^+ K^- K^+ K^-$

$\eta(2225)$ REFERENCES

NODE=M115

REFID=16595
REFID=52255
REFID=41354
REFID=22101

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.)

$\rho_3(2250)$

$$I^G(J^{PC}) = 1^+(3^{--})$$

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

NODE=M044

$\rho_3(2250)$ MASS

NODE=M044205

$\bar{p}p \rightarrow \pi\pi$ or $K\bar{K}$

NODE=M044M1
NODE=M044M1

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
~ 2232	HASAN	94	RVUE	$\bar{p}p \rightarrow \pi\pi$
~ 2090	¹ OAKDEN	94	RVUE	0.36–1.55 $\bar{p}p \rightarrow \pi\pi$
~ 2250	² MARTIN	80B	RVUE	
~ 2300	² MARTIN	80C	RVUE	
~ 2140	³ CARTER	78B	CNTR 0	0.7–2.4 $\bar{p}p \rightarrow K^- K^+$
~ 2150	⁴ CARTER	77	CNTR 0	0.7–2.4 $\bar{p}p \rightarrow \pi\pi$

¹ See however KLOET 96 who fit $\pi^+\pi^-$ only and find waves only up to $J = 3$ to be important but not significantly resonant.

² $I(J^P) = 1(3^-)$ from simultaneous analysis of $p\bar{p} \rightarrow \pi^-\pi^+$ and $\pi^0\pi^0$.

³ $I = 0, 1. J^P = 3^-$ from Barrelet-zero analysis.

⁴ $I(J^P) = 1(3^-)$ from amplitude analysis.

NODE=M044M1;LINKAGE=CC

NODE=M044M1;LINKAGE=P
NODE=M044M1;LINKAGE=K
NODE=M044M1;LINKAGE=J

S-CHANNEL $\bar{N}N$

NODE=M044M2
NODE=M044M2

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2260 ± 20	⁵ ANISOVICH	02	SPEC	0.6–1.9 $p\bar{p} \rightarrow \omega\pi^0, \omega\eta\pi^0, \pi^+\pi^-$
~ 2190	⁶ CUTTS	78B	CNTR	0.97–3 $\bar{p}p \rightarrow \bar{N}N$
2155 ± 15	^{6,7} COUPLAND	77	CNTR 0	0.7–2.4 $\bar{p}p \rightarrow \bar{p}p$
2193 ± 2	^{6,8} ALSPECTOR	73	CNTR	$\bar{p}p$ S channel
2190 ± 10	⁹ ABRAMS	70	CNTR	S channel $\bar{p}N$

⁵ From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.

⁶ Isospins 0 and 1 not separated.

⁷ From a fit to the total elastic cross section.

⁸ Referred to as T or T region by ALSPECTOR 73.

⁹ 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

$\pi^- p \rightarrow \eta\pi\pi$

NODE=M044M3
NODE=M044M3

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2290 ± 20 ± 30	AMELIN	00	VES	37 $\pi^- p \rightarrow \eta\pi^+\pi^- n$

$\rho_3(2250)$ WIDTH

NODE=M044210

$\bar{p}p \rightarrow \pi\pi$ or $K\bar{K}$

NODE=M044W1
NODE=M044W1

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
~ 220	HASAN	94	RVUE	$\bar{p}p \rightarrow \pi\pi$
~ 60	¹⁰ OAKDEN	94	RVUE	0.36–1.55 $\bar{p}p \rightarrow \pi\pi$
~ 250	¹¹ MARTIN	80B	RVUE	
~ 200	¹¹ MARTIN	80C	RVUE	
~ 150	¹² CARTER	78B	CNTR 0	0.7–2.4 $\bar{p}p \rightarrow K^- K^+$
~ 200	¹³ CARTER	77	CNTR 0	0.7–2.4 $\bar{p}p \rightarrow \pi\pi$

¹⁰ See however KLOET 96 who fit $\pi^+\pi^-$ only and find waves only up to $J = 3$ to be important but not significantly resonant.

¹¹ $I(J^P) = 1(3^-)$ from simultaneous analysis of $p\bar{p} \rightarrow \pi^-\pi^+$ and $\pi^0\pi^0$.

¹² $I = 0, 1. J^P = 3^-$ from Barrelet-zero analysis.

¹³ $I(J^P) = 1(3^-)$ from amplitude analysis.

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	¹⁴ ANISOVICH	02	SPEC	0.6–1.9 $p\bar{p} \rightarrow \omega\pi^0, \omega\eta\pi^0, \pi^+\pi^-$
135±75	^{15,16} COUPLAND	77	CNTR	0.7–2.4 $\bar{p}p \rightarrow \bar{p}p$
98±8	¹⁶ ALSPECTOR	73	CNTR	$\bar{p}p$ S channel
~ 85	¹⁷ ABRAMS	70	CNTR	S channel $\bar{p}N$

- ¹⁴ From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.
¹⁵ From a fit to the total elastic cross section.
¹⁶ Isospins 0 and 1 not separated.
¹⁷ 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

 $\pi^- p \rightarrow \eta\pi\pi$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
230±50±80	AMELIN	00	VES 37 $\pi^- p \rightarrow \eta\pi^+\pi^- n$

NODE=M044W3
 NODE=M044W3

 $\rho_3(2250)$ 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>	
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>	
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=48828
 REFID=48327
 REFID=48349
 REFID=47432
 REFID=47950
 REFID=45212
 REFID=44103
 REFID=45210
 REFID=21838
 REFID=45210
 REFID=21837
 REFID=21964
 REFID=21733
 REFID=21963
 REFID=21830
 REFID=21824
 REFID=21813
 REFID=21807
 REFID=21805

NODE=M107

$f_2(2300)$

$$I^G(J^{PC}) = 0^+(2^{++})$$

 $f_2(2300)$ MASS

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. • • •			
2270±12	VLADIMIRSK...06	SPEC	40 $\pi^- p \rightarrow K_S^0 K_S^0 n$
2327±9±6	ABE	04	BELL 10.6 $e^+e^- \rightarrow e^+e^- K^+ K^-$
2231±10	BOOTH	86	OMEG 85 $\pi^- \text{Be} \rightarrow 2\phi\text{Be}$
2220 ⁺⁹⁰ ₋₂₀	LINDENBAUM	84	RVUE
2320±40	ETKIN	82	MPS 22 $\pi^- p \rightarrow 2\phi n$

- 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.

NODE=M107M

NODE=M107M

NODE=M107M;LINKAGE=C

 $f_2(2300)$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
149±41	² ETKIN	88	MPS 22 $\pi^- p \rightarrow \phi\phi n$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
90±29	VLADIMIRSK...06	SPEC	40 $\pi^- p \rightarrow K_S^0 K_S^0 n$
275±36±20	ABE	04	BELL 10.6 $e^+e^- \rightarrow e^+e^- K^+ K^-$
133±50	BOOTH	86	OMEG 85 $\pi^- \text{Be} \rightarrow 2\phi\text{Be}$
200±50	LINDENBAUM	84	RVUE
220±70	ETKIN	82	MPS 22 $\pi^- p \rightarrow 2\phi n$

- ² Includes data of ETKIN 85.

NODE=M107W

NODE=M107W

NODE=M107W;LINKAGE=C

$f_2(2300)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \phi\phi$	seen
$\Gamma_2 \quad K\bar{K}$	seen
$\Gamma_3 \quad \gamma\gamma$	seen

NODE=M107215;NODE=M107

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

$\Gamma(K\bar{K}) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$	$\Gamma_2\Gamma_3/\Gamma$
VALUE (eV)	DOCUMENT ID TECN COMMENT

NODE=M107G1
 NODE=M107G1

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

$44 \pm 6 \pm 12$ ³ ABE 04 BELL $10.6 e^+ e^- \rightarrow e^+ e^- K^+ K^-$

³ Assuming spin 2.

NODE=M107G1;LINKAGE=AB

 $f_2(2300)$ REFERENCES

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)

NODE=M107

REFID=51191

REFID=49650
 REFID=40285
 REFID=21870
 REFID=21871
 REFID=21869
 REFID=21866

NODE=M041

 $f_4(2300)$

$$I^G(J^{PC}) = 0^+(4^{++})$$

OMITTED FROM SUMMARY TABLE

This entry was previously called $U_0(2350)$. Contains results mostly from formation experiments. For further production experiments see the Further States entry. See also $\rho(2150)$, $f_2(2150)$, $\rho_3(2250)$, $\rho_5(2350)$.

NODE=M041

 $f_4(2300)$ MASS

NODE=M041205

NODE=M041M

 $\bar{p}p \rightarrow \pi\pi$ or $\bar{K}K$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

NODE=M041M1
 NODE=M041M1

• • • 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;LINKAGE=P
 NODE=M041M1;LINKAGE=K
 NODE=M041M1;LINKAGE=J

S-CHANNEL $\bar{p}p$ or $\bar{N}N$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

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

2283 ± 17	⁴ ANISOVICH	00J	SPEC
~ 2380	⁵ CUTTS	78B	CNTR $0.97-3 \bar{p}p \rightarrow \bar{N}N$
2345 ± 15	^{5,6} COUPLAND	77	CNTR $0.7-2.4 \bar{p}p \rightarrow \bar{p}p$
2359 ± 2	^{5,7} ALSPECTOR	73	CNTR $\bar{p}p$ S channel
2375 ± 10	ABRAMS	70	CNTR S channel $\bar{N}N$

⁴ From the combined analysis of ANISOVICH 99C and ANISOVICH 99F on $\bar{p}p \rightarrow \eta \pi^0 \pi^0$, $\pi^0 \pi^0$, $\eta \eta$, $\eta \eta'$, $\pi^+ \pi^-$.

⁵ Isospins 0 and 1 not separated.

⁶ From a fit to the total elastic cross section.

⁷ Referred to as U or U region by ALSPECTOR 73.

NODE=M041M2
 NODE=M041M2

NODE=M041M2;LINKAGE=AN

NODE=M041M2;LINKAGE=I
 NODE=M041M2;LINKAGE=E
 NODE=M041M2;LINKAGE=M

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

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$2330 \pm 20 \pm 40$	AMELIN	00	VES $37 \pi^- p \rightarrow \eta \pi^+ \pi^- n$

NODE=M041M3
 NODE=M041M3

 pp CENTRAL PRODUCTION

VALUE (MeV)	DOCUMENT ID	COMMENT
2320±60 OUR ESTIMATE		
• • • We do not use the following data for averages, fits, limits, etc. • • •		
2332 ± 15	BARBERIS	00F 450 $pp \rightarrow p_f \omega \omega p_s$

NODE=M041M4
 NODE=M041M4
 → UNCHECKED ←

 $f_4(2300)$ WIDTH **$\bar{p} p \rightarrow \pi \pi$ or $\bar{K} K$**

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
~ 278	HASAN	94	RVUE $\bar{p} p \rightarrow \pi \pi$
~ 200	⁸ MARTIN	80C	RVUE
~ 150	⁹ CARTER	78B	CNTR 0.7–2.4 $\bar{p} p \rightarrow K^- K^+$
~ 210	¹⁰ CARTER	77	CNTR 0.7–2.4 $\bar{p} p \rightarrow \pi \pi$
⁸ $I(J^P) = 0(4^+)$ from simultaneous analysis of $p\bar{p} \rightarrow \pi^- \pi^+$ and $\pi^0 \pi^0$.			
⁹ $I(J^P) = 0(4^+)$ from Barrelet-zero analysis.			
¹⁰ $I(J^P) = 0(4^+)$ from amplitude analysis.			

NODE=M041210

NODE=M041W1
 NODE=M041W1

NODE=M041W1;LINKAGE=P
 NODE=M041W1;LINKAGE=K
 NODE=M041W1;LINKAGE=J

S-CHANNEL $\bar{p} p$ or $\bar{N} N$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
310 ± 25	¹¹ ANISOVICH	00J	SPEC
135^{+150}_{-65}	^{12,13} COUPLAND	77	CNTR 0.7–2.4 $\bar{p} p \rightarrow \bar{p} p$
165^{+18}_{-8}	¹³ ALSPECTOR	73	CNTR $\bar{p} p$ S channel
~ 190	ABRAMS	70	CNTR S channel $\bar{N} N$
¹¹ From the combined analysis of ANISOVICH 99C and ANISOVICH 99F on $\bar{p} p \rightarrow \eta \pi^0 \pi^0$, $\pi^0 \pi^0$, $\eta \eta$, $\eta \eta'$, $\pi^+ \pi^-$.			
¹² From a fit to the total elastic cross section.			
¹³ Isospins 0 and 1 not separated.			

NODE=M041W2
 NODE=M041W2

NODE=M041W2;LINKAGE=AN

NODE=M041W2;LINKAGE=E
 NODE=M041W2;LINKAGE=I

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

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$235 \pm 50 \pm 40$	AMELIN	00	VES $37 \pi^- p \rightarrow \eta \pi^+ \pi^- n$

NODE=M041W3
 NODE=M041W3

 pp CENTRAL PRODUCTION

VALUE (MeV)	DOCUMENT ID	COMMENT
250±80 OUR ESTIMATE		
• • • We do not use the following data for averages, fits, limits, etc. • • •		
260 ± 57	BARBERIS	00F 450 $pp \rightarrow p_f \omega \omega p_s$

NODE=M041W4
 NODE=M041W4
 → UNCHECKED ←

 $f_4(2300)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $\rho \rho$	seen
Γ_2 $\omega \omega$	seen
Γ_3 $\eta \pi \pi$	seen
Γ_4 $\pi \pi$	seen
Γ_5 $K \bar{K}$	seen
Γ_6 $N \bar{N}$	seen

NODE=M041215;NODE=M041

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

 $f_4(2300)$ BRANCHING RATIOS **$\Gamma(\rho\rho)/\Gamma(\omega\omega)$**

VALUE	DOCUMENT ID	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •		
2.8 ± 0.5	BARBERIS	00F 450 $pp \rightarrow p_f \omega \omega p_s$

 Γ_1/Γ_2

NODE=M041220

NODE=M041R1
 NODE=M041R1

$f_4(2300)$ REFERENCES

AMELIN	00	NP A668 83	D. Amelin <i>et al.</i>	(VES Collab.)
ANISOVICH	00J	PL B491 47	A.V. Anisovich <i>et al.</i>	
BARBERIS	00F	PL B484 198	D. Barberis <i>et al.</i>	(WA 102 Collab.)
ANISOVICH	99C	PL B452 173	A.V. Anisovich <i>et al.</i>	
ANISOVICH	99F	NP A651 253	A.V. Anisovich <i>et al.</i>	
HASAN	94	PL B334 215	A. Hasan, D.V. Bugg	(LOQM)
MARTIN	80B	NP B176 355	B.R. Martin, D. Morgan	(LOUC, RHEL) JP
MARTIN	80C	NP B169 216	A.D. Martin, M.R. Pennington	(DURH) JP
CARTER	78B	NP B141 467	A.A. Carter	(LOQM)
CUTTS	78B	PR D17 16	D. Cutts <i>et al.</i>	(STON, WISC)
DULUDE	78B	PL 79B 335	R.S. Dulude <i>et al.</i>	(BROW, MIT, BARI) JP
CARTER	77	PL 67B 117	A.A. Carter <i>et al.</i>	(LOQM, RHEL) JP
COUPLAND	77	PL 71B 460	M. Coupland <i>et al.</i>	(LOQM, RHEL)
ALSPECTOR	73	PRL 30 511	J. Alspector <i>et al.</i>	(RUTG, UPNJ)
ABRAMS	70	PR D1 1917	R.J. Abrams <i>et al.</i>	(BNL)

NODE=M041

REFID=47432
REFID=47950
REFID=47962
REFID=46903
REFID=46926
REFID=44103
REFID=21838
REFID=21837
REFID=21964
REFID=21733
REFID=21850
REFID=21963
REFID=21830
REFID=21813
REFID=21807

$f_0(2330)$

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

OMITTED FROM SUMMARY TABLE

NODE=M169

$f_0(2330)$ MASS

NODE=M169M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
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;LINKAGE=BU

$f_0(2330)$ WIDTH

NODE=M169W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
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;LINKAGE=BU

$f_0(2330)$ REFERENCES

NODE=M169

BUGG	04A	EPJ C36 161	D.V. Bugg	
ANISOVICH	00J	PL B491 47	A.V. Anisovich <i>et al.</i>	
BARNES	00	PR C62 055203	P.D. Barnes <i>et al.</i>	
HASAN	94	PL B334 215	A. Hasan, D.V. Bugg	(LOQM)

REFID=50158
REFID=47950
REFID=47965
REFID=44103

$f_2(2340)$

$I^G(J^{PC}) = 0^+(2^{++})$

NODE=M108

$f_2(2340)$ MASS

NODE=M108M

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
2339±55		¹ 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	² UMAN 06	E835	5.2 $\bar{p} p \rightarrow \eta \eta \pi^0$
2392±10		BOOTH 86	OMEG	85 $\pi^- Be \rightarrow 2 \phi Be$
2360±20		LINDENBAUM 84	RVUE	
¹ 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.				
² Statistical error only.				

NODE=M108M

NODE=M108M;LINKAGE=C

NODE=M108M;LINKAGE=ST

$f_2(2340)$ WIDTH

NODE=M108W

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
319⁺⁸¹₋₆₉		³ ETKIN 88	MPS	22 $\pi^- p \rightarrow \phi \phi n$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
218± 16	80k	⁴ UMAN 06	E835	5.2 $\bar{p} p \rightarrow \eta \eta \pi^0$
198± 50		BOOTH 86	OMEG	85 $\pi^- Be \rightarrow 2 \phi Be$
150 ⁺¹⁵⁰ ₋₅₀		LINDENBAUM 84	RVUE	
³ Includes data of ETKIN 85.				
⁴ Statistical error only.				

NODE=M108W

NODE=M108W;LINKAGE=C
NODE=M108W;LINKAGE=ST

$f_2(2340)$ DECAY MODES

NODE=M108215;NODE=M108

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \phi \phi$	seen
$\Gamma_2 \quad \eta \eta$	seen

DESIG=1;OUR EST;→ UNCHECKED ←
DESIG=2

$f_2(2340)$ BRANCHING RATIOS

NODE=M108220

$\Gamma(\eta \eta)/\Gamma_{\text{total}}$				Γ_2/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
seen	UMAN	06	E835	5.2 $\bar{p} p \rightarrow \eta \eta \pi^0$

NODE=M108R01
NODE=M108R01

$f_2(2340)$ REFERENCES

NODE=M108

UMAN	06	PR D73 052009	I. Uman <i>et al.</i>	(FNAL E835)
ETKIN	88	PL B201 568	A. Etkin <i>et al.</i>	(BNL, CUNY)
BOOTH	86	NP B273 677	P.S.L. Booth <i>et al.</i>	(LIVP, GLAS, CERN)
ETKIN	85	PL 165B 217	A. Etkin <i>et al.</i>	(BNL, CUNY)
LINDENBAUM	84	CNPP 13 285	S.J. Lindenbaum	(CUNY)

REFID=51063
REFID=40285
REFID=21870
REFID=21871
REFID=21869

$\rho_5(2350)$

$$I^G(J^{PC}) = 1^+(5^{--})$$

OMITTED FROM SUMMARY TABLE

This entry was previously called $U_1(2400)$. See also $\rho(2150)$, $f_2(2150)$, $\rho_3(2250)$, $f_4(2300)$.

NODE=M033

NODE=M033

 $\rho_5(2350)$ MASS

NODE=M033205

NODE=M033M

 $\pi^- p \rightarrow \omega \pi^0 n$
 NODE=M033M3
 NODE=M033M3

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
2330±35	ALDE	95	GAM2 38 $\pi^- p \rightarrow \omega \pi^0 n$

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT

NODE=M033M1

• • • 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	0.7-2.4 $\bar{p} p \rightarrow$ $K^- K^+$
~ 2480	³ CARTER	77	CNTR 0	0.7-2.4 $\bar{p} p \rightarrow$ $\pi \pi$

S-CHANNEL $\bar{N} N$
 NODE=M033M2
 NODE=M033M2

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT

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

2300±45	⁴ ANISOVICH	02	SPEC	0.6-1.9 $\bar{p} \bar{p} \rightarrow$ $\omega \pi^0, \omega \eta \pi^0,$ $\pi^+ \pi^-$
2295±30	ANISOVICH	00J	SPEC	
~ 2380	⁵ CUTTS	78B	CNTR	0.97-3 $\bar{p} p \rightarrow$ $\bar{N} N$
2345±15	^{5,6} COUPLAND	77	CNTR 0	0.7-2.4 $\bar{p} p \rightarrow$ $\bar{p} p$
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	$\bar{p}(pn), K^* K 2\pi$

 $\pi^- p \rightarrow K^+ K^- n$
 NODE=M033M4
 NODE=M033M4

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 $\bar{p} \bar{p} \rightarrow \pi^- \pi^+$ 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=M033M1;LINKAGE=P

NODE=M033M1;LINKAGE=K

NODE=M033M1;LINKAGE=J

NODE=M033M2;LINKAGE=AY

NODE=M033M2;LINKAGE=I

NODE=M033M2;LINKAGE=E

NODE=M033M2;LINKAGE=M

NODE=M033M2;LINKAGE=A

NODE=M033M2;LINKAGE=N

 $\rho_5(2350)$ WIDTH

NODE=M033210

 $\pi^- p \rightarrow \omega \pi^0 n$
 NODE=M033W3
 NODE=M033W3

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
400±100	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. • • •				
~ 169	HASAN	94	RVUE	$\bar{p}p \rightarrow \pi\pi$
~ 250	10 MARTIN	80B	RVUE	
~ 300	10 MARTIN	80C	RVUE	
~ 150	11 CARTER	78B	CNTR 0	0.7-2.4 $\bar{p}p \rightarrow$ $K^- K^+$
~ 210	12 CARTER	77	CNTR 0	0.7-2.4 $\bar{p}p \rightarrow$ $\pi\pi$

NODE=M033W1
 NODE=M033W1

S-CHANNEL $\bar{N}N$

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
260 ± 75	13 ANISOVICH	02	SPEC	0.6-1.9 $p\bar{p} \rightarrow$ $\omega\pi^0, \omega\eta\pi^0,$ $\pi^+\pi^-$
235 ⁺⁶⁵ ₋₄₀	ANISOVICH	00J	SPEC	
135 ⁺¹⁵⁰ ₋₆₅	14,15 COUPLAND	77	CNTR 0	0.7-2.4 $\bar{p}p \rightarrow$ $\bar{p}p$
165 ⁺¹⁸ ₋₈	15 ALSPECTOR	73	CNTR	$\bar{p}p$ S channel
< 60	16 OH	70B	HDBC -0	$\bar{p}(pn), K^*K2\pi$
~ 140	ABRAMS	67C	CNTR	S channel $\bar{p}N$

NODE=M033W2
 NODE=M033W2

 $\pi^- p \rightarrow K^+ K^- n$

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
245 ± 20	ALPER	80	CNTR 0	62 $\pi^- p \rightarrow$ $K^+ K^- n$
¹⁰ $I(J^P) = 1(5^-)$ from simultaneous analysis of $p\bar{p} \rightarrow \pi^- \pi^+$ and $\pi^0 \pi^0$. ¹¹ $I = 0(1); J^P = 5^-$ from Barrelet-zero analysis. ¹² $I(J^P) = 1(5^-)$ from amplitude analysis. ¹³ From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02. ¹⁴ From a fit to the total elastic cross section. ¹⁵ Isospins 0 and 1 not separated. ¹⁶ No evidence for this bump seen in the $\bar{p}p$ data of CHAPMAN 71B. Narrow state not confirmed by OH 73 with more data.				

NODE=M033W4
 NODE=M033W4

OCCUR=2

NODE=M033W1;LINKAGE=P
 NODE=M033W1;LINKAGE=K
 NODE=M033W1;LINKAGE=J
 NODE=M033W2;LINKAGE=AY
 NODE=M033W2;LINKAGE=E
 NODE=M033W2;LINKAGE=I
 NODE=M033W2;LINKAGE=N

 $\rho_5(2350)$ REFERENCES

ANISOVICH 02	PL B542 8	A.V. Anisovich <i>et al.</i>	
ANISOVICH 01D	PL B508 6	A.V. Anisovich <i>et al.</i>	
ANISOVICH 01E	PL B513 281	A.V. Anisovich <i>et al.</i>	
ANISOVICH 00J	PL B491 47	A.V. Anisovich <i>et al.</i>	
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

$a_6(2450)$

$I^G(J^{PC}) = 1^-(6^{++})$

OMITTED FROM SUMMARY TABLE
Needs confirmation.

$a_6(2450)$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
2450±130	¹ CLELAND	82B	SPEC	± 50 $\pi p \rightarrow K_S^0 K^\pm p$
¹ From an amplitude analysis.				

$a_6(2450)$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
400±250	² CLELAND	82B	SPEC	± 50 $\pi p \rightarrow K_S^0 K^\pm p$
² From an amplitude analysis.				

$a_6(2450)$ DECAY MODES

Mode
$\Gamma_1 \quad K \bar{K}$

$a_6(2450)$ REFERENCES

CLELAND	82B	NP B208 228	W.E. Cleland <i>et al.</i>	(DURH, GEVA, LAUS+)

$f_6(2510)$

$I^G(J^{PC}) = 0^+(6^{++})$

OMITTED FROM SUMMARY TABLE
Needs confirmation.

$f_6(2510)$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
2469±29 OUR AVERAGE	Error includes scale factor of 1.5. See the ideogram below.		
2485±40	¹ ANISOVICH	00J	SPEC 1.92–2.41 $p\bar{p}$
2420±30	ALDE	98	GAM4 100 $\pi^-p \rightarrow \pi^0\pi^0n$
2510±30	BINON	84B	GAM2 38 $\pi^-p \rightarrow n2\pi^0$
¹ From the combined analysis of ANISOVICH 99C, ANISOVICH 99F, ANISOVICH 99J, ANISOVICH 99K, and ANISOVICH 00B.			

NODE=M024

NODE=M024

NODE=M024M

NODE=M024M

NODE=M024M;LINKAGE=C

NODE=M024W

NODE=M024W

NODE=M024W;LINKAGE=C

NODE=M024215;NODE=M024

DESIG=1

NODE=M024

REFID=21281

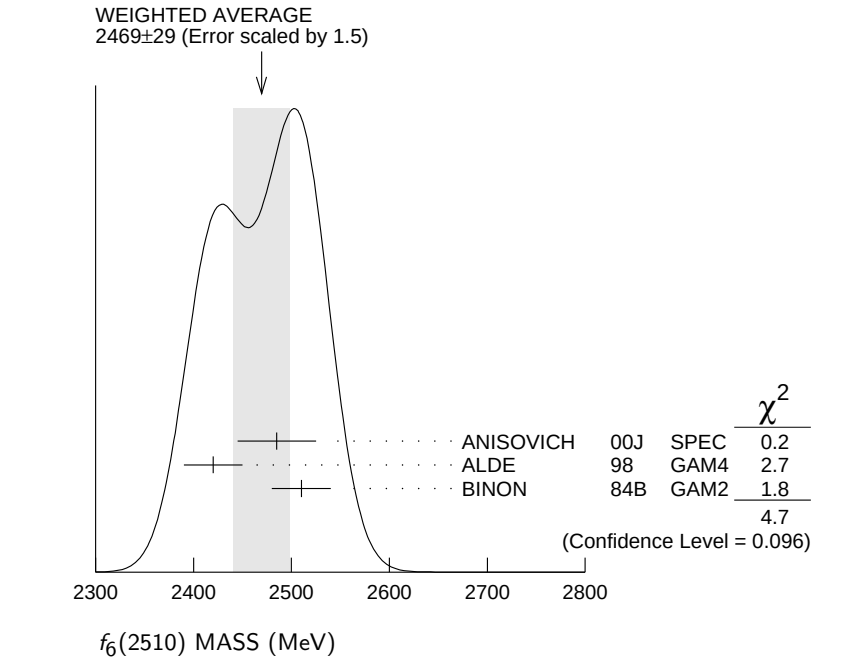
NODE=M089

NODE=M089

NODE=M089M

NODE=M089M

NODE=M089M;LINKAGE=AN



$f_6(2510)$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
283±40 OUR AVERAGE	Error includes scale factor of 1.1.		
410±90	² ANISOVICH	00J SPEC	1.92–2.41 $p\bar{p}$
270±60	ALDE	98 GAM4	100 $\pi^- p \rightarrow \pi^0 \pi^0 n$
240±60	BINON	84B GAM2	38 $\pi^- p \rightarrow n 2\pi^0$

² From the combined analysis of ANISOVICH 99C, ANISOVICH 99F, ANISOVICH 99J, ANISOVICH 99K, and ANISOVICH 00B.

NODE=M089W

NODE=M089W

NODE=M089W;LINKAGE=AN

$f_6(2510)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \pi\pi$	(6.0±1.0) %

NODE=M089215;NODE=M089

DESIG=1

$f_6(2510)$ BRANCHING RATIOS

$\Gamma(\pi\pi)/\Gamma_{\text{total}}$	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=M089220

NODE=M089R1

NODE=M089R1

NODE=M089R1;LINKAGE=A

$f_6(2510)$ REFERENCES

ANISOVICH	00B	NP A662 319	A.V. Anisovich <i>et al.</i>	
ANISOVICH	00J	PL B491 47	A.V. Anisovich <i>et al.</i>	
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)

NODE=M089

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		² VLADIMIRSK...08		$40 \pi^- p \rightarrow K_S^0 K_S^0 n + m\pi^0$

² 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}	³	ANISOVICH 03	SPEC	
1530^{+90}_{-250}	560 ± 40	⁴	ANISOVICH 03	SPEC	

³ 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.

⁴ 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=M300J98
NODE=M300J98

OCCUR=2

NODE=M300;LINKAGE=KM

NODE=M300;LINKAGE=MK

X(1420) $I^G(J^{PC}) = 2^+(0^{++})$					
MASS (MeV)	WIDTH (MeV)		DOCUMENT ID	TECN	COMMENT
1420 ± 20	160 ± 10		FILIPPI	00	OBLX
					$0 \bar{n} p \rightarrow \pi^+ \pi^+ \pi^-$

NODE=M300J61
NODE=M300J61

X(1545) $I^G(J^{PC}) = ?^?(?^{++})$					
MASS (MeV)	WIDTH (MeV)		DOCUMENT ID		COMMENT
1545 ± 3	6.0 ± 2.5	⁵	VLADIMIRSK...08		$40 \pi^- p \rightarrow K_S^0 K_S^0 n + m\pi^0$

⁵ 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}	$818^{+22+64}_{-23-133}$	⁶	ABLIKIM	06S	BES
					$J/\psi \rightarrow K^+ K^- \pi^0$

NODE=M300J08
NODE=M300J08

⁶ A broad peak observed at $K^+ K^-$ invariant mass. Mass and width above are its pole position. The observed branching ratio is $B(J/\psi \rightarrow X \pi^0) B(X \rightarrow K^+ K^-) = (8.5 \pm 0.6^{+2.7}_{-3.6}) \times 10^{-4}$.

NODE=M300J08;LINKAGE=AB

X(1600) $I^G(J^{PC}) = 2^+(2^{++})$					
<u>MASS (MeV)</u>	<u>WIDTH (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
1600±100	400 ± 200	⁷ ALBRECHT	91F ARG	10.2	$e^+ e^- \rightarrow e^+ e^- 2(\pi^+ \pi^-)$
⁷ Our estimate.					

NODE=M300J99
NODE=M300J99

NODE=M300J99;LINKAGE=A

X(1650) $I^G(J^{PC}) = 0^-(?^{--})$					
MASS (MeV)	WIDTH (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
1652 ± 7	< 50	100	PROKOSHKIN 96	GAM2	32,38 $\pi p \rightarrow \omega \eta n$

NODE=M300J62
NODE=M300J62

X(1730) $I^G(J^{PC}) = ?^?(?^{?+})$					
MASS (MeV)	WIDTH (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
1731.0 ± 1.2 ± 2.0	3.2 ± 0.8 ± 1.3	58	VLADIMIRSK...07	SPEC	40 $\pi^- p \rightarrow K_S^0 K_S^0 X$

NODE=M300K06
NODE=M300K06

X(1750) $I^G(J^{PC}) = ?^?(1^{--})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
1753.5 ± 1.5 ± 2.3	122.2 ± 6.2 ± 8.0	LINK	02K	FOCS	20–160 $\gamma p \rightarrow K^+ K^- p$

NODE=M300J94
NODE=M300J94

B(X(1750) → $\bar{K}^*(892)^0 K^0 \rightarrow K^\pm \pi^\mp K_S^0$)/B(X(1750) → $K^+ K^-$)					
VALUE	CL%	DOCUMENT ID	TECN		
< 0.065	90	LINK	02K	FOCS	

NODE=M300B5
NODE=M300B5

B(X(1750) → $\bar{K}^*(892)^\pm K^\mp \rightarrow K^\pm \pi^\mp K_S^0$)/B(X(1750) → $K^+ K^-$)					
VALUE	CL%	DOCUMENT ID	TECN		
< 0.183	90	LINK	02K	FOCS	

NODE=M300B6
NODE=M300B6

f₂(1750) $I^G(J^{PC}) = 0^+(2^{++})$					
MASS (MeV)	WIDTH (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
1755 ± 10	67 ± 12	870	⁸ 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	⁹ 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	⁹ 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	⁹ 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	⁹ SCHEGELSKY 06A	RVUE	$\gamma\gamma \rightarrow K_S^0 K_S^0$	

NODE=M300JA4
NODE=M300JA4

⁸ From analysis of L3 data at 91 and 183–209 GeV.

⁹ 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) $I^G(J^{PC}) = 1^-(?^{-+})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
1763 ± 20	192 ± 60	CONDO 91	SHF	$\gamma p \rightarrow (p \pi^+)(\pi^+ \pi^- \pi^-)$	
1787 ± 18	118 ± 60	CONDO 91	SHF	$\gamma p \rightarrow n \pi^+ \pi^+ \pi^-$	

NODE=M300J60
NODE=M300J60

OCCUR=2

f₀(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	¹⁰ ABLIKIM	06J	BES2	$J/\psi \rightarrow \gamma \omega \phi$

NODE=M300K29
NODE=M300K29

¹⁰ Not seen by LIU 09 in $B^\pm \rightarrow K^\pm \omega \phi$.

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	¹¹ ANASHIN	11	KEDR	$e^+e^- \rightarrow \text{hadrons}$
¹¹ 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	
$1874 \pm 43 \pm 96$	$385 \pm 121 \pm 114$	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	¹² CHUNG	02	B852	$18.3 \pi^- p \rightarrow \pi^+ \pi^- \pi^- p$	
¹² 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	¹³ CHUNG	02	B852	$18.3 \pi^- p \rightarrow \pi^+ \pi^- \pi^- p$	
¹³ 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	$10,16 \pi^- p \rightarrow \bar{p} p n$

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	¹⁴ ANISOVICH	02	SPEC	$0.6-1.9 \bar{p} \bar{p} \rightarrow \omega \pi^0, \omega \eta \pi^0, \pi^+ \pi^-$

NODE=M300J85
NODE=M300J85

¹⁴ 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	¹⁵ ANISOVICH	02B	SPEC	$0.6-1.9 \bar{p} \bar{p} \rightarrow \omega \eta, \omega \pi^0 \pi^0$

NODE=M300J65
NODE=M300J65

¹⁵ 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}	¹⁶ ANISOVICH	01F	SPEC	$1.96-2.41 \bar{p} p$

NODE=M300K24
NODE=M300K24

¹⁶ 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	¹⁷ ANISOVICH	02B	SPEC	0.6–1.9 $p\bar{p} \rightarrow \omega\eta, \omega\pi^0\pi^0$

NODE=M300J79
NODE=M300J79

¹⁷ 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	¹⁸ ANISOVICH	02	SPEC	0.6–1.9 $p\bar{p} \rightarrow \omega\pi^0, \omega\eta\pi^0, \pi^+\pi^-$

NODE=M300J67
NODE=M300J67

¹⁸ 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	¹⁹ ANISOVICH	02B	SPEC	0.6–1.9 $p\bar{p} \rightarrow \omega\eta, \omega\pi^0\pi^0$

NODE=M300J64
NODE=M300J64

¹⁹ 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	²⁰ ANISOVICH	02B	SPEC	0.6–1.9 $p\bar{p} \rightarrow \omega\eta, \omega\pi^0\pi^0$

²⁰ 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 ± 10 ± 40	190 ± 22 ± 100	18k	²¹ SCHEGELSKY	06	RVUE $\gamma\gamma \rightarrow \pi^+\pi^-\pi^0$
2003 ± 10 ± 19	249 ± 23 ± 32		LU	05	B852 18 $\pi^-p \rightarrow \omega\pi^-\pi^0p$

²¹ From analysis of L3 data at 183–209 GeV.

NODE=M300J2;LINKAGE=SC

$\Gamma(\gamma\gamma) \Gamma(\pi^+\pi^-\pi^0) / \Gamma(\text{total})$					
VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT	
0.11 ± 0.04 ± 0.05	18k	²² SCHEGELSKY	06	RVUE	$\gamma\gamma \rightarrow \pi^+\pi^-\pi^0$

²² From analysis of L3 data at 183–209 GeV.

NODE=M300J2G
NODE=M300J2G

NODE=M300J2G;LINKAGE=SC

$\rho(2000)$ $I^G(J^{PC}) = 1^+(1^{--})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2000 ± 30	260 ± 45	²³ BUGG	04C	RVUE	Compilation
~ 1988	~ 244	HASAN	94	RVUE	$\bar{p}p \rightarrow \pi\pi$

NODE=M300J77
NODE=M300J77

²³From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.

NODE=M300;LINKAGE=AY

$f_2(2000)$		$I^G(J^{PC}) = 0^+(2^{++})$			
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

$X(2000)$		$I^G(J^{PC}) = 1^-(\gamma^{?+})$			
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
1964 ± 35	225 ± 50	²⁴ ARMSTRONG 93D	E760		$\bar{p}p \rightarrow 3\pi^0 \rightarrow 6\gamma$
~ 2100	~ 500	²⁴ ANTIPOV 77	CIBS	-	$25 \pi^- p \rightarrow p\pi^- \rho_3$
2214 ± 15	355 ± 21	²⁵ BALTAY 77	HBC	0	$15 \pi^- p \rightarrow \Delta^{++} 3\pi$
2080 ± 40	340 ± 80	KALELKAR 75	HBC	+	$15 \pi^+ p \rightarrow p\pi^+ \rho_3$

NODE=M300K01
NODE=M300K01

²⁴ Cannot determine spin to be 3.

²⁵ BALTAY 77 favors $J^P = ,3^+$.

NODE=M300K01;LINKAGE=AA
NODE=M300K01;LINKAGE=B

$X(2000)$		$I^G(J^{PC}) = ?^?(4^{++})$			
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
1998 ± 3 ± 5	<15	VLADIMIRSK...03	SPEC	$\pi^- p \rightarrow K_S^0 K_S^0 M M$	

NODE=M300J97
NODE=M300J97

$\pi_2(2005)$		$I^G(J^{PC}) = 1^-(2^{-+})$			
MASS (MeV)	WIDTH (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
1974 ± 14 ± 83	341 ± 61 ± 139	145k	LU 05	B852	$18 \pi^- p \rightarrow \omega \pi^- \pi^0 p$
2005 ± 15	200 ± 40		ANISOVICH 01F	SPEC	$2.0 \bar{p}p \rightarrow 3\pi^0, \pi^0 \eta, \pi^0 \eta'$

NODE=M300J71
NODE=M300J71

$\eta(2010)$		$I^G(J^{PC}) = 0^+(0^{-+})$			
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2010 ⁺³⁵ ₋₆₀	270 ± 60	ANISOVICH	00J	SPEC	

NODE=M300J5
NODE=M300J5

$\pi_1(2015)$		$I^G(J^{PC}) = 1^-(1^{-+})$			
MASS (MeV)	WIDTH (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
2014 ± 20 ± 16	230 ± 32 ± 73	145k	LU 05	B852	$18 \pi^- p \rightarrow \omega \pi^- \pi^0 p$
2001 ± 30 ± 92	333 ± 52 ± 49	69k	KUHN 04	B852	$18 \pi^- p \rightarrow \eta \pi^+ \pi^- \pi^- p$

NODE=M300J05
NODE=M300J05

$a_0(2020)$		$I^G(J^{PC}) = 1^-(0^{++})$			
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2025 ± 30	330 ± 75	ANISOVICH	99C	SPEC	

NODE=M300J6
NODE=M300J6

$X(2020)$		$I^G(J^{PC}) = ?^?(??)$			
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2015 ± 3	10 ± 4	FERRER	99	RVUE	$\pi p \rightarrow p p \bar{p} \pi(\pi)$

NODE=M300J34
NODE=M300J34

$h_3(2025)$		$I^G(J^{PC}) = 0^-(3^{+-})$			
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2025 ± 20	145 ± 30	²⁶ ANISOVICH 02B	SPEC	$0.6-1.9 p\bar{p} \rightarrow \omega \eta, \omega \pi^0 \pi^0$	

NODE=M300J78
NODE=M300J78

²⁶From the combined analysis of ANISOVICH 00D, ANISOVICH 01C, and ANISOVICH 02B.

NODE=M300J78;LINKAGE=AZ

$b_3(2030)$		$I^G(J^{PC}) = 1^+(3^{+-})$			
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2032 ± 12	117 ± 11	²⁷ ANISOVICH 02	SPEC	$0.6-1.9 p\bar{p} \rightarrow \omega \pi^0, \omega \eta \pi^0, \pi^+ \pi^-$	

NODE=M300J69
NODE=M300J69

²⁷ 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	²⁸ ANISOVICH	01F	SPEC	1.96–2.41 $\bar{p}p$

NODE=M300K23
NODE=M300K23

²⁸ 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	²⁹ ANISOVICH	01F	SPEC	1.96–2.41 $\bar{p}p$

NODE=M300K20
NODE=M300K20

²⁹ 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	³⁰ ANISOVICH	11	SPEC 0.9–1.94 $p\bar{p}$

NODE=M300B1
NODE=M300B1

³⁰ 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	³¹ ANISOVICH	11	SPEC 0.9–1.94 $p\bar{p}$

NODE=M300B2
NODE=M300B2

³¹ 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	³² ANISOVICH	11	SPEC 0.9–1.94 $p\bar{p}$

NODE=M300B3
NODE=M300B3

³² 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	³³ OAKDEN	94	RVUE	0.36–1.55 $\bar{p}p \rightarrow \pi\pi$
~ 2060	~ 50	³³ OAKDEN	94	RVUE	0.36–1.55 $\bar{p}p \rightarrow \pi\pi$

NODE=M300J59
NODE=M300J59

³³ 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	³⁴ ABLIKIM	04J	BES2	$J/\psi \rightarrow K^- p\bar{\Lambda}$

NODE=M300J01
NODE=M300J01

³⁴ 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
2103 ± 50	187 ± 75	586	³⁵ BISELLO	89B	DM2 $J/\psi \rightarrow 4\pi\gamma$
³⁵ ASTON 81B sees no peak, has 850 events in Ajinenko+Barth bins. ARESTOV 80 sees no peak.					

NODE=M300J48
NODE=M300J48

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 $pA \rightarrow 4KX$

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	³⁶ ANISOVICH	02B	SPEC	0.6–1.9 $p\bar{p} \rightarrow \omega\eta, \omega\pi^0\pi^0$
³⁶ From the combined analysis of ANISOVICH 00D, ANISOVICH 01C, and ANISOVICH 02B.					

NODE=M300J82
NODE=M300J82

NODE=M300J82;LINKAGE=AZ

ω(2205) $I^G(J^{PC}) = 0^-(1^{--})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2205 ± 30	350 ± 90	³⁷ ANISOVICH	02B	SPEC	0.6–1.9 $p\bar{p} \rightarrow \omega\eta, \omega\pi^0\pi^0$

NODE=M300J80
NODE=M300J80

³⁷ 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	³⁸ ANISOVICH	02B	SPEC	0.6–1.9 $p\bar{p} \rightarrow \omega\eta, \omega\pi^0\pi^0$

³⁸ From the combined analysis of ANISOVICH 00D, ANISOVICH 01C, and ANISOVICH 02B.

NODE=M300J27
NODE=M300J27

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	³⁹ ANISOVICH	02	SPEC	0.6–1.9 $p\bar{p} \rightarrow \omega\pi^0, \omega\eta\pi^0, \pi^+\pi^-$

NODE=M300J70
NODE=M300J70

³⁹ 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	⁴⁰ ANISOVICH	02	SPEC	0.6–1.9 $p\bar{p} \rightarrow \omega\pi^0, \omega\eta\pi^0, \pi^+\pi^-$

NODE=M300J74
NODE=M300J74

⁴⁰ 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	⁴¹ ANISOVICH	02	SPEC	0.6–1.9 $p\bar{p} \rightarrow \omega\pi^0, \omega\eta\pi^0, \pi^+\pi^-$

NODE=M300J87
NODE=M300J87

⁴¹ 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	⁴² ANISOVICH	00J	SPEC	1.92–2.41 $p\bar{p}$

NODE=M300K26
NODE=M300K26

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

~ 2226 ~ 226 HASAN 94 RVUE $p\bar{p} \rightarrow \pi\pi$

⁴² 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		
2245 ± 50	320 ± 70	⁴³ BUGG	04C	RVUE	

NODE=M300K10
NODE=M300K10

⁴³ 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		
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	⁴⁴ ANISOVICH	02B	SPEC	0.6–1.9 $p\bar{p} \rightarrow \omega\eta, \omega\pi^0\pi^0$
⁴⁴ 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	⁴⁵ BUGG	04	RVUE	
⁴⁵ 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	⁴⁶ ANISOVICH	02B	SPEC	0.6–1.9 $p\bar{p} \rightarrow \omega\eta, \omega\pi^0\pi^0$
⁴⁶ 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 OUR AVERAGE					
2237 ± 5	291 ± 12	UMAN	06	E835	5.2 $\bar{p}p \rightarrow \eta\eta\pi^0$
2255 ± 40	330 ⁺¹¹⁰ ₋₅₀	⁴⁷ ANISOVICH	01F	SPEC	1.96–2.41 $\bar{p}p$
⁴⁷ 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	⁴⁸ ANISOVICH	01G	SPEC	1.96–2.41 $\bar{p}p$
⁴⁸ 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	⁴⁹ 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 $\gamma p \rightarrow p\omega\pi^+\pi^-\pi^0$
⁴⁹ 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	⁵⁰ ANISOVICH	02B	SPEC	0.6–1.9 $p\bar{p} \rightarrow \omega\eta, \omega\pi^0\pi^0$

NODE=M300J28
NODE=M300J28

⁵⁰ From the combined analysis of ANISOVICH 00D, ANISOVICH 01C, and ANISOVICH 02B.

NODE=M300J28;LINKAGE=AZ

$a_3(2275)$ $I^G(J^{PC}) = 1^-(3^{++})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2275 ± 35	350 ⁺¹⁰⁰ ₋₅₀	⁵¹ ANISOVICH	01G	SPEC	1.96–2.41 $\bar{p}p$

NODE=M300K19
NODE=M300K19

⁵¹ 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	⁵² ANISOVICH	11	SPEC	0.9–1.94 $p\bar{p}$

NODE=M300K25
NODE=M300K25

⁵² Reanalysis of ADOEIT 96 and ANISOVICH 00E.

NODE=M300K25;LINKAGE=AN

$\omega_3(2285)$ $I^G(J^{PC}) = 0^-(3^{--})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2278 ± 28	224 ± 50	⁵³ BUGG	04A	RVUE	
2285 ± 60	230 ± 40	⁵⁴ ANISOVICH	02B	SPEC	0.6–1.9 $p\bar{p} \rightarrow \omega\eta, \omega\pi^0\pi^0$

NODE=M300J83
NODE=M300J83

⁵³ Partial wave analysis of the data on $p\bar{p} \rightarrow \bar{\Lambda}\Lambda$ from BARNES 00.

NODE=M300J83;LINKAGE=BU
NODE=M300J83;LINKAGE=AZ

⁵⁴ From the combined analysis of ANISOVICH 00D, ANISOVICH 01C, and ANISOVICH 02B.

$\omega(2290)$ $I^G(J^{PC}) = 0^-(1^{--})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2290 ± 20	275 ± 35	⁵⁵ BUGG	04A	RVUE	

NODE=M300J02
NODE=M300J02

⁵⁵ 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	⁵⁶ ANISOVICH	00J	SPEC	1.92–2.41 $p\bar{p}$

NODE=M300K27
NODE=M300K27

⁵⁶ From the combined analysis of ANISOVICH 99C, ANISOVICH 99F, ANISOVICH 99J, ANISOVICH 99K, and ANISOVICH 00B. See also ANISOVICH 12.

NODE=M300K27;LINKAGE=AN

$f_3(2300)$ $I^G(J^{PC}) = 0^+(3^{++})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2334 ± 25	200 ± 20	⁵⁷ BUGG	04A	RVUE	

NODE=M300J19
NODE=M300J19

⁵⁷ 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	COMMENT	
2310 ± 60	255 ± 70	ANISOVICH	00J	SPEC	

NODE=M300J23
NODE=M300J23

$\eta(2320)$ $I^G(J^{PC}) = 0^+(0^{-+})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2320 ± 15	230 ± 35	⁵⁸ ANISOVICH	00M	SPEC	

NODE=M300J18
NODE=M300J18

⁵⁸ 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	⁵⁹ BALTAY	75	HBC 15 $\pi^+ p \rightarrow p5\pi$

NODE=M300J54
NODE=M300J54

⁵⁹ 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

$X(2632)$ $I^G(J^{PC}) = ?^?(??)$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2635.2 ± 3.3		⁶⁰ EVDOKIMOV	04 SELX	$X(2632) \rightarrow D_s^+ \eta$	
2631.6 ± 2.1	< 17	⁶¹ EVDOKIMOV	04 SELX	$X(2632) \rightarrow D_s^0 K^+$	

NODE=M300J03
NODE=M300J03

OCCUR=2

⁶⁰ From a mass difference to D_s^+ of 666.9 ± 3.3 MeV.

⁶¹ 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	⁶² EVDOKIMOV	04 SELX			

NODE=M300B01
NODE=M300B01

⁶² 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 ± 20	70 ⁺⁴⁰ ₋₃₀ ± 40	50 ± 10	⁶³ GABYSHEV	06A	BELL $B^- \rightarrow \Lambda_c^+ \bar{p} \pi^-$

NODE=M300J09
NODE=M300J09

⁶³A 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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NODE=M300

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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)
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+)
ROZANSKA	80	NP B162 505	M. Rozanska <i>et al.</i>	(MPIM, CERN)
EVANGELIS...	79	NP B153 253	C. Evangelista <i>et al.</i>	(BARI, BONN, CERN+)
EVANGELIS...	79B	NP B154 381	C. Evangelista <i>et al.</i>	(BARI, BONN, CERN+)
BALTAY	78	PR D17 52	C. Baltay <i>et al.</i>	(COLU, BING)
ANTIPOV	77	NP B119 45	Y.M. Antipov <i>et al.</i>	(SERP, GEVA)
BALTAY	77	PRL 39 591	C. Baltay, C.V. Cautis, M. Kalelkar	(COLU)
BALTAY	75	PRL 35 891	C. Baltay <i>et al.</i>	(COLU, BING)
KALELKAR	75	Thesis Nevis 207	M.S. Kalelkar	(COLU)
CASO	70	LNC 3 707	C. Caso <i>et al.</i>	(GENO, HAMB, MILA, SACL)

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STRANGE MESONS

$(S = \pm 1, C = B = 0)$

$K^+ = u\bar{s}, K^0 = d\bar{s}, \bar{K}^0 = \bar{d}s, K^- = \bar{u}s,$ similarly for K^{*} 's

NODE=MXXX020

NODE=MXXX020

NODE=M174

$K_0^{*}(800)$

or κ

$I(J^P) = \frac{1}{2}(0^+)$

OMITTED FROM SUMMARY TABLE

Needs confirmation. See the mini-review on scalar mesons under $f_0(500)$ (see the index for the page number).

NODE=M174

$K_0^{*}(800)$ MASS

NODE=M174M

NODE=M174M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
682 ±29	OUR AVERAGE	Error includes scale factor of 2.4. See the ideogram below.		
826 ±49	$^{+49}_{-34}$	1338	¹ ABLIKIM	11B BES2 $J/\psi \rightarrow K_S^0 K_S^0 \pi^+ \pi^-$
849 ±77	$^{+18}_{-14}$	1421	^{2,3} ABLIKIM	10E BES2 $J/\psi \rightarrow K^\pm K_S^0 \pi^\mp \pi^0$
841 ±30	$^{+81}_{-73}$	25k	^{4,5} ABLIKIM	06C BES2 $J/\psi \rightarrow \bar{K}^{*}(892)^0 K^+ \pi^-$
658 ±13			⁶ DESCOTES-G..06	RVUE $\pi K \rightarrow \pi K$
797 ±19	±43	15k	^{7,8} AITALA	02 E791 $D^+ \rightarrow K^- \pi^+ \pi^+$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
663 ± 8	±34		⁹ BUGG	10 RVUE S-matrix pole
706.0 ± 1.8	±22.8	141k	¹⁰ BONVICINI	08A CLEO $D^+ \rightarrow K^- \pi^+ \pi^+$
856 ±17	±13	54k	¹¹ LINK	07B FOCUS $D^+ \rightarrow K^- \pi^+ \pi^+$
750	$^{+30}_{-55}$		¹² BUGG	06 RVUE
855 ±15		0.6k	¹³ CAWLFIELD	06A CLEO $D^0 \rightarrow K^+ K^- \pi^0$
694 ±53			^{3,14} ZHOU	06 RVUE $K p \rightarrow K^- \pi^+ n$
753 ±52			¹⁵ PELAEZ	04A RVUE $K \pi \rightarrow K \pi$
594 ±79			¹⁴ ZHENG	04 RVUE $K^- p \rightarrow K^- \pi^+ n$
722 ±60			¹⁶ BUGG	03 RVUE $11 K^- p \rightarrow K^- \pi^+ n$
905	$^{+65}_{-30}$		¹⁷ ISHIDA	97B RVUE $11 K^- p \rightarrow K^- \pi^+ n$

- ¹ The Breit-Wigner parameters from a fit with seven intermediate resonances. The S-matrix pole position is $(764 \pm 63^{+71}_{-54}) - i(306 \pm 149^{+143}_{-85})$ MeV.
- ² From a fit including ten additional resonances and energy-independent Breit-Wigner width.
- ³ S-matrix pole.
- ⁴ S-matrix pole. GUO 06 in a chiral unitary approach report a mass of 757 ± 33 MeV and a width of 558 ± 82 MeV.
- ⁵ A fit in the $K^*_0(800) + K^*(892) + K^*(1410)$ model with mass and width of the $K^*_0(800)$ from ABLIKIM 06C well describes the left slope of the $K^*_S \pi^-$ invariant mass spectrum in $\tau^- \rightarrow K^*_S \pi^- \nu_\tau$ decay studied by EPIFANOV 07.
- ⁶ S-matrix pole. Using Roy-Steiner equations (ROY 71) as well as unitarity, analyticity and crossing symmetry constraints.
- ⁷ 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 $K^*_0(800)$ in their high statistics analysis of $D^+ \rightarrow K^- \pi^+ \mu^+ \nu_\mu$.
- ⁸ AUBERT 07T does not find evidence for the charged $K^*_0(800)$ using 11k events of $D^0 \rightarrow K^- K^+ \pi^0$.
- ⁹ 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.
- ¹⁰ T-matrix pole.
- ¹¹ A Breit-Wigner mass and width.
- ¹² S-matrix pole. Reanalysis of ASTON 88, AITALA 02, and ABLIKIM 06C using for the κ an s-dependent width with an Adler zero near threshold.
- ¹³ Breit-Wigner parameters. A significant S-wave can be also modeled as a non-resonant contribution.
- ¹⁴ Using ASTON 88.
- ¹⁵ T-matrix pole. Reanalysis of data from LINGLIN 73, ESTABROOKS 78, and ASTON 88 in the unitarized ChPT model.
- ¹⁶ T-matrix pole. Reanalysis of ASTON 88 data.
- ¹⁷ Reanalysis of ASTON 88 using interfering Breit-Wigner amplitudes.

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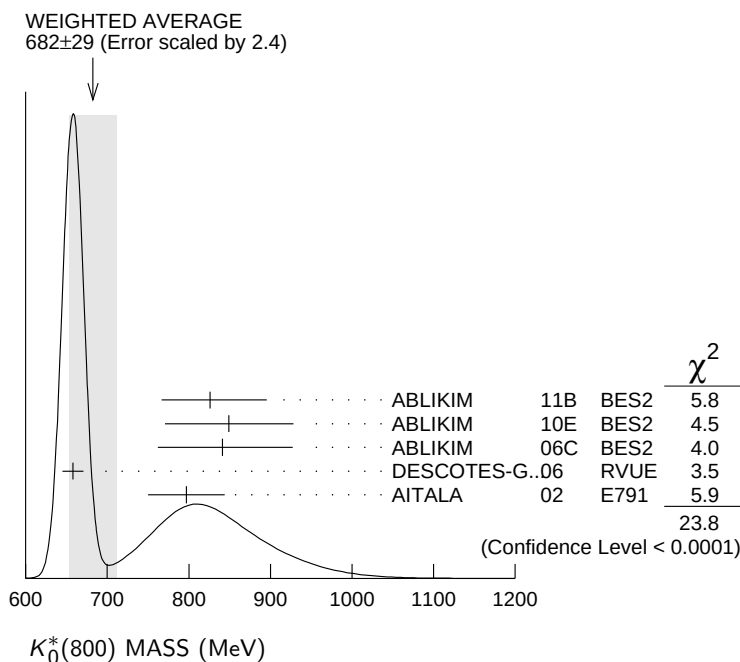
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NODE=M174M;LINKAGE=IS

 **$K^*_0(800)$ WIDTH**

NODE=M174W

NODE=M174W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
547 ± 24	OUR AVERAGE	Error includes scale factor of 1.1.		
449 ± 156	⁺¹⁴⁴ ₋₈₁	1338	¹⁸ ABLIKIM	11B BES2 $J/\psi \rightarrow K^*_S K^*_S \pi^+ \pi^-$
512 ± 80	⁺⁹² ₋₄₄	1421	^{19,20} ABLIKIM	10E BES2 $J/\psi \rightarrow K^\pm K^*_S \pi^\mp \pi^0$
618 ± 90	⁺⁹⁶ ₋₁₄₄	25k	^{19,21} ABLIKIM	06C BES2 $J/\psi \rightarrow \bar{K}^*(892)^0 K^+ \pi^-$
557 ± 24			²² DESCOTES-G..06	RVUE $\pi K \rightarrow \pi K$
410 ± 43	± 87	15k	^{23,24} AITALA	02 E791 $D^+ \rightarrow K^- \pi^+ \pi^+$

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

658 ± 10 ± 44	25	BUGG	10	RVUE	S-matrix pole
638.8 ± 4.4 ± 40.4 141k	26	BONVICINI	08A	CLEO	$D^+ \rightarrow K^- \pi^+ \pi^+$
464 ± 28 ± 22 54k	27	LINK	07B	FOCS	$D^+ \rightarrow K^- \pi^+ \pi^+$
684 ± 120	28	BUGG	06	RVUE	
251 ± 48	29	CAWLFIELD	06A	CLEO	$D^0 \rightarrow K^+ K^- \pi^0$
606 ± 59	19,30	ZHOU	06	RVUE	$K p \rightarrow K^- \pi^+ n$
470 ± 66	31	PELAEZ	04A	RVUE	$K \pi \rightarrow K \pi$
724 ± 332	30	ZHENG	04	RVUE	$K^- p \rightarrow K^- \pi^+ n$
772 ± 100	32	BUGG	03	RVUE	11 $K^- p \rightarrow K^- \pi^+ n$
545 +235 -110	33	ISHIDA	97B	RVUE	11 $K^- p \rightarrow K^- \pi^+ n$

18 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.

19 S-matrix pole.

20 From a fit including ten additional resonances and energy-independent Breit-Wigner width.

21 A fit in the $K_0^*(800) + K^*(892) + K^*(1410)$ model with mass and width of the $K_0^*(800)$ 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.

22 S-matrix pole. Using Roy-Steiner equations (ROY 71) as well as unitarity, analyticity and crossing symmetry constraints.

23 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 $K_0^*(800)$ in their high statistics analysis of $D^+ \rightarrow K^- \pi^+ \mu^+ \nu_\mu$.

24 AUBERT 07T does not find evidence for the charged $K_0^*(800)$ using 11k events of $D^0 \rightarrow K^- K^+ \pi^0$.

25 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.

26 T-matrix pole.

27 A Breit-Wigner mass and width.

28 S-matrix pole. Reanalysis of ASTON 88, AITALA 02, and ABLIKIM 06C using for the κ an s-dependent width with an Adler zero near threshold.

29 Statistical error only. A fit to the Dalitz plot including the $K_0^*(800)^\pm$, $K^*(892)^\pm$, and ϕ resonances modeled as Breit-Wigners. A significant S-wave can be also modeled as a non-resonant contribution.

30 Using ASTON 88.

31 T-matrix pole. Reanalysis of data from LINGLIN 73, ESTABROOKS 78, and ASTON 88 in the unitarized ChPT model.

32 T-matrix pole. Reanalysis of ASTON 88 data.

33 Reanalysis of ASTON 88 using interfering Breit-Wigner amplitudes.

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$K_0^*(800)$ REFERENCES

ABLIKIM	11B	PL B698 183	M. Ablikim <i>et al.</i>	(BES II Collab.)
ABLIKIM	10E	PL B693 88	M. Ablikim <i>et al.</i>	(BES II Collab.)
BUGG	10	PR D81 014002	D.V. Bugg	(LOQM)
LINK	09	PL B681 14	J.M. Link <i>et al.</i>	(FNAL FOCUS Collab.)
BONVICINI	08A	PR D78 052001	G. Bonvicini <i>et al.</i>	(CLEO Collab.)
AUBERT	07T	PR D76 011102	B. Aubert <i>et al.</i>	(BABAR Collab.)
EPIFANOV	07	PL B654 65	D. Epifanov <i>et al.</i>	(BELLE Collab.)
LINK	07B	PL B653 1	J.M. Link <i>et al.</i>	(FNAL FOCUS Collab.)
ABLIKIM	06C	PL B633 681	M. Ablikim <i>et al.</i>	(BES Collab.)
AITALA	06	PR D73 032004	E.M. Aitala <i>et al.</i>	(FNAL E791 Collab.)
Also		PR D74 059901 (errat.)	E.M. Aitala <i>et al.</i>	(FNAL E791 Collab.)
BUGG	06	PL B632 471	D.V. Bugg	(LOQM)
CAWLFIELD	06A	PR D74 031108	C. Cawfield <i>et al.</i>	(CLEO Collab.)
DESCOTES-G...	06	EPJ C48 553	S. Descotes-Genon, B. Moussallam	
GUO	06	NP A773 78	F.K. Guo <i>et al.</i>	
ZHOU	06	NP A775 212	Z.Y. Zhou, H.Q. Zheng	
LINK	05I	PL B621 72	J.M. Link <i>et al.</i>	(FNAL FOCUS Collab.)
PELAEZ	04A	MPL A19 2879	J.R. Pelaez	
ZHENG	04	NP A733 235	H.Q. Zheng <i>et al.</i>	
BUGG	03	PL B572 1	D.V. Bugg	
AITALA	02	PRL 89 121801	E.M. Aitala <i>et al.</i>	(FNAL E791 Collab.)
LINK	02E	PL B535 43	J.M. Link <i>et al.</i>	(FNAL FOCUS Collab.)
KOPP	01	PR D63 092001	S. Kopp <i>et al.</i>	(CLEO Collab.)
ISHIDA	97B	PTP 98 621	S. Ishida <i>et al.</i>	
ASTON	88	NP B296 493	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)
ESTABROOKS	78	NP B133 490	P.G. Estabrooks <i>et al.</i>	(MCGI, CARL, DURH+)
LINGLIN	73	NP B55 408	D. Linglin	(CERN)
ROY	71	PL 36B 353	S.M. Roy	

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$K^*(892)$

$$I(J^P) = \frac{1}{2}(1^-)$$

NODE=M018

 $K^*(892)$ MASS

NODE=M018205

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VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
891.66±0.26 OUR AVERAGE					
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 $K^- p \rightarrow \bar{K}^0 \pi^- p$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
893.5 ±1.1	27k	⁴ ABELE 99D	CBAR	±	0.0 $\bar{p} p \rightarrow K^+ K^- \pi^0$
890.4 ±0.2 ±0.5	80±0.8k	⁵ BIRD 89	LASS	—	11 $K^- p \rightarrow \bar{K}^0 \pi^- p$
890.0 ±2.3	800	^{2,3} CLELAND 82	SPEC	+	30 $K^+ p \rightarrow K_S^0 \pi^+ p$
896.0 ±1.1	3200	^{2,3} CLELAND 82	SPEC	+	50 $K^+ p \rightarrow K_S^0 \pi^+ p$
893 ±1	3600	^{2,3} CLELAND 82	SPEC	—	50 $K^+ p \rightarrow K_S^0 \pi^- p$
896.0 ±1.9	380	DELFOSSSE 81	SPEC	+	50 $K^\pm p \rightarrow K^\pm \pi^0 p$
886.0 ±2.3	187	DELFOSSSE 81	SPEC	—	50 $K^\pm p \rightarrow K^\pm \pi^0 p$
894.2 ±2.0	765	² CLARK 73	HBC	—	3.13 $K^- p \rightarrow \bar{K}^0 \pi^- p$
894.3 ±1.5	1150	^{2,3} CLARK 73	HBC	—	3.3 $K^- p \rightarrow \bar{K}^0 \pi^- p$
892.0 ±2.6	341	² SCHWEING...68	HBC	—	5.5 $K^- p \rightarrow \bar{K}^0 \pi^- p$

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VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
895.47±0.20±0.74				
	53k	⁶ EPIFANOV 07	BELL	$\tau^- \rightarrow K_S^0 \pi^- \nu_\tau$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
892.0 ±0.5		⁷ BOITO 10	RVUE	$\tau^- \rightarrow K_S^0 \pi^- \nu_\tau$
892.0 ±0.9		^{8,9} BOITO 09	RVUE	$\tau^- \rightarrow K_S^0 \pi^- \nu_\tau$
895.3 ±0.2		^{8,10} JAMIN 08	RVUE	$\tau^- \rightarrow K_S^0 \pi^- \nu_\tau$
896.4 ±0.9	11970	¹¹ BONVICINI 02	CLEO	$\tau^- \rightarrow K^- \pi^0 \nu_\tau$
895 ±2		¹² BARATE 99R	ALEP	$\tau^- \rightarrow K^- \pi^0 \nu_\tau$

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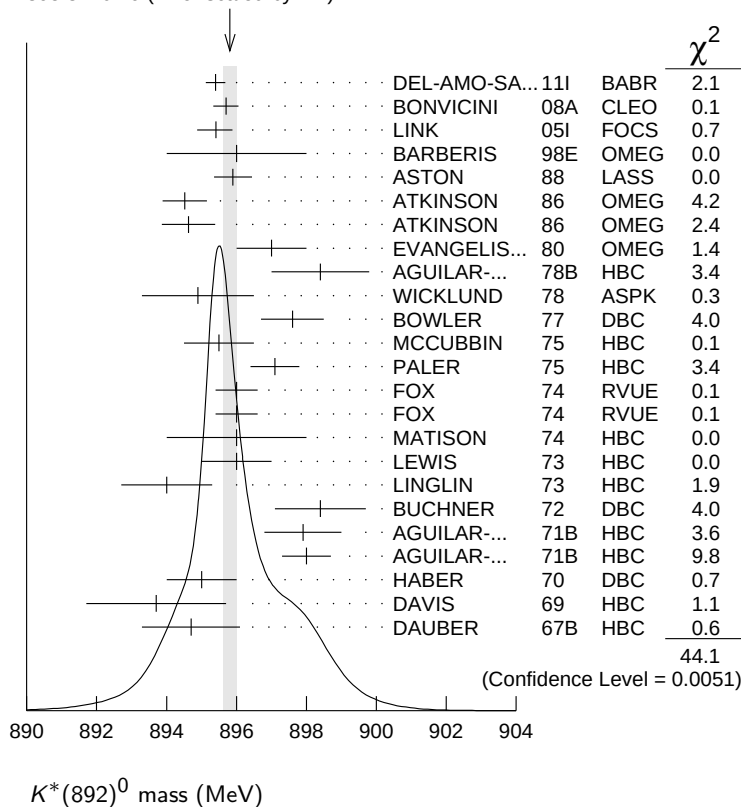
VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
895.81±0.19 OUR AVERAGE Error includes scale factor of 1.4. See the ideogram below.				
[895.94 ± 0.22 MeV OUR 2012 AVERAGE Scale factor = 1.4]				
895.4 ±0.2 ±0.2	243k	¹³ DEL-AMO-SA..11i	BABR	$D^+ \rightarrow K^- \pi^+ e^+ \nu_e$
895.7 ±0.2 ±0.3	141k	¹⁴ BONVICINI 08A	CLEO	$D^+ \rightarrow K^- \pi^+ \pi^+$
895.41±0.32 ^{+0.35} _{-0.43}	18k	¹⁵ LINK 05i	FOCS	$D^+ \rightarrow K^- \pi^+ \mu^+ \nu_\mu$
896 ±2		BARBERIS 98E	OMEG	450 $pp \rightarrow p_f p_s K^* \bar{K}^*$
895.9 ±0.5 ±0.2		ASTON 88	LASS	11 $K^- p \rightarrow K^- \pi^+ n$
894.52±0.63	25k	¹ ATKINSON 86	OMEG	20-70 γp
894.63±0.76	20k	¹ ATKINSON 86	OMEG	20-70 γp
897 ±1	28k	EVANGELIS... 80	OMEG	10 $\pi^- p \rightarrow K^+ \pi^- (\Lambda, \Sigma)$
898.4 ±1.4	1180	AGUILAR-... 78B	HBC	0.76 $\bar{p} p \rightarrow K^\mp K_S^0 \pi^\pm$
894.9 ±1.6		WICKLUND 78	ASPK	3,4,6 $K^\pm N \rightarrow (K\pi)^0 N$
897.6 ±0.9		BOWLER 77	DBC	5.4 $K^+ d \rightarrow K^+ \pi^- pp$
895.5 ±1.0	3600	MCCUBBIN 75	HBC	3.6 $K^- p \rightarrow K^- \pi^+ n$

NEW

OCCUR=2

897.1 ± 0.7	22k	¹ PALER	75	HBC	14.3 $K^- p \rightarrow (K\pi)^0 X$	
896.0 ± 0.6	10k	FOX	74	RVUE	2 $K^- p \rightarrow K^- \pi^+ n$	
896.0 ± 0.6		FOX	74	RVUE	2 $K^+ n \rightarrow K^+ \pi^- p$	OCCUR=2
896 ± 2		¹⁶ MATISON	74	HBC	12 $K^+ p \rightarrow K^+ \pi^- \Delta$	
896 ± 1	3186	LEWIS	73	HBC	2.1-2.7 $K^+ p \rightarrow K \pi \pi p$	
894.0 ± 1.3		¹⁶ LINGLIN	73	HBC	2-13 $K^+ p \rightarrow$ $K^+ \pi^- \pi^+ p$	
898.4 ± 1.3	1700	² BUCHNER	72	DBC	4.6 $K^+ n \rightarrow K^+ \pi^- p$	
897.9 ± 1.1	2934	² AGUILAR-...	71B	HBC	3.9,4.6 $K^- p \rightarrow K^- \pi^+ n$	
898.0 ± 0.7	5362	² AGUILAR-...	71B	HBC	3.9,4.6 $K^- p \rightarrow$ $K^- \pi^+ \pi^- p$	OCCUR=2
895 ± 1	4300	³ HABER	70	DBC	3 $K^- N \rightarrow K^- \pi^+ X$	
893.7 ± 2.0	10k	DAVIS	69	HBC	12 $K^+ p \rightarrow K^+ \pi^- \pi^+ p$	
894.7 ± 1.4	1040	² DAUBER	67B	HBC	2.0 $K^- p \rightarrow K^- \pi^+ \pi^- p$	
• • • We do not use the following data for averages, fits, limits, etc. • • •						
894.9 ± 0.5 ± 0.7	14.4k	¹⁷ MITCHELL	09A	CLEO	$D_s^+ \rightarrow K^+ K^- \pi^+$	
896.2 ± 0.3	20k	⁸ AUBERT	07AK	BABR	10.6 $e^+ e^- \rightarrow$ $K^{*0} K^\pm \pi^\mp \gamma$	
900.7 ± 1.1	5900	BARTH	83	HBC	70 $K^+ p \rightarrow K^+ \pi^- X$	

WEIGHTED AVERAGE
895.81±0.19 (Error scaled by 1.4)



¹ Inclusive reaction. Complicated background and phase-space effects.

² Mass errors enlarged by us to $\Gamma/\sqrt{N}$. See note.

³ Number of events in peak reevaluated by us.

⁴ K-matrix pole.

⁵ From a partial wave amplitude analysis.

⁶ From a fit in the $K_0^*(800) + K^*(892) + K^*(1410)$ model.

⁷ From the pole position of the $K\pi$ vector form factor using EPIFANOV 07 and constraints from K_{f3} decays in ANTONELLI 10.

⁸ Systematic uncertainties not estimated.

⁹ From the pole position of the $K\pi$ vector form factor in the complex s -plane and using EPIFANOV 07 data.

¹⁰ Reanalysis of EPIFANOV 07 using resonance chiral theory.

¹¹ 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.

¹² With mass and width of the $K^*(1410)$ fixed at 1412 MeV and 227 MeV, respectively.

¹³ Taking into account the $K^*(892)^0$, S -wave and P -wave ($K^*(1410)^0$).

¹⁴ From the isobar model with a complex pole for the κ .

NODE=M018M;LINKAGE=I
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NODE=M018M1;LINKAGE=F
NODE=M018MCT;LINKAGE=EF
NODE=M018MCT;LINKAGE=BT

NODE=M018M2;LINKAGE=NS
NODE=M018MCT;LINKAGE=BI

NODE=M018MCT;LINKAGE=JA
NODE=M018MCT;LINKAGE=BO

NODE=M018MCT;LINKAGE=BA
NODE=M018M2;LINKAGE=DE
NODE=M018M2;LINKAGE=BO

¹⁵ Fit to $K\pi$ mass spectrum includes a non-resonant scalar component.

¹⁶ From pole extrapolation.

¹⁷ This value comes from a fit with χ^2 of 178/117.

NODE=M018W2;LINKAGE=LI

NODE=M018M;LINKAGE=C

NODE=M018M2;LINKAGE=MI

A REVIEW GOES HERE – Check our WWW List of Reviews

NODE=M018209

$m_{K^*(892)^0} - m_{K^*(892)^\pm}$

NODE=M018D

NODE=M018D

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
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	¹⁸ BARASH	67B	HBC	0.0 $\bar{p}p$

¹⁸ Number of events in peak reevaluated by us.

NODE=M018D;LINKAGE=W

$K^*(892)$ RANGE PARAMETER

NODE=M018R

NODE=M018R

All from partial wave amplitude analyses.

NODE=M018R

VALUE (GeV ⁻¹)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
Average is meaningless. [3.6 ± 0.6 GeV ⁻¹ OUR 2012 AVERAGE]					
2.1 ±0.5 ±0.5	243k	¹⁹ DEL-AMO-SA.11i	BABR	0	$D^+ \rightarrow K^- \pi^+ e^+ \nu_e$
3.96±0.54 ^{+1.31} _{-0.90}	18k	²⁰ 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 $K^- p \rightarrow \bar{K}^0 \pi^- p$

¹⁹ Taking into account the $K^*(892)^0$, S-wave and P-wave ($K^*(1410)^0$).

²⁰ Fit to $K\pi$ mass spectrum includes a non-resonant scalar component.

NODE=M018R;LINKAGE=DE

NODE=M018R;LINKAGE=LI

$K^*(892)$ WIDTH

NODE=M018215

CHARGED ONLY, HADROPRODUCED

NODE=M018W1
NODE=M018W1

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
50.8±0.9 OUR FIT					
50.8±0.9 OUR AVERAGE					
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	²¹ COOPER	78	HBC	± 0.76 $\bar{p}p \rightarrow (K\pi)^\pm X$
52.1±2.2	9000	²² PALER	75	HBC	- 14.3 $K^- p \rightarrow (K\pi)^- X$
46.3±6.7	765	²¹ CLARK	73	HBC	- 3.13 $K^- p \rightarrow \bar{K}^0 \pi^- p$
48.2±5.7	1150	^{21,23} CLARK	73	HBC	- 3.3 $K^- p \rightarrow \bar{K}^0 \pi^- p$
54.3±3.3	4404	²¹ AGUILAR-...	71B	HBC	- 3.9,4.6 $K^- p \rightarrow (K\pi)^- p$
46 ±5	1700	^{21,23} 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. • • •					
54.8±1.7	27k	²⁴ ABELE	99D	CBAR	± 0.0 $\bar{p}p \rightarrow K^+ K^- \pi^0$
45.2±1 ±2	79.7±0.8k	²⁵ 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	^{21,23} CLELAND	82	SPEC	+ 30 $K^+ p \rightarrow K_S^0 \pi^+ p$
62.0±4.4	3200	^{21,23} CLELAND	82	SPEC	+ 50 $K^+ p \rightarrow K_S^0 \pi^+ p$
55 ±4	3600	^{21,23} CLELAND	82	SPEC	- 50 $K^+ p \rightarrow K_S^0 \pi^- p$
62.6±3.8	380	DELFOSSSE	81	SPEC	+ 50 $K^\pm p \rightarrow K^\pm \pi^0 p$
50.5±3.9	187	DELFOSSSE	81	SPEC	- 50 $K^\pm p \rightarrow K^\pm \pi^0 p$

OCCUR=2

OCCUR=2

OCCUR=2

OCCUR=3

OCCUR=2

CHARGED ONLY, PRODUCED IN τ LEPTON DECAYS

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
46.2$\pm$0.6$\pm$1.2	53k	²⁶ 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		²⁷ BOITO	10 RVUE	$\tau^- \rightarrow K_S^0 \pi^- \nu_\tau$
46.2 $\pm$ 0.4		^{28,29} BOITO	09 RVUE	$\tau^- \rightarrow K_S^0 \pi^- \nu_\tau$
47.5 $\pm$ 0.4		^{28,30} JAMIN	08 RVUE	$\tau^- \rightarrow K_S^0 \pi^- \nu_\tau$
55 $\pm$ 8		³¹ BARATE	99R ALEP	$\tau^- \rightarrow K^- \pi^0 \nu_\tau$

NODE=M018W5
NODE=M018W5

NEUTRAL ONLY

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
47.4 $\pm$0.6 OUR FIT	Error includes scale factor of 2.2. [48.7 $\pm$ 0.8 MeV OUR 2012 FIT Scale factor = 1.7]			
47.4 $\pm$0.6 OUR AVERAGE	Error includes scale factor of 2.0. See the ideogram below. [48.7 $\pm$ 0.7 MeV OUR 2012 AVERAGE Scale factor = 1.6]			
46.5 $\pm$ 0.3 $\pm$ 0.2	243k	³² DEL-AMO-SA...11I	BABR	$D^+ \rightarrow K^- \pi^+ e^+ \nu_e$
45.3 $\pm$ 0.5 $\pm$ 0.6	141k	³³ BONVICINI	08A CLEO	$D^+ \rightarrow K^- \pi^+ \pi^+$
47.79 $\pm$ 0.86 $^{+1.32}_{-1.06}$	18k	³⁴ 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	²² 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	²¹ LEWIS	73 HBC	2.1-2.7 $K^+ p \rightarrow K\pi\pi p$
51.4 $\pm$ 5.0	1700	²¹ BUCHNER	72 DBC	4.6 $K^+ n \rightarrow K^+ \pi^- p$
55.8 $^{+4.2}_{-3.4}$	2934	²¹ 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	^{21,23} HABER	70 DBC	3 $K^- N \rightarrow K^- \pi^+ X$
53.2 $\pm$ 2.1	10k	²¹ DAVIS	69 HBC	12 $K^+ p \rightarrow K^+ \pi^- \pi^+ p$
44 $\pm$ 5.5	1040	²¹ DAUBER	67B HBC	2.0 $K^- p \rightarrow K^- \pi^+ \pi^- p$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
45.7 $\pm$ 1.1 $\pm$ 0.5	14.4k	³⁵ MITCHELL	09A CLEO	$D_s^+ \rightarrow K^+ K^- \pi^+$
50.6 $\pm$ 0.9	20k	²⁸ AUBERT	07AK BABR	10.6 $e^+ e^- \rightarrow K^{*0} K^\pm \pi^\mp \gamma$

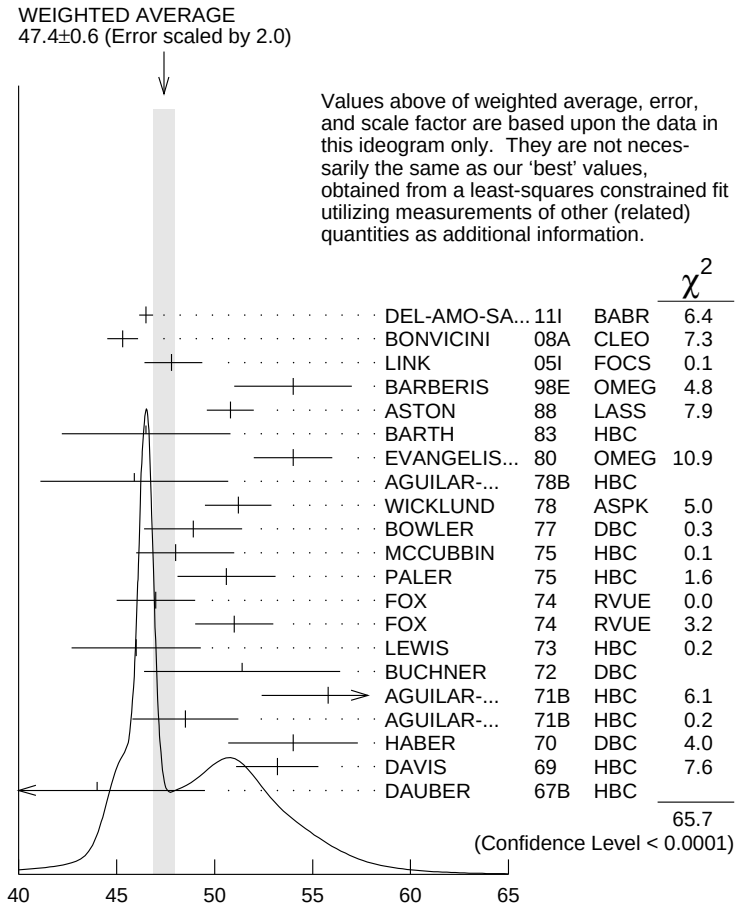
NODE=M018W2
NODE=M018W2

NEW

NEW

OCCUR=2

OCCUR=2



NEUTRAL ONLY (MeV)

- 21 Width errors enlarged by us to $4 \times \Gamma/\sqrt{N}$; see note.
22 Inclusive reaction. Complicated background and phase-space effects.
23 Number of events in peak reevaluated by us.
24 K-matrix pole.
25 From a partial wave amplitude analysis.
26 From a fit in the $K_0^*(800) + K^*(892) + K^*(1410)$ model.
27 From the pole position of the $K\pi$ vector form factor using EPIFANOV 07 and constraints from K_{J3} decays in ANTONELLI 10.
28 Systematic uncertainties not estimated.
29 From the pole position of the $K\pi$ vector form factor in the complex s -plane and using EPIFANOV 07 data.
30 Reanalysis of EPIFANOV 07 using resonance chiral theory.
31 With mass and width of the $K^*(1410)$ fixed at 1412 MeV and 227 MeV, respectively.
32 Taking into account the $K^*(892)^0$, S -wave and P -wave ($K^*(1410)^0$).
33 From the isobar model with a complex pole for the κ .
34 Fit to $K\pi$ mass spectrum includes a non-resonant scalar component.
35 This value comes from a fit with χ^2 of 178/117.

NODE=M018W;LINKAGE=D
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NODE=M018W;LINKAGE=W
NODE=M018W1;LINKAGE=AN
NODE=M018W1;LINKAGE=F
NODE=M018W5;LINKAGE=EF
NODE=M018W5;LINKAGE=BT

NODE=M018W2;LINKAGE=NS
NODE=M018W5;LINKAGE=BI

NODE=M018W2;LINKAGE=JA
NODE=M018W5;LINKAGE=BA
NODE=M018W2;LINKAGE=DE
NODE=M018W2;LINKAGE=BO
NODE=M018M2;LINKAGE=LI
NODE=M018W2;LINKAGE=MI

NODE=M018220;NODE=M018

$K^*(892)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 $K\pi$	~ 100	%
Γ_2 $(K\pi)^\pm$	$(99.901 \pm 0.009) \%$	
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 $K^\pm\gamma$	$(9.9 \pm 0.9) \times 10^{-4}$	
Γ_6 $K\pi\pi$	< 7	$\times 10^{-4}$ 95%

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 13 measurements and one constraint to determine 3 parameters. The overall fit has a $\chi^2 = 7.8$ for 11 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	19	−19
	x_2	x_5

	Mode	Rate (MeV)
Γ_2	$(K\pi)^\pm$	50.7 $\pm$ 0.9
Γ_5	$K^\pm \gamma$	0.050 $\pm$ 0.005

DESIG=11

DESIG=3

CONSTRAINED FIT INFORMATION

An overall fit to the total width and a partial width uses 22 measurements and one constraint to determine 3 parameters. The overall fit has a $\chi^2 = 66.8$ for 20 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	15	−15
	x_3	x_4

	Mode	Rate (MeV)	Scale factor
Γ_3	$(K\pi)^0$	47.3 $\pm$ 0.6	2.1
Γ_4	$K^0 \gamma$	0.116 $\pm$ 0.010	

DESIG=12

DESIG=4

 $K^*(892)$ PARTIAL WIDTHS

NODE=M018225

$\Gamma(K^0 \gamma)$							Γ_4
VALUE (keV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT		
116 $\pm$ 10 OUR FIT							
[117 $\pm$ 10 keV OUR 2012 FIT]							
116.5 $\pm$ 9.9	584	CARLSMITH	86	SPEC	0	$K_L^0 A \rightarrow K_S^0 \pi^0 A$	

NODE=M018W4
NODE=M018W4
NEW

$\Gamma(K^\pm \gamma)$							Γ_5
VALUE (keV)		DOCUMENT ID	TECN	CHG	COMMENT		
50 $\pm$ 5 OUR FIT							
50 $\pm$ 5 OUR AVERAGE							
48 $\pm$ 11		BERG	83	SPEC	−	156 $K^- A \rightarrow \bar{K} \pi A$	
51 $\pm$ 5		CHANDLEE	83	SPEC	+	200 $K^+ A \rightarrow K \pi A$	

NODE=M018W3
NODE=M018W3

 $K^*(892)$ BRANCHING RATIOS

NODE=M018230

$\Gamma(K^0 \gamma) / \Gamma_{\text{total}}$							Γ_4 / Γ
VALUE (units 10^{-3})		DOCUMENT ID	TECN	CHG	COMMENT		
2.46 $\pm$ 0.21 OUR FIT							
[(2.39 $\pm$ 0.21) $\times 10^{-3}$ OUR 2012 FIT]							
• • • We do not use the following data for averages, fits, limits, etc. • • •							
1.5 $\pm$ 0.7		CARITHERS	75B	CNTR	0	8–16 $\bar{K}^0 A$	

NODE=M018R3
NODE=M018R3
NEW

$\Gamma(K^\pm\gamma)/\Gamma_{\text{total}}$ Γ_5/Γ

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

0.99±0.09 OUR FIT

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

<1.6	95	BEMPORAD	73	CNTR	+	10-16 K^+A

 $\Gamma(K\pi\pi)/\Gamma((K\pi)^\pm)$ 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=M018R2
 NODE=M018R2

NODE=M018R1
 NODE=M018R1

K*(892) REFERENCES

NODE=M018

DEL-AMO-SA... 111	PR D83 072001	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)
ANTONELLI 10	EPJ C69 399	M. Antonelli <i>et al.</i>	(FlaviaNet Working Group)
BOITO 10	JHEP 1009 031	D.R. Boito, R. Escribano, M. Jamin	(BARC)
BOITO 09	EPJ C59 821	D.R. Boito, R. Escribano, M. Jamin	
MITCHELL 09A	PR D79 072008	R.E. Mitchell <i>et al.</i>	(CLEO Collab.)
BONVICINI 08A	PR D78 052001	G. Bonvicini <i>et al.</i>	(CLEO Collab.)
JAMIN 08	PL B664 78	M. Jamin, A. Pich, J. Portoles	
AUBERT 07AK	PR D76 012008	B. Aubert <i>et al.</i>	(BABAR Collab.)
EPIFANOV 07	PL B654 65	D. Epifanov <i>et al.</i>	(BELLE Collab.)
LINK 05I	PL B621 72	J.M. Link <i>et al.</i>	(FNAL FOCUS Collab.)
BONVICINI 02	PRL 88 111803	G. Bonvicini <i>et al.</i>	(CLEO Collab.)
PDG 00	EPJ C15 1	D.E. Groom <i>et al.</i>	
ABELE 99D	PL B468 178	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
BARATE 99R	EPJ C11 599	R. Barate <i>et al.</i>	(ALEPH Collab.)
BARBERIS 98E	PL B436 204	D. Barberis <i>et al.</i>	(Omega Expt.)
BIRD 89	SLAC-332	P.F. Bird	(SLAC)
ASTON 88	NP B296 493	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)
ATKINSON 86	ZPHY C30 521	M. Atkinson <i>et al.</i>	(BONN, CERN, GLAS+)
CARLSMITH 86	PL 56 18	D. Carlsmith <i>et al.</i>	(EFI, SACL)
BAUBILLIER 84B	ZPHY C26 37	M. Baubillier <i>et al.</i>	(BIRM, CERN, GLAS+)
NAPIER 84	PL 149B 514	A. Napier <i>et al.</i>	(TUFTS, ARIZ, FNAL, FLOR+)
BARTH 83	NP B223 296	M. Barth <i>et al.</i>	(BRUX, CERN, GENO, MONS+)
BERG 83	Thesis UMI 83-21652	D.M. Berg	(ROCH)
CHANDLEE 83	PRL 51 168	C. Chandlee <i>et al.</i>	(ROCH, FNAL, MINN)
CLELAND 82	NP B208 189	W.E. Cleland <i>et al.</i>	(DURH, GEVA, LAUS+)
DELFOSSE 81	NP B183 349	A. Delfosse <i>et al.</i>	(GEVA, LAUS)
TOAFF 81	PR D23 1500	S. Toaff <i>et al.</i>	(ANL, KANS)
AJINENKO 80	ZPHY C5 177	I.V. Ajinenko <i>et al.</i>	(SERP, BRUX, MONS+)
EVANGELIS... 80	NP B165 383	C. Evangelista <i>et al.</i>	(BARI, BONN, CERN+)
AGUILAR-... 78B	NP B141 101	M. Aguilar-Benitez <i>et al.</i>	(MADR, TATA+)
BALAND 78	NP B140 220	J.F. Baland <i>et al.</i>	(MONS, BELG, CERN+)
COOPER 78	NP B136 365	A.M. Cooper <i>et al.</i>	(TATA, CERN, CDEF+)
JONGEJANS 78	NP B139 383	B. Jongejans <i>et al.</i>	(ZEEM, CERN, NIJM+)
WICKLUND 78	PR D17 1197	A.B. Wicklund <i>et al.</i>	(ANL)
BOWLER 77	NP B126 31	M.G. Bowler <i>et al.</i>	(OXF)
CARITHERS 75B	PRL 35 349	W.C.J. Carithers <i>et al.</i>	(ROCH, MCGI)
MCCUBBIN 75	NP B86 13	N.A. McCubbin, L. Lyons	(OXF)
PALER 75	NP B96 1	K. Paler <i>et al.</i>	(RHEL, SACL, EPOL)
FOX 74	NP B80 403	G.C. Fox, M.L. Griss	(CIT)
MATISON 74	PR D9 1872	M.J. Matison <i>et al.</i>	(LBL)
BEMPORAD 73	NP B51 1	C. Bemporad <i>et al.</i>	(CERN, ETH, LOIC)
CLARK 73	NP B54 432	A.G. Clark, L. Lyons, D. Radojicic	(OXF)
LEWIS 73	NP B60 283	P.H. Lewis <i>et al.</i>	(LOWC, LOIC, CDEF)
LINGLIN 73	NP B55 408	D. Linglin	(CERN)
BUCHNER 72	NP B45 333	K. Buchner <i>et al.</i>	(MPIM, CERN, BRUX)
AGUILAR-... 71B	PR D4 2583	M. Aguilar-Benitez, R.L. Eisner, J.B. Kinson	(BNL)
HABER 70	NP B17 289	B. Haber <i>et al.</i>	(REHO, SACL, BGNA, EPOL)
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)
SCHWEING... 68	PR 166 1317	F. Schweingruber <i>et al.</i>	(ANL, NWES)
BARASH 67B	PR 156 1399	N. Barash <i>et al.</i>	(COLU)
BARLOW 67	NC 50A 701	J. Barlow <i>et al.</i>	(CERN, CDEF, IRAD, LIVP)
DAUBER 67B	PR 153 1403	P.M. Dauber <i>et al.</i>	(UCLA)
DEBAERE 67B	NC 51A 401	W. de Baere <i>et al.</i>	(BRUX, CERN)
WOJCICKI 64	PR 135 B484	S.G. Wojcicki	(LRL)

REFID=16493
 REFID=53448
 REFID=53632
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$K_1(1270)$

$$I(J^P) = \frac{1}{2}(1^+)$$

NODE=M028

 $K_1(1270)$ MASS

NODE=M028205

VALUE (MeV)	DOCUMENT ID

NODE=M028MX

1272±7 OUR AVERAGE Includes data from the 2 datablocks that follow this one.**PRODUCED BY K^- , BACKWARD SCATTERING, HYPERON EXCHANGE**NODE=M028M2
NODE=M028M2

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 $K^- p \rightarrow \Xi^- (K\pi\pi)^+$ **PRODUCED BY K BEAMS**NODE=M028M3
NODE=M028M3

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**NODE=M028M1
NODE=M028M1

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

1248.1± 3.3±1.4 GULER 11 BELL $B^+ \rightarrow J/\psi K^+ \pi^+ \pi^-$

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

1279 ±10	25k	⁴ 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	0 4.5 $\pi^- p \rightarrow \Lambda K 2\pi$
1242 $^{+9}_{-10}$		⁵ ASTIER	69	HBC	0 $\bar{p} p$
1300	45	CRENNELL	67	HBC	0 6 $\pi^- p \rightarrow \Lambda K 2\pi$

⁴ Systematic errors not estimated.⁵ This was called the C meson.NODE=M028M1;LINKAGE=AB
NODE=M028M1;LINKAGE=A**PRODUCED IN τ LEPTON DECAYS**NODE=M028MT
NODE=M028MT

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

1254±33±34 7k ASNER 00B CLEO ± $\tau^- \rightarrow K^- \pi^+ \pi^- \nu_\tau$ **$K_1(1270)$ WIDTH**

NODE=M028210

VALUE (MeV)	DOCUMENT ID

NODE=M028WX
→ UNCHECKED ←**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.**87± 7 OUR AVERAGE** Includes data from the 2 datablocks that follow this one.**PRODUCED BY K^- , BACKWARD SCATTERING, HYPERON EXCHANGE**NODE=M028W2
NODE=M028W2

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

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

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.

90 ± 8 ⁶ 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 ⁷ CARNEGIE 77 ASPK $\pm$ $13 K^\pm p \rightarrow (K \pi \pi)^\pm p$
 ~ 200 BRANDENB... 76 ASPK $\pm$ $13 K^\pm p \rightarrow (K \pi \pi)^\pm p$
 120 DAVIS 72 HBC + $12 K^+ p$
 188 ± 21 FIRESTONE 72B DBC + $12 K^+ d$

⁶ 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.

⁷ 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 CHG COMMENT

119.5 $\pm$ 5.2 $\pm$ 6.7 GULER 11 BELL $B^+ \rightarrow J/\psi K^+ \pi^+ \pi^-$

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

131 ± 21 25k ⁸ 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 0 $4.5 \pi^- p \rightarrow \Lambda K 2\pi$
 127 $^{+7}_{-25}$ ASTIER 69 HBC 0 $\bar{p} p$
 60 45 CRENNELL 67 HBC 0 $6 \pi^- p \rightarrow \Lambda K 2\pi$

⁸ Systematic errors not estimated.

NODE=M028W1
 NODE=M028W1

NODE=M028W1;LINKAGE=AB

PRODUCED IN τ LEPTON DECAYS

VALUE (MeV) EVTS DOCUMENT ID TECN CHG COMMENT

$260^{+90}_{-70} \pm 80$ 7k ASNER 00B CLEO $\pm$ $\tau^- \rightarrow K^- \pi^+ \pi^- \nu_\tau$

NODE=M028WT
 NODE=M028WT

 $K_1(1270)$ DECAY MODES

NODE=M028215;NODE=M028

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 K \rho$	(42 $\pm$ 6) %
$\Gamma_2 K_0^*(1430) \pi$	(28 $\pm$ 4) %
$\Gamma_3 K^*(892) \pi$	(16 $\pm$ 5) %
$\Gamma_4 K \omega$	(11.0 $\pm$ 2.0) %
$\Gamma_5 K f_0(1370)$	(3.0 $\pm$ 2.0) %
$\Gamma_6 \gamma K^0$	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 $\pm$ 5 MAZZUCATO 79 HBC + $4.2 K^- p \rightarrow \Xi^- (K \pi \pi)^+$
 75 $\pm$ 6 CARNEGIE 77B ASPK $\pm$ $13 K^\pm p \rightarrow (K \pi \pi)^\pm p$

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 $\pm$ 6 CARNEGIE 77B ASPK $\pm$ $13 K^\pm p \rightarrow (K \pi \pi)^\pm p$

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 $\pm$ 11 MAZZUCATO 79 HBC + $4.2 K^- p \rightarrow \Xi^- (K \pi \pi)^+$
 2 $\pm$ 2 CARNEGIE 77B ASPK $\pm$ $13 K^\pm p \rightarrow (K \pi \pi)^\pm p$

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	$\pm$	$13 K^\pm p \rightarrow (K\pi\pi)^\pm p$

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	$\pm$	$13 K^\pm p \rightarrow (K\pi\pi)^\pm p$

NODE=M028W8
 NODE=M028W8

 $\Gamma(\gamma K^0)$ Γ_6

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
$73.2 \pm 6.1 \pm 28.3$	ALAVI-HARATI02B	KTEV	$K + A \rightarrow K^* + A$

NODE=M028W9
 NODE=M028W9

 $K_1(1270)$ BRANCHING RATIOS

NODE=M028225

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

VALUE	DOCUMENT ID	TECN	COMMENT
0.42 ± 0.06	⁹ 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	¹⁰ 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	⁹ 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	¹⁰ 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	⁹ 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	¹⁰ 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	⁹ 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	¹⁰ 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	⁹ DAUM 81C	CNTR	$63 K^- p \rightarrow K^- 2\pi p$

NODE=M028R5
 NODE=M028R5

 $D\text{-wave}/S\text{-wave RATIO FOR } K_1(1270) \rightarrow K^*(892)\pi$

VALUE	DOCUMENT ID	TECN	COMMENT
1.0 ± 0.7	⁹ DAUM 81C	CNTR	$63 K^- p \rightarrow K^- 2\pi p$

NODE=M028R9
 NODE=M028R9

⁹ Average from low and high t data.

¹⁰ 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

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. Ablilikim <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	(HELSE)
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

NODE=M028

REFID=53668
REFID=51623
REFID=51037
REFID=48822
REFID=47766
REFID=20573
REFID=22548
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REFID=22536
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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	+ $12 K^+ d$

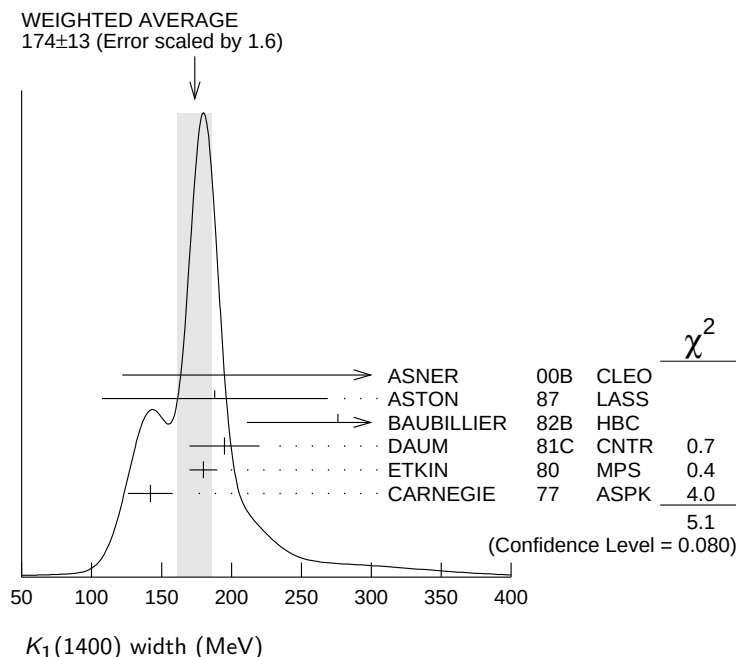
NODE=M064W

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

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

NODE=M064215;NODE=M064

DESIG=1

DESIG=2

DESIG=8

DESIG=5

DESIG=7;OUR EST;→ UNCHECKED ←

DESIG=9;OUR EST;→ UNCHECKED ←

$K_1(1400)$ PARTIAL WIDTHS

$\Gamma(K^*(892)\pi)$	Γ_1
VALUE (MeV)	DOCUMENT ID TECN CHG COMMENT
117 ± 10	CARNEGIE 77 ASPK ± 13 $K^\pm p \rightarrow (K\pi\pi)^\pm p$
$\Gamma(K\rho)$	Γ_2
VALUE (MeV)	DOCUMENT ID TECN CHG COMMENT
2 ± 1	CARNEGIE 77 ASPK ± 13 $K^\pm p \rightarrow (K\pi\pi)^\pm p$
$\Gamma(K\omega)$	Γ_4
VALUE (MeV)	DOCUMENT ID TECN CHG COMMENT
23 ± 12	CARNEGIE 77 ASPK ± 13 $K^\pm p \rightarrow (K\pi\pi)^\pm p$
$\Gamma(\gamma K^0)$	Γ_6
VALUE (keV)	DOCUMENT ID TECN COMMENT
280.8 ± 23.2 ± 40.4	ALAVI-HARATI02B KTEV $K + A \rightarrow K^* + A$

NODE=M064220

NODE=M064W1
NODE=M064W1

NODE=M064W2
NODE=M064W2

NODE=M064W5
NODE=M064W5

NODE=M064W6
NODE=M064W6

$K_1(1400)$ BRANCHING RATIOS

$\Gamma(K^*(892)\pi)/\Gamma_{\text{total}}$	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 $K^- p \rightarrow K^- 2\pi p$

NODE=M064225

NODE=M064R1
NODE=M064R1

NODE=M064R2
NODE=M064R2

$\Gamma(K f_0(1370))/\Gamma_{\text{total}}$ 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=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

 $K^*(1410)$ MASS

VALUE (MeV)	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. • • •

1276 ⁺⁷² ₋₇₇	^{1,2} BOITO	09	RVUE		$\tau^- \rightarrow K_S^0 \pi^- \nu_\tau$
1367±54	BIRD	89	LASS	-	11 $K^- p \rightarrow \bar{K}^0 \pi^- p$
1474±25	BAUBILLIER	82B	HBC	0	8.25 $K^- p \rightarrow \bar{K}^0 2\pi n$
1500±30	ETKIN	80	MPS	0	6 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$

¹ From the pole position of the $K\pi$ vector form factor in the complex s -plane and using EPIFANOV 07 data.

² Systematic uncertainties not estimated.

NODE=M094M

NODE=M094M

NODE=M094M;LINKAGE=BI

NODE=M094M;LINKAGE=NS

 $K^*(1410)$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
232±21 OUR AVERAGE	Error includes scale factor of 1.1.			

176±52±22	ASTON	88	LASS	0	11 $K^- p \rightarrow K^- \pi^+ n$
240±18±12	ASTON	87	LASS	0	11 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$

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

198 ⁺⁶¹ ₋₈₇	^{3,4} 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 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$

³ From the pole position of the $K\pi$ vector form factor in the complex s -plane and using EPIFANOV 07 data.

⁴ Systematic uncertainties not estimated.

NODE=M094W

NODE=M094W

NODE=M094W;LINKAGE=BI

NODE=M094W;LINKAGE=NS

$K^*(1410)$ DECAY MODES

NODE=M094215;NODE=M094

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	seen	

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

 $K^*(1410)$ PARTIAL WIDTHS

NODE=M094217

$\Gamma(\gamma K^0)$			Γ_4		
VALUE (keV)	CL%	DOCUMENT ID	TECN	COMMENT	
<52.9	90	ALAVI-HARATI02B	KTEV	$K + A \rightarrow K^* + A$	

NODE=M094W1
 NODE=M094W1

 $K^*(1410)$ BRANCHING RATIOS

NODE=M094220

$\Gamma(K\rho)/\Gamma(K^*(892)\pi)$						Γ_3/Γ_1
VALUE	CL%	DOCUMENT ID	TECN	CHG	COMMENT	
<0.17	95	ASTON	84	LASS	0 11 $K^-p \rightarrow \bar{K}^0 2\pi n$	

NODE=M094R1
 NODE=M094R1

$\Gamma(K\pi)/\Gamma(K^*(892)\pi)$						Γ_2/Γ_1
VALUE	CL%	DOCUMENT ID		TECN	CHG	COMMENT
<0.16	95	ASTON	84	LASS	0	11 $K^-p \rightarrow \bar{K}^0 2\pi n$

NODE=M094R2
 NODE=M094R2

$\Gamma(K\pi)/\Gamma_{\text{total}}$	Γ_2/Γ				
VALUE	DOCUMENT ID	TECN	CHG	COMMENT	
$0.066\pm 0.010\pm 0.008$	ASTON	88	LASS	0	11 $K^- p \rightarrow K^- \pi^+ n$

NODE=M094R3
 NODE=M094R3

 $K^*(1410)$ REFERENCES

NODE=M094

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

REFID=52728
 REFID=51929
 REFID=48822
 REFID=41002
 REFID=40262
 REFID=40234
 REFID=22689
 REFID=22551
 REFID=22545

$K_0^*(1430)$

$$I(J^P) = \frac{1}{2}(0^+)$$

NODE=M019

See our minireview in the 1994 edition and in this edition under the $f_0(500)$.

NODE=M019

 $K_0^*(1430)$ MASS

NODE=M019M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
1425 ± 50 OUR ESTIMATE					
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1427 ± 4 ± 13	1	BUGG	10	RVUE	S-matrix pole
1466.6 ± 0.7 ± 3.4 141k	2	BONVICINI	08A	CLEO	$D^+ \rightarrow K^- \pi^+ \pi^+$
~ 1412	3	LINK	07	FOCS	0 $D^+ \rightarrow K^- K^+ \pi^+$
1461.0 ± 4.0 ± 2.1 54k	4	LINK	07B	FOCS	$D^+ \rightarrow K^- \pi^+ \pi^+$
1406 ± 29	5	BUGG	06	RVUE	
1435 ± 6	6	ZHOU	06	RVUE	$K\rho \rightarrow K^- \pi^+ n$
1455 ± 20 ± 15		ABLIKIM	05Q	BES2	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$
1456 ± 8	7	ZHENG	04	RVUE	$K^- p \rightarrow K^- \pi^+ n$
~ 1419	8	BUGG	03	RVUE	11 $K^- p \rightarrow K^- \pi^+ n$
~ 1440	9	LI	03	RVUE	11 $K^- p \rightarrow K^- \pi^+ n$

NODE=M019M
 → UNCHECKED ←

1459 ± 9	15k	10 AITALA	02	E791	$D^+ \rightarrow K^- \pi^+ \pi^+$
~ 1440		11 JAMIN	00	RVUE	$K p \rightarrow K p$
1436 ± 8		12 BARBERIS	98E	OMEG	450 $p p \rightarrow$ $p_f p_s K^+ K^- \pi^+ \pi^-$
1415 ± 25		8 ANISOVICH	97C	RVUE	11 $K^- p \rightarrow K^- \pi^+ n$
~ 1450		13 TORNQVIST	96	RVUE	$\pi \pi \rightarrow \pi \pi, K \bar{K}, K \pi$
1412 ± 6		14 ASTON	88	LASS 0	11 $K^- p \rightarrow K^- \pi^+ n$
~ 1430		BAUBILLIER	84B	HBC -	8.25 $K^- p \rightarrow \bar{K}^0 \pi^- p$
~ 1425		15,16 ESTABROOKS	78	ASPK	13 $K^\pm p \rightarrow$ $K^\pm \pi^\pm (n, \Delta)$
~ 1450.0		MARTIN	78	SPEC	10 $K^\pm p \rightarrow K_S^0 \pi p$

1 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.

2 From the isobar model with a complex pole for the κ .

3 From a non-parametric analysis.

4 A Breit-Wigner mass and width.

5 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.

6 S-matrix pole. Using ASTON 88 and assuming $K_0^*(800)$, $K_0^*(1950)$.

7 Using ASTON 88 and assuming $K_0^*(800)$.

8 T-matrix pole. Reanalysis of ASTON 88 data.

9 Breit-Wigner fit. Using ASTON 88.

10 Assuming a low-mass scalar $K \pi$ resonance, $\kappa(800)$.

11 T-matrix pole. Using data from ESTABROOKS 78 and ASTON 88.

12 J^P not determined, could be $K_2^*(1430)$.

13 T-matrix pole.

14 Uses a model for the background, without this background they get a mass 1340 MeV, where the phase shift passes 90° .

15 Mass defined by pole position.

16 From elastic $K \pi$ partial-wave analysis.

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

NODE=M019M;LINKAGE=C

$K_0^*(1430)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
270 ± 80 OUR ESTIMATE					
• • • We do not use the following data for averages, fits, limits, etc. • • •					
270 ± 10 ± 40		17 BUGG	10	RVUE	S-matrix pole
174.2 ± 1.9 ± 3.2	141k	18 BONVICINI	08A	CLEO	$D^+ \rightarrow K^- \pi^+ \pi^+$
~ 500		19 LINK	07	FOCS 0	$D^+ \rightarrow K^- K^+ \pi^+$
177.0 ± 8.0 ± 3.4	54k	20 LINK	07B	FOCS	$D^+ \rightarrow K^- \pi^+ \pi^+$
350 ± 40		21 BUGG	06	RVUE	
288 ± 22		22 ZHOU	06	RVUE	$K p \rightarrow K^- \pi^+ n$
270 ± 45 $^{+30}_{-35}$		ABLIKIM	05Q	BES2	$\psi(2S) \rightarrow$ $\gamma \pi^+ \pi^- K^+ K^-$
217 ± 31		23 ZHENG	04	RVUE	$K^- p \rightarrow K^- \pi^+ n$
~ 316		24 BUGG	03	RVUE	11 $K^- p \rightarrow K^- \pi^+ n$
~ 350		25 LI	03	RVUE	11 $K^- p \rightarrow K^- \pi^+ n$
175 ± 17	15k	26 AITALA	02	E791	$D^+ \rightarrow K^- \pi^+ \pi^+$
~ 300		27 JAMIN	00	RVUE	$K p \rightarrow K p$
196 ± 45		28 BARBERIS	98E	OMEG	450 $p p \rightarrow$ $p_f p_s K^+ K^- \pi^+ \pi^-$
330 ± 50		24 ANISOVICH	97C	RVUE	11 $K^- p \rightarrow K^- \pi^+ n$
~ 320		29 TORNQVIST	96	RVUE	$\pi \pi \rightarrow \pi \pi, K \bar{K}, K \pi$
294 ± 23		ASTON	88	LASS 0	11 $K^- p \rightarrow K^- \pi^+ n$
~ 200		BAUBILLIER	84B	HBC -	8.25 $K^- p \rightarrow \bar{K}^0 \pi^- p$
200 to 300		30 ESTABROOKS	78	ASPK	13 $K^\pm p \rightarrow$ $K^\pm \pi^\pm (n, \Delta)$

17 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.

18 From the isobar model with a complex pole for the κ .

19 From a non-parametric analysis.

20 A Breit-Wigner mass and width.

21 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.

NODE=M019W

NODE=M019W

→ UNCHECKED ←

NODE=M019W;LINKAGE=BG

NODE=M019W;LINKAGE=BO

NODE=M019W;LINKAGE=LI

NODE=M019W;LINKAGE=BW

NODE=M019W;LINKAGE=BU

- 22 S-matrix pole. Using ASTON 88 and assuming $K_0^*(800)$, $K_0^*(1950)$.
- 23 Using ASTON 88 and assuming $K_0^*(800)$.
- 24 T-matrix pole. Reanalysis of ASTON 88 data.
- 25 Breit-Wigner fit. Using ASTON 88.
- 26 Assuming a low-mass scalar $K\pi$ resonance, $\kappa(800)$.
- 27 T-matrix pole. Using data from ESTABROOKS 78 and ASTON 88.
- 28 J^P not determined, could be $K_2^*(1430)$.
- 29 T-matrix pole.
- 30 From elastic $K\pi$ partial-wave analysis.

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)
$\Gamma_1 \quad K\pi$	(93±10) %

DESIG=1

$K_0^*(1430)$ 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 $K^- p \rightarrow K^- \pi^+ n$

NODE=M019R1
NODE=M019R1

$K_0^*(1430)$ REFERENCES

NODE=M019

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 (errat.)	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=53213
REFID=53056
REFID=52426
REFID=51702
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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

 $K_2^*(1430)$ MASS

NODE=M022205

CHARGED ONLY, WITH FINAL STATE $K\pi$ NODE=M022M1
NODE=M022M1

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
1425.6± 1.5 OUR AVERAGE		Error includes scale factor of 1.1.			
1420 ± 4	1587	BAUBILLIER	84B	HBC	— 8.25 $K^- p \rightarrow \bar{K}^0 \pi^- p$
1436 ± 5.5	400	^{1,2} CLELAND	82	SPEC	+ 30 $K^+ p \rightarrow K_S^0 \pi^+ p$
1430 ± 3.2	1500	^{1,2} CLELAND	82	SPEC	+ 50 $K^+ p \rightarrow K_S^0 \pi^+ p$
1430 ± 3.2	1200	^{1,2} CLELAND	82	SPEC	— 50 $K^+ p \rightarrow K_S^0 \pi^- p$
1423 ± 5	935	TOAFF	81	HBC	— 6.5 $K^- p \rightarrow \bar{K}^0 \pi^- p$
1428.0± 4.6		³ MARTIN	78	SPEC	+ 10 $K^\pm p \rightarrow K_S^0 \pi p$
1423.8± 4.6		³ MARTIN	78	SPEC	— 10 $K^\pm p \rightarrow K_S^0 \pi p$
1420.0± 3.1	1400	AGUILAR-...	71B	HBC	— 3.9,4.6 $K^- p$
1425 ± 8.0	225	^{1,2} 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	¹ LIND	69	HBC	+ 9 $K^+ p \rightarrow K^0 \pi^+ p$
1427 ±12	63	¹ SCHWEING...	68	HBC	— 5.5 $K^- p \rightarrow \bar{K} \pi N$
1423 ±11.0	39	¹ 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 ± 820	⁴ BIRD	89	LASS	—	11 $K^- p \rightarrow \bar{K}^0 \pi^- p$

NEUTRAL ONLYNODE=M022M4
NODE=M022M4

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1432.4± 1.3 OUR AVERAGE				
1431.2± 1.8± 0.7	⁵	ASTON 88	LASS	11 $K^-p \rightarrow K^- \pi^+ n$
1434 ± 4 ± 6	⁵	ASTON 87	LASS	11 $K^-p \rightarrow \bar{K}^0 \pi^+ \pi^- n$
1433 ± 6 ± 10	⁵	ASTON 84B	LASS	11 $K^-p \rightarrow \bar{K}^0 2\pi n$
1471 ± 12	⁵	BAUBILLIER 82B	HBC	8.25 $K^-p \rightarrow N K_S^0 \pi \pi$
1428 ± 3	⁵	ASTON 81C	LASS	11 $K^-p \rightarrow K^- \pi^+ n$
1434 ± 2	⁵	ESTABROOKS 78	ASPK	13 $K^\pm p \rightarrow p K \pi$
1440 ± 10	⁵	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	⁶ 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		⁷ 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 $K^+ p \rightarrow K^+ \pi^- X$

¹ Errors enlarged by us to $\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.

² Number of events in peak re-evaluated by us.

³ Systematic error added by us.

⁴ From a partial wave amplitude analysis.

⁵ From phase shift or partial-wave analysis.

⁶ Systematic errors not estimated.

⁷ From pole extrapolation, using world $K^+ p$ data summary tape.

NODE=M022M;LINKAGE=D

NODE=M022M;LINKAGE=W

NODE=M022M;LINKAGE=B

NODE=M022M;LINKAGE=F

NODE=M022M;LINKAGE=P

NODE=M022M4;LINKAGE=NS

NODE=M022M;LINKAGE=C

$K_2^*(1430)$ WIDTH

NODE=M022210

CHARGED ONLY, WITH FINAL STATE $K\pi$

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
98.5 ± 2.7 OUR FIT	Error includes scale factor of 1.1.				
98.5 ± 2.9 OUR AVERAGE	Error includes scale factor of 1.1.				
109 ± 22	400	^{8,9} CLELAND	82	SPEC +	30 $K^+ p \rightarrow K_S^0 \pi^+ p$
124 ± 12.8	1500	^{8,9} CLELAND	82	SPEC +	50 $K^+ p \rightarrow K_S^0 \pi^+ p$
113 ± 12.8	1200	^{8,9} CLELAND	82	SPEC -	50 $K^+ p \rightarrow K_S^0 \pi^- p$
85 ± 16	935	TOAFF	81	HBC -	6.5 $K^- p \rightarrow \bar{K}^0 \pi^- p$
96.5 ± 3.8		MARTIN	78	SPEC +	10 $K^\pm p \rightarrow K_S^0 \pi p$
97.7 ± 4.0		MARTIN	78	SPEC -	10 $K^\pm p \rightarrow K_S^0 \pi p$
94.7 ^{+15.1} _{-12.5}	1400	AGUILAR-...	71B	HBC -	3.9,4.6 $K^- p$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
98 ± 4 ± 4	25k	¹⁰ BIRD	89	LASS -	11 $K^- p \rightarrow \bar{K}^0 \pi^- p$

OCCUR=2

OCCUR=3

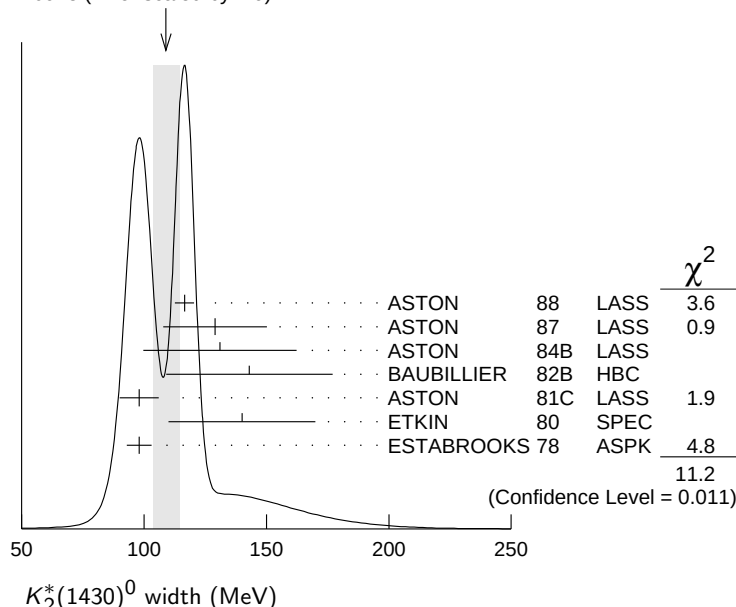
OCCUR=2

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		¹¹ ASTON	88	LASS 11 $K^-p \rightarrow K^- \pi^+ n$
129 ±15 ±15		¹¹ ASTON	87	LASS 11 $K^-p \rightarrow \bar{K}^0 \pi^+ \pi^- n$
131 ±24 ±20		¹¹ ASTON	84B	LASS 11 $K^-p \rightarrow \bar{K}^0 2\pi n$
143 ±34		¹¹ BAUBILLIER	82B	HBC 8.25 $K^-p \rightarrow NK_S^0 \pi \pi$
98 ± 8		¹¹ ASTON	81C	LASS 11 $K^-p \rightarrow K^- \pi^+ n$
140 ±30		¹¹ ETKIN	80	SPEC 6 $K^-p \rightarrow \bar{K}^0 \pi^+ \pi^- n$
98 ± 5		¹¹ ESTABROOKS	78	ASPK 13 $K^\pm p \rightarrow pK\pi$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
113.7± 9.2	1786± 127	¹² AUBERT	07AK	BABR 10.6 $e^+e^- \rightarrow K^{*0} K^\pm \pi^\mp \gamma$
125 ±29	300	⁸ 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		¹³ 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	⁸ 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

WEIGHTED AVERAGE
109±5 (Error scaled by 1.9)⁸ Errors enlarged by us to $4\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.⁹ Number of events in peak re-evaluated by us.¹⁰ From a partial wave amplitude analysis.¹¹ From phase shift or partial-wave analysis.¹² Systematic errors not estimated.¹³ From pole extrapolation, using world $K^+ p$ data summary tape.

NODE=M022W;LINKAGE=D

NODE=M022W;LINKAGE=W

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 $K\pi$	$(49.9 \pm 1.2) \%$	
Γ_2 $K^*(892)\pi$	$(24.7 \pm 1.5) \%$	
Γ_3 $K^*(892)\pi\pi$	$(13.4 \pm 2.2) \%$	
Γ_4 $K\rho$	$(8.7 \pm 0.8) \%$	S=1.2
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=1

DESIG=2

DESIG=6

DESIG=3

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 31 measurements and one constraint to determine 8 parameters. The overall fit has a $\chi^2 = 20.2$ for 24 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	−13	0
	x_1	x_2	x_3	x_4	x_5	x_6	x_7

Mode	Rate (MeV)	Scale factor
Γ_1 $K\pi$	49.1 ± 1.8	
Γ_2 $K^*(892)\pi$	24.3 ± 1.6	
Γ_3 $K^*(892)\pi\pi$	13.2 ± 2.2	
Γ_4 $K\rho$	8.5 ± 0.8	1.2
Γ_5 $K\omega$	2.9 ± 0.8	
Γ_6 $K^+\gamma$	0.24 ± 0.05	1.1
Γ_7 $K\eta$	$0.15^{+0.33}_{-0.10}$	1.3

DESIG=1

DESIG=2

DESIG=6

DESIG=3

DESIG=4

DESIG=8

DESIG=5

 $K_2^*(1430)$ PARTIAL WIDTHS

NODE=M022220

 $\Gamma(K^+\gamma)$ **Γ_6**

VALUE (keV)	DOCUMENT ID	TECN	CHG	COMMENT
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

 $\Gamma(K^0\gamma)$ **Γ_9**

VALUE (keV)	CL%	DOCUMENT ID	TECN	CHG	COMMENT
< 5.4	90	ALAVI-HARATI02B	KTEV		$K + A \rightarrow K^* + A$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<84	90	CARLSMITH	87	SPEC 0	$60-200 K_L^0 A \rightarrow$ $K_S^0 \pi^0 A$

NODE=M022W9

NODE=M022W9

$K^*(1430)$ BRANCHING RATIOS

NODE=M022225

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

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
0.499 ± 0.012 OUR FIT				
0.488 ± 0.014 OUR AVERAGE				
$0.485 \pm 0.006 \pm 0.020$	¹⁴ ASTON	88	LASS	0 11 $K^- p \rightarrow K^- \pi^+ n$
0.49 ± 0.02	¹⁴ ESTABROOKS	78	ASPK	$\pm$ 13 $K^\pm p \rightarrow p K \pi$

NODE=M022R1
NODE=M022R1 **$\Gamma(K^*(892)\pi)/\Gamma(K\pi)$** **$\Gamma_2/\Gamma_1$**

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 $K^- p$

NODE=M022R4
NODE=M022R4 **$\Gamma(K\omega)/\Gamma(K\pi)$** **$\Gamma_5/\Gamma_1$**

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 $K^+ p$

NODE=M022R5
NODE=M022R5

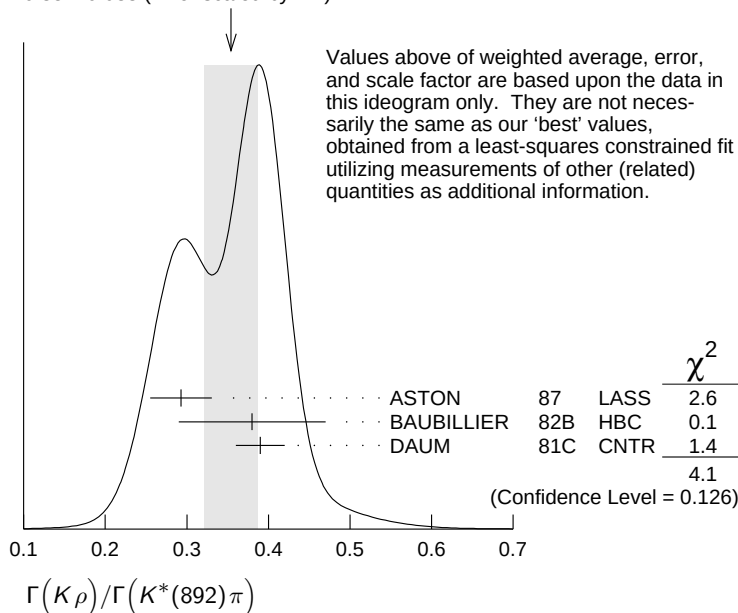
OCCUR=2

 $\Gamma(K\rho)/\Gamma(K\pi)$ **Γ_4/Γ_1**

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				

NODE=M022R6
NODE=M022R6 **$\Gamma(K\rho)/\Gamma(K^*(892)\pi)$** **$\Gamma_4/\Gamma_2$**

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.			
$0.293 \pm 0.032 \pm 0.020$	ASTON	87	LASS	0 11 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$
0.38 ± 0.09	BAUBILLIER	82B	HBC	0 8.25 $K^- p \rightarrow N K_S^0 \pi \pi$
0.39 ± 0.03	DAUM	81C	CNTR	63 $K^- p \rightarrow K^- 2\pi p$

NODE=M022R7
NODE=M022R7WEIGHTED AVERAGE
 0.354 ± 0.033 (Error scaled by 1.4)

$\Gamma(K\omega)/\Gamma(K^*(892)\pi)$ Γ_5/Γ_2

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
0.118±0.034 OUR FIT				
0.10 ±0.04	FIELD	67	HBC	— 3.8 $K^- p$

NODE=M022R8
 NODE=M022R8

 $\Gamma(K\eta)/\Gamma(K^*(892)\pi)$ Γ_7/Γ_2

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 $K^- p$

NODE=M022R9
 NODE=M022R9

 $\Gamma(K\eta)/\Gamma(K\pi)$ Γ_7/Γ_1

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	15	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	16	BASSOMPIE...	69	HBC	5.0 $K^+ p$
<0.02		BISHOP	69	HBC	3.5 $K^+ p$

NODE=M022R10
 NODE=M022R10

 $\Gamma(K^*(892)\pi\pi)/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
0.134±0.022 OUR FIT				
0.12 ±0.04	¹⁷ GOLDBERG	76	HBC	— 3 $K^- p \rightarrow p \bar{K}^0 \pi \pi \pi$

NODE=M022R11
 NODE=M022R11

 $\Gamma(K^*(892)\pi\pi)/\Gamma(K\pi)$ Γ_3/Γ_1

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
0.27±0.05 OUR FIT				
0.21±0.08	^{16,17} JONGEJANS	78	HBC	— 4 $K^- p \rightarrow p \bar{K}^0 \pi \pi \pi$

NODE=M022R12
 NODE=M022R12

 $\Gamma(K\omega\pi)/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE (units 10 ⁻³)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<0.72	95	0	JONGEJANS	78	HBC 4 $K^- p \rightarrow p \bar{K}^0 4\pi$

NODE=M022R13
 NODE=M022R13

¹⁴ From phase shift analysis.

¹⁵ 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.

¹⁶ Restated by us.

¹⁷ 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

NODE=M022

AUBERT	07AK	PR D76 012008	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51908
ALAVI-HARATI	02B	PRL 89 072001	A. Alavi-Harati <i>et al.</i>	(FNAL KTeV Collab.)	REFID=48822
BIRD	89	SLAC-332	P.F. Bird	(SLAC)	REFID=41002
ASTON	88	NP B296 493	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)	REFID=40262
ASTON	88B	PL B201 169	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)	REFID=40281
ASTON	87	NP B292 693	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)	REFID=40234
CARLSMITH	87	PR D36 3502	D. Carlsmith <i>et al.</i>	(EFI, SACL)	REFID=40557
ASTON	84B	NP B247 261	D. Aston <i>et al.</i>	(SLAC, CARL, OTTA)	REFID=22763
BAUBILLIER	84B	ZPHY C26 37	M. Baubillier <i>et al.</i>	(BIRM, CERN, GLAS+)	REFID=22459
BAUBILLIER	82B	NP B202 21	M. Baubillier <i>et al.</i>	(BIRM, CERN, GLAS+)	REFID=22551
CIHANGIR	82	PL 117B 123	S. Cihangir <i>et al.</i>	(FNAL, MINN, ROCH)	REFID=21280
CLELAND	82	NP B208 189	W.E. Cleland <i>et al.</i>	(DURH, GEVA, LAUS+)	REFID=22455
ASTON	81C	PL 106B 235	D. Aston <i>et al.</i>	(SLAC, CARL, OTTA)	REFID=22821
DAUM	81C	NP B187 1	C. Daum <i>et al.</i>	(AMST, CERN, CRAC, MPIM+)	REFID=22548
TOAFF	81	PR D23 1500	S. Toaff <i>et al.</i>	(ANL, KANS)	REFID=22454
ETKIN	80	PR D22 42	A. Etkin <i>et al.</i>	(BNL, CUNY) JP	REFID=22545
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
MARTIN	78	NP B134 392	A.D. Martin <i>et al.</i>	(DURH, GEVA)	REFID=22446
BOWLER	77	NP B126 31	M.G. Bowler <i>et al.</i>	(OXF)	REFID=22437
GOLDBERG	76	LNC 17 253	J. Goldberg	(HAIF)	REFID=22742
HENDRICK	76	NP B112 189	K. Hendrickx <i>et al.</i>	(MONS, SACL, PARIS+)	REFID=22743
LAUSCHER	75	NP B86 189	P. Lauscher <i>et al.</i>	(ABCLV Collab.) JP	REFID=22582
MCCUBBIN	75	NP B86 13	N.A. McCubbin, L. Lyons	(OXF)	REFID=22434
DEHM	74	NP B75 47	G. Dehm <i>et al.</i>	(MPIM, BRUX, MONS, CERN)	REFID=22736
LINGLIN	73	NP B55 408	D. Linglin	(CERN)	REFID=22428
AGUILAR-...	71B	PR D4 2583	M. Aguilar-Benitez, R.L. Eisner, J.B. Kinson	(BNL)	REFID=22408
BARNHAM	71C	NP B28 171	K.W.J. Barnham <i>et al.</i>	(BIRM, GLAS)	REFID=22409
CORDS	71	PR D4 1974	D. Cords <i>et al.</i>	(PURD, UCD, IUPU)	REFID=22411
BASSOMPIE...	69	NP B13 189	G. Bassompierre <i>et al.</i>	(CERN, BRUX) JP	REFID=22710
BISHOP	69	NP B9 403	J.M. Bishop <i>et al.</i>	(WISC)	REFID=22485
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
LIND	69	NP B14 1	V.G. Lind <i>et al.</i>	(LRL) JP	REFID=22404
SCHWEING...	68	PR 166 1317	F. Schweingruber <i>et al.</i>	(ANL, NWES)	REFID=22398
Also		Thesis	F.L. Schweingruber	(NWES, NWES)	REFID=22709
BASSANO	67	PRL 19 968	D. Bassano <i>et al.</i>	(BNL, SYRA)	REFID=22695
FIELD	67	PL 24B 638	J.H. Field <i>et al.</i>	(UCSD)	REFID=22701
BADIER	65C	PL 19 612	J. Badier <i>et al.</i>	(EPOL, SACL, AMST)	REFID=22690

K(1460)

I(J^P) = 1/2(0^-)

OMITTED FROM SUMMARY TABLE
Observed in K pi pi partial-wave analysis.

K(1460) MASS

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
~ 1460	DAUM	81C	CNTR	- 63 K^- p -> K^- 2 pi p
~ 1400	¹ BRANDENB...	76B	ASPK	± 13 K^± p -> K^+ 2 pi p
¹ Coupled mainly to K f_0(1370). Decay into K*(892) pi seen.				

K(1460) WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
~ 260	DAUM	81C	CNTR	- 63 K^- p -> K^- 2 pi p
~ 250	² BRANDENB...	76B	ASPK	± 13 K^± p -> K^+ 2 pi p
² Coupled mainly to K f_0(1370). Decay into K*(892) pi seen.				

K(1460) DECAY MODES

Mode	Fraction (Gamma_i/Gamma)
Gamma_1 K*(892) pi	seen
Gamma_2 K rho	seen
Gamma_3 K*_0(1430) pi	seen

K(1460) PARTIAL WIDTHS

Gamma(K*(892) pi)				Gamma_1
VALUE (MeV)	DOCUMENT ID	TECN	COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
~ 109	DAUM	81C	CNTR	63 K^- p -> K^- 2 pi p
Gamma(K rho)				Gamma_2
VALUE (MeV)	DOCUMENT ID	TECN	COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
~ 34	DAUM	81C	CNTR	63 K^- p -> K^- 2 pi p
Gamma(K*_0(1430) pi)				Gamma_3
VALUE (MeV)	DOCUMENT ID	TECN	COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
~ 117	DAUM	81C	CNTR	63 K^- p -> K^- 2 pi p

K(1460) REFERENCES

DAUM	81C	NP B187 1	C. Daum et al.	(AMST, CERN, CRAC, MPIM+)
BRANDENB...	76B	PRL 36 1239	G.W. Brandenburg et al.	(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=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
<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>CHG</u>	<u>COMMENT</u>		
possibly seen	OTTER	79	HBC	—	10,14,16 $K^- p$	

NODE=M039R2
NODE=M039R2 **$K_2(1580)$ REFERENCES**

NODE=M039

GULER	11	PR D83 032005	H. Guler <i>et al.</i>	(BELLE Collab.)
OTTER	79	NP B147 1	G. Otter <i>et al.</i>	(AACH3, BERL, CERN, LOIC+) JP

REFID=53668
REFID=22772

K(1630)

$I(J^P) = \frac{1}{2}(?^?)$

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)	EPTS	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)	EPTS	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. Karnaukhov, C. Coca, V.I. Moroz
Translated from YAF 61 252.

K₁(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.

K₁(1650) MASS

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
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 $K^- p \rightarrow K^- 2 \pi p$

K₁(1650) WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
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 $K^- p \rightarrow K^- 2 \pi p$

K₁(1650) DECAY MODES

Mode
$\Gamma_1 \quad K \pi \pi$
$\Gamma_2 \quad K \phi$

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=M099W

NODE=M099W

NODE=M099215;NODE=M099

DESIG=1

DESIG=2

$K_1(1650)$ REFERENCES

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+)

NODE=M099

REFID=20569
REFID=22801
REFID=22548

NODE=M095

 $K^*(1680)$

$$I(J^P) = \frac{1}{2}(1^-)$$

 $K^*(1680)$ MASS

NODE=M095M

NODE=M095M

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
1717±27 OUR AVERAGE	Error includes scale factor of 1.4.			
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 $K^\pm p \rightarrow K^\pm \pi^\pm n$

 $K^*(1680)$ WIDTH

NODE=M095W

NODE=M095W

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
322±110 OUR AVERAGE	Error includes scale factor of 4.2.			
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 $K^\pm p \rightarrow K^\pm \pi^\pm n$

 $K^*(1680)$ 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}) %

DESIG=1

DESIG=3

DESIG=2

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

$\Gamma(K\pi)/\Gamma_{\text{total}}$	DOCUMENT ID	TECN	CHG	COMMENT	Γ_1/Γ
0.387±0.026 OUR FIT					
0.388±0.014±0.022	ASTON	88	LASS	0 11 $K^- p \rightarrow K^- \pi^+ n$	

NODE=M095R4
NODE=M095R4

$\Gamma(K\pi)/\Gamma(K^*(892)\pi)$

VALUE	DOCUMENT ID	TECN	CHG	COMMENT

1.30^{+0.23}_{-0.14} OUR FIT**2.8 ± 1.1** ASTON 84 LASS 0 11 $K^- p \rightarrow \bar{K}^0 2\pi n$ $\Gamma(K\rho)/\Gamma(K\pi)$

VALUE	DOCUMENT ID	TECN	CHG	COMMENT

0.81^{+0.14}_{-0.09} OUR FIT**1.2 ± 0.4** ASTON 84 LASS 0 11 $K^- p \rightarrow \bar{K}^0 2\pi n$ $\Gamma(K\rho)/\Gamma(K^*(892)\pi)$

VALUE	DOCUMENT ID	TECN	CHG	COMMENT

1.05^{+0.27}_{-0.11} OUR FIT**0.97 ± 0.09^{+0.30}_{-0.10}** ASTON 87 LASS 0 11 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$ **$K^*(1680)$ REFERENCES**

BIRD	89	SLAC-332	P.F. Bird	(SLAC)
ASTON	88	NP B296 493	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)
ASTON	87	NP B292 693	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)
ASTON	84	PL 149B 258	D. Aston <i>et al.</i>	(SLAC, CARL, OTTA) JP
ETKIN	80	PR D22 42	A. Etkin <i>et al.</i>	(BNL, CUNY) JP
ESTABROOKS	78	NP B133 490	P.G. Estabrooks <i>et al.</i>	(MCGI, CARL, DURH+) JP

 $K_2(1770)$

$$I(J^P) = \frac{1}{2}(2^-)$$

See our mini-review in the 2004 edition of this *Review*, PDG 04. **$K_2(1770)$ MASS**

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

1773 ± 8 ¹ ASTON 93 LASS 11 $K^- p \rightarrow K^- \omega p$

• • • 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 ² 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 ³ FIRESTONE 72B DBC + 12 $K^+ d$ 1765 ± 40 ⁴ 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 a partial wave analysis of the $K^- \omega$ system.² From a partial wave analysis of the $K^- 2\pi$ system.³ Produced in conjunction with excited deuteron.⁴ Systematic errors added correspond to spread of different fits. **$K_2(1770)$ WIDTH**

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

186 ± 14 ⁵ ASTON 93 LASS 11 $K^- p \rightarrow K^- \omega p$ NODE=M095R2
NODE=M095R2NODE=M095R3
NODE=M095R3NODE=M095R1
NODE=M095R1

NODE=M095

REFID=41002
REFID=40262
REFID=40234
REFID=22689
REFID=22545
REFID=22443

NODE=M023

NODE=M023

NODE=M023M

NODE=M023M

NODE=M023M;LINKAGE=A
NODE=M023M;LINKAGE=B
NODE=M023M;LINKAGE=P
NODE=M023M;LINKAGE=X

NODE=M023W

NODE=M023W

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

147±70		TIKHOMIROV 03	SPEC	40.0 $\pi^- C \rightarrow K_S^0 K_S^0 K_L^0 X$
140±40		FRAME	86 OMEG +	13 $K^+ p \rightarrow \phi K^+ p$
~ 220		ARMSTRONG	83 OMEG -	18.5 $K^- p \rightarrow 3K p$
~ 210		⁶ 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	⁷ FIRESTONE	72B DBC +	12 $K^+ d$
90±70		⁸ COLLEY	71 HBC +	10 $K^+ p \rightarrow K 2\pi N$
130		DENEGRI	71 DBC -	12.6 $K^- d \rightarrow \bar{K} 2\pi d$
100±50		AGUILAR-...	70C HBC -	4.6 $K^- p$
138±40		BARTSCH	70C HBC -	10.1 $K^- p$
50 ⁺⁴⁰ ₋₂₀		LUDLAM	70 HBC -	12.6 $K^- p$

⁵ From a partial wave analysis of the $K^- \omega$ system.

⁶ From a partial wave analysis of the $K^- 2\pi$ system.

⁷ Produced in conjunction with excited deuteron.

⁸ Systematic errors added correspond to spread of different fits.

NODE=M023W;LINKAGE=B

NODE=M023W;LINKAGE=C

NODE=M023W;LINKAGE=P

NODE=M023W;LINKAGE=X

$K_2(1770)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $K \pi \pi$	
Γ_2 $K_2^*(1430) \pi$	dominant
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

NODE=M023215;NODE=M023

DESIG=1;OUR EST;→ UNCHECKED ←

DESIG=2;OUR EST;→ UNCHECKED ←

DESIG=4;OUR EST;→ UNCHECKED ←

DESIG=9;OUR EST;→ UNCHECKED ←

DESIG=11

DESIG=10

DESIG=8

$K_2(1770)$ BRANCHING RATIOS

$\Gamma(K_2^*(1430)\pi)/\Gamma(K\pi\pi)$ Γ_2/Γ_1
 $(K_2^*(1430) \rightarrow K\pi)$

VALUE	DOCUMENT ID	TECN	CHG	COMMENT

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

~ 0.03	DAUM	81C	CNTR	63 $K^- p \rightarrow K^- 2\pi p$
~ 1.0	⁹ 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 $K^+ p$

⁹ Produced in conjunction with excited deuteron.

NODE=M023220

NODE=M023R1

NODE=M023R1

NODE=M023R1

$\Gamma(K^*(892)\pi)/\Gamma(K\pi\pi)$ Γ_3/Γ_1

VALUE	DOCUMENT ID	TECN	COMMENT

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

~ 0.23	DAUM	81C	CNTR	63 $K^- p \rightarrow K^- 2\pi p$

$\Gamma(K f_2(1270))/\Gamma(K\pi\pi)$ Γ_4/Γ_1

$(f_2(1270) \rightarrow \pi\pi)$

VALUE	DOCUMENT ID	TECN	COMMENT

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

~ 0.74	DAUM	81C	CNTR	63 $K^- p \rightarrow K^- 2\pi p$

$\Gamma(K f_0(980))/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE	DOCUMENT ID	TECN	COMMENT

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

possibly seen

TIKHOMIROV 03 SPEC 40.0 $\pi^- C \rightarrow K_S^0 K_S^0 K_L^0 X$

NODE=M023R1;LINKAGE=P

NODE=M023R3

NODE=M023R3

NODE=M023R4

NODE=M023R4

NODE=M023R4

NODE=M023R6

NODE=M023R6

$\Gamma(K\phi)/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	CHG	COMMENT	Γ_6/Γ
seen	ARMSTRONG 83	OMEG	—	$18.5 K^- p \rightarrow K^- \phi N$	

NODE=M023R5
 NODE=M023R5

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

VALUE	DOCUMENT ID	TECN	CHG	COMMENT	Γ_7/Γ
seen	OTTER 81	HBC	$\pm$	$8.25, 10, 16 K^\pm p$	
seen	CHUNG 74	HBC	—	$7.3 K^- p \rightarrow K^- \omega p$	

NODE=M023R2
 NODE=M023R2

 $K_2(1770)$ REFERENCES

PDG 04	PL B592 1	S. Eidelman <i>et al.</i>	(PDG Collab.)
TIKHOMIROV 03	PAN 66 828	G.D. Tikhomirov <i>et al.</i>	
	Translated from YAF 66 860.		
ASTON 93	PL B308 186	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)
FRAME 86	NP B276 667	D. Frame <i>et al.</i>	(GLAS)
ARMSTRONG 83	NP B221 1	T.A. Armstrong <i>et al.</i>	(BARI, BIRM, CERN+)
DAUM 81C	NP B187 1	C. Daum <i>et al.</i>	(AMST, CERN, CRAC, MPIM+)
OTTER 81	NP B181 1	G. Otter	(AACH3, BERL, LOIC, VIEN, BIRM+)
CHUNG 74	PL 51B 413	S.U. Chung <i>et al.</i>	(BNL)
BLIEDEN 72	PL 39B 668	H.R. Blieden <i>et al.</i>	(STON, NEAS)
FIRESTONE 72B	PR D5 505	A. Firestone <i>et al.</i>	(LBL)
COLLEY 71	NP B26 71	D.C. Colley <i>et al.</i>	(BIRM, GLAS)
DENEGRI 71	NP B28 13	D. Denegri <i>et al.</i>	(JHU) JP
AGUILAR-... 70C	PRL 25 54	M. Aguilar-Benitez <i>et al.</i>	(BNL)
BARTSCH 70C	PL 33B 186	J. Bartsch <i>et al.</i>	(AACH, BERL, CERN+)
LUDLAM 70	PR D2 1234	T. Ludlam, J. Sandweiss, A.J. Slaughter	(YALE)
BARBARO-... 69	PRL 22 1207	A. Barbaro-Galtieri <i>et al.</i>	(LRL)

NODE=M023

REFID=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

NODE=M060

 $K_3^*(1780)$

$$I(J^P) = \frac{1}{2}(3^-)$$

 $K_3^*(1780)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
1776$\pm$ 7 OUR AVERAGE		Error includes scale factor of 1.1.			
1781 $\pm$ 8 $\pm$ 4		¹ ASTON	88	LASS	0 11 $K^- p \rightarrow K^- \pi^+ n$
1740 $\pm$ 14 $\pm$ 15		¹ ASTON	87	LASS	0 11 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$
1779 $\pm$ 11		² BALDI	76	SPEC	+ 10 $K^+ p \rightarrow K^0 \pi^+ p$
1776 $\pm$ 26		³ BRANDENB...	76D	ASPK	0 13 $K^\pm p \rightarrow K^\pm \pi^\mp N$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1720 $\pm$ 10 $\pm$ 15	6111	⁴ BIRD	89	LASS	— 11 $K^- p \rightarrow \bar{K}^0 \pi^- p$
1749 $\pm$ 10		ASTON	88B	LASS	— 11 $K^- p \rightarrow K^- \eta p$
1780 $\pm$ 9	300	BAUBILLIER	84B	HBC	— 8.25 $K^- p \rightarrow \bar{K}^0 \pi^- p$
1790 $\pm$ 15		BAUBILLIER	82B	HBC	0 8.25 $K^- p \rightarrow K_S^0 2\pi N$
1784 $\pm$ 9	2060	CLELAND	82	SPEC	$\pm$ 50 $K^+ p \rightarrow K_S^0 \pi^\pm p$
1786 $\pm$ 15		⁵ ASTON	81D	LASS	0 11 $K^- p \rightarrow K^- \pi^+ n$
1762 $\pm$ 9	190	TOAFF	81	HBC	— 6.5 $K^- p \rightarrow \bar{K}^0 \pi^- p$
1850 $\pm$ 50		ETKIN	80	MPS	0 6 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^-$
1812 $\pm$ 28		BEUSCH	78	OMEG	10 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$
1786 $\pm$ 8		CHUNG	78	MPS	0 6 $K^- p \rightarrow K^- \pi^+ n$

¹ From energy-independent partial-wave analysis.² From a fit to Y_6^2 moment. $J^P = 3^-$ found.³ Confirmed by phase shift analysis of ESTABROOKS 78, yields $J^P = 3^-$.⁴ From a partial wave amplitude analysis.⁵ From a fit to the Y_6^0 moment.

NODE=M060M;LINKAGE=K

NODE=M060M;LINKAGE=M

NODE=M060M;LINKAGE=A

NODE=M060M;LINKAGE=F

NODE=M060M;LINKAGE=J

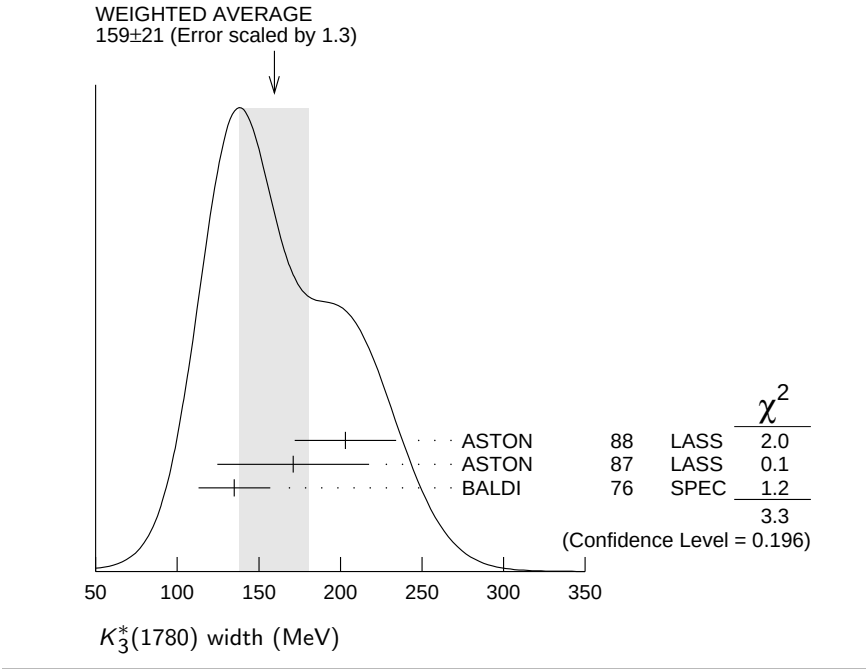
 $K_3^*(1780)$ WIDTH

NODE=M060W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
159±21 OUR AVERAGE		Error includes scale factor of 1.3. See the ideogram below.			
203±30± 8		⁶ ASTON	88	LASS	0 11 $K^- p \rightarrow K^- \pi^+ n$
171±42±20		⁶ ASTON	87	LASS	0 11 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$
135±22		⁷ 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	⁸ 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		⁹ 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		¹⁰ 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		¹¹ BRANDENB...	76D	ASPK	0 13 $K^\pm p \rightarrow K^\pm \pi^\mp N$

⁶ From energy-independent partial-wave analysis.
⁷ From a fit to Y_6^2 moment. $J^P = 3^-$ found.
⁸ From a partial wave amplitude analysis.
⁹ From a fit to Y_6^0 moment.
¹⁰ Errors enlarged by us to $4\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.
¹¹ ESTABROOKS 78 find that BRANDENBURG 76D data are consistent with 175 MeV width. Not averaged.

NODE=M060W;LINKAGE=K
NODE=M060W;LINKAGE=M
NODE=M060W;LINKAGE=F
NODE=M060W;LINKAGE=J
NODE=M060W;LINKAGE=D
NODE=M060W;LINKAGE=E



$K_3^*(1780)$ DECAY MODES

NODE=M060215;NODE=M060

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 $K\rho$	(31 ± 9) %	DESIG=3
Γ_2 $K^*(892)\pi$	(20 ± 5) %	DESIG=2
Γ_3 $K\pi$	(18.8± 1.0) %	DESIG=1
Γ_4 $K\eta$	(30 ±13) %	DESIG=6
Γ_5 $K_2^*(1430)\pi$	< 16 %	95% 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 $\langle \delta x_i \delta x_j \rangle / (\delta x_i \cdot \delta x_j)$, 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	85		
x_3	18	21	
x_4	-98	-94	-27
	x_1	x_2	x_3

$K_3^*(1780)$ BRANCHING RATIOS

NODE=M060220

$\Gamma(K\rho)/\Gamma(K^*(892)\pi)$

 Γ_1/Γ_2

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
1.52±0.23 OUR FIT				
1.52±0.21±0.10	ASTON	87	LASS	0 11 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$

NODE=M060R5
NODE=M060R5

$\Gamma(K^*(892)\pi)/\Gamma(K\pi)$

 Γ_2/Γ_3

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
1.09±0.26 OUR FIT				
1.09±0.26	ASTON	84B	LASS	0 11 $K^- p \rightarrow \bar{K}^0 2\pi n$

NODE=M060R7
NODE=M060R7

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

 Γ_3/Γ

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
0.188±0.010 OUR FIT				
0.188±0.010 OUR AVERAGE				
0.187±0.008±0.008	ASTON	88	LASS	0 11 $K^- p \rightarrow K^- \pi^+ n$
0.19 ±0.02	ESTABROOKS	78	ASPK	0 13 $K^\pm p \rightarrow K\pi N$

NODE=M060R4
NODE=M060R4

$\Gamma(K\eta)/\Gamma(K\pi)$

 Γ_4/Γ_3

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
1.6 ±0.7 OUR FIT				
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.41±0.050	¹² BIRD	89	LASS	- 11 $K^- p \rightarrow \bar{K}^0 \pi^- p$
0.50±0.18	ASTON	88B	LASS	- 11 $K^- p \rightarrow K^- \eta p$

NODE=M060R8
NODE=M060R8

¹² This result supersedes ASTON 88B.

NODE=M060R8;LINKAGE=H

$\Gamma(K_2^*(1430)\pi)/\Gamma(K^*(892)\pi)$

 Γ_5/Γ_2

VALUE	CL%	DOCUMENT ID	TECN	CHG	COMMENT
<0.78	95	ASTON	87	LASS	0 11 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$

NODE=M060R6
NODE=M060R6

$K_3^*(1780)$ REFERENCES

NODE=M060

BIRD	89	SLAC-332	P.F. Bird	(SLAC)	REFID=41002
ASTON	88	NP B296 493	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)	REFID=40262
ASTON	88B	PL B201 169	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS) JP	REFID=40281
ASTON	87	NP B292 693	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)	REFID=40234
ASTON	84B	NP B247 261	D. Aston <i>et al.</i>	(SLAC, CARL, OTTA)	REFID=22763
BAUBILLIER	84B	ZPHY C26 37	M. Baubillier <i>et al.</i>	(BIRM, CERN, GLAS+)	REFID=22459
BAUBILLIER	82B	NP B202 21	M. Baubillier <i>et al.</i>	(BIRM, CERN, GLAS+)	REFID=22551
CLELAND	82	NP B208 189	W.E. Cleland <i>et al.</i>	(DURH, GEVA, LAUS+)	REFID=22455
ASTON	81D	PL 99B 502	D. Aston <i>et al.</i>	(SLAC, CARL, OTTA) JP	REFID=22820
TOAFF	81	PR D23 1500	S. Toaff <i>et al.</i>	(ANL, KANS)	REFID=22454
ETKIN	80	PR D22 42	A. Etkin <i>et al.</i>	(BNL, CUNY) JP	REFID=22545
BEUSCH	78	PL 74B 282	W. Beusch <i>et al.</i>	(CERN, AACH3, ETH) JP	REFID=22537
CHUNG	78	PRL 40 355	S.U. Chung <i>et al.</i>	(BNL, BRAN, CUNY+) JP	REFID=22814
ESTABROOKS	78	NP B133 490	P.G. Estabrooks <i>et al.</i>	(MCGI, CARL, DURH+) JP	REFID=22443
Also		PR D17 658	P.G. Estabrooks <i>et al.</i>	(MCGI, CARL, DURH+)	REFID=22444
BALDI	76	PL 63B 344	R. Baldi <i>et al.</i>	(GEVA) JP	REFID=22807
BRANDENB...	76D	PL 60B 478	G.W. Brandenburg <i>et al.</i>	(SLAC) JP	REFID=22808

$K_2(1820)$

$$I(J^P) = \frac{1}{2}(2^-)$$

See our mini-review in the 2004 edition of this *Review* (PDG 04) under $K_2(1770)$.

NODE=M146

NODE=M146

NODE=M146M

NODE=M146M

NODE=M146M;LINKAGE=A
NODE=M146M;LINKAGE=C

NODE=M146W

NODE=M146W

NODE=M146W;LINKAGE=B
NODE=M146W;LINKAGE=C

NODE=M146215;NODE=M146

DESIG=5
DESIG=1;OUR EVAL;→ UNCHECKED ←
DESIG=2;OUR EVAL;→ UNCHECKED ←
DESIG=3;OUR EVAL;→ UNCHECKED ←
DESIG=6;OUR EVAL;→ UNCHECKED ←

NODE=M146220

NODE=M146R1
NODE=M146R1

NODE=M146R2
NODE=M146R2

NODE=M146R3
NODE=M146R3

NODE=M146

REFID=49653
REFID=43597
REFID=22548

$K_2(1820)$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
1816±13	¹ ASTON	93 LASS	11 $K^- p \rightarrow K^- \omega p$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
~ 1840	² DAUM	81C CNTR	63 $K^- p \rightarrow K^- 2\pi p$
¹ From a partial wave analysis of the $K^- \omega$ system.			
² From a partial wave analysis of the $K^- 2\pi$ system.			

$K_2(1820)$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
276±35	³ ASTON	93 LASS	11 $K^- p \rightarrow K^- \omega p$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
~ 230	⁴ DAUM	81C CNTR	63 $K^- p \rightarrow K^- 2\pi p$
³ From a partial wave analysis of the $K^- \omega$ system.			
⁴ From a partial wave analysis of the $K^- 2\pi$ system.			

$K_2(1820)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $K \pi \pi$	
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

$K_2(1820)$ BRANCHING RATIOS

$\Gamma(K_2^*(1430)\pi)/\Gamma(K\pi\pi)$			Γ_2/Γ_1
VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
~ 0.77	DAUM	81C CNTR	63 $K^- p \rightarrow \bar{K} 2\pi p$
$\Gamma(K^*(892)\pi)/\Gamma(K\pi\pi)$			Γ_3/Γ_1
VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
~ 0.05	DAUM	81C CNTR	63 $K^- p \rightarrow \bar{K} 2\pi p$
$\Gamma(K f_2(1270))/\Gamma(K\pi\pi)$			Γ_4/Γ_1
VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
~ 0.18	DAUM	81C CNTR	63 $K^- p \rightarrow \bar{K} 2\pi p$

$K_2(1820)$ REFERENCES

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+)

K(1830)

I(J^P) = 1/2(0^-)

OMITTED FROM SUMMARY TABLE
Seen in partial-wave analysis of K^- phi system. Needs confirmation.

K(1830) MASS

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
~ 1830	ARMSTRONG 83	OMEG	-	18.5 K^- p -> 3K p

K(1830) WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
~ 250	ARMSTRONG 83	OMEG	-	18.5 K^- p -> 3K p

K(1830) DECAY MODES

Mode
Gamma_1 K phi

K(1830) REFERENCES

ARMSTRONG 83	NP B221 1	T.A. Armstrong et al.	(BARI, BIRM, CERN+) JP

K_0^*(1950)

I(J^P) = 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 +/- 10 +/- 20	¹ ASTON 88	LASS	0	11 K^- p -> K^- pi^+ n
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1917 +/- 12	² ZHOU 06	RVUE		K p -> K^- pi^+ n
1820 +/- 40	³ ANISOVICH 97C	RVUE		11 K^- p -> K^- pi^+ n

¹We take the central value of the two solutions and the larger error given.
²S-matrix pole. Using ASTON 88 and assuming K_0^*(800), K_0^*(1430).
³T-matrix pole. Reanalysis of ASTON 88 data.

K_0^*(1950) WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
201 +/- 34 +/- 79	⁴ ASTON 88	LASS	0	11 K^- p -> K^- pi^+ n
• • • We do not use the following data for averages, fits, limits, etc. • • •				
145 +/- 38	⁵ ZHOU 06	RVUE		K p -> K^- pi^+ n
250 +/- 100	⁶ ANISOVICH 97C	RVUE		11 K^- p -> K^- pi^+ n

⁴We take the central value of the two solutions and the larger error given.
⁵S-matrix pole. Using ASTON 88 and assuming K_0^*(800), K_0^*(1430).
⁶T-matrix pole. Reanalysis of ASTON 88 data.

K_0^*(1950) DECAY MODES

Mode	Fraction (Gamma_i / Gamma)
Gamma_1 K pi	(52 +/- 14) %

NODE=M088

NODE=M088

NODE=M088M

NODE=M088M

NODE=M088W

NODE=M088W

NODE=M088215;NODE=M088

DESIG=1

NODE=M088

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

NODE=M134215;NODE=M134

DESIG=1

$K_0^*(1950)$ BRANCHING RATIOS

$\Gamma(K\pi)/\Gamma_{\text{total}}$						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 $K_0^*(800)$, $K_0^*(1430)$.						

NODE=M134220

NODE=M134R1
NODE=M134R1NODE=M134R1;LINKAGE=A
NODE=M134R1;LINKAGE=ZU **$K_0^*(1950)$ REFERENCES**

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 et al. (SLAC, NAGO, CINC, INUS)

NODE=M134

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

<u>VALUE (MeV)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>CHG</u>	<u>COMMENT</u>
1973± 8±25		ASTON	87	LASS	0 11 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
2020±20		TIKHOMIROV	03	SPEC	40.0 $\pi^- C \rightarrow K_S^0 K_S^0 K_L^0 X$
1978±40	241 ± 47	BIRD	89	LASS	— 11 $K^- p \rightarrow \bar{K}^0 \pi^- p$

NODE=M104M

NODE=M104M

 $K_2^*(1980)$ WIDTH

<u>VALUE (MeV)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>CHG</u>	<u>COMMENT</u>
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 ± 47	BIRD	89	LASS	– 11 $K^- p \rightarrow \bar{K}^0 \pi^- p$

NODE=M104W

NODE=M104W

 $K_2^*(1980)$ DECAY MODES

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

NODE=M104215;NODE=M104

DESIG=2

DESIG=3

DESIG=4

 $K_2^*(1980)$ BRANCHING RATIOS

$\Gamma(K^*(892)\pi)/\Gamma_{\text{total}}$						Γ_1/Γ
VALUE	DOCUMENT ID	TECN	CHG	COMMENT		
possibly seen	GULER	11	BELL	$B^+ \rightarrow J/\psi K^+ \pi^+ \pi^-$		
$\Gamma(K\rho)/\Gamma_{\text{total}}$						Γ_2/Γ
VALUE	DOCUMENT ID	TECN	CHG	COMMENT		
possibly seen	GULER	11	BELL	$B^+ \rightarrow J/\psi K^+ \pi^+ \pi^-$		
$\Gamma(K\rho)/\Gamma(K^*(892)\pi)$						Γ_2/Γ_1
VALUE	DOCUMENT ID	TECN	CHG	COMMENT		
$1.49 \pm 0.24 \pm 0.09$	ASTON	87	LASS	0	11 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$	

NODE=M104220

NODE=M104R01
NODE=M104R01NODE=M104R02
NODE=M104R02NODE=M104R1
NODE=M104R1

$\Gamma(K f_2(1270))/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
possibly seen	TIKHOMIROV 03	SPEC	$40.0 \pi^- C \rightarrow K_S^0 K_S^0 K_L^0 X$

NODE=M104R3
 NODE=M104R3

 $K_2^*(1980)$ REFERENCES

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>	
BIRD	89	Translated from YAF 66 860.	P.F. Bird	(SLAC)
ASTON	87	NP B292 693	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)

NODE=M104

REFID=53668
 REFID=49423

REFID=41002
 REFID=40234

NODE=M035

 $K_4^*(2045)$

$$I(J^P) = \frac{1}{2}(4^+)$$

 $K_4^*(2045)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
2045 ± 9 OUR AVERAGE		Error includes scale factor of 1.1.			
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 $pA \rightarrow 4K X$
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

NODE=M035M;LINKAGE=E
 NODE=M035M;LINKAGE=B
 NODE=M035M;LINKAGE=W
 NODE=M035M;LINKAGE=D

 $K_4^*(2045)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
198 ± 30 OUR AVERAGE					
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 $pA \rightarrow 4K X$
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

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 ± 1.2) %
Γ_2 $K^*(892) \pi \pi$	(9 ± 5) %
Γ_3 $K^*(892) \pi \pi \pi$	(7 ± 5) %
Γ_4 $\rho K \pi$	(5.7 ± 3.2) %
Γ_5 $\omega K \pi$	(5.0 ± 3.0) %
Γ_6 $\phi K \pi$	(2.8 ± 1.4) %
Γ_7 $\phi K^*(892)$	(1.4 ± 0.7) %

DESIG=1

DESIG=2

DESIG=5

DESIG=3

DESIG=4

DESIG=6

DESIG=7

$K_4^*(2045)$ BRANCHING RATIOS

NODE=M035220

$\Gamma(K\pi)/\Gamma_{\text{total}}$						Γ_1/Γ
VALUE	DOCUMENT ID	TECN	CHG	COMMENT		
0.099±0.012	ASTON	88	LASS	0	11 $K^- p \rightarrow K^- \pi^+ n$	

NODE=M035R1
NODE=M035R1

$\Gamma(K^*(892)\pi\pi)/\Gamma(K\pi)$						Γ_2/Γ_1
VALUE	DOCUMENT ID	TECN	CHG	COMMENT		
0.89±0.53	BAUBILLIER	82	HBC	—	8.25 $K^- p \rightarrow p K_S^0 3\pi$	

NODE=M035R2
NODE=M035R2

$\Gamma(K^*(892)\pi\pi\pi)/\Gamma(K\pi)$						Γ_3/Γ_1
VALUE	DOCUMENT ID	TECN	CHG	COMMENT		
0.75±0.49	BAUBILLIER	82	HBC	—	8.25 $K^- p \rightarrow p K_S^0 3\pi$	

NODE=M035R5
NODE=M035R5

$\Gamma(\rho K\pi)/\Gamma(K\pi)$						Γ_4/Γ_1
VALUE	DOCUMENT ID	TECN	CHG	COMMENT		
0.58±0.32	BAUBILLIER	82	HBC	—	8.25 $K^- p \rightarrow p K_S^0 3\pi$	

NODE=M035R3
NODE=M035R3

$\Gamma(\omega K\pi)/\Gamma(K\pi)$						Γ_5/Γ_1
VALUE	DOCUMENT ID	TECN	CHG	COMMENT		
0.50±0.30	BAUBILLIER	82	HBC	—	8.25 $K^- p \rightarrow p K_S^0 3\pi$	

NODE=M035R4
NODE=M035R4

$\Gamma(\phi K\pi)/\Gamma_{\text{total}}$						Γ_6/Γ
VALUE	DOCUMENT ID	TECN	COMMENT			
0.028±0.014	⁹ TORRES	86	MPSF	400 $pA \rightarrow 4KX$		

NODE=M035R6
NODE=M035R6

$\Gamma(\phi K^*(892))/\Gamma_{\text{total}}$						Γ_7/Γ
VALUE	DOCUMENT ID	TECN	COMMENT			
0.014±0.007	⁹ TORRES	86	MPSF	400 $pA \rightarrow 4KX$		

NODE=M035R7
NODE=M035R7⁹ Error determination is model dependent.

NODE=M035R;LINKAGE=A

 $K_4^*(2045)$ REFERENCES

NODE=M035

ASTON	88	NP B296 493	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)
ASTON	86	PL B180 308	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)
TORRES	86	PR D34 707	S. Torres <i>et al.</i>	(VPI, ARIZ, FNAL, FSU+)
BAUBILLIER	82	PL 118B 447	M. Baubillier <i>et al.</i>	(BIRM, CERN, GLAS+)
CLELAND	82	NP B208 189	W.E. Cleland <i>et al.</i>	(DURH, GEVA, LAUS+)
ASTON	81C	PL 106B 235	D. Aston <i>et al.</i>	(SLAC, CARL, OTTA) JP
CARMONY	77	PR D16 1251	D.D. Carmony <i>et al.</i>	(PURD, UCD, IUPU)

REFID=40262
REFID=22462
REFID=22845
REFID=22842
REFID=22455
REFID=22821
REFID=22811 **$K_2(2250)$**

$$I(J^P) = \frac{1}{2}(2^-)$$

NODE=M040

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

NODE=M040M

VALUE (MeV)	EVS	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 $K^+ p$

NODE=M040M

$1 J^P = 2^-$ from moments analysis.

NODE=M040M;LINKAGE=Q

$K_2(2250)$ WIDTH

NODE=M040W

NODE=M040W

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;LINKAGE=Q

$K_2(2250)$ 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	$p \bar{\Lambda}$

DESIG=1
DESIG=3
DESIG=4
DESIG=2

$K_2(2250)$ REFERENCES

NODE=M040

REFID=49423

REFID=22852
REFID=22850
REFID=22851
REFID=22849
REFID=22847

NODE=M090

$K_3(2320)$

$I(J^P) = \frac{1}{2}(3^+)$

OMITTED FROM SUMMARY TABLE
Seen in the $J^P = 3^+$ wave of the antihyperon-nucleon system.
Needs confirmation.

NODE=M090

$K_3(2320)$ MASS

NODE=M090M

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;LINKAGE=P

$K_3(2320)$ WIDTH

NODE=M090W

NODE=M090W

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
150±30				
● ● ● 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;LINKAGE=P

$K_3(2320)$ DECAY MODES

NODE=M090215;NODE=M090

Mode	
Γ_1	$p \bar{\Lambda}$

DESIG=1

$K_3(2320)$ REFERENCES

NODE=M090

REFID=22852
REFID=22851

ARMSTRONG 83c	NP B227 365	T.A. Armstrong <i>et al.</i>	(BARI, BIRM, CERN+)
CLELAND 81	NP B184 1	W.E. Cleland <i>et al.</i>	(PITT, GEVA, LAUS+)

$K_5^*(2380)$

$$I(J^P) = \frac{1}{2}(5^-)$$

OMITTED FROM SUMMARY TABLE
Needs confirmation. **$K_5^*(2380)$ MASS**

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
$2382 \pm 14 \pm 19$	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 ± 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)

$$I^G(J^{PC}) = ?^?(??)$$

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 $\Lambda\bar{p}\pi^-$). Needs confirmation.

NODE=M129

NODE=M129

K(3100) MASS

VALUE (MeV)

DOCUMENT ID

≈ 3100 OUR ESTIMATE

NODE=M129205

NODE=M129M

→ UNCHECKED ←

3-BODY DECAYS

VALUE (MeV)

DOCUMENT ID

TECN

COMMENT

3054±11 OUR AVERAGE

3060± 7±20

¹ ALEEV 93 BIS2 $K(3100) \rightarrow \Lambda\bar{p}\pi^+$

3056± 7±20

¹ ALEEV 93 BIS2 $K(3100) \rightarrow \bar{\Lambda}p\pi^-$

3055± 8±20

¹ ALEEV 93 BIS2 $K(3100) \rightarrow \Lambda\bar{p}\pi^-$

3045± 8±20

¹ ALEEV 93 BIS2 $K(3100) \rightarrow \bar{\Lambda}p\pi^+$

NODE=M129M1

NODE=M129M1

OCCUR=2

OCCUR=3

OCCUR=4

4-BODY DECAYS

VALUE (MeV)

DOCUMENT ID

TECN

COMMENT

3059±11 OUR AVERAGE

3067± 6±20

¹ ALEEV 93 BIS2 $K(3100) \rightarrow \Lambda\bar{p}\pi^+\pi^+$

3060± 8±20

¹ ALEEV 93 BIS2 $K(3100) \rightarrow \Lambda\bar{p}\pi^+\pi^-$

3055± 7±20

¹ ALEEV 93 BIS2 $K(3100) \rightarrow \bar{\Lambda}p\pi^-\pi^-$

3052± 8±20

¹ ALEEV 93 BIS2 $K(3100) \rightarrow \bar{\Lambda}p\pi^-\pi^+$

• • • 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 $K(3100) \rightarrow \Lambda\bar{p}\pi^+\pi^-$

NODE=M129M2

NODE=M129M2

OCCUR=2

OCCUR=3

OCCUR=4

OCCUR=2

5-BODY DECAYS

VALUE (MeV)

DOCUMENT ID

TECN

COMMENT

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

3095±30

BOURQUIN 86 SPEC $K(3100) \rightarrow \Lambda\bar{p}\pi^+\pi^+\pi^-$

NODE=M129M3

NODE=M129M3

¹Supersedes ALEEV 90.

NODE=M129M;LINKAGE=A

K(3100) WIDTH

NODE=M129210

3-BODY DECAYS

VALUE (MeV)

DOCUMENT ID

TECN

COMMENT

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

42±16

² ALEEV 93 BIS2 $K(3100) \rightarrow \Lambda\bar{p}\pi^+$

36±15

² ALEEV 93 BIS2 $K(3100) \rightarrow \bar{\Lambda}p\pi^-$

50±18

² ALEEV 93 BIS2 $K(3100) \rightarrow \Lambda\bar{p}\pi^-$

30±15

² ALEEV 93 BIS2 $K(3100) \rightarrow \bar{\Lambda}p\pi^+$

NODE=M129W1

NODE=M129W1

OCCUR=2

OCCUR=3

OCCUR=4

4-BODY DECAYS

VALUE (MeV)

CL%

DOCUMENT ID

TECN

COMMENT

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

22± 8

² ALEEV 93 BIS2 $K(3100) \rightarrow \Lambda\bar{p}\pi^+\pi^+$

28±12

² ALEEV 93 BIS2 $K(3100) \rightarrow \Lambda\bar{p}\pi^+\pi^-$

32±15

² ALEEV 93 BIS2 $K(3100) \rightarrow \bar{\Lambda}p\pi^-\pi^-$

30±15

² ALEEV 93 BIS2 $K(3100) \rightarrow \bar{\Lambda}p\pi^-\pi^+$

<30 90

BOURQUIN 86 SPEC $K(3100) \rightarrow \Lambda\bar{p}\pi^+\pi^+$

<80 90

BOURQUIN 86 SPEC $K(3100) \rightarrow \Lambda\bar{p}\pi^+\pi^-$

NODE=M129W2

NODE=M129W2

OCCUR=2

OCCUR=3

OCCUR=4

OCCUR=2

5-BODY DECAYS

VALUE (MeV)

CL%

DOCUMENT ID

TECN

COMMENT

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

<30

90

BOURQUIN 86 SPEC $K(3100) \rightarrow \Lambda\bar{p}\pi^+\pi^+\pi^-$ ²Supersedes ALEEV 90.

NODE=M129W3

NODE=M129W3

NODE=M129W;LINKAGE=A

K(3100) DECAY MODES

NODE=M129215;NODE=M129

Mode	
Γ_1	$K(3100)^0 \rightarrow \Lambda \bar{p} \pi^+$
Γ_2	$K(3100)^{--} \rightarrow \Lambda \bar{p} \pi^-$
Γ_3	$K(3100)^- \rightarrow \Lambda \bar{p} \pi^+ \pi^-$
Γ_4	$K(3100)^+ \rightarrow \Lambda \bar{p} \pi^+ \pi^+$
Γ_5	$K(3100)^0 \rightarrow \Lambda \bar{p} \pi^+ \pi^+ \pi^-$
Γ_6	$K(3100)^0 \rightarrow \Sigma(1385)^+ \bar{p}$

DESIG=1

DESIG=2

DESIG=3

DESIG=4

DESIG=5

DESIG=6

$\Gamma(\Sigma(1385)^+ \bar{p})/\Gamma(\Lambda \bar{p} \pi^+)$					Γ_6/Γ_1
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
<0.04	90	ALEEV	93	BIS2	$K(3100)^0 \rightarrow \Sigma(1385)^+ \bar{p}$

NODE=M129R1

NODE=M129R1

K(3100) REFERENCES

NODE=M129

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+)

REFID=43668

REFID=41743

REFID=42173

REFID=22928

CHARMED MESONS

($C = \pm 1$)

$$D^+ = c\bar{d}, D^0 = c\bar{u}, \bar{D}^0 = \bar{c}u, D^- = \bar{c}d, \text{ similarly for } D^{*'}\text{'s}$$

NODE=MXXX035

NODE=MXXX035

 $D^*(2007)^0$

$$I(J^P) = \frac{1}{2}(1^-)$$

I, J, P need confirmation.

J consistent with 1, value 0 ruled out (NGUYEN 77).

NODE=M061

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

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
2006.99±0.15 OUR FIT			
[2006.98 ± 0.15 MeV OUR 2012 FIT]			

NODE=M061M

NEW

• • • 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;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
142.12±0.07 OUR FIT				
142.12±0.07 OUR AVERAGE				

NODE=M061DM

142.2 ±0.3 ±0.2	145	ALBRECHT	95F	ARG	$e^+e^- \rightarrow \text{hadrons}$
142.12±0.05±0.05	1176	BORTOLETTO	92B	CLE2	$e^+e^- \rightarrow \text{hadrons}$

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

142.2 ±2.0 SADROZINSKI 80 CBAL $D^{*0} \rightarrow D^0 \pi^0$

142.7 ±1.7 ² GOLDHABER 77 MRK1 e^+e^-

²From simultaneous fit to $D^*(2010)^+$, $D^*(2007)^0$, D^+ , and D^0 .

NODE=M061DM;LINKAGE=G

$D^*(2007)^0$ WIDTH

VALUE (MeV)	CL%	DOCUMENT ID	TECN	COMMENT
<2.1	90	³ ABACHI	88B HRS	$D^{*0} \rightarrow D^+ \pi^-$

³ Assuming $m_{D^{*0}} = 2007.2 \pm 2.1 \text{ MeV}/c^2$.

NODE=M061W

NODE=M061W

NODE=M061W;LINKAGE=A

$D^*(2007)^0$ DECAY MODES

$\bar{D}^*(2007)^0$ modes are charge conjugates of modes below.

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad D^0 \pi^0$	(61.9 $\pm$ 2.9) %
$\Gamma_2 \quad D^0 \gamma$	(38.1 $\pm$ 2.9) %

NODE=M061220;NODE=M061

NODE=M061

DESIG=1

DESIG=2

CONSTRAINED FIT INFORMATION

An overall fit to a branching ratio uses 3 measurements and one constraint to determine 2 parameters. The overall fit has a $\chi^2 = 0.5$ 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	-100
x_1	

$D^*(2007)^0$ BRANCHING RATIOS

NODE=M061225

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

Γ_1/Γ_2

VALUE	DOCUMENT ID	TECN	COMMENT
1.74$\pm$0.02$\pm$0.13	AUBERT,BE	05G BABR	10.6 $e^+ e^- \rightarrow$ hadrons

NODE=M061R3
NODE=M061R3

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

Γ_1/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.619$\pm$0.029 OUR FIT				

NODE=M061R2
NODE=M061R2

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

0.635 $\pm$ 0.003 $\pm$ 0.017	69k	⁴ AUBERT,BE	05G BABR	10.6 $e^+ e^- \rightarrow$ hadrons
0.596 $\pm$ 0.035 $\pm$ 0.028	858	⁵ ALBRECHT	95F ARG	$e^+ e^- \rightarrow$ hadrons
0.636 $\pm$ 0.023 $\pm$ 0.033	1097	⁵ BUTLER	92 CLE2	$e^+ e^- \rightarrow$ hadrons

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

Γ_2/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.381$\pm$0.029 OUR FIT				
0.381$\pm$0.029 OUR AVERAGE				

NODE=M061R1
NODE=M061R1

0.404 $\pm$ 0.035 $\pm$ 0.028	456	⁵ ALBRECHT	95F ARG	$e^+ e^- \rightarrow$ hadrons
0.364 $\pm$ 0.023 $\pm$ 0.033	621	⁵ BUTLER	92 CLE2	$e^+ e^- \rightarrow$ hadrons
0.37 $\pm$ 0.08 $\pm$ 0.08		ADLER	88D MRK3	$e^+ e^-$
0.365 $\pm$ 0.003 $\pm$ 0.017	68k	⁴ AUBERT,BE	05G BABR	10.6 $e^+ e^- \rightarrow$ hadrons
0.47 $\pm$ 0.23		LOW	87 HRS	29 GeV $e^+ e^-$
0.53 $\pm$ 0.13		BARTEL	85G JADE	$e^+ e^-$, hadrons
0.47 $\pm$ 0.12		COLES	82 MRK2	$e^+ e^-$
0.45 $\pm$ 0.15		GOLDHABER	77 MRK1	$e^+ e^-$

⁴ 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%

⁵ 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

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=50942
REFID=44374
REFID=43116
REFID=43170
REFID=40584
REFID=40579
REFID=40017
REFID=22880
REFID=22866
REFID=22877
REFID=11434
REFID=11543

 $D^*(2010)^\pm$

$$I(J^P) = \frac{1}{2}(1^-)$$

I, J, P need confirmation.

NODE=M062

 $D^*(2010)^\pm$ 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

2010.29±0.13 OUR FIT

[2010.28 ± 0.13 MeV OUR 2012 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

NEW

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

140.66±0.10 OUR FIT Error includes scale factor of 1.1.**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

145.421±0.010 OUR FIT Error includes scale factor of 1.1.**145.421±0.010 OUR AVERAGE**

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	$D^{*\pm} \rightarrow D^0 \pi^\pm \rightarrow (K \pi) \pi^\pm$
145.42 ±0.05		³ BREITWEG 99	ZEUS	$D^{*\pm} \rightarrow D^0 \pi^\pm \rightarrow (K^- 3 \pi) \pi^\pm$
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	$D^{*0} \rightarrow K^- 3 \pi,$
145.4 ±0.2	48	⁴ DERRICK 95	ZEUS	$D^{*0} \rightarrow K^- \pi^+$
145.39 ±0.06 ±0.03		BARLAG 92B	ACCM	$\pi^- 230$ 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	$D^{*\pm} \rightarrow D^0 \pi^\pm$
145.5 ±0.3	60	FITCH 81	SPEC	$\pi^- A$
145.3 ±0.5	30	FELDMAN 77B	MRK1	$D^{*+} \rightarrow D^0 \pi^+$

NODE=M062DM

OCCUR=2

OCCUR=2

OCCUR=2

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

145.44 ± 0.09	122	⁴ BREITWEG	97B	ZEUS	$D^{*\pm} \rightarrow D^0 \pi^{\pm},$ $D^0 \rightarrow K^- \pi^+$
145.8 ± 1.5	16	AHLEN	83	HRS	$D^{*+} \rightarrow D^0 \pi^+$
145.1 ± 1.8	12	BAILEY	83	SPEC	$D^{*\pm} \rightarrow D^0 \pi^{\pm}$
145.1 ± 0.5	14	BAILEY	83	SPEC	$D^{*\pm} \rightarrow D^0 \pi^{\pm}$
145.5 ± 0.5	14	YELTON	82	MRK2	$29 e^+ e^- \rightarrow K^- \pi^+$
~ 145.5		AVERY	80	SPEC	γA
145.2 ± 0.6	2	BLIETSCHAU	79	BEBC	νp

³ Statistical errors only.

⁴ Systematic error not evaluated.

OCCUR=3

NODE=M062DM;LINKAGE=AV

NODE=M062DM;LINKAGE=A

$m_{D^*(2010)^+} - m_{D^*(2007)^0}$

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.

NODE=M062EM

NODE=M062EM

NODE=M062EM;LINKAGE=P

$D^*(2010)^{\pm}$ WIDTH

VALUE (keV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT

96 ± 4 ± 22

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. • • •

<131	90	110	BARLAG	92B	ACCM π^- 230 GeV

NODE=M062W

NODE=M062W

$D^*(2010)^{\pm}$ DECAY MODES

$D^*(2010)^-$ modes are charge conjugates of the modes below.

NODE=M062225;NODE=M062

NODE=M062

Mode	Fraction (Γ_i/Γ)
Γ_1 $D^0 \pi^+$	(67.7 ± 0.5) %
Γ_2 $D^+ \pi^0$	(30.7 ± 0.5) %
Γ_3 $D^+ \gamma$	(1.6 ± 0.4) %

DESIG=1

DESIG=3

DESIG=2

CONSTRAINED FIT INFORMATION

An overall fit to 3 branching ratios uses 6 measurements and one constraint to determine 3 parameters. The overall fit has a $\chi^2 = 0.3$ for 4 degrees of freedom.

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

x_2	-62	
x_3	-43	-44
	x_1	x_2

$D^*(2010)^+$ BRANCHING RATIOS

NODE=M062230

$\Gamma(D^0 \pi^+) / \Gamma_{\text{total}}$	DOCUMENT ID	TECN	COMMENT	Γ_1/Γ

VALUE

0.677 ± 0.005 OUR FIT

0.677 ± 0.006 OUR AVERAGE

0.6759 ± 0.0029 ± 0.0064	^{6,7,8} BARTELT	98	CLE2	$e^+ e^-$
0.688 ± 0.024 ± 0.013	ALBRECHT	95F	ARG	$e^+ e^- \rightarrow \text{hadrons}$
0.681 ± 0.010 ± 0.013	⁶ BUTLER	92	CLE2	$e^+ e^- \rightarrow \text{hadrons}$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.57 ± 0.04 ± 0.04	ADLER	88D	MRK3	$e^+ e^-$
0.44 ± 0.10	COLES	82	MRK2	$e^+ e^-$
0.6 ± 0.15	⁸ 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 ± 0.005 OUR FIT					
0.3073 ± 0.0013 ± 0.0062	6,7,8	BARTELT	98	CLE2	e^+e^-
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.312 ± 0.011 ± 0.008	1404	ALBRECHT	95F	ARG	$e^+e^- \rightarrow$ hadrons
0.308 ± 0.004 ± 0.008	410	⁶ BUTLER	92	CLE2	$e^+e^- \rightarrow$ hadrons
0.26 ± 0.02 ± 0.02		ADLER	88D	MRK3	e^+e^-
0.34 ± 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		6,7	BARTELT	98	CLE2 e^+e^-
0.011 ± 0.014 ± 0.016	12	⁶ 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		⁹ COLES	82	MRK2	e^+e^-

NODE=M062R2
NODE=M062R2

⁶ The branching ratios are not independent, they have been constrained by the authors to sum to 100%.

⁷ Systematic error includes theoretical error on the prediction of the ratio of hadronic modes.

⁸ Assuming that isospin is conserved in the decay.

⁹ 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

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=11434
REFID=11435

$D_0^*(2400)^0$

$$I(J^P) = \frac{1}{2}(0^+)$$

$J^P = 0^+$ assignment favored (ABE 04D).

NODE=M178

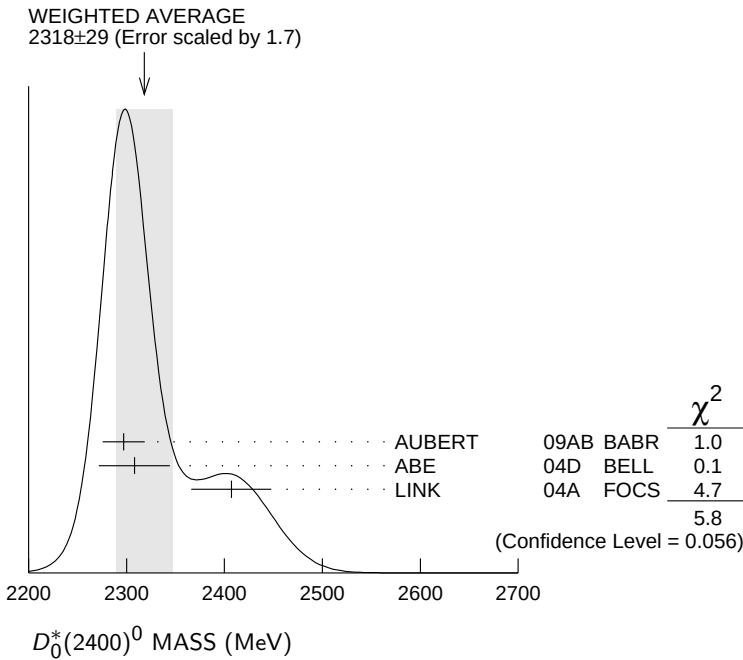
NODE=M178

NODE=M178M

NODE=M178M

$D_0^*(2400)^0$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2318±29 OUR AVERAGE Error includes scale factor of 1.7. See the ideogram below.				
2297± 8±20	3.4k	AUBERT	09AB BABR	$B^- \rightarrow D^+ \pi^- \pi^-$
2308±17±32		ABE	04D BELL	$B^- \rightarrow D^+ \pi^- \pi^-$
2407±21±35	9.8k	LINK	04A FOCS	γ A



$D_0^*(2400)^0$ WIDTH

NODE=M178W

NODE=M178W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
267±40 OUR AVERAGE				
273±12±48	3.4k	AUBERT	09AB BABR	$B^- \rightarrow D^+ \pi^- \pi^-$
276±21±63		ABE	04D BELL	$B^- \rightarrow D^+ \pi^- \pi^-$
240±55±59	9.8k	LINK	04A FOCS	γ A

$D_0^*(2400)^0$ DECAY MODES

NODE=M178215;NODE=M178

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad D^+ \pi^-$	seen

DESIG=1;OUR EVAL;→ UNCHECKED ←

$D_0^*(2400)^0$ 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

$D_0^*(2400)^\pm$

$$I(J^P) = \frac{1}{2}(0^+)$$

OMITTED FROM SUMMARY TABLE

 J, P need confirmation. $D_0^*(2400)^\pm$ MASS

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
2403 ± 14 ± 35	18.8k	LINK	04A	FOCS γ A

 $D_0^*(2400)^\pm$ WIDTH

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
283 ± 24 ± 34	18.8k	LINK	04A	FOCS γ A

 $D_0^*(2400)^\pm$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad D^0 \pi^+$	seen

 $D_0^*(2400)^\pm$ REFERENCES

LINK	04A	PL B586 11	J.M. Link <i>et al.</i>	(FOCUS Collab.)

 $D_1(2420)^0$

$$I(J^P) = \frac{1}{2}(1^+)$$

I needs confirmation.

 $D_1(2420)^0$ MASS

The fit includes $D^\pm, D^0, D_s^\pm, D^{*\pm}, D^{*0}, D_s^{*\pm}, D_1(2420)^0, D_2^*(2460)^0$, and $D_{s1}(2536)^\pm$ mass and mass difference measurements.

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
2421.4 ± 0.6 OUR FIT	Error includes scale factor of 1.2.	[2421.3 ± 0.6 MeV OUR 2012 FIT Scale factor = 1.2]		
2421.1 ± 0.7 OUR AVERAGE	Error includes scale factor of 1.2.	[2420.9 ± 0.8 MeV OUR 2012 AVERAGE Scale factor = 1.2]		

2423.1 ± 1.5 ^{+0.4} _{-1.0}	2.7k	¹ 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		² 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	³ 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	⁴ ABREU	98M	DLPH $e^+ e^-$

¹ From the combined fit of the $M(D^+ \pi^-)$ and $M(D^{*+} \pi^-)$ distributions. and A_{D_2} fixed to the theoretical prediction of -1.

² Fit includes the contribution from $D_1^*(2430)^0$.

³ 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.

⁴ No systematic error given.

NODE=M179

NODE=M179

NODE=M179M

NODE=M179M

NODE=M179W

NODE=M179W

NODE=M179215;NODE=M179

DESIG=1;OUR EVAL;→ UNCHECKED ←

NODE=M179

REFID=49775

NODE=M097

NODE=M097M

NODE=M097M

NODE=M097M

NEW

NEW

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 $D^\pm, D^0, D_S^\pm, D^{*\pm}, D^{*0}, D_S^{*0}, D_1(2420)^0, D_2^*(2460)^0$,
and $D_{S1}(2536)^\pm$ mass and mass difference measurements.

NODE=M097DM

NODE=M097DM

NODE=M097DM
NEW

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
411.1±0.6 OUR FIT	Error includes scale factor of 1.2.	[411.0 ± 0.6 OUR 2012 FIT		Scale factor = 1.2]
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
27.4± 2.5 OUR AVERAGE	Error includes scale factor of 2.3. See the ideogram below.	[27.1 ± 2.7 MeV OUR 2012 AVERAGE		Scale factor = 2.4]
38.8± 5.0 ^{+1.9} _{-5.4}	2.7k	⁵ 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		⁶ ABE	04D BELL	$B^- \rightarrow D^{*+} \pi^- \pi^-$
20 ⁺⁶ ₋₅ ± 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 ⁺⁸ ₋₆ ⁺¹⁰ ₋₃	279	AVERY	90 CLEO	$e^+ e^- \rightarrow D^{*+} \pi^- X$
13 ± 6 ⁺¹⁰ ₋₅	171	ALBRECHT	89H ARG	$e^+ e^- \rightarrow D^{*+} \pi^- X$

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

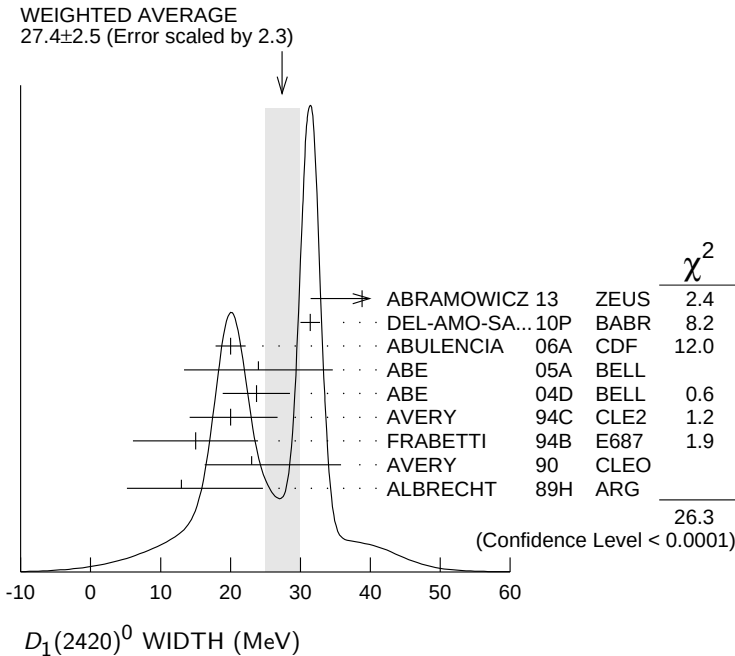
53.2± 7.2 ^{+3.3} _{-4.9}	3110 ± 340	CHEKANOV	09 ZEUS	$e^\pm p \rightarrow D^{*+} \pi^- X$
58 ±14 ±10	171	ANJOS	89C TPS	$\gamma N \rightarrow D^{*+} \pi^- X$

⁵ From the combined fit of the $M(D^+ \pi^-)$ and $M(D^{*+} \pi^-)$ distributions. and A_{D_2} fixed to the theoretical prediction of -1.

⁶ Fit includes the contribution from $D_1^*(2430)^0$.

NODE=M097W;LINKAGE=AR

NODE=M097W;LINKAGE=AB



$D_1(2420)^0$ 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 $D_0^{*+}(2400)\pi^-$	
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 $\gamma N \rightarrow D^{*+}\pi^-X$

$\Gamma(D^+\pi^-)/\Gamma(D^{*+}(2010)\pi^-)$	Γ_6/Γ_1
VALUE	CL% DOCUMENT ID TECN COMMENT
<0.24	90 AVERY 90 CLEO $e^+e^- \rightarrow D^+\pi^-X$

NODE=M097220

NODE=M097R1

NODE=M097R1

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				
[5.72 ± 0.25 OUR 2012 AVERAGE]				
7.8 $^{+6.7}_{-2.7}$ $^{+4.6}_{-1.8}$	2.7k	⁷ 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. • • •				
3.8 ±0.6 ±0.8		⁸ AUBERT 09Y	BABR	$B^+ \rightarrow D_1^0 \ell^+ \nu_\ell$
2.74 $^{+1.40}_{-0.93}$		⁹ AVERY 94C	CLE2	$e^+e^- \rightarrow D^{*+}\pi^-X$

NODE=M097PAH

NEW

⁷ 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.

⁸ 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.

⁹ Systematic uncertainties not estimated.

NODE=M097PAH;LINKAGE=AR

NODE=M097PAH;LINKAGE=AU

NODE=M097PAH;LINKAGE=AV

 $D_1(2420)^0$ REFERENCES

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=54743

REFID=53534

REFID=52929

REFID=52733

REFID=51054

REFID=50755

REFID=50011

REFID=46315

REFID=45788

REFID=44096

REFID=43687

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

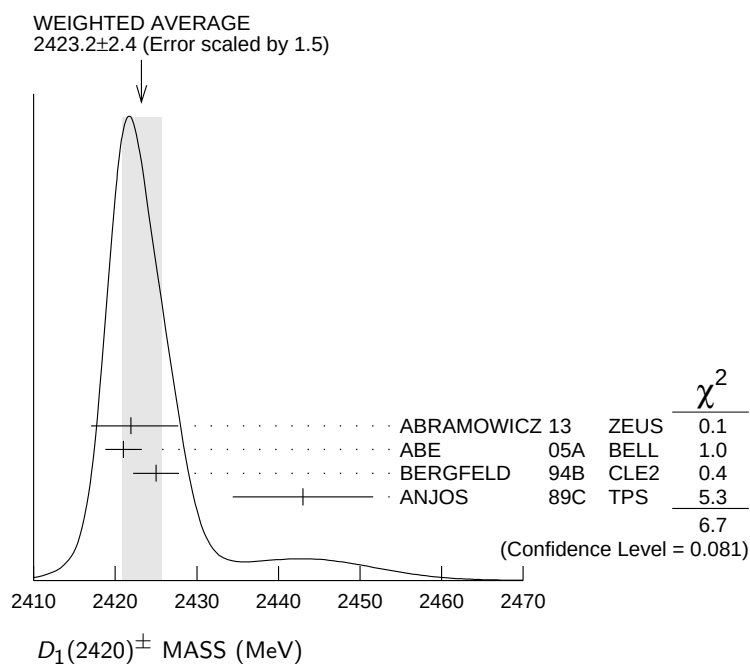
 $D_1(2420)^\pm$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2423.2 ± 2.4 OUR AVERAGE		Error includes scale factor of 1.5. See the ideogram below.		
$[2423.4 \pm 3.1$ MeV OUR 2012 AVERAGE		Scale factor = 1.8]		

2421.9 ± 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.

NODE=M120M;LINKAGE=AB

 **$m_{D_1^*(2420)^\pm} = m_{D_1^*(2420)^0}$**

NODE=M120DM

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$4^{+2}_{-3} \pm 3$	BERGFELD	94B CLE2	$e^+ e^- \rightarrow \text{hadrons}$

NODE=M120DM

 $D_1(2420)^\pm$ WIDTH

NODE=M120W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
25 ± 6 OUR AVERAGE				
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

$D_1(2420)^\pm$ 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 $D_0^*(2400)^0 \pi^+$	
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
<u>VALUE</u>	<u>DOCUMENT ID</u> <u>TECN</u> <u>COMMENT</u>
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
<u>VALUE</u> <u>CL%</u> <u>DOCUMENT ID</u> <u>TECN</u> <u>COMMENT</u>	
• • • 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 $A_{D_1} = 3$.

NODE=M120PAH

NODE=M120PAH

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

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;LINKAGE=AU

 $D_1(2420)^\pm$ REFERENCES

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=54743

REFID=52929

REFID=50755

REFID=44099

REFID=40737

$D_1(2430)^0$

$$I(J^P) = \frac{1}{2}(1^+)$$

OMITTED FROM SUMMARY TABLE

 $J = 1^+$ assignment favored (ABE 04D). $D_1(2430)^0$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$2427 \pm 26 \pm 25$	ABE	04D	BELL $B^- \rightarrow D^{*+} \pi^- \pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
2477 ± 28	¹ AUBERT	06L	BABR $\bar{B}^0 \rightarrow D^{*+} \omega \pi^-$
¹ Systematic errors not estimated.			

 $D_1(2430)^0$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$384^{+107}_{-75} \pm 74$	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 $\bar{B}^0 \rightarrow D^{*+} \omega \pi^-$
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

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),

 $D_2^*(2460)^0$ MASS

The fit includes $D^\pm$, D^0 , $D_s^\pm$, D^{*0} , D_s^{*0} , $D_1(2420)^0$, $D_2^*(2460)^0$, and $D_{s1}(2536)^\pm$ mass and mass difference measurements.

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2462.6 ± 0.6 OUR FIT	Error includes scale factor of 1.2.	[2462.6 $\pm$ 0.7 MeV OUR 2012 FIT Scale factor = 1.3]		
2461.8 ± 0.7 OUR AVERAGE	Error includes scale factor of 1.1.	[2461.8 $\pm$ 0.8 MeV OUR 2012 AVERAGE Scale factor = 1.2]		
$2462.5 \pm 2.4^{+1.3}_{-1.1}$	2.3k	¹ 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 $B^- \rightarrow D^+ \pi^- \pi^-$
$2461.6 \pm 2.1 \pm 3.3$		² ABE	04D	BELL $B^- \rightarrow D^+ \pi^- \pi^-$
$2464.5 \pm 1.1 \pm 1.9$	5.8k	² LINK	04A	FOCS 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 $\gamma N \rightarrow D^+ \pi^- X$

NODE=M180

NODE=M180

NODE=M180M

NODE=M180M

NODE=M180M;LINKAGE=AU

NODE=M180W

NODE=M180W

NODE=M180W;LINKAGE=AU

NODE=M180215;NODE=M180

DESIG=1;OUR EVAL;→ UNCHECKED ←

NODE=M180

REFID=51140
REFID=50011

NODE=M119

NODE=M119

NODE=M119M

NODE=M119M

NODE=M119M
NEW

NEW

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

2469.1 $\pm$ 3.7 $^{+1.2}_{-1.3}$	1560 $\pm$ 230	³ 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	⁴ ABREU	98M	DLPH	$e^{+}e^{-}$
2466 $\pm$ 7	1	ASRATYAN	95	BEBC	53,40 $\nu(\bar{\nu}) \rightarrow pX, dX$

¹ From the combined fit of the $M(D^{+}\pi^{-})$ and $M(D^{*+}\pi^{-})$ distributions. and A_{D_2} fixed to the theoretical prediction of -1 .

² Fit includes the contribution from $D_0^{*}(2400)^0$.

³ 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.

⁴ No systematic error given.

NODE=M119M;LINKAGE=AR

NODE=M119M;LINKAGE=LI

NODE=M119M;LINKAGE=CH

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
593.0$\pm$0.6 OUR FIT	Error includes scale factor of 1.3.	[593.0 $\pm$ 0.7 MeV OUR 2012 FIT Scale factor = 1.3]		
593.9$\pm$0.6$\pm$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
452.3$\pm$0.6 OUR FIT	Error includes scale factor of 1.3.	[452.3 $\pm$ 0.7 MeV OUR 2012 FIT Scale factor = 1.3]		
458.8$\pm$3.7$^{+1.2}_{-1.3}$	1560 $\pm$ 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
49.0$\pm$1.3 OUR AVERAGE	Error includes scale factor of 1.5. See the ideogram below.	[49.0 $\pm$ 1.4 MeV OUR 2012 AVERAGE Scale factor = 1.7]		

NODE=M119W

NEW

46.6 $\pm$ 8.1 $^{+5.9}_{-3.8}$	2.3k	⁵ ABRAMOWICZ13	ZEUS	$e^{\pm}p \rightarrow D^{(*)+}\pi^{-}X$
50.5 $\pm$ 0.6 $\pm$ 0.7	243k	DEL-AMO-SA...10P	BABR	$e^{+}e^{-} \rightarrow D^{+}\pi^{-}X$
41.8 $\pm$ 2.5 $\pm$ 2.9	3.4k	AUBERT	09AB BABR	$B^{-} \rightarrow D^{+}\pi^{-}\pi^{-}$
49.2 $\pm$ 2.3 $\pm$ 1.3	20k	ABULENCIA	06A CDF	1900 $p\bar{p} \rightarrow D^{+}\pi^{-}X$
45.6 $\pm$ 4.4 $\pm$ 6.7		⁶ ABE	04D BELL	$B^{-} \rightarrow D^{+}\pi^{-}\pi^{-}$
38.7 $\pm$ 5.3 $\pm$ 2.9	5.8k	⁶ LINK	04A FOCS	γA
28 $^{+8}_{-7}$ $\pm$ 6	486	AVERY	94C CLE2	$e^{+}e^{-} \rightarrow D^{+}\pi^{-}X$
25 $\pm$ 10 $\pm$ 5	128	FRABETTI	94B E687	$\gamma Be \rightarrow D^{+}\pi^{-}X$
20 $^{+9}_{-12}$ $^{+9}_{-10}$	440	AVERY	90 CLEO	$e^{+}e^{-} \rightarrow D^{*+}\pi^{-}X$
15 $^{+13}_{-10}$ $^{+5}_{-10}$	337	ALBRECHT	89B ARG	$e^{+}e^{-} \rightarrow D^{+}\pi^{-}X$
20 $\pm$ 10 $\pm$ 5	153	ANJOS	89C TPS	$\gamma N \rightarrow D^{+}\pi^{-}X$

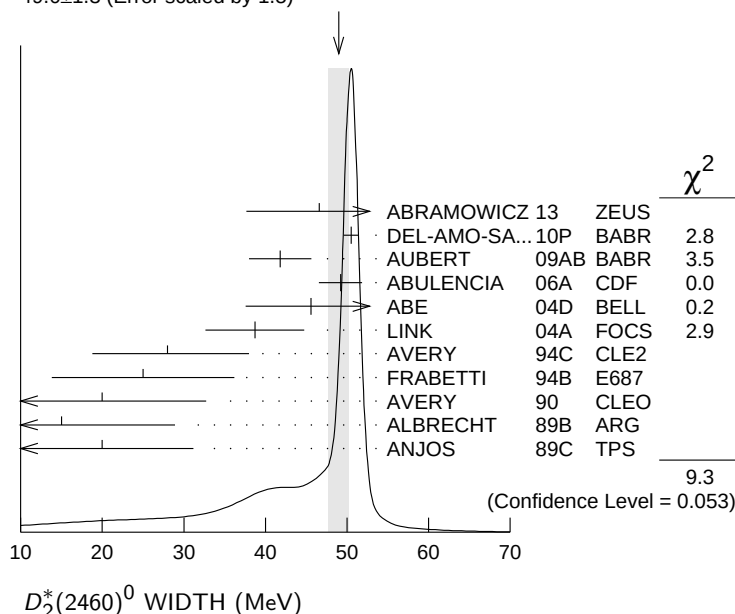
⁵ From the combined fit of the $M(D^{+}\pi^{-})$ and $M(D^{*+}\pi^{-})$ distributions. and A_{D_2} fixed to the theoretical prediction of -1 .

⁶ Fit includes the contribution from $D_0^{*}(2400)^0$.

NODE=M119W;LINKAGE=AR

NODE=M119W;LINKAGE=LI

WEIGHTED AVERAGE
49.0±1.3 (Error scaled by 1.5)



$D_2^*(2460)^0$ DECAY MODES

$\bar{D}_2^*(2460)^0$ modes are charge conjugates of modes below.

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

NODE=M119215;NODE=M119

NODE=M119

CLUMP=A;DESIG=1

DESIG=2

DESIG=3;OUR EST;→ UNCHECKED ←

DESIG=4;OUR EST;→ UNCHECKED ←

$D_2^*(2460)^0$ BRANCHING RATIOS

$\Gamma(D^+ \pi^-)/\Gamma_{\text{total}}$				Γ_1/Γ	
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
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=M119220

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					
[1.56 ± 0.16 OUR 2012 AVERAGE]					

NODE=M119R3
NODE=M119R3
NEW

1.4 ±0.3 ±0.3	2.3k	⁷ 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	$e^+ e^- \rightarrow D^* \pi^- X$	
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
1.9 ±0.5		ABE	04D BELL	$B^- \rightarrow D^{(*)+} \pi^- \pi^-$	

⁷ 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

$$\frac{\Gamma(D^+\pi^-)}{[\Gamma(D^+\pi^-) + \Gamma(D^*(2010)^+\pi^-)]} \quad \Gamma_1/(\Gamma_1+\Gamma_2)$$

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	⁸ AUBERT	09Y BABR	$B^+ \rightarrow D_2^{*0} \ell^+ \nu_\ell$

⁸ 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
NODE=M119R01

NODE=M119R01;LINKAGE=AU

$D_2^*(2460)^0$ POLARIZATION AMPLITUDE A_{D_2}

A polarization amplitude A_{D_2} is a parameter that depends on the initial polarization of the D_2 . For $\bar{D}_2$ 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

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	⁹ 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}		¹⁰ AVERY	94C CLE2	$e^+ e^- \rightarrow D^{*+} \pi^- X$

⁹ From the combined fit of the $M(D^+ \pi^-)$ and $M(D^{*+} \pi^-)$ distributions.

¹⁰ Systematic uncertainties not estimated.

NODE=M119PAM

NODE=M119PAM;LINKAGE=AB
NODE=M119PAM;LINKAGE=AV

$D_2^*(2460)^0$ REFERENCES

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.)

NODE=M119

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

NEW

$D_2^*(2460)^\pm$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2464.3±1.6 OUR AVERAGE		Error includes scale factor of 1.7. See the ideogram below.		
[2464.4 ± 1.9 MeV OUR 2012 AVERAGE Scale factor = 1.9]				

2460.6±4.4 ^{+3.6} _{-0.8}	1371	¹ ABRAMOWICZ13	ZEUS	$e^\pm p \rightarrow D(*)^0 \pi^+ X$
2465.4±0.2±1.1	111k	² DEL-AMO-SA...10P	BABR	$e^+ e^- \rightarrow D^0 \pi^+ X$
2465.7±1.8 ^{+1.4} _{-4.8}	2909	KUZMIN	07	BELL $e^+ e^- \rightarrow$ hadrons
2463 ±3 ±3	310	BERGFELD	94B	CLE2 $e^+ e^- \rightarrow D^0 \pi^+ X$
2453 ±3 ±2	185	FRABETTI	94B	E687 $\gamma Be \rightarrow D^0 \pi^+ X$
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. • • •

2467.6±1.5±0.8	3.5k	³ LINK	04A	FOCS γA

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.

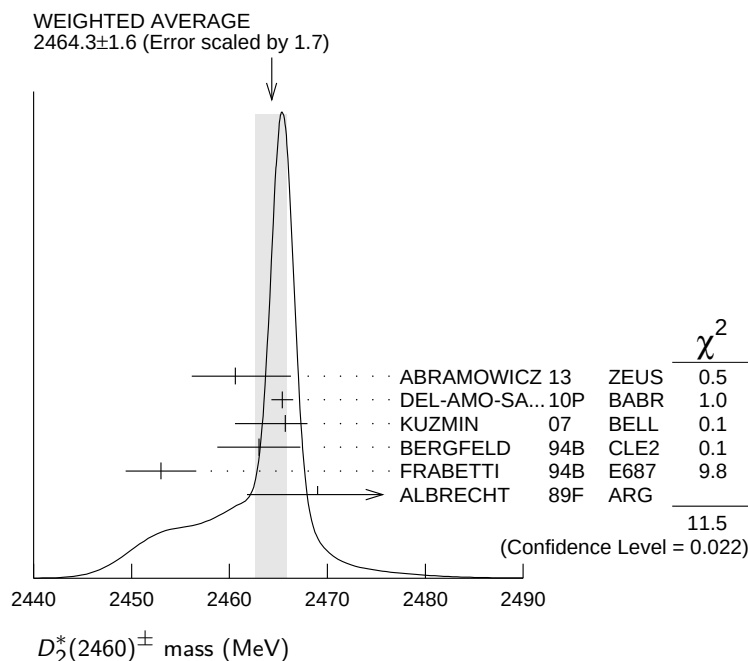
² At a fixed width of 50.5 MeV.

³ Fit includes the contribution from $D_0^*(2400)^\pm$. Not independent of the corresponding mass difference measurement, $(m_{D_2^*(2460)^\pm} - (m_{D_2^*(2460)^0})$.

NODE=M150M;LINKAGE=AB

NODE=M150M;LINKAGE=DE

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 $e^+ e^- \rightarrow$ hadrons
0 ±4	FRABETTI	94B	E687 $\gamma Be \rightarrow D \pi X$
14 ±5 ±8	ALBRECHT	89F	ARG $e^+ e^- \rightarrow D^0 \pi^+ X$

$D_2^*(2460)^\pm$ WIDTH

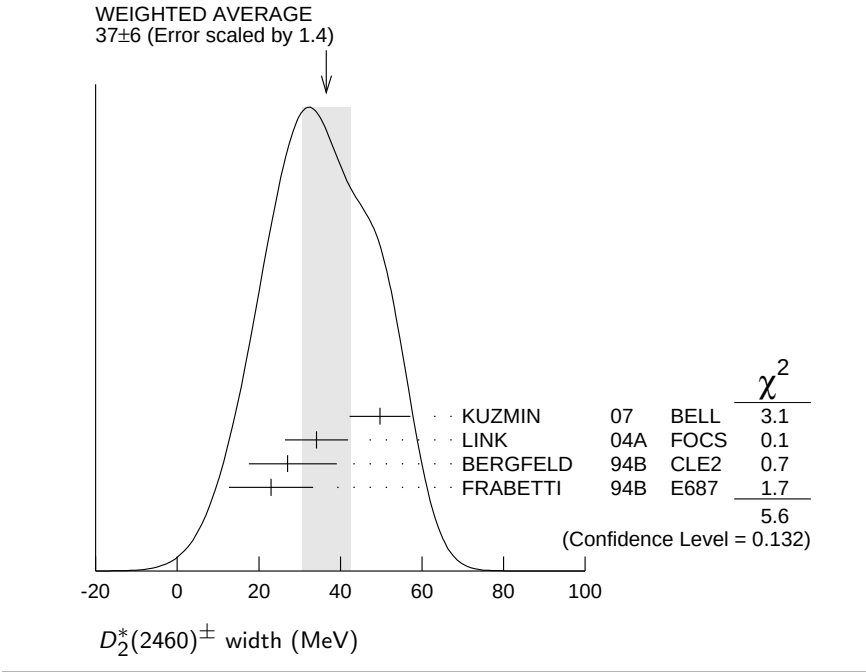
NODE=M150W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
37 ± 6 OUR AVERAGE	Error includes scale factor of 1.4. See the ideogram below.			
49.7 ± 3.8 ± 6.4	2909	KUZMIN	07	BELL $e^+e^- \rightarrow \text{hadrons}$
34.1 ± 6.5 ± 4.2	3.5k	⁴ LINK	04A	FOCS γA
27 ⁺¹¹ / ₋₈ ± 5	310	BERGFELD	94B	CLE2 $e^+e^- \rightarrow D^0\pi^+X$
23 ± 9 ± 5	185	FRABETTI	94B	E687 $\gamma Be \rightarrow D^0\pi^+X$

⁴ Fit includes the contribution from $D_0^*(2400)^\pm$.

NODE=M150W

NODE=M150W;LINKAGE=LI



$D_2^*(2460)^\pm$ 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;→ UNCHECKED ←
DESIG=3;OUR EST;→ UNCHECKED ←
DESIG=4;OUR EST;→ UNCHECKED ←

$D_2^*(2460)^\pm$ 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				
[1.9 ± 1.1 OUR 2012 AVERAGE]				

NODE=M150R2
NODE=M150R2
NEW

1.1 ± 0.4 ^{+0.3} / _{-0.2}	1371	⁵ ABRAMOWICZ13	ZEUS	$e^\pm p \rightarrow D^{(*)0}\pi^+X$
1.9 ± 1.1 ± 0.3		BERGFELD	94B	CLE2 $e^+e^- \rightarrow \text{hadrons}$

⁵ 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

$$\frac{\Gamma(D^0\pi^+)}{[\Gamma(D^0\pi^+) + \Gamma(D^{*0}\pi^+)]}$$

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

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

0.62±0.03±0.02 3361 ⁶ AUBERT 09Y BABR $\bar{B}^0 \rightarrow D_2^{*+} \ell^- \nu_\ell$

⁶ 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
NODE=M150R01

NODE=M150R01;LINKAGE=AU

$D_2^*(2460)^\pm$ REFERENCES

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.)

NODE=M150

REFID=54743
REFID=53534
REFID=52929
REFID=51854
REFID=49775
REFID=44099
REFID=43687
REFID=40736
REFID=40931

NODE=M198

$$D(2550)^0$$

$$I(J^P) = \frac{1}{2}(0^-)$$

OMITTED FROM SUMMARY TABLE
 $J^P = 0^-$ assignment based on the helicity analysis (DEL-AMO-SANCHEZ 10P).

NODE=M198

$D(2550)^0$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2539.4±4.5±6.8	34k	DEL-AMO-SA...10P	BABR	$e^+ e^- \rightarrow D^{*+} \pi^- X$

NODE=M198M

NODE=M198M

$D(2550)^0$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
130±12±13	34k	DEL-AMO-SA...10P	BABR	$e^+ e^- \rightarrow D^{*+} \pi^- X$

NODE=M198W

NODE=M198W

$D(2550)^0$ DECAY MODES

NODE=M198215;NODE=M198

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad D^{*+} \pi^-$	seen

DESIG=1;OUR EVAL;→ UNCHECKED ←

$D(2550)^0$ REFERENCES

DEL-AMO-SA... 10P	PR D82 111101	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)

NODE=M198

REFID=53534

D(2600)

$I(J^P) = \frac{1}{2}(?)^2$

OMITTED FROM SUMMARY TABLE
 J^P consistent with natural parity (DEL-AMO-SANCHEZ 10P).

D(2600) MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
2612 ±6 OUR AVERAGE		Error includes scale factor of 1.9.			
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	¹ DEL-AMO-SA...10P	BABR	+	$e^+e^- \rightarrow D^0\pi^+X$

¹ At a fixed width of 93 MeV.

D(2600) WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
93±6±13	26k	DEL-AMO-SA...10P	BABR	$e^+e^- \rightarrow D^+\pi^-X$

D(2600) DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad D\pi$	seen
$\Gamma_2 \quad D^+\pi^-$	seen
$\Gamma_3 \quad D^0\pi^\pm$	seen
$\Gamma_4 \quad D^*\pi$	seen
$\Gamma_5 \quad D^{*+}\pi^-$	seen

D(2600) 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	$e^+e^- \rightarrow D^{(*)+}\pi^-X$	

D(2600) REFERENCES

DEL-AMO-SA... 10P PR D82 111101 P. del Amo Sanchez *et al.* (BABAR Collab.)

NODE=M199

NODE=M199

NODE=M199M

NODE=M199M

OCCUR=2

NODE=M199M;LINKAGE=DE

NODE=M199W

NODE=M199W

NODE=M199215;NODE=M199

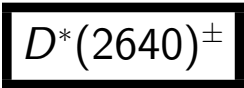
DESIG=1;OUR EVAL;→ UNCHECKED ←
DESIG=2;OUR EVAL;→ UNCHECKED ←
DESIG=3;OUR EVAL;→ UNCHECKED ←
DESIG=4;OUR EVAL;→ UNCHECKED ←
DESIG=5;OUR EVAL;→ UNCHECKED ←

NODE=M199220

NODE=M199R01
NODE=M199R01

NODE=M199

REFID=53534



$$I(J^P) = \frac{1}{2}(??)$$

OMITTED FROM SUMMARY TABLE
Seen in Z decays by ABREU 98M. Not seen by ABBIENDI 01N and
CHEKANOV 09. Needs confirmation.

NODE=M158

NODE=M158

$D^*(2640)^\pm$ MASS

NODE=M158M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2637±2±6	66 ± 14	ABREU	98M DLPH	$e^+e^- \rightarrow D^{*+}\pi^+\pi^-X$

NODE=M158M

$D^*(2640)^\pm$ WIDTH

NODE=M158W

VALUE (MeV)	CL%	DOCUMENT ID	TECN	COMMENT
<15	95	ABREU	98M DLPH	$e^+e^- \rightarrow D^{*+}\pi^+\pi^-X$

NODE=M158W

$D^*(2640)^+$ DECAY MODES

NODE=M158215;NODE=M158

$D^*(2640)^-$ modes are charge conjugates of modes below.

NODE=M158

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad D^*(2010)^+\pi^+\pi^-$	seen

DESIG=1;OUR EST;→ UNCHECKED ←

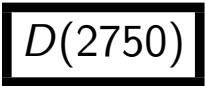
$D^*(2640)^\pm$ REFERENCES

NODE=M158

CHEKANOV 09 EPJ C60 25	S. Chekanov <i>et al.</i>	(ZEUS Collab.)
ABBIENDI 01N EPJ C20 445	G. Abbiendi <i>et al.</i>	(OPAL Collab.)
ABREU 98M PL B426 231	P. Abreu <i>et al.</i>	(DELPHI Collab.)

REFID=52733
REFID=48296
REFID=46315

NODE=M203



$$I(J^P) = \frac{1}{2}(??)$$

OMITTED FROM SUMMARY TABLE

NODE=M203M

NODE=M203M

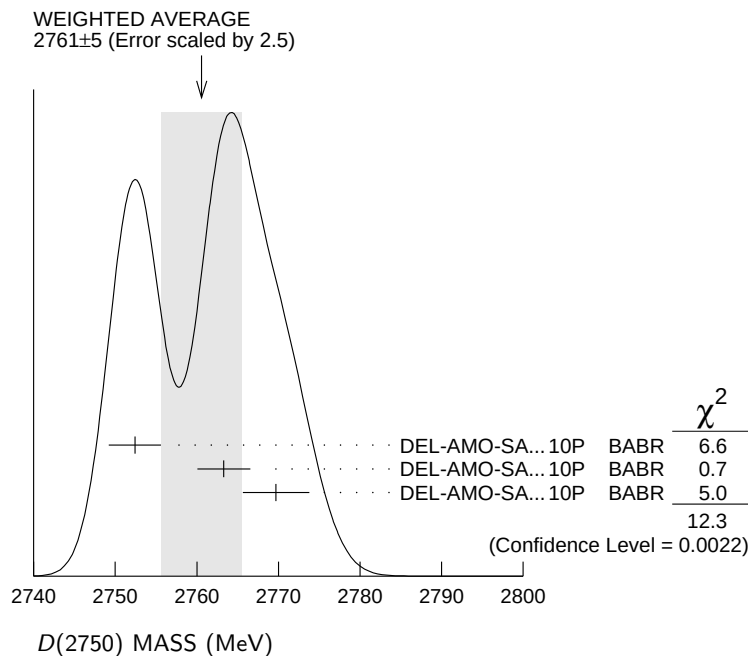
$D(2750)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
2761 ±5 OUR AVERAGE		Error includes scale factor of 2.5. See the ideogram below.			
2752.4±1.7±2.7	23.5k	¹ DEL-AMO-SA..10P	BABR	0	$e^+e^- \rightarrow D^{*+}\pi^-X$
2763.3±2.3±2.3	11.3k	¹ DEL-AMO-SA..10P	BABR	0	$e^+e^- \rightarrow D^+\pi^-X$
2769.7±3.8±1.5	5.7k	^{1,2} DEL-AMO-SA..10P	BABR	+	$e^+e^- \rightarrow D^0\pi^+X$

OCCUR=2
OCCUR=3

¹ The states observed in the $D^*\pi$ and $D\pi$ final states are not necessarily the same.
² At a fixed width of 60.9 MeV.

NODE=M203M;LINKAGE=DE
NODE=M203M;LINKAGE=DA



$D(2750)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
63 ±6 OUR AVERAGE				
71 ±6 ±11	23.5k	³ DEL-AMO-SA...10P	BABR	$e^+e^- \rightarrow D^{*+}\pi^- X$
60.9±5.1± 3.6	11.3k	³ DEL-AMO-SA...10P	BABR	$e^+e^- \rightarrow D^+\pi^- X$

³ The states observed in the $D^*\pi$ and $D\pi$ final states are not necessarily the same.

$D(2750)$ 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

$D(2750)$ BRANCHING RATIOS

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_2/Γ_5
0.42±0.05±0.11	34.8k	⁴ DEL-AMO-SA...10P	BABR	$e^+e^- \rightarrow D^{(*)+}\pi^- X$	

⁴ The states observed in the $D^*\pi$ and $D\pi$ final states are not necessarily the same.

$D(2750)$ POLARIZATION AMPLITUDE A_D

A polarization amplitude A_D is a parameter that depends on the initial polarization of the $D(2750)$. For $D(2750)$ 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 $D(2750) \rightarrow D^*\pi$ 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	⁵ DEL-AMO-SA...10P	BABR	$e^+e^- \rightarrow D^{*+}\pi^- X$

⁵ Systematic uncertainties not estimated. The states observed in the $D^*\pi$ and $D\pi$ final states are not necessarily the same.

$D(2750)$ REFERENCES

DEL-AMO-SA...10P PR D82 111101 P. del Amo Sanchez *et al.* (BABAR Collab.)

NODE=M203W

NODE=M203W

OCCUR=2

NODE=M203W;LINKAGE=DE

NODE=M203215;NODE=M203

DESIG=1;OUR EVAL;→ UNCHECKED ←
DESIG=2;OUR EVAL;→ UNCHECKED ←
DESIG=3;OUR EVAL;→ UNCHECKED ←
DESIG=4;OUR EVAL;→ UNCHECKED ←
DESIG=5;OUR EVAL;→ UNCHECKED ←

NODE=M203220

NODE=M203R01
NODE=M203R01

NODE=M203R01;LINKAGE=DE

NODE=M203PAM

NODE=M203PAM

NODE=M203PAM

NODE=M203PAM;LINKAGE=DE

NODE=M203

REFID=53534

CHARMED, STRANGE MESONS ($C = S = \pm 1$)

$$D_s^+ = c\bar{s}, D_s^- = \bar{c}s, \text{ similarly for } D_s^{*+}s$$

$$D_s^{*\pm}$$

$$I(J^P) = 0(?)^?$$

J^P is natural, width and decay modes consistent with 1^- .

$D_s^{*\pm}$ MASS

The fit includes $D_s^\pm, D_s^0, D_s^\pm, D^{*\pm}, D^{*0}, D_s^{*\pm}, D_1(2420)^0, D_2^*(2460)^0$, and $D_{s1}(2536)^\pm$ mass and mass difference measurements.

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
2112.3$\pm$0.5 OUR FIT	Error includes scale factor of 1.1.		
2106.6$\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 $D_s^\pm, D_s^0, D_s^\pm, D^{*\pm}, D^{*0}, D_s^{*\pm}, D_1(2420)^0, D_2^*(2460)^0$, 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 $e^+e^- \rightarrow \text{hadrons}$
• • • 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 $E_{\text{cm}}^{\text{ee}} = 10.2 \text{ GeV}$
• • • 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)
$\Gamma_1 \quad D_s^+ \gamma$	(94.2 $\pm$ 0.7) %
$\Gamma_2 \quad D_s^+ \pi^0$	(5.8 $\pm$ 0.7) %

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

CONSTRAINED FIT INFORMATION

An overall fit to a branching ratio uses 2 measurements and one constraint to determine 2 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.

$$x_2 \begin{vmatrix} & -100 \\ & x_1 \end{vmatrix}$$

D_s^{*+} BRANCHING RATIOS

NODE=S074220

$\Gamma(D_s^+ \gamma) / \Gamma_{\text{total}}$ Γ_1 / Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

0.942±0.007 OUR FIT

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

0.942±0.004±0.006	16k	³ AUBERT,BE	05G	BABR	10.6 $e^+ e^- \rightarrow$ hadrons
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		

NODE=S074R1

NODE=S074R1

$\Gamma(D_s^+ \pi^0) / \Gamma_{\text{total}}$ Γ_2 / Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

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

0.059±0.004±0.006	560	³ AUBERT,BE	05G	BABR	10.6 $e^+ e^- \rightarrow$ hadrons

NODE=S074R3

NODE=S074R3

$\Gamma(D_s^+ \pi^0) / \Gamma(D_s^+ \gamma)$ Γ_2 / Γ_1

VALUE	DOCUMENT ID	TECN	COMMENT

0.062±0.008 OUR FIT**0.062±0.008 OUR AVERAGE**

0.062±0.005±0.006	AUBERT,BE	05G	BABR	10.6 $e^+ e^- \rightarrow$ hadrons
0.062 $^{+0.020}_{-0.018}$ ±0.022	GRONBERG	95	CLE2	$e^+ e^-$

NODE=S074R2

NODE=S074R2

³Derived from the ratio $\Gamma(D_s^+ \pi^0) / \Gamma(D_s^+ \gamma)$ assuming that the branching fractions of $D_s^{*+} \rightarrow D_s^+ \pi^0$ and $D_s^{*+} \rightarrow D_s^+ \gamma$ decays sum to 100%.

NODE=S074R;LINKAGE=AU

$D_s^{*\pm}$ REFERENCES

NODE=S074

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 does not observe neutral and doubly charged partners of the $D_{s0}^*(2317)^\pm$.

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±0.6 OUR FIT	Error includes scale factor of 1.1.			
2318.0±1.0 OUR AVERAGE	Error includes scale factor of 1.4.			
2319.6±0.2±1.4	3180	AUBERT	06P BABR	10.6 $e^+e^- \rightarrow D_s^+\pi^0 X$
2317.3±0.4±0.8	1022	¹ AUBERT	04E BABR	10.6 e^+e^-
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2317.2±1.3	88	² AUBERT,B	04S BABR	$B \rightarrow D_{s0}^{(*)}(2317)^+\bar{D}^{(*)}$
2317.2±0.5±0.9	761	³ MIKAMI	04 BELL	10.6 e^+e^-
2316.8±0.4±3.0	1267 ± 53	^{3,4} AUBERT	03G BABR	10.6 e^+e^-
2317.6±1.3	273 ± 33	^{3,5} AUBERT	03G BABR	10.6 e^+e^-
2319.8±2.1±2.0	24	³ KROKOVNY	03B BELL	10.6 e^+e^-
¹ Supersedes AUBERT 03G.				
² Systematic errors not evaluated.				
³ Not independent of the corresponding $m_{D_{s0}^*(2317)} - m_{D_s}$.				
⁴ From $D_s^+ \rightarrow K^+K^-\pi^+$ decay.				
⁵ From $D_s^+ \rightarrow K^+K^-\pi^+\pi^0$ decay.				

NODE=M172M

OCCUR=2

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
349.3±0.6 OUR FIT	Error includes scale factor of 1.1.			
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	⁶ 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	^{7,8} AUBERT	03G BABR	10.6 e^+e^-
350.2±1.3	273	^{9,10} AUBERT	03G BABR	10.6 e^+e^-
⁶ Recalculated by us using $m_{D_s^+} = 1968.5 \pm 0.6$ MeV.				
⁷ From $D_s^+ \rightarrow K^+K^-\pi^+$ decay.				
⁸ Recalculated by us using $m_{D_s^+} = 1967.20 \pm 0.03$ MeV.				
⁹ From $D_s^+ \rightarrow K^+K^-\pi^+\pi^0$ decay.				
¹⁰ Recalculated by us using $m_{D_s^+} = 1967.4 \pm 0.2$ MeV. Systematic errors not estimated.				

NODE=M172DM

OCCUR=2

NODE=M172DM;LINKAGE=K3

NODE=M172DM;LINKAGE=A1

NODE=M172DM;LINKAGE=C1

NODE=M172DM;LINKAGE=A2

NODE=M172DM;LINKAGE=C2

$D_{s0}^*(2317)^\pm$ WIDTH

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 $D_{s0}^*(2317)^-$ modes are charge conjugates of modes below.

NODE=M172215;NODE=M172

NODE=M172

Mode	Fraction (Γ_i/Γ)
Γ_1 $D_s^+ \pi^0$	seen
Γ_2 $D_s^+ \gamma$	
Γ_3 $D_s^{*+}(2112) \gamma$	
Γ_4 $D_s^+ \gamma \gamma$	
Γ_5 $D_s^{*+}(2112) \pi^0$	
Γ_6 $D_s^+ \pi^+ \pi^-$	
Γ_7 $D_s^+ \pi^0 \pi^0$	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
seen	1540 ± 62	AUBERT	03G BABR	$10.6 e^+ e^-$

NODE=M172R1
NODE=M172R1

$\Gamma(D_s^+ \gamma)/\Gamma(D_s^+ \pi^0)$					Γ_2/Γ_1
<u>VALUE</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
<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	BESSON	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	BESSON	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	BESSON	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	BESSON	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**

NODE=M172

AUBERT	06P	PR D74 032007	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51144
AUBERT	04E	PR D69 031101	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=49747
AUBERT,B	04S	PRL 93 181801	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=50195
MIKAMI	04	PRL 92 012002	Y. Mikami <i>et al.</i>	(BELLE Collab.)	REFID=49629
AUBERT	03G	PRL 90 242001	B. Aubert <i>et al.</i>	(BaBar Collab.)	REFID=49417
BESSON	03	PR D68 032002	D. Besson <i>et al.</i>	(CLEO Collab.)	REFID=49583
KROKOVNY	03B	PRL 91 262002	P. Krokovny <i>et al.</i>	(BELLE Collab.)	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
2459.6±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.

² Systematic errors not evaluated. From the decay to $D_s^{*+} \pi^0$.

³ Systematic errors not evaluated. From the decay to $D_s^+ \gamma$.

⁴ Not independent of the corresponding $m_{D_{s1}(2460)^{\pm}} - m_{D_s^{*\pm}}$.

⁵ Using $m_{D_s^{*+}} = 2112.4 \pm 0.7$ MeV.

⁶ Not independent of the corresponding $m_{D_{s1}(2460)^{\pm}} - m_{D_s^{\pm}}$.

⁷ Using $m_{D_s^+} = 1968.5 \pm 0.6$ MeV.

NODE=M173M;LINKAGE=UB

NODE=M173M;LINKAGE=AU

NODE=M173M;LINKAGE=AB

NODE=M173M;LINKAGE=B1

NODE=M173M;LINKAGE=B2

NODE=M173M;LINKAGE=B3

NODE=M173M;LINKAGE=B4

$m_{D_{s1}(2460)^{\pm}} - m_{D_s^{*\pm}}$

NODE=M173MD

The fit includes $D^{\pm}$, D^0 , $D_s^{\pm}$, $D^{*\pm}$, D^{*0} , $D_s^{*\pm}$, $D_1(2420)^0$, $D_2^*(2460)^0$, and $D_{s1}(2536)^{\pm}$ mass and mass difference measurements.

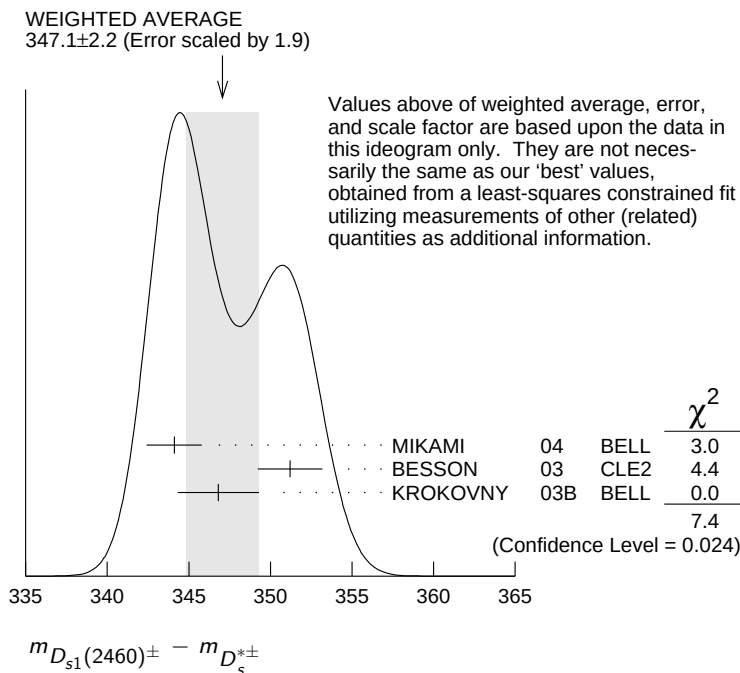
NODE=M173MD

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
347.2±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	BESSON	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 , $D_s^{\pm}$, $D^{*\pm}$, D^{*0} , $D_s^{*\pm}$, $D_1(2420)^0$, $D_2^{*}(2460)^0$, and $D_{s1}(2536)^{\pm}$ mass and mass difference measurements.

NODE=M173DM

NODE=M173DM

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
491.1±0.7 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

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

NODE=M173W

OCCUR=2

$D_{s1}(2460)^+$ DECAY MODES

$D_{s1}(2460)^-$ modes are charge conjugates of the modes below.

NODE=M173215;NODE=M173

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%
Γ_5 $D_{s0}^*(2317)^+\gamma$	(3.7 ± 5.0 / 2.4) %	
Γ_6 $D_s^+\pi^0$		
Γ_7 $D_s^+\pi^0\pi^0$		
Γ_8 $D_s^+\gamma\gamma$		

DESIG=1

DESIG=2

DESIG=3

DESIG=4

DESIG=5

DESIG=7

DESIG=8

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

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

$\Gamma(D_{s0}^*(2317)^+ \gamma) / \Gamma(D_s^{*+} \pi^0)$ Γ_5 / Γ_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 BESSON 03 CLE2 10.6 $e^+ e^-$ NODE=M173R5
NODE=M173R5

$$\Gamma(D_s^{*+}\pi^0)/[\Gamma(D_s^{*+}\pi^0) + \Gamma(D_{s0}^*(2317)^+\gamma)] \quad \Gamma_1/(\Gamma_1+\Gamma_5)$$

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

$$\Gamma(D_s^+\gamma)/[\Gamma(D_s^{*+}\pi^0) + \Gamma(D_{s0}^*(2317)^+\gamma)] \quad \Gamma_2/(\Gamma_1+\Gamma_5)$$

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

$$\Gamma(D_s^+\pi^+\pi^-)/[\Gamma(D_s^{*+}\pi^0) + \Gamma(D_{s0}^*(2317)^+\gamma)] \quad \Gamma_3/(\Gamma_1+\Gamma_5)$$

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

$$\Gamma(D_s^{*+}\gamma)/[\Gamma(D_s^{*+}\pi^0) + \Gamma(D_{s0}^*(2317)^+\gamma)] \quad \Gamma_4/(\Gamma_1+\Gamma_5)$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.24	95	AUBERT	06P	BABR 10.6 e ⁺ e ⁻

NODE=M173R10
NODE=M173R10

$$\Gamma(D_{s0}^*(2317)^+\gamma)/[\Gamma(D_s^{*+}\pi^0) + \Gamma(D_{s0}^*(2317)^+\gamma)] \quad \Gamma_5/(\Gamma_1+\Gamma_5)$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.25	95	AUBERT	06P	BABR 10.6 e ⁺ e ⁻

NODE=M173R11
NODE=M173R11

$$\Gamma(D_s^+\pi^0)/[\Gamma(D_s^{*+}\pi^0) + \Gamma(D_{s0}^*(2317)^+\gamma)] \quad \Gamma_6/(\Gamma_1+\Gamma_5)$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.042	95	AUBERT	06P	BABR 10.6 e ⁺ e ⁻

NODE=M173R12
NODE=M173R12

$$\Gamma(D_s^+\pi^0\pi^0)/[\Gamma(D_s^{*+}\pi^0) + \Gamma(D_{s0}^*(2317)^+\gamma)] \quad \Gamma_7/(\Gamma_1+\Gamma_5)$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.68	95	AUBERT	06P	BABR 10.6 e ⁺ e ⁻

NODE=M173R13
NODE=M173R13

$$\Gamma(D_s^+\gamma\gamma)/[\Gamma(D_s^{*+}\pi^0) + \Gamma(D_{s0}^*(2317)^+\gamma)] \quad \Gamma_8/(\Gamma_1+\Gamma_5)$$

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

2535.12 $\pm$ 0.13 OUR FIT

2535.18 $\pm$ 0.24 OUR AVERAGE

2535.7 $\pm$ 0.6 $\pm$ 0.5	46 $\pm$ 9	¹ ABAZOV	09G D0	$B_s^0 \rightarrow D_{s1}^{\pm} \mu^+ \nu_{\mu} X$
2534.78 $\pm$ 0.31 $\pm$ 0.40	182	AUBERT	08B BABR	$B \rightarrow \overline{D}^{(*)} D^{*} K$
2534.6 $\pm$ 0.3 $\pm$ 0.7	193	AUBERT	06P BABR	$10.6 e^+ e^- \rightarrow D_s^+ \pi^+ \pi^- X$
2535.3 $\pm$ 0.7	92	² HEISTER	02B ALEP	$e^+ e^- \rightarrow D^{*+} K^0 X$, $D^{*0} K^+ X$
2534.2 $\pm$ 1.2	9	ASRATYAN	94 BEBC	$\nu N \rightarrow D^{*} K^0 X, D^{*0} K^{\pm} X$
2535 $\pm$ 0.6 $\pm$ 1	75	FRABETTI	94B E687	$\gamma Be \rightarrow D^{*+} K^0 X$, $D^{*0} K^+ X$
2535.3 $\pm$ 0.2 $\pm$ 0.5	134	ALEXANDER	93 CLE2	$e^+ e^- \rightarrow D^{*0} K^+ X$
2534.8 $\pm$ 0.6 $\pm$ 0.6	44	ALEXANDER	93 CLE2	$e^+ e^- \rightarrow D^{*+} K^0 X$
2535.2 $\pm$ 0.5 $\pm$ 1.5	28	ALBRECHT	92R ARG	$10.4 e^+ e^- \rightarrow D^{*0} K^+ X$
2536.6 $\pm$ 0.7 $\pm$ 0.4		AVERY	90 CLEO	$e^+ e^- \rightarrow D^{*+} K^0 X$
2535.9 $\pm$ 0.6 $\pm$ 2.0		ALBRECHT	89E ARG	$D_{s1}^* \rightarrow D^*(2010) K^0$

NODE=M121M

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

2534.1 $\pm$ 0.6	116	³ AUSHEV	11 BELL	$B \rightarrow D_{s1}(2536)^+ D^{(*)}$
2535.08 $\pm$ 0.01 $\pm$ 0.15	8038	⁴ LEES	11B BABR	$10.6 e^+ e^- \rightarrow D^{*+} K_S^0 X$
2535.57 $^{+0.44}_{-0.41}$ $\pm$ 0.10	236 $\pm$ 30	⁵ CHEKANOV	09 ZEUS	$e^{\pm} p \rightarrow D^{*+} K_S^0 X$, $D^{*0} K^+ X$
2535 $\pm$ 28		⁶ ASRATYAN	88 HLBC	$\nu N \rightarrow D_s \gamma \gamma X$

OCCUR=2

¹ Using the $D^*(2010)^{\pm}$ mass of 2010.0 ± 0.4 MeV from PDG 06.

² 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.

³ Systematic uncertainties not evaluated.

⁴ 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 $L=0$.

⁵ Calculated using the mass difference $m(D_{s1}^+) - m(D^{*+})_{PDG}$ reported below and $m(D^{*+})_{PDG} = 2010.27 \pm 0.17$ MeV.

⁶ Not seen in $D^* K$.

NODE=M121M;LINKAGE=AB

NODE=M121M;LINKAGE=HI

NODE=M121M;LINKAGE=AU

NODE=M121M;LINKAGE=LE

NODE=M121M;LINKAGE=CH

NODE=M121M;LINKAGE=B

$m_{D_{s1}(2536)^{\pm}} - m_{D_s^*(2111)}$

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

422.8 $\pm$ 0.5 OUR FIT Error includes scale factor of 1.1.

424 $\pm$ 28 ASRATYAN 88 HLBC $D_s^{*\pm} \gamma$

NODE=M121DM

$m_{D_{s1}(2536)^{\pm}} - m_{D^*(2010)^{\pm}}$

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=M121DN

NODE=M121DN

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
524.84±0.04 OUR FIT				
524.84±0.04 OUR AVERAGE				
524.83±0.01±0.04	8038	⁷ 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	$e^\pm p \rightarrow D^{*+} K_S^0 X,$
525.3 ±0.6 ±0.1	41	HEISTER	02B ALEP	$e^+ e^- \rightarrow D^{*0} K^+ X$
⁷ Assuming <i>S</i> -wave decay of the $D_{s1}(2536)$ to $D^{*+} K_S^0$, using a Breit-Wigner line shape corresponding to <i>L</i> =0.				

NODE=M121DN

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
528.14±0.08 OUR FIT				
528.1 ±1.5 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	$e^+ e^- \rightarrow D^{*0} K^+ X$

NODE=M121DP

$D_{s1}(2536)^\pm$ WIDTH

NODE=M121W

NODE=M121W

VALUE (MeV)	CL% EVTS	DOCUMENT ID	TECN	COMMENT
0.92±0.03±0.04	8038	⁸ 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	⁹ 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	$\gamma \text{Be} \rightarrow D^{*+} K^0 X,$
< 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	$D_{s1}^* \rightarrow D^*(2010) K^0$
⁸ Assuming <i>S</i> -wave decay of the $D_{s1}(2536)$ to $D^{*+} K_S^0$, using a Breit-Wigner line shape corresponding to <i>L</i> =0.				
⁹ Systematic uncertainties not evaluated.				

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)
Γ_1 $D^*(2010)^+ K^0$	seen
Γ_2 $(D^*(2010)^+ K^0)_{S\text{-wave}}$	
Γ_3 $(D^*(2010)^+ K^0)_{D\text{-wave}}$	
Γ_4 $D^+ \pi^- K^+$	
Γ_5 $D^*(2007)^0 K^+$	seen
Γ_6 $D^+ K^0$	not seen
Γ_7 $D^0 K^+$	not seen
Γ_8 $D_s^{*+} \gamma$	possibly seen
Γ_9 $D_s^+ \pi^+ \pi^-$	seen

DESIG=1;OUR EST;→ UNCHECKED ←

DESIG=7

DESIG=9

DESIG=8

DESIG=4;OUR EST;→ UNCHECKED ←

DESIG=2;OUR EST;→ UNCHECKED ←

DESIG=5;OUR EST;→ UNCHECKED ←

DESIG=3

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	10 HEISTER	02B	ALEP $e^+ e^- \rightarrow D^{*+} K^0 X$,
				$D^{*0} K^+ X$
1.9 $^{+1.1}_{-0.9}$ ±0.4	35	10 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		11 ALBRECHT	92R	ARG 10.4 $e^+ e^- \rightarrow$
				$D^{*0} K^+ X, D^{*+} K^0 X$

¹⁰ Ratio of the production rates measured in Z^0 decays.¹¹ Evaluated by us from published inclusive cross-sections.

NODE=M121R6;LINKAGE=6A

NODE=M121R6;LINKAGE=A

 $\Gamma((D^*(2010)^+ K^0)_{S\text{-wave}})/\Gamma(D^*(2010)^+ K^0)$ **Γ_2/Γ_1**

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.72±0.05±0.01	5485	BALAGURA	08	BELL 10.6 $e^+ e^- \rightarrow D^{*+} K^0 X$

NODE=M121R8

NODE=M121R8

 $\Gamma(D^+ \pi^- K^+)/\Gamma(D^*(2010)^+ K^0)$ **Γ_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 $e^+ e^- \rightarrow D^{*+} K^0 X$
<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

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	JPG 33 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

$D_{s2}^*(2573)$

$I(J^P) = 0(?)^?$

J^P is natural, width and decay modes consistent with 2^+ .

NODE=M148

NODE=M148

NODE=M148M

NODE=M148M

NODE=M148M;LINKAGE=EV
NODE=M148M;LINKAGE=HI

NODE=M148DM

NODE=M148DM

NODE=M148DM;LINKAGE=EV

NODE=M148W

NODE=M148W

NODE=M148W;LINKAGE=EV

$D_{s2}^*(2573)$ MASS

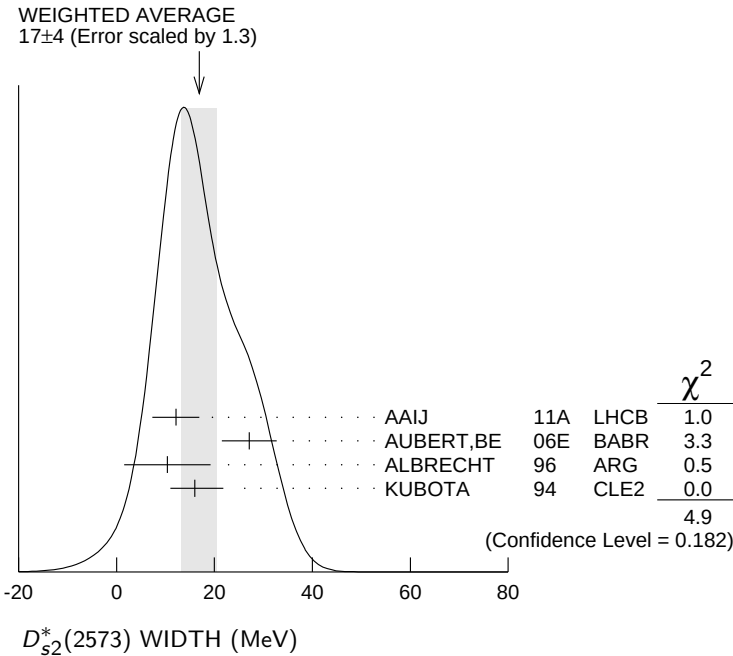
VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2571.9±0.8 OUR AVERAGE				
2569.4±1.6±0.5	82 ± 17	AAIJ	11A LHCb	$B_s \rightarrow D_{s2}^*(2573) \mu \bar{\nu} X$
2572.2±0.3±1.0		AUBERT,BE	06E BABR	$e^+ e^- \rightarrow D K X$
2574.5±3.3±1.6		ALBRECHT	96 ARG	$e^+ e^- \rightarrow D^0 K^+ X$
2573.2 ^{+1.7} _{-1.6} ±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	¹ EVDOKIMOV	04 SELX	$600 \Sigma^- A \rightarrow D^0 K^+ X$
2568.6±3.2	64	² HEISTER	02B ALEP	$e^+ e^- \rightarrow D^0 K^+ X$
¹ Not independent of the mass difference below. ² Calculated using $m_{D^0} = 1864.5 \pm 0.5 \text{ MeV}$ and the mass difference below.				

$m_{D_{s2}^*(2573)} - m_{D^0}$

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
704 ±3 ±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	³ EVDOKIMOV	04 SELX	$600 \Sigma^- A \rightarrow D^0 K^+ X$
³ Systematic errors not estimated.				

$D_{s2}^*(2573)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
17 ±4 OUR AVERAGE	Error includes scale factor of 1.3. See the ideogram below.			
12.1±4.5±1.6	82 ± 17	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	⁴ EVDOKIMOV	04 SELX	$600 \Sigma^- A \rightarrow D^0 K^+ X$
⁴ Systematic errors not estimated.				



$D_{s2}^*(2573)^+$ 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

NODE=M148215;NODE=M148

NODE=M148

DESIG=1

DESIG=2;OUR EVAL;→ UNCHECKED ←

 $D_{s2}^*(2573)^+$ BRANCHING RATIOS

$\Gamma(D^0 K^+)/\Gamma_{\text{total}}$						Γ_1/Γ
VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT	
seen	217	KUBOTA	94	CLE2	$\pm$	$e^+ e^- \sim 10.5$ GeV

NODE=M148220

NODE=M148R2
NODE=M148R2

$\Gamma(D^*(2007)^0 K^+)/\Gamma(D^0 K^+)$						Γ_2/Γ_1
VALUE	CL%	DOCUMENT ID	TECN	CHG	COMMENT	
<0.33	90	KUBOTA	94	CLE2	+	$e^+ e^- \sim 10.5$ GeV

NODE=M148R1
NODE=M148R1 **$D_{s2}^*(2573)$ REFERENCES**

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=16665
REFID=51512
REFID=50337
REFID=48562
REFID=44631
REFID=43781 **$D_{s1}^*(2700)^\pm$**

$$I(J^P) = 0(1^-)$$

NODE=M182

 $D_{s1}^*(2700)^+$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2709 ± 4 OUR AVERAGE				
[2709 $^{+9}_{-6}$ MeV OUR 2012 AVERAGE]				

NODE=M182M

NODE=M182M
NEW

2709.2 $\pm 1.9 \pm 4.5$	52k	¹ AAIJ	12AU LHCb	$pp \rightarrow (DK)^+ X$ at 7 TeV
2710 ± 2 $^{+12}_{-7}$	10.4k	² 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. • • •				
2688 $\pm 4 \pm 3$		³ AUBERT,BE	06E BABR	10.6 $e^+ e^- \rightarrow DKX$

¹ 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 $D_{sJ}^*(2860)^+$.

² From simultaneous fits to the two DK mass spectra and to the total $D^* K$ mass spectrum.

³ Superseded by AUBERT 09AR.

NODE=M182M;LINKAGE=AA

NODE=M182M;LINKAGE=AB

NODE=M182M;LINKAGE=AU

 $D_{s1}^*(2700)^+$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
117 ± 13 OUR AVERAGE				
[125 ± 30 MeV OUR 2012 AVERAGE]				

NODE=M182W

NODE=M182W
NEW

115.8 $\pm 7.3 \pm 12.1$	52k	⁴ AAIJ	12AU LHCb	$pp \rightarrow (DK)^+ X$ at 7 TeV
149 ± 7 $^{+39}_{-52}$	10.4k	⁵ 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. • • •				
112 $\pm 7 \pm 36$		⁶ AUBERT,BE	06E BABR	10.6 $e^+ e^- \rightarrow DKX$

⁴ 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 $D_{sJ}^*(2860)^+$.

⁵ From simultaneous fits to the two DK mass spectra and to the total $D^* K$ mass spectrum.

⁶ Superseded by AUBERT 09AR.

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	⁷ AUBERT	09AR BABR $e^+ e^- \rightarrow D^{(*)} K X$

⁷ From the average of the corresponding ratios with $D^{(*)0} K^+$ and $D^{(*)+} K_S^0$.

NODE=M182R01
NODE=M182R01

NODE=M182R01;LINKAGE=AU

$\Gamma(D^{*0} K^+)/\Gamma(D^0 K^+)$		Γ_5/Γ_2	
VALUE	EVTS	DOCUMENT ID	TECN COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$0.88 \pm 0.14 \pm 0.14$	7716	⁸ AUBERT	09AR BABR $e^+ e^- \rightarrow D^{(*)} K X$

⁸ From the $D^{*0} K^+$ and $D^0 K^+$, where $D^{*0} \rightarrow D^0 \pi^0$.

NODE=M182R02
NODE=M182R02

NODE=M182R02;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. • • •			
$1.14 \pm 0.39 \pm 0.23$	2700	⁹ AUBERT	09AR BABR $e^+ e^- \rightarrow D^{(*)} K X$

⁹ From the $D^{*+} K_S^0$ and $D^+ K_S^0$, where $D^{*+} \rightarrow D^+ \pi^0$.

NODE=M182R03
NODE=M182R03

NODE=M182R03;LINKAGE=AU

 $D_{s1}^*(2700)^\pm$ REFERENCES

NODE=M182

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 Collb.)	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

NODE=M196

$$D_{sJ}^*(2860)^\pm$$

$$I(J^P) = 0(?)$$

OMITTED FROM SUMMARY TABLE

Observed by AUBERT,BE 06E and AUBERT 09AR in inclusive production of DK and $D^* K$ in $e^+ e^-$ annihilation. J^P is natural.

NODE=M196

 $D_{sJ}^*(2860)^+$ MASS

NODE=M196M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$2863.2^{+4.0}_{-2.6}$ OUR AVERAGE				
[$2862^{+5.4}_{-2.8}$ MeV OUR 2012 AVERAGE]				
$2866.1 \pm 1.0 \pm 6.3$	36k	¹ AAIJ	12AU LHCb	$p p \rightarrow (DK)^+ X$ at 7 TeV
$2862 \pm 2 \pm 5_{-2}$	3122	² AUBERT	09AR BABR	$e^+ e^- \rightarrow D^{(*)} K X$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
$2856.6 \pm 1.5 \pm 5.0$		³ AUBERT,BE	06E BABR	$e^+ e^- \rightarrow D K X$

NODE=M196M

NEW

¹ 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 $D_{sJ}^*(2860)^+$.

² From simultaneous fits to the two DK mass spectra and to the total $D^* K$ mass spectrum.

³ Superseded by AUBERT 09AR.

$D_{sJ}^*(2860)^+$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
58 ± 11 OUR AVERAGE		Error includes scale factor of 2.2. [48 ± 7 MeV OUR 2012 AVERAGE]		
69.9 ± 3.2 ± 6.6	36k	⁴ AAIJ	12AU LHCb	$pp \rightarrow (DK)^+ X$ at 7 TeV
48 ± 3 ± 6	3122	⁵ AUBERT	09AR BABR	$e^+ e^- \rightarrow D^{(*)} K X$

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

47 ± 7 ± 10 ⁶ AUBERT, BE 06E BABR $e^+ e^- \rightarrow DK X$

⁴ 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 $D_{sJ}^*(2860)^+$.

⁵ From simultaneous fits to the two DK mass spectra and to the total $D^* K$ mass spectrum.

⁶ Superseded by AUBERT 09AR.

$D_{sJ}^*(2860)^\pm$ DECAY MODES

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	$D^{*+} K_S^0$

$D_{sJ}^*(2860)^\pm$ BRANCHING RATIOS

$\Gamma(D^* K)/\Gamma(DK)$				Γ_4/Γ_1
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
1.10 ± 0.15 ± 0.19	3122	⁷ AUBERT	09AR BABR	$e^+ e^- \rightarrow D^{(*)} K X$

⁷ From the average of the corresponding ratios with $D^{(*)0} K^+$ and $D^{(*)+} K_S^0$.

$\Gamma(D^{*0} K^+)/\Gamma(D^0 K^+)$				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 ⁸ AUBERT 09AR BABR $e^+ e^- \rightarrow D^{(*)} K X$

⁸ From the $D^{*0} K^+$ and $D^0 K^+$, where $D^{*0} \rightarrow D^0 \pi^0$.

$\Gamma(D^{*+} K_S^0)/\Gamma(D^+ K_S^0)$				Γ_6/Γ_3
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

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

1.38 ± 0.35 ± 0.49 881 ⁹ AUBERT 09AR BABR $e^+ e^- \rightarrow D^{(*)} K X$

⁹ From the $D^{*+} K_S^0$ and $D^+ K_S^0$, where $D^{*+} \rightarrow D^+ \pi^0$.

$D_{sJ}^*(2860)^\pm$ REFERENCES

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=M196M;LINKAGE=AA

NODE=M196M;LINKAGE=AB

NODE=M196M;LINKAGE=AU

NODE=M196W

NODE=M196W

NEW

NODE=M196W;LINKAGE=AA

NODE=M196W;LINKAGE=AB

NODE=M196W;LINKAGE=AU

NODE=M196215;NODE=M196

DESIG=1

DESIG=2

DESIG=3

DESIG=4

DESIG=5

DESIG=6

NODE=M196225

NODE=M196R01

NODE=M196R01

NODE=M196R01;LINKAGE=AU

NODE=M196R02

NODE=M196R02

NODE=M196R02;LINKAGE=AU

NODE=M196R03

NODE=M196R03

NODE=M196R03;LINKAGE=AU

NODE=M196

REFID=54735

REFID=53135

REFID=51512

$D_{sJ}(3040)^{\pm}$

$$I(J^P) = 0(?)^?$$

OMITTED FROM SUMMARY TABLE

Observed by AUBERT 09AR in inclusive production of $D^* K$ in $e^+ e^-$ annihilation.

NODE=M197

NODE=M197

$D_{sJ}(3040)^+$ MASS

NODE=M197M

NODE=M197M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$3044 \pm 8^{+30}_{-5}$	AUBERT	09AR BABR	$e^+ e^- \rightarrow D^* K X$

$D_{sJ}(3040)^+$ WIDTH

NODE=M197W

NODE=M197W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$239 \pm 35^{+46}_{-42}$	AUBERT	09AR BABR	$e^+ e^- \rightarrow D^* K X$

$D_{sJ}(3040)^{\pm}$ 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

REFID=53135

AUBERT 09AR PR D80 092003 B. Aubert *et al.* (BABAR Collb.)

OTHER RELATED PAPERS

REFID=53128

SUN 09 PR D80 074037 Z.-F. Sun, X. Lin

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

BOTTOM, STRANGE MESONS

$(B = \pm 1, S = \mp 1)$

NODE=MXXX046

$$B^0_s = s\bar{b}, \bar{B}^0_s = \bar{s}b, \text{ similarly for } B^{*'}_s\text{'s}$$

NODE=MXXX046

BOTTOM, CHARMED MESONS

$(B = C = \pm 1)$

NODE=MXXX049

$$B^+_c = c\bar{b}, B^-_c = \bar{c}b, \text{ similarly for } B^{*'}_c\text{'s}$$

NODE=MXXX049

c $\bar{c}$ MESONS

NODE=MXXX025

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NODE=M826

$\eta_c(1S)$

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

NODE=M026

η_c(1S) MASS

NODE=M026M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2983.7 ± 0.7 OUR AVERAGE Error includes scale factor of 1.4. See the ideogram below. [2981.0 ± 1.1 MeV OUR 2012 AVERAGE Scale factor = 1.7]				
2984.3 ± 0.6 ± 0.6		^{1,2} ABLIKIM	12F BES3	$\psi(2S) \rightarrow \gamma \eta_c$
2984.49 ± 1.16 ± 0.52	832	³ ABLIKIM	12N BES3	$\psi(2S) \rightarrow \pi^0 \gamma$ hadrons
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	² VINOKUROVA	11 BELL	$B^\pm \rightarrow K^\pm (K_S^0 K^\pm \pi^\mp)$
2982.2 ± 0.4 ± 1.6	14k	⁴ LEES	10 BABR	$10.6 e^+ e^- \rightarrow e^+ e^- K_S^0 K^\pm \pi^\mp$
2985.8 ± 1.5 ± 3.1	0.9k	AUBERT	08AB BABR	$B \rightarrow \eta_c(1S) K(*) \rightarrow K \bar{K} \pi K(*)$
2986.1 ± 1.0 ± 2.5	7.5k	UEHARA	08 BELL	$\gamma \gamma \rightarrow \eta_c \rightarrow$ hadrons
2970 ± 5 ± 6	501	⁵ 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	$B^+ \rightarrow \Lambda \bar{\Lambda} K^+$
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	⁶ 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	⁷ DEL-AMO-SA...11M	BABR	$\gamma \gamma \rightarrow K_S^0 K^\pm \pi^\mp$
2982.2 ± 0.6		⁸ MITCHELL	09 CLEO	$e^+ e^- \rightarrow \gamma X$
2982 ± 5	270	⁹ AUBERT	06E BABR	$B^\pm \rightarrow K^\pm X_{c\bar{c}}$
2982.5 ± 1.1 ± 0.9	2.5k	¹⁰ AUBERT	04D BABR	$\gamma \gamma \rightarrow \eta_c(1S) \rightarrow K \bar{K} \pi$
2977.5 ± 1.0 ± 1.2		^{8,11} BAI	03 BES	$J/\psi \rightarrow \gamma \eta_c$
2979.6 ± 2.3 ± 1.6	180	¹² FANG	03 BELL	$B \rightarrow \eta_c K$
2976.3 ± 2.3 ± 1.2		^{8,13} BAI	00F BES	$J/\psi, \psi(2S) \rightarrow \gamma \eta_c$
2976.6 ± 2.9 ± 1.3	140	^{8,14} BAI	00F BES	$J/\psi \rightarrow \gamma \eta_c$
2980.4 ± 2.3 ± 0.6		¹⁵ BRANDENB...	00B CLE2	$\gamma \gamma \rightarrow \eta_c \rightarrow K^\pm K_S^0 \pi^\mp$
2975.8 ± 3.9 ± 1.2		¹⁴ 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		^{8,16} BISELLO	91 DM2	$J/\psi \rightarrow \eta_c \gamma$
2969 ± 4 ± 4	80	⁸ BAI	90B MRK3	$J/\psi \rightarrow \gamma K^+ K^- K^+ K^-$
2956 ± 12 ± 12		⁸ BAI	90B MRK3	$J/\psi \rightarrow \gamma K^+ K^- K_S^0 K_L^0$
2982.6 ± 2.7 - 2.3	12	BAGLIN	87B SPEC	$\bar{p} p \rightarrow \gamma \gamma$
2980.2 ± 1.6		^{8,16} BALTRUSAIT...	86 MRK3	$J/\psi \rightarrow \eta_c \gamma$
2984 ± 2.3 ± 4.0		⁸ GAISER	86 CBAL	$J/\psi \rightarrow \gamma X, \psi(2S) \rightarrow \gamma X$
2976 ± 8		^{8,17} BALTRUSAIT...	84 MRK3	$J/\psi \rightarrow 2\phi \gamma$
2982 ± 8	18	¹⁸ HIMEL	80B MRK2	$e^+ e^-$
2980 ± 9		¹⁸ PARTRIDGE	80B CBAL	$e^+ e^-$

NODE=M026M

NEW

OCCUR=2

OCCUR=2

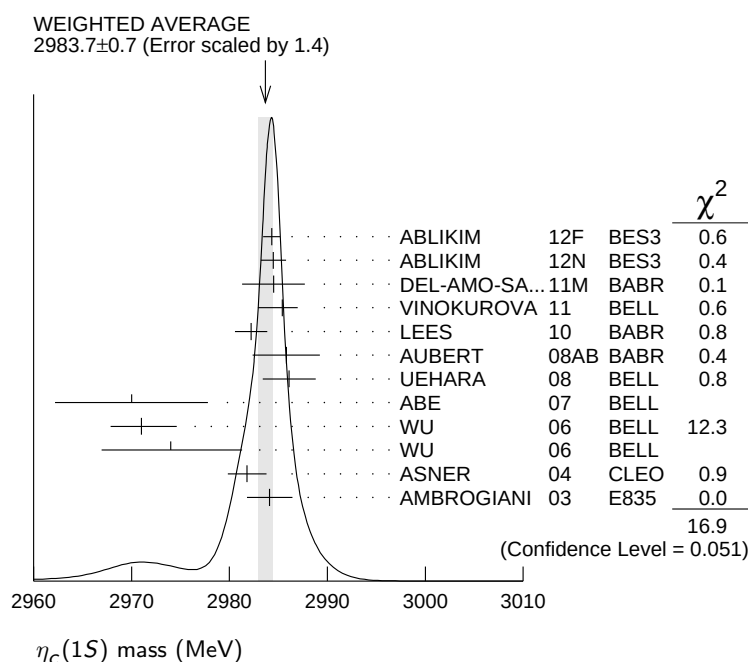
OCCUR=2

OCCUR=3

- 1 From a simultaneous fit to six decay modes of the η_c .
- 2 Accounts for interference with non-resonant continuum.
- 3 With floating width.
- 4 Taking into account interference with the non-resonant $J^P = 0^-$ amplitude.
- 5 From a fit of the J/ψ recoil mass spectrum. Supersedes ABE,K 02 and ABE 04G.
- 6 Using mass of $\psi(2S) = 3686.00$ MeV.
- 7 Not independent from the measurements reported by LEES 10.
- 8 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.
- 9 From the fit of the kaon momentum spectrum. Systematic errors not evaluated.
- 10 Superseded by LEES 10.
- 11 From a simultaneous fit of five decay modes of the η_c .
- 12 Superseded by VINOKUROVA 11.
- 13 Weighted average of the $\psi(2S)$ and $J/\psi(1S)$ samples. Using an η_c width of 13.2 MeV.
- 14 Average of several decay modes. Using an η_c width of 13.2 MeV.
- 15 Superseded by ASNER 04.
- 16 Average of several decay modes.
- 17 $\eta_c \rightarrow \phi \phi$.
- 18 Mass adjusted by us to correspond to $J/\psi(1S)$ mass = 3097 MeV.

NODE=M026M;LINKAGE=BL
 NODE=M026M;LINKAGE=VA
 NODE=M026M;LINKAGE=AL
 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

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
32.0± 0.9 OUR FIT				
[29.7 ± 1.0 MeV OUR 2012 FIT]				
32.2± 1.0 OUR AVERAGE				Error includes scale factor of 1.2. [29.7 ± 2.1 MeV OUR 2012 AVERAGE Scale factor = 2.0]
32.0± 1.2±1.0		^{1,2} 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
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	² VINOKUROVA	11 BELL	$B^\pm \rightarrow K^\pm (K_S^0 K^\pm \pi^\mp)$
31.7± 1.2±0.8	14k	⁴ 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	$\bar{p} p \rightarrow \gamma\gamma$

NODE=M026W

NODE=M026W
 NEW

NEW

OCCUR=2

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

32.1 ± 1.1 ± 1.3	12k	⁵ DEL-AMO-SA..11M	BABR	$\gamma\gamma \rightarrow K_S^0 K^\pm \pi^\mp$
34.3 ± 2.3 ± 0.9	2.5k	⁶ AUBERT	04D BABR	$\gamma\gamma \rightarrow \eta_c(1S) \rightarrow K \bar{K} \pi$
17.0 ± 3.7 ± 7.4		⁷ BAI	03 BES	$J/\psi \rightarrow \gamma \eta_c$
29 ± 8 ± 6	180	⁸ FANG	03 BELL	$B \rightarrow \eta_c K$
11.0 ± 8.1 ± 4.1		⁹ BAI	00F BES	$J/\psi \rightarrow \gamma \eta_c$ and $\psi(2S) \rightarrow \gamma \eta_c$
27.0 ± 5.8 ± 1.4		¹⁰ BRANDENB...	00B CLE2	$\gamma\gamma \rightarrow \eta_c \rightarrow K^\pm K_S^0 \pi^\mp$
7.0 ⁺ _{-7.0}	12	BAGLIN	87B SPEC	$\bar{p}p \rightarrow \gamma\gamma$
10.1 ⁺ _{-8.2}	23	¹¹ BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \gamma p \bar{p}$
11.5 ± 4.5		GAISER	86 CBAL	$J/\psi \rightarrow \gamma X, \psi(2S) \rightarrow \gamma X$
< 40 90% CL	18	HIMEL	80B MRK2	$e^+ e^-$
< 20 90% CL		PARTRIDGE	80B CBAL	$e^+ e^-$

¹ From a simultaneous fit to six decay modes of the η_c .

² Accounts for interference with non-resonant continuum.

³ With floating mass.

⁴ Taking into account interference with the non-resonant $J^P = 0^-$ amplitude.

⁵ Not independent from the measurements reported by LEES 10.

⁶ Superseded by LEES 10.

⁷ From a simultaneous fit of five decay modes of the η_c .

⁸ Superseded by VINOKUROVA 11.

⁹ 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.

¹⁰ Superseded by ASNER 04.

¹¹ Positive and negative errors correspond to 90% confidence level.

OCCUR=2

NODE=M026W;LINKAGE=BL
 NODE=M026W;LINKAGE=VA
 NODE=M026W;LINKAGE=AL
 NODE=M026W;LINKAGE=LE
 NODE=M026W;LINKAGE=DE
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 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

Γ_1	$\eta'(958) \pi \pi$	(4.1 ± 1.7) %	
Γ_2	$\rho \rho$	(1.8 ± 0.5) %	
Γ_3	$K^*(892)^0 K^- \pi^+ + \text{c.c.}$	(2.0 ± 0.7) %	
Γ_4	$K^*(892) \bar{K}^*(892)$	(7.1 ± 1.3) × 10 ⁻³	
Γ_5	$K^* \bar{K}^* \pi^+ \pi^-$	(1.1 ± 0.5) %	
Γ_6	$\phi K^+ K^-$	(2.9 ± 1.4) × 10 ⁻³	
Γ_7	$\phi \phi$	(1.76 ± 0.20) × 10 ⁻³	
Γ_8	$\phi 2(\pi^+ \pi^-)$	< 3.5 × 10 ⁻³	90%
Γ_9	$a_0(980) \pi$	< 2 %	90%
Γ_{10}	$a_2(1320) \pi$	< 2 %	90%
Γ_{11}	$K^*(892) \bar{K} + \text{c.c.}$	< 1.28 %	90%
Γ_{12}	$f_2(1270) \eta$	< 1.1 %	90%
Γ_{13}	$\omega \omega$	< 3.1 × 10 ⁻³	90%
Γ_{14}	$\omega \phi$	< 1.7 × 10 ⁻³	90%
Γ_{15}	$f_2(1270) f_2(1270)$	(9.8 ± 2.5) × 10 ⁻³	
Γ_{16}	$f_2(1270) f_2'(1525)$	(9.7 ± 3.2) × 10 ⁻³	

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

Decays into stable hadrons

Γ_{17}	$K \bar{K} \pi$	(7.3 ± 0.5) %	
Γ_{18}	$\eta \pi^+ \pi^-$	(1.7 ± 0.5) %	
Γ_{19}	$\eta 2(\pi^+ \pi^-)$	(4.4 ± 1.3) %	
Γ_{20}	$K^+ K^- \pi^+ \pi^-$	(6.9 ± 1.1) × 10 ⁻³	
Γ_{21}	$K^+ K^- \pi^+ \pi^- \pi^0$	(3.5 ± 0.6) %	
Γ_{22}	$K^0 K^- \pi^+ \pi^- \pi^+ + \text{c.c.}$	(5.6 ± 1.5) %	
Γ_{23}	$K^+ K^- 2(\pi^+ \pi^-)$	(7.5 ± 2.4) × 10 ⁻³	
Γ_{24}	$2(K^+ K^-)$	(1.47 ± 0.31) × 10 ⁻³	
Γ_{25}	$\pi^+ \pi^- \pi^0 \pi^0$	(4.7 ± 1.0) %	
Γ_{26}	$2(\pi^+ \pi^-)$	(9.7 ± 1.2) × 10 ⁻³	
Γ_{27}	$2(\pi^+ \pi^- \pi^0)$	(17.4 ± 3.3) %	
Γ_{28}	$3(\pi^+ \pi^-)$	(1.7 ± 0.4) %	
Γ_{29}	$p \bar{p}$	(1.51 ± 0.16) × 10 ⁻³	
Γ_{30}	$p \bar{p} \pi^0$	(3.6 ± 1.3) × 10 ⁻³	
Γ_{31}	$\Lambda \bar{\Lambda}$	(1.09 ± 0.24) × 10 ⁻³	
Γ_{32}	$K \bar{K} \eta$	(10 ± 5) × 10 ⁻³	
Γ_{33}	$\pi^+ \pi^- p \bar{p}$	(5.3 ± 1.8) × 10 ⁻³	

NODE=M026;CLUMP=B
 DESIG=14
 DESIG=16
 DESIG=61
 DESIG=15
 DESIG=60
 DESIG=62
 DESIG=55
 DESIG=27
 DESIG=63
 DESIG=11
 DESIG=64
 DESIG=56
 DESIG=12
 DESIG=65
 DESIG=45
 DESIG=25
 DESIG=13

Radiative decays

$$\Gamma_{34} \quad \gamma\gamma \quad (1.57 \pm 0.12) \times 10^{-4}$$

 NODE=M026;CLUMP=C
 DESIG=31

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

NODE=M026;CLUMP=D

Γ_{35}	$\pi^+ \pi^-$	P, CP	< 1.1	$\times 10^{-4}$	90%
Γ_{36}	$\pi^0 \pi^0$	P, CP	< 3.5	$\times 10^{-5}$	90%
Γ_{37}	$K^+ K^-$	P, CP	< 6	$\times 10^{-4}$	90%
Γ_{38}	$K_S^0 K_S^0$	P, CP	< 3.1	$\times 10^{-4}$	90%

 DESIG=51
 DESIG=52
 DESIG=53
 DESIG=54
CONSTRAINED FIT INFORMATION

An overall fit to the total width, 8 combinations of partial widths obtained from integrated cross section, and 17 branching ratios uses 79 measurements and one constraint to determine 12 parameters. The overall fit has a $\chi^2 = 112.1$ for 68 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_7	18									
x_{15}	3	6								
x_{17}	22	42	7							
x_{20}	11	21	4	25						
x_{24}	9	16	3	25	10					
x_{26}	14	25	5	31	16	12				
x_{29}	14	26	5	36	16	13	20			
x_{31}	3	6	1	9	4	3	5	25		
x_{34}	-29	-54	-10	-66	-34	-27	-41	-45	-11	
Γ	-2	-3	-1	-4	-2	-2	-2	7	2	-29
	x_4	x_7	x_{15}	x_{17}	x_{20}	x_{24}	x_{26}	x_{29}	x_{31}	x_{34}

	Mode	Rate (MeV)	
Γ_4	$K^*(892) \bar{K}^*(892)$	0.23 $\pm$ 0.04	DESIG=18
Γ_7	$\phi\phi$	0.056 $\pm$ 0.007	DESIG=17
Γ_{15}	$f_2(1270) f_2(1270)$	0.31 $\pm$ 0.08	DESIG=46
Γ_{17}	$K \bar{K} \pi$	2.35 $\pm$ 0.17	DESIG=14
Γ_{20}	$K^+ K^- \pi^+ \pi^-$	0.222 $\pm$ 0.035	DESIG=15
Γ_{24}	$2(K^+ K^-)$	0.047 $\pm$ 0.010	DESIG=27
Γ_{26}	$2(\pi^+ \pi^-)$	0.31 $\pm$ 0.04	DESIG=11
Γ_{29}	$\rho \bar{\rho}$	0.049 $\pm$ 0.005	DESIG=12
Γ_{31}	$\Lambda \bar{\Lambda}$	0.035 $\pm$ 0.008	DESIG=45
Γ_{34}	$\gamma\gamma$	0.0050 $\pm$ 0.0004	DESIG=31

 $\eta_c(1S)$ PARTIAL WIDTHS

NODE=M026217

 $\Gamma(\gamma\gamma)$ **Γ_{34}**

VALUE (keV) EVTS DOCUMENT ID TECN COMMENT

5.0 $\pm$ 0.4 OUR FIT

 [5.3 $\pm$ 0.5 keV OUR 2012 FIT]

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

5.2 $\pm$ 1.2	273 $\pm$ 43	^{1,2} AUBERT	06E BABR	$B^\pm \rightarrow K^\pm X_{c\bar{c}}$
5.5 $\pm$ 1.2 $\pm$ 1.8	157 $\pm$ 33	³ KUO	05 BELL	$\gamma\gamma \rightarrow \rho \bar{\rho}$
7.4 $\pm$ 0.4 $\pm$ 2.3		⁴ ASNER	04 CLEO	$\gamma\gamma \rightarrow \eta_c \rightarrow K_S^0 K^\pm \pi^\mp$
13.9 $\pm$ 2.0 $\pm$ 3.0	41	⁵ ABDALLAH	03J DLPH	$\gamma\gamma \rightarrow \eta_c$
3.8 $\pm$ 1.1 $\pm$ 1.9	190	⁶ AMBROGIANI	03 E835	$\bar{\rho} \rho \rightarrow \eta_c \rightarrow \gamma\gamma$
7.6 $\pm$ 0.8 $\pm$ 2.3		^{4,7} BRANDENB...	00B CLE2	$\gamma\gamma \rightarrow \eta_c \rightarrow K^\pm K_S^0 \pi^\mp$
6.9 $\pm$ 1.7 $\pm$ 2.1	76	⁸ ACCIARRI	99T L3	$e^+ e^- \rightarrow e^+ e^- \eta_c$
27 $\pm$ 16 $\pm$ 10	5	⁴ SHIRAI	98 AMY	58 $e^+ e^-$

 NODE=M026W1
 NODE=M026W1
 NEW

$6.7^{+2.4}_{-1.7} \pm 2.3$		³ ARMSTRONG 95F E760	$\bar{p}p \rightarrow \gamma\gamma$
11.3 ± 4.2		⁹ ALBRECHT 94H ARG	$e^+e^- \rightarrow e^+e^-\eta_c$
$8.0 \pm 2.3 \pm 2.4$	17	¹⁰ ADRIANI 93N L3	$e^+e^- \rightarrow e^+e^-\eta_c$
$5.9^{+2.1}_{-1.8} \pm 1.9$		⁶ CHEN 90B CLEO	$e^+e^- \rightarrow e^+e^-\eta_c$
$6.4^{+5.0}_{-3.4}$		¹¹ AIHARA 88D TPC	$e^+e^- \rightarrow e^+e^-X$
$4.3^{+3.4}_{-3.7} \pm 2.4$		³ BAGLIN 87B SPEC	$\bar{p}p \rightarrow \gamma\gamma$
28 ± 15		^{4,12} BERGER 86 PLUT	$\gamma\gamma \rightarrow K\bar{K}\pi$
¹ 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.			
² Systematic errors not evaluated.			
³ Normalized to $B(\eta_c \rightarrow p\bar{p}) = (1.3 \pm 0.4) \times 10^{-3}$.			
⁴ Normalized to $B(\eta_c \rightarrow K^\pm K_S^0 \pi^\mp)$.			
⁵ Average of $K_S^0 K^\pm \pi^\mp$, $\pi^+ \pi^- K^+ K^-$, and $2(K^+ K^-)$ decay modes.			
⁶ 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 $B(\eta_c \rightarrow 2\pi^+ 2\pi^-)$.			
⁷ Superseded by ASNER 04.			
⁸ Normalized to the sum of 9 branching ratios.			
⁹ 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 $B(\eta_c \rightarrow 2\pi^+ 2\pi^-)$.			
¹⁰ Superseded by ACCIARRI 99T.			
¹¹ 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 $B(\eta_c \rightarrow 2\pi^+ 2\pi^-)$.			
¹² Re-evaluated by AIHARA 88D.			

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

$\Gamma(\rho\rho) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$					$\Gamma_2 \Gamma_{34} / \Gamma$
VALUE (eV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<39	90	< 1556	UEHARA	08	BELL $\gamma\gamma \rightarrow 2(\pi^+ \pi^-)$

NODE=M026G09
NODE=M026G09

$\Gamma(K^*(892)\bar{K}^*(892)) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$					$\Gamma_4 \Gamma_{34} / \Gamma$
VALUE (eV)		EVTS	DOCUMENT ID	TECN	COMMENT
35 ± 6 OUR FIT					
[36 ± 6 eV OUR 2012 FIT]					
32.4 ± 4.2 ± 5.8		882 ± 115	UEHARA	08	BELL $\gamma\gamma \rightarrow \pi^+ \pi^- K^+ K^-$

NODE=M026G08
NODE=M026G08
NEW

$\Gamma(\phi\phi) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$					$\Gamma_7 \Gamma_{34} / \Gamma$
VALUE (eV)		EVTS	DOCUMENT ID	TECN	COMMENT
8.9 ± 0.8 OUR FIT					
[10.2 ± 1.4 eV OUR 2012 FIT]					
7.8 ± 0.9 OUR AVERAGE		[6.8 ± 1.8 eV OUR 2012 AVERAGE]			
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. • • •					
$6.8 \pm 1.2 \pm 1.3$		132 ± 23	UEHARA	08	BELL $\gamma\gamma \rightarrow 2(K^+ K^-)$
¹ Supersedes UEHARA 08. Using $B(\phi \rightarrow K^+ K^-) = (48.9 \pm 0.5)\%$.					

NODE=M026G07
NODE=M026G07
NEW

NEW

NODE=M026G07;LINKAGE=LI

$\Gamma(\omega\omega) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$					$\Gamma_{13} \Gamma_{34} / \Gamma$
VALUE (eV)		EVTS	DOCUMENT ID	TECN	COMMENT
8.67 ± 2.86 ± 0.96		85 ± 29	¹ LIU	12B	BELL $\gamma\gamma \rightarrow 2(\pi^+ \pi^- \pi^0)$
¹ Using $B(\omega \rightarrow \pi^+ \pi^- \pi^0) = (89.2 \pm 0.7)\%$.					

NODE=M026G03
NODE=M026G03

NODE=M026G03;LINKAGE=LI

$\Gamma(\omega\phi) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$					$\Gamma_{14} \Gamma_{34} / \Gamma$
VALUE (eV)	CL%		DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.49	90	¹ LIU	12B	BELL	$\gamma\gamma \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$
¹ Using $B(\phi \rightarrow K^+ K^-) = (48.9 \pm 0.5)\%$ and $B(\omega \rightarrow \pi^+ \pi^- \pi^0) = (89.2 \pm 0.7)\%$.					

NODE=M026G04
NODE=M026G04

NODE=M026G04;LINKAGE=LI

$\Gamma(f_2(1270)f_2(1270)) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$					$\Gamma_{15} \Gamma_{34} / \Gamma$
VALUE (eV)		EVTS	DOCUMENT ID	TECN	COMMENT
49 ± 13 OUR FIT					
[51 ± 13 eV OUR 2012 FIT]					
69 ± 17 ± 12		3182 ± 766	UEHARA	08	BELL $\gamma\gamma \rightarrow 2(\pi^+ \pi^-)$

NODE=M026G19
NODE=M026G19
NEW

$$\Gamma(f_2(1270)f_2'(1525)) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{16}\Gamma_{34}/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
49±9±13	1128 ± 206	UEHARA	08 BELL	$\gamma\gamma \rightarrow \pi^+ \pi^- K^+ K^-$

NODE=M026G20
NODE=M026G20

$$\Gamma(K\bar{K}\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{17}\Gamma_{34}/\Gamma$$

VALUE (keV)	CL% EVTS	DOCUMENT ID	TECN	COMMENT

0.369±0.021 OUR FIT

[0.377 ± 0.021 keV OUR 2012 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	$\gamma\gamma \rightarrow K\bar{K}\pi$

¹ From the corrected and unfolded mass spectrum.

² Calculated by us from the value reported in ASNER 04 that assumes $B(\eta_c \rightarrow K\bar{K}\pi) = 5.5 \pm 1.7\%$

³ We have multiplied $K^\pm K_S^0 \pi^\mp$ measurement by 3 to obtain $K\bar{K}\pi$.

⁴ Calculated by us from the value reported in ABDALLAH 03J, which uses $B(\eta_c \rightarrow K_S^0 K^\pm \pi^\mp) = (1.5 \pm 0.4)\%$.

⁵ Not independent from the measurements reported by LEES 10.

⁶ Superseded 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

$$\Gamma(K^+ K^- \pi^+ \pi^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{20}\Gamma_{34}/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

35 ± 5 OUR FIT

[32 ± 6 eV OUR 2012 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
NEW

NODE=M026G;LINKAGE=CC

$$\Gamma(K^+ K^- \pi^+ \pi^- \pi^0) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{21}\Gamma_{34}/\Gamma$$

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	$\gamma\gamma \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$

¹ Not independent from other measurements reported in DEL-AMO-SANCHEZ 11M.

NODE=M026G02
NODE=M026G02

NODE=M026G02;LINKAGE=DE

$$\Gamma(2(K^+ K^-)) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{24}\Gamma_{34}/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

7.4± 1.5 OUR FIT

[7.0 ± 1.6 eV OUR 2012 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
NEW

NODE=M026G;LINKAGE=DD

NODE=M026G;LINKAGE=EE

$$\Gamma(2(\pi^+\pi^-)) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$$

VALUE (eV) EVTS

49 ± 6 OUR FIT

[45 ± 6 eV OUR 2012 FIT]

42 ± 6 OUR AVERAGE

40.7 ± 3.7 ± 5.3 5381 ± 492

180 ± 70 ± 20 21.4 ± 8.6

DOCUMENT ID

TECN

COMMENT

UEHARA

08 BELL

$\gamma\gamma \rightarrow 2(\pi^+\pi^-)$

ALBRECHT

94H ARG

$\gamma\gamma \rightarrow 2(\pi^+\pi^-)$

$$\Gamma_{26}\Gamma_{34}/\Gamma$$

NODE=M026G11

NODE=M026G11

NEW

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

VALUE (eV) EVTS

7.6 ± 0.8 OUR FIT

[7.4 ± 0.8 eV OUR 2012 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.

$$\Gamma_{29}\Gamma_{34}/\Gamma$$

NODE=M026G01

NODE=M026G01

NEW

$\eta_c(1S)$ BRANCHING RATIOS

HADRONIC DECAYS

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

VALUE EVTS

0.041 ± 0.017

14

¹ BALTRUSAIT..86

.86

MRK3

$J/\psi \rightarrow \eta_c\gamma$

$$\Gamma_1/\Gamma$$

NODE=M026R14

NODE=M026R14

¹ The quoted branching ratios use $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = 0.0127 \pm 0.0036$.

NODE=M026R14;LINKAGE=E

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

VALUE (units 10⁻³) CL% EVTS

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

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

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

<14

90

¹ BALTRUSAIT..86

.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

$$\Gamma(K^*(892)^0 K^- \pi^+ + \text{c.c.})/\Gamma_{\text{total}}$$

VALUE EVTS

0.02 ± 0.007

63

^{1,2} BALTRUSAIT..86

.86

MRK3

$J/\psi \rightarrow \eta_c\gamma$

$$\Gamma_3/\Gamma$$

NODE=M026R16

NODE=M026R16

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=M026R;LINKAGE=03

NODE=M026R16;LINKAGE=E

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

VALUE (units 10⁻⁴) EVTS

71 ± 13 OUR FIT

[(68 ± 13) × 10⁻⁴ OUR 2012 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

.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

NEW

NODE=M026R8;LINKAGE=E

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

VALUE (units 10⁻⁴) EVTS

112 ± 47 ± 25

45

¹ ABLIKIM

06A

BES2

$J/\psi \rightarrow K^{*0}\bar{K}^{*0}\pi^+\pi^-\gamma$

$$\Gamma_5/\Gamma$$

NODE=M026R25

NODE=M026R25

¹ ABLIKIM 06A reports $[\Gamma(\eta_c(1S) \rightarrow K^{*0}\bar{K}^{*0}\pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta_c(1S))] = (1.91 \pm 0.64 \pm 0.48) \times 10^{-4}$ 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;LINKAGE=AB

$\Gamma(\phi K^+ K^-)/\Gamma_{\text{total}}$ Γ_6/Γ

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

$2.9^{+0.9}_{-0.8} \pm 1.1$	$14.1^{+4.4}_{-3.7}$	¹ HUANG	03 BELL	$B^+ \rightarrow (\phi K^+ K^-) K^+$

¹ Using $B(B^+ \rightarrow \eta_c K^+) = (1.25 \pm 0.12^{+0.10}_{-0.12}) \times 10^{-3}$ from FANG 03 and $B(\eta_c \rightarrow K \bar{K} \pi) = (5.5 \pm 1.7) \times 10^{-2}$.

NODE=M026R21
NODE=M026R21

NODE=M026R;LINKAGE=BB

 $\Gamma(\phi\phi)/\Gamma_{\text{total}}$ Γ_7/Γ

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

17.6 ± 2.0 OUR FIT[(19.4 ± 3.0) × 10⁻⁴ OUR 2012 FIT]**30 ± 5 OUR AVERAGE**

$25.3 \pm 5.1 \pm 9.1$	72	¹ ABLIKIM	05L BES2	$J/\psi \rightarrow K^+ K^- K^+ K^- \gamma$
26 ± 9	357 ± 64	¹ BAI	04 BES	$J/\psi \rightarrow \gamma K^+ K^- K^+ K^-$
$31 \pm 7 \pm 10$	19	¹ BISELLO	91 DM2	$J/\psi \rightarrow \gamma K^+ K^- K^+ K^-$
$30^{+18}_{-12} \pm 10$	5	¹ BISELLO	91 DM2	$J/\psi \rightarrow \gamma K^+ K^- K_S^0 K_L^0$
$74 \pm 18 \pm 24$	80	¹ BAI	90B MRK3	$J/\psi \rightarrow \gamma K^+ K^- K^+ K^-$
$67 \pm 21 \pm 24$		¹ 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. • • •

$18^{+8}_{-6} \pm 7$	$7.0^{+3.0}_{-2.3}$	² HUANG	03 BELL	$B^+ \rightarrow (\phi\phi) K^+$

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.

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=M026R7
NODE=M026R7

NEW

OCCUR=2

OCCUR=3

NODE=M026R;LINKAGE=E

NODE=M026R7;LINKAGE=BB

 $\Gamma(\phi\phi)/\Gamma(K\bar{K}\pi)$ Γ_7/Γ_{17}

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT

0.0240 ± 0.0026 OUR FIT

[0.027 ± 0.004 OUR 2012 FIT]

0.044 $^{+0.012}_{-0.010}$ OUR AVERAGE

$0.055 \pm 0.014 \pm 0.005$		AUBERT,B	04B BABR	$B^\pm \rightarrow K^\pm \eta_c$
$0.032^{+0.014}_{-0.010} \pm 0.009$	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
NEW

NODE=M026R39;LINKAGE=BB

 $\Gamma(\phi 2(\pi^+ \pi^-))/\Gamma_{\text{total}}$ Γ_8/Γ

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

<35	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=M026R11

NODE=M026R11;LINKAGE=E
NODE=M026R11;LINKAGE=F

 $\Gamma(a_2(1320)\pi)/\Gamma_{\text{total}}$ Γ_{10}/Γ

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	$J/\psi \rightarrow \gamma K^+ K^- \pi^0$

¹ The quoted branching ratios use $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = 0.0127 \pm 0.0036$.

NODE=M026R17
NODE=M026R17

OCCUR=2

NODE=M026R17;LINKAGE=E

$\Gamma(f_2(1270)\eta)/\Gamma_{\text{total}}$

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 $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = 0.0127 \pm 0.0036$.

 Γ_{12}/Γ

NODE=M026R13
NODE=M026R13

NODE=M026R13;LINKAGE=E

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

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.0031	90	¹ BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \eta_c \gamma$

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

<0.0063	90	¹ ABLIKIM	05L BES2	$J/\psi \rightarrow \pi^+ \pi^- \pi^0 \pi^+ \pi^- \pi^0 \gamma$
<0.0063		¹ BISELLO	91 DM2	$J/\psi \rightarrow \gamma \omega \omega$

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=M026R10
NODE=M026R10

NODE=M026R10;LINKAGE=E

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

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.0017	90	¹ ABLIKIM	05L BES2	$J/\psi \rightarrow \pi^+ \pi^- \pi^0 K^+ K^- \gamma$

¹ The quoted branching ratios use $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = 0.0127 \pm 0.0036$.

 Γ_{14}/Γ

NODE=M026R22
NODE=M026R22

NODE=M026R22;LINKAGE=E

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

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

0.98 ± 0.25 OUR FIT

[(0.97 ± 0.25) × 10⁻² OUR 2012 FIT]

0.77^{+0.30}_{-0.34} OUR AVERAGE [(0.76^{+0.30}_{-0.34}) × 10⁻² OUR 2012 AVERAGE]

0.77^{+0.25}_{-0.29} ± 0.17 91.2 ± 19.8 ¹ ABLIKIM 04M BES $J/\psi \rightarrow \gamma 2\pi^+ 2\pi^-$

¹ ABLIKIM 04M reports $[\Gamma(\eta_c(1S) \rightarrow f_2(1270)f_2(1270))/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma \eta_c(1S))] = (1.3 \pm 0.3 \pm 0.3) \times 10^{-4}$ 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

NEW

NEW

NODE=M026R19;LINKAGE=AB

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

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

7.3 ± 0.5 OUR FIT

[(7.2 ± 0.6) × 10⁻² OUR 2012 FIT]

6.5 ± 0.6 OUR AVERAGE

[(6.1 ± 0.8) × 10⁻² OUR 2012 AVERAGE]

6.3 ± 1.3 ± 0.6	55	^{1,2} ABLIKIM	12N BES3	$\psi(2S) \rightarrow \pi^0 \gamma K^+ K^- \pi^0$
7.9 ± 1.4 ± 0.7	107	^{3,4} ABLIKIM	12N BES3	$\psi(2S) \rightarrow \pi^0 \gamma K_S^0 K^\mp \pi^\pm$
8.5 ± 1.8		⁵ AUBERT	06E BABR	$B^\pm \rightarrow K^\pm X_{c\bar{c}}$
5.1 ± 2.1	0.6k	⁶ BAI	04 BES	$J/\psi \rightarrow \gamma K^\pm \pi^\mp K_S^0$
6.90 ± 1.42 ± 1.32	33	⁶ BISELLO	91 DM2	$J/\psi \rightarrow \gamma K^+ K^- \pi^0$
5.43 ± 0.94 ± 0.94	68	⁶ BISELLO	91 DM2	$J/\psi \rightarrow \gamma K^\pm \pi^\mp K_S^0$
4.8 ± 1.7	95	^{6,7} BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \eta_c \gamma$
16.1 ^{+9.2} _{-7.3}		^{8,9} HIMEL	80B MRK2	$\psi(2S) \rightarrow \eta_c \gamma$

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

< 10.7 90% CL ^{6,10} PARTRIDGE 80B CBAL $J/\psi \rightarrow \eta_c \gamma$

¹ ABLIKIM 12N quotes $B(\psi(2S) \rightarrow \pi^0 h_c) \cdot B(h_c \rightarrow \gamma \eta_c) \cdot B(\eta_c \rightarrow K^+ K^- \pi^0) = (4.54 \pm 0.76 \pm 0.48) \times 10^{-6}$ which we multiply by 6 to account for isospin symmetry.

² ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow K\bar{K}\pi)/\Gamma_{\text{total}}] \times [\Gamma(h_c(1P) \rightarrow \eta_c(1S)\gamma)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}}] = (27.24 \pm 4.56 \pm 2.88) \times 10^{-6}$ which we divide by our best value $\Gamma(h_c(1P) \rightarrow \eta_c(1S)\gamma)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}} = (4.3 \pm 0.4) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

³ ABLIKIM 12N quotes $B(\psi(2S) \rightarrow \pi^0 h_c) \cdot B(h_c \rightarrow \gamma \eta_c) \cdot B(\eta_c \rightarrow K_S^0 K^\pm \pi^\mp) = (11.35 \pm 1.25 \pm 1.50) \times 10^{-6}$ which we multiply by 3 to account for isospin symmetry.

⁴ ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow K\bar{K}\pi)/\Gamma_{\text{total}}] \times [\Gamma(h_c(1P) \rightarrow \eta_c(1S)\gamma)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}}] = (34.05 \pm 3.75 \pm 4.50) \times 10^{-6}$ which we divide by our best value $\Gamma(h_c(1P) \rightarrow \eta_c(1S)\gamma)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}} = (4.3 \pm 0.4) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

 Γ_{17}/Γ

NODE=M026R4
NODE=M026R4

NEW

NEW

OCCUR=2

OCCUR=2

NODE=M026R4;LINKAGE=BK

NODE=M026R4;LINKAGE=CK

NODE=M026R4;LINKAGE=BL

NODE=M026R4;LINKAGE=CL

⁵ 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.

⁶ 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.

⁷ Average from $K^+ K^- \pi^0$ and $K^{\pm} K_S^0 \pi^{\mp}$ decay channels.

⁸ $K^{\pm} K_S^0 \pi^{\mp}$ corrected to $K \bar{K} \pi$ by factor 3. KS, MR.

⁹ Estimated using $B(\psi(2S) \rightarrow \gamma \eta_c(1S)) = 0.0028 \pm 0.0006$.

¹⁰ $K^+ K^- \pi^0$ corrected to $K \bar{K} \pi$ by factor 6. KS, MR

NODE=M026R4;LINKAGE=AB

NODE=M026R4;LINKAGE=E

NODE=M026R4;LINKAGE=D

NODE=M026R4;LINKAGE=01

NODE=M026R4;LINKAGE=A

NODE=M026R4;LINKAGE=02

$\Gamma(\phi K^+ K^-)/\Gamma(K \bar{K} \pi)$

Γ_6/Γ_{17}

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
0.052^{+0.016}_{-0.014} ± 0.014	7	¹ HUANG	03	BELL $B^{\pm} \rightarrow K^{\pm} \phi \phi$

NODE=M026R02
NODE=M026R02

¹ Using $B(B^+ \rightarrow \eta_c K^+) = (1.25 \pm 0.12^{+0.10}_{-0.12}) \times 10^{-3}$ from FANG 03 and $B(\eta_c \rightarrow K \bar{K} \pi) = (5.5 \pm 1.7) \times 10^{-2}$.

NODE=M026R02;LINKAGE=BB

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

Γ_{18}/Γ

VALUE (units 10^{-2})	EVTs	DOCUMENT ID	TECN	COMMENT
1.7 ± 0.5 OUR AVERAGE	[0.047 ± 0.015 OUR 2012 AVERAGE]			

1.7 ± 0.4 ± 0.1 33 ¹ ABLIKIM 12N BES3 $\psi(2S) \rightarrow \pi^0 \gamma \eta \pi^+ \pi^-$

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

5.4 ± 2.0 75 ² BALTRUSAIT..86 MRK3 $J/\psi \rightarrow \eta_c \gamma$

3.7 ± 1.3 ± 2.0 18 ² PARTRIDGE 80B CBAL $J/\psi \rightarrow \eta \pi^+ \pi^- \gamma$

NODE=M026R6
NODE=M026R6

NEW

¹ ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow \eta \pi^+ \pi^-)/\Gamma_{\text{total}}] \times [\Gamma(h_c(1P) \rightarrow \eta_c(1S) \gamma)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}}] = (7.22 \pm 1.47 \pm 1.11) \times 10^{-6}$ which we divide by our best value $\Gamma(h_c(1P) \rightarrow \eta_c(1S) \gamma)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}} = (4.3 \pm 0.4) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R6;LINKAGE=AB

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;LINKAGE=E

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

Γ_{19}/Γ

VALUE (units 10^{-2})	EVTs	DOCUMENT ID	TECN	COMMENT
4.4 ± 1.2 ± 0.4	39	¹ ABLIKIM	12N	BES3 $\psi(2S) \rightarrow \pi^0 \gamma \eta 2(\pi^+ \pi^-)$

NODE=M026R05
NODE=M026R05

¹ ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow \eta 2(\pi^+ \pi^-))/\Gamma_{\text{total}}] \times [\Gamma(h_c(1P) \rightarrow \eta_c(1S) \gamma)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}}] = (19.17 \pm 3.77 \pm 3.72) \times 10^{-6}$ which we divide by our best value $\Gamma(h_c(1P) \rightarrow \eta_c(1S) \gamma)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}} = (4.3 \pm 0.4) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R05;LINKAGE=AB

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

Γ_{20}/Γ

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
6.9 ± 1.1 OUR FIT	[0.0061 ± 0.0012 OUR 2012 FIT]			

NODE=M026R5
NODE=M026R5

NEW

11.2 ± 1.9 OUR AVERAGE
[0.0142 ± 0.0033 OUR 2012 AVERAGE]

NEW

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 $[\Gamma(\eta_c(1S) \rightarrow K^+ K^- \pi^+ \pi^-)/\Gamma_{\text{total}}] \times [\Gamma(h_c(1P) \rightarrow \eta_c(1S) \gamma)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}}] = (4.16 \pm 0.76 \pm 0.59) \times 10^{-6}$ which we divide by our best value $\Gamma(h_c(1P) \rightarrow \eta_c(1S) \gamma)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}} = (4.3 \pm 0.4) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R5;LINKAGE=AB

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=M026R5;LINKAGE=E

³ Estimated using $B(\psi(2S) \rightarrow \gamma \eta_c(1S)) = 0.0028 \pm 0.0006$.

NODE=M026R5;LINKAGE=A

$\Gamma(K^+K^-\pi^+\pi^-\pi^0)/\Gamma(K\bar{K}\pi)$ Γ_{21}/Γ_{17}

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

 $\Gamma(K^0K^-\pi^+\pi^-\pi^++c.c.)/\Gamma_{total}$ Γ_{22}/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 $[\Gamma(\eta_c(1S) \rightarrow K^0K^-\pi^+\pi^-\pi^++c.c.)/\Gamma_{total}] \times [\Gamma(h_c(1P) \rightarrow \eta_c(1S)\gamma)/\Gamma_{total} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{total}] = (24.02 \pm 4.44 \pm 4.08) \times 10^{-6}$ which we divide by our best value $\Gamma(h_c(1P) \rightarrow \eta_c(1S)\gamma)/\Gamma_{total} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{total} = (4.3 \pm 0.4) \times 10^{-4}$. 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

 $\Gamma(K^+K^-2(\pi^+\pi^-))/\Gamma_{total}$ Γ_{23}/Γ

VALUE (units 10 ⁻³)	EVTS	DOCUMENT ID	TECN	COMMENT

7.5±2.4 OUR AVERAGE

[(71 ± 29) × 10⁻⁴ OUR 2012 AVERAGE]

8 ± 4 ± 1	10	¹ ABLIKIM	12N BES3	$\psi(2S) \rightarrow \pi^0\gamma K^+K^-2(\pi^+\pi^-)$
7.1±2.4±1.6	100	² ABLIKIM	06A BES2	$J/\psi \rightarrow K^+K^-2(\pi^+\pi^-)\gamma$

NODE=M026R23
 NODE=M026R23

NEW

¹ ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow K^+K^-2(\pi^+\pi^-))/\Gamma_{total}] \times [\Gamma(h_c(1P) \rightarrow \eta_c(1S)\gamma)/\Gamma_{total} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{total}] = (3.60 \pm 1.71 \pm 0.64) \times 10^{-6}$ which we divide by our best value $\Gamma(h_c(1P) \rightarrow \eta_c(1S)\gamma)/\Gamma_{total} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{total} = (4.3 \pm 0.4) \times 10^{-4}$. 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 $[\Gamma(\eta_c(1S) \rightarrow K^+K^-2(\pi^+\pi^-))/\Gamma_{total}] \times [B(J/\psi(1S) \rightarrow \gamma\eta_c(1S))] = (1.21 \pm 0.32 \pm 0.24) \times 10^{-4}$ 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

 $\Gamma(2(K^+K^-))/\Gamma_{total}$ Γ_{24}/Γ

VALUE (units 10 ⁻³)	EVTS	DOCUMENT ID	TECN	COMMENT

1.47± 0.31 OUR FIT

[(1.34 ± 0.32) × 10⁻³ OUR 2012 FIT]

2.2 ± 0.9 OUR AVERAGE [0.0015 ± 0.0007 OUR 2011 AVERAGE]

2.2 ± 0.9 ± 0.2	7	¹ ABLIKIM	12N BES3	$\psi(2S) \rightarrow \pi^0\gamma 2(K^+K^-)$

NODE=M026R20
 NODE=M026R20

NEW

NEW

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

1.4 ± 0.5 ± 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 $[\Gamma(\eta_c(1S) \rightarrow 2(K^+K^-))/\Gamma_{total}] \times [\Gamma(h_c(1P) \rightarrow \eta_c(1S)\gamma)/\Gamma_{total} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{total}] = (0.94 \pm 0.37 \pm 0.14) \times 10^{-6}$ which we divide by our best value $\Gamma(h_c(1P) \rightarrow \eta_c(1S)\gamma)/\Gamma_{total} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{total} = (4.3 \pm 0.4) \times 10^{-4}$. 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_{24}/Γ_{17}

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

0.020±0.004 OUR FIT

[0.019 ± 0.004 OUR 2012 FIT]

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	$B^\pm \rightarrow K^\pm(2K^+2K^-)$

NODE=M026R38
 NODE=M026R38

NEW

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

$\Gamma(\pi^+\pi^-\pi^0\pi^0)/\Gamma_{\text{total}}$ Γ_{25}/Γ VALUE (units 10^{-2}) EVTS

DOCUMENT ID TECN COMMENT

4.7±0.9±0.4 118 1 ABLIKIM 12N BES3 $\psi(2S) \rightarrow \pi^0\gamma\pi^+\pi^-2\pi^0$

1 ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow \pi^+\pi^-\pi^0\pi^0)/\Gamma_{\text{total}}] \times [\Gamma(h_c(1P) \rightarrow \eta_c(1S)\gamma)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}}] = (20.31 \pm 2.20 \pm 3.33) \times 10^{-6}$ which we divide by our best value $\Gamma(h_c(1P) \rightarrow \eta_c(1S)\gamma)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}} = (4.3 \pm 0.4) \times 10^{-4}$. 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_{26}/Γ VALUE (units 10^{-2}) EVTS

DOCUMENT ID TECN COMMENT

0.97±0.12 OUR FIT

[(0.86 ± 0.13) × 10⁻² OUR 2012 FIT]

1.35±0.21 OUR AVERAGE

[(1.15 ± 0.26) × 10⁻² OUR 2012 AVERAGE]1.74±0.32±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±0.17±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 $\psi(2S) \rightarrow \eta_c\gamma$

1 ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow 2(\pi^+\pi^-))/\Gamma_{\text{total}}] \times [\Gamma(h_c(1P) \rightarrow \eta_c(1S)\gamma)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}}] = (7.51 \pm 0.85 \pm 1.11) \times 10^{-6}$ which we divide by our best value $\Gamma(h_c(1P) \rightarrow \eta_c(1S)\gamma)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}} = (4.3 \pm 0.4) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R1
NODE=M026R1

NEW

NEW

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=M026R1;LINKAGE=AB

NODE=M026R1;LINKAGE=E

3 Estimated using $B(\psi(2S) \rightarrow \gamma\eta_c(1S)) = 0.0028 \pm 0.0006$.

NODE=M026R1;LINKAGE=A

 $\Gamma(2(\pi^+\pi^-\pi^0))/\Gamma_{\text{total}}$ Γ_{27}/Γ VALUE (units 10^{-2}) EVTS

DOCUMENT ID TECN COMMENT

17.4±2.9±1.5 175 1 ABLIKIM 12N BES3 $\psi(2S) \rightarrow \pi^0\gamma 2(\pi^+\pi^-2\pi^0)$

1 ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow 2(\pi^+\pi^-\pi^0))/\Gamma_{\text{total}}] \times [\Gamma(h_c(1P) \rightarrow \eta_c(1S)\gamma)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}}] = (75.13 \pm 7.42 \pm 9.99) \times 10^{-6}$ which we divide by our best value $\Gamma(h_c(1P) \rightarrow \eta_c(1S)\gamma)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}} = (4.3 \pm 0.4) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R08
NODE=M026R08

NODE=M026R08;LINKAGE=AB

 $\Gamma(3(\pi^+\pi^-))/\Gamma_{\text{total}}$ Γ_{28}/Γ VALUE (units 10^{-3}) EVTS

DOCUMENT ID TECN COMMENT

17 ±4 OUR AVERAGE

[(150 ± 50) × 10⁻⁴ OUR 2012 AVERAGE]20 ±5 ±2 51 1 ABLIKIM 12N BES3 $\psi(2S) \rightarrow \pi^0\gamma 3(\pi^+\pi^-)$ 15.2±3.3±3.4 479 2 ABLIKIM 06A BES2 $J/\psi \rightarrow 3(\pi^+\pi^-)\gamma$

1 ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow 3(\pi^+\pi^-))/\Gamma_{\text{total}}] \times [\Gamma(h_c(1P) \rightarrow \eta_c(1S)\gamma)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}}] = (8.82 \pm 1.57 \pm 1.59) \times 10^{-6}$ which we divide by our best value $\Gamma(h_c(1P) \rightarrow \eta_c(1S)\gamma)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}} = (4.3 \pm 0.4) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R24
NODE=M026R24

NEW

NODE=M026R24;LINKAGE=AL

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

 $\Gamma(p\bar{p})/\Gamma_{\text{total}}$ Γ_{29}/Γ VALUE (units 10^{-4}) EVTS

DOCUMENT ID TECN COMMENT

15.1± 1.6 OUR FIT

[(14.1 ± 1.7) × 10⁻⁴ OUR 2012 FIT]

13.2± 2.7 OUR AVERAGE

NODE=M026R2
NODE=M026R2

NEW

NEW

$[(12.5 \pm 3.2) \times 10^{-4}]$ OUR 2012 AVERAGE]

15 $\pm$ 5 $\pm$ 1	15	¹ ABLIKIM	12N BES3	$\psi(2S) \rightarrow \pi^0 \gamma p \bar{p}$
15 $\pm$ 6	213 $\pm$ 33	² BAI	04 BES	$J/\psi \rightarrow \gamma p \bar{p}$
10 $\pm$ 3 $\pm$ 4	18	² BISELLO	91 DM2	$J/\psi \rightarrow \gamma p \bar{p}$
11 $\pm$ 6	23	² BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \eta_c \gamma$
29 $\frac{+29}{-15}$		³ HIMEL	80B MRK2	$\psi(2S) \rightarrow \eta_c \gamma$

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

14.8 $\frac{+2.0+1.7}{-2.4-1.8}$	195	⁴ WU	06 BELL	$B^+ \rightarrow p \bar{p} K^+$

¹ ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow p \bar{p})/\Gamma_{\text{total}}] \times [\Gamma(h_c(1P) \rightarrow \eta_c(1S)\gamma)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}}] = (0.65 \pm 0.19 \pm 0.10) \times 10^{-6}$ which we divide by our best value $\Gamma(h_c(1P) \rightarrow \eta_c(1S)\gamma)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}} = (4.3 \pm 0.4) \times 10^{-4}$. 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 $[\Gamma(\eta_c(1S) \rightarrow p \bar{p})/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \eta_c K^+)] = (1.42 \pm 0.11 \pm 0.16) \times 10^{-6}$ which we divide by our best value $B(B^+ \rightarrow \eta_c K^+) = (9.6 \pm 1.1) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R2;LINKAGE=AB

NODE=M026R2;LINKAGE=E

NODE=M026R2;LINKAGE=A

NODE=M026R2;LINKAGE=WU

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

Γ_{29}/Γ_{17}

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.0206 $\pm$ 0.0021 OUR FIT				
[0.0197 $\pm$ 0.0022 OUR 2012 FIT]				

0.021 $\pm$ 0.002 $\frac{+0.004}{-0.006}$	195	¹ WU	06 BELL	$B^\pm \rightarrow K^\pm p \bar{p}$

¹ Using $B(B^+ \rightarrow \eta_c K^+) = (1.25 \pm 0.12 \pm 0.10) \times 10^{-3}$ from FANG 03 and $B(\eta_c \rightarrow K \bar{K} \pi) = (5.5 \pm 1.7) \times 10^{-2}$.

NODE=M026R03
NODE=M026R03
NEW

NODE=M026R03;LINKAGE=BB

$\Gamma(p \bar{p})/\Gamma_{\text{total}} \times \Gamma(\phi \phi)/\Gamma_{\text{total}}$

$\Gamma_{29}/\Gamma \times \Gamma_7/\Gamma$

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
0.27 $\pm$ 0.05 OUR FIT			
[(0.27 $\pm$ 0.06) $\times 10^{-5}$ OUR 2012 FIT]			

4.0 $\frac{+3.5}{-3.2}$	BAGLIN	89 SPEC	$\bar{p} p \rightarrow K^+ K^- K^+ K^-$

NODE=M026R33
NODE=M026R33
NEW

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

Γ_{30}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
0.36 $\pm$ 0.13 $\pm$ 0.03	14	¹ ABLIKIM	12N BES3	$\psi(2S) \rightarrow \pi^0 \gamma p \bar{p} \pi^0$

¹ ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow p \bar{p} \pi^0)/\Gamma_{\text{total}}] \times [\Gamma(h_c(1P) \rightarrow \eta_c(1S)\gamma)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}}] = (1.53 \pm 0.49 \pm 0.23) \times 10^{-6}$ which we divide by our best value $\Gamma(h_c(1P) \rightarrow \eta_c(1S)\gamma)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}} = (4.3 \pm 0.4) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R09
NODE=M026R09

NODE=M026R09;LINKAGE=AB

$\Gamma(\Lambda \bar{\Lambda})/\Gamma_{\text{total}}$

Γ_{31}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
10.9 $\pm$ 2.4 OUR FIT					

11.7 $\pm$ 3.5 OUR AVERAGE [(10.4 $\pm$ 3.1) $\times 10^{-4}$ OUR 2011 AVERAGE]

11.7 $\pm$ 2.3 $\pm$ 2.6 ¹ ABLIKIM 12B BES3

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

9.9 $\frac{+2.7}{-2.6} \pm 1.2$	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.

² WU 06 reports $[\Gamma(\eta_c(1S) \rightarrow \Lambda \bar{\Lambda})/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \eta_c K^+)] = (0.95 \pm 0.25 \pm 0.08) \times 10^{-6}$ which we divide by our best value $B(B^+ \rightarrow \eta_c K^+) = (9.6 \pm 1.1) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

³ The quoted branching ratios use $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = 0.0127 \pm 0.0036$.

NODE=M026R18
NODE=M026R18

NEW

NODE=M026R18;LINKAGE=AB

NODE=M026R18;LINKAGE=WU

NODE=M026R18;LINKAGE=E

$\Gamma(\Lambda\bar{\Lambda})/\Gamma(p\bar{p})$ Γ_{31}/Γ_{29}

VALUE	DOCUMENT ID	TECN	COMMENT
0.72±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

 $\Gamma(K\bar{K}\eta)/\Gamma_{\text{total}}$ Γ_{32}/Γ

VALUE (units 10^{-2})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
1.0±0.5±0.1	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 $B(\psi(2S) \rightarrow \pi^0 h_c) \cdot B(h_c \rightarrow \gamma \eta_c) \cdot B(\eta_c \rightarrow K^+ K^- \eta) = (12.01 \pm 2.22 \pm 2.04) \times 10^{-6}$ which we multiply by 2 to account for isospin symmetry.

² ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow K\bar{K}\eta)/\Gamma_{\text{total}}] \times [\Gamma(h_c(1P) \rightarrow \eta_c(1S)\gamma)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}}] = (4.22 \pm 2.02 \pm 0.64) \times 10^{-6}$ which we divide by our best value $\Gamma(h_c(1P) \rightarrow \eta_c(1S)\gamma)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}} = (4.3 \pm 0.4) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

³ The quoted branching ratios use $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = 0.0127 \pm 0.0036$.

NODE=M026R15
NODE=M026R15

NODE=M026R15;LINKAGE=AK

NODE=M026R15;LINKAGE=AL

NODE=M026R15;LINKAGE=E

 $\Gamma(\pi^+ \pi^- p\bar{p})/\Gamma_{\text{total}}$ Γ_{33}/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 $[\Gamma(\eta_c(1S) \rightarrow \pi^+ \pi^- p\bar{p})/\Gamma_{\text{total}}] \times [\Gamma(h_c(1P) \rightarrow \eta_c(1S)\gamma)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}}] = (2.30 \pm 0.65 \pm 0.36) \times 10^{-6}$ which we divide by our best value $\Gamma(h_c(1P) \rightarrow \eta_c(1S)\gamma)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}} = (4.3 \pm 0.4) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R3
NODE=M026R3

NODE=M026R3;LINKAGE=AB

RADIATIVE DECAYS

 $\Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ Γ_{34}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
1.57±0.12 OUR FIT					
[(1.78 ± 0.16) × 10 ⁻⁴ OUR 2012 FIT]					

1.9^{+0.7}_{-0.6} OUR AVERAGE

[(1.4^{+0.7}_{-0.6}) × 10⁻⁴ OUR 2012 AVERAGE]

2.6 ± 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 $\psi(2S) \rightarrow \pi^+ \pi^- J/\psi$

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

2.3^{+1.0}_{-0.8} ± 0.3 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} ± 0.3) × 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}) × 10⁻⁷ which we divide by our best value $B(B^+ \rightarrow \eta_c K^+) = (9.6 \pm 1.1) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.$

NODE=M026310

NODE=M026R31
NODE=M026R31
NEW

NEW

NODE=M026R31;LINKAGE=AL

NODE=M026R31;LINKAGE=AD

NODE=M026R31;LINKAGE=WI

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=AB

NODE=M026R31;LINKAGE=E
NODE=M026R31;LINKAGE=C

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

Γ_{34}/Γ_{17}

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

2.14 $\pm$ 0.29 OUR FIT

[(2.5 $\pm$ 0.4) $\times 10^{-3}$ OUR 2012 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
NEW

NODE=M026R04;LINKAGE=BB

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

$\Gamma_{29}/\Gamma \times \Gamma_{34}/\Gamma$

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

0.238 $\pm$ 0.024 OUR FIT

[(0.250 $\pm$ 0.026) $\times 10^{-6}$ OUR 2012 FIT]

0.26 $\pm$ 0.05 OUR AVERAGE Error includes scale factor of 1.4.

0.224 $^{+0.038}_{-0.037} \pm 0.020$ 190 AMBROGIANI 03 E835 $\bar{\rho}\rho \rightarrow \eta_c \rightarrow \gamma\gamma$

0.336 $^{+0.080}_{-0.070}$ ARMSTRONG 95F E760 $\bar{\rho}\rho \rightarrow \gamma\gamma$

0.68 $^{+0.42}_{-0.31}$ 12 BAGLIN 87B SPEC $\bar{\rho}\rho \rightarrow \gamma\gamma$

NODE=M026R32
NODE=M026R32
NEW

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

NODE=M026320

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

Γ_{35}/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. • • •

<60 90 ² ABLIKIM 06B BES2 $J/\psi \rightarrow \pi^+ \pi^- \gamma$

¹ ABLIKIM 11G reports $[\Gamma(\eta_c(1S) \rightarrow \pi^+ \pi^-)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma \eta_c(1S))]$ < 1.82×10^{-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 $[\Gamma(\eta_c(1S) \rightarrow \pi^+ \pi^-)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma \eta_c(1S))]$ < 1.1×10^{-5} which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = 1.7 \times 10^{-2}$.

NODE=M026R34
NODE=M026R34

NODE=M026R34;LINKAGE=AL

NODE=M026R34;LINKAGE=AB

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

Γ_{36}/Γ

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

< 3.5 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 $[\Gamma(\eta_c(1S) \rightarrow \pi^0 \pi^0)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma \eta_c(1S))]$ < 6.0×10^{-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 $[\Gamma(\eta_c(1S) \rightarrow \pi^0 \pi^0)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma \eta_c(1S))]$ < 0.71×10^{-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

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

Γ_{37}/Γ

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 $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = 1.7 \times 10^{-2}$.

NODE=M026R36
NODE=M026R36

NODE=M026R36;LINKAGE=AB

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

Γ_{38}/Γ

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

<31 90 ¹ ABLIKIM 06B BES2 $J/\psi \rightarrow K_S^0 K_S^0 \gamma$

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 $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = 1.7 \times 10^{-2}$.

NODE=M026R37
NODE=M026R37

NODE=M026R37;LINKAGE=AB

$\eta_c(1S)$ REFERENCES

NODE=M026

ABLIKIM	13I	PR D87 032003	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=54954
ABLIKIM	12B	PR D86 032008	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=54267
ABLIKIM	12F	PRL 108 222002	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=54271
ABLIKIM	12N	PR D86 092009	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=54741
LIU	12B	PRL 108 232001	Z.Q. Liu <i>et al.</i>	(BELLE Collab.)	REFID=54303
ABLIKIM	11G	PR D84 032006	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=53711
DEL-AMO-SA...	11M	PR D84 012004	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)	REFID=16751
VINOKUROVA	11	PL B706 139	A. Vinokurova <i>et al.</i>	(BELLE Collab.)	REFID=53927
LEES	10	PR D81 052010	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=53236
MITCHELL	09	PRL 102 011801	R.E. Mitchell <i>et al.</i>	(CLEO Collab.)	REFID=52676
ADAMS	08	PRL 101 101801	G.S. Adams <i>et al.</i>	(CLEO Collab.)	REFID=52261
AUBERT	08AB	PR D78 012006	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52267
UEHARA	08	EPJ C53 1	S. Uehara <i>et al.</i>	(BELLE Collab.)	REFID=52064
WICHT	08	PL B662 323	J. Wicht <i>et al.</i>	(BELLE Collab.)	REFID=52204
ABE	07	PRL 98 082001	K. Abe <i>et al.</i>	(BELLE Collab.)	REFID=51627
ABLIKIM	06A	PL B633 19	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50987
ABLIKIM	06B	EPJ C45 337	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50988
AUBERT	06E	PRL 96 052002	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51059
PDG	06	JPG 33 1	W.-M. Yao <i>et al.</i>	(PDG Collab.)	REFID=51004
WU	06	PRL 97 162003	C.-H. Wu <i>et al.</i>	(BELLE Collab.)	REFID=51472
ABLIKIM	05L	PR D72 072005	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50837
KUO	05	PL B621 41	C.C. Kuo <i>et al.</i>	(BELLE Collab.)	REFID=50801
ABE	04G	PR D70 071102	K. Abe <i>et al.</i>	(BELLE Collab.)	REFID=50182
ABLIKIM	04M	PR D70 112008	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50329
ASNER	04	PRL 92 142001	D.M. Asner <i>et al.</i>	(CLEO Collab.)	REFID=49745
AUBERT	04D	PRL 92 142002	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=49746
AUBERT,B	04B	PR D70 011101	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=50043
BAI	04	PL B578 16	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49620
ABDALLAH	03J	EPJ C31 481	J. Abdallah <i>et al.</i>	(DELPHI Collab.)	REFID=49625
AMBROGIANI	03	PL B566 45	M. Ambrogiani <i>et al.</i>	(FNAL E835 Collab.)	REFID=49465
BAI	03	PL B555 174	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49185
FANG	03	PRL 90 071801	F. Fang <i>et al.</i>	(BELLE Collab.)	REFID=49206
HUANG	03	PRL 91 241802	H.-C. Huang <i>et al.</i>	(BELLE Collab.)	REFID=49621
ABE,K	02	PRL 89 142001	K. Abe <i>et al.</i>	(BELLE Collab.)	REFID=49188
BAI	00F	PR D62 072001	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=48546
BRANDENB...	00B	PRL 85 3095	G. Brandenburg <i>et al.</i>	(CLEO Collab.)	REFID=48553
ACCIARRI	99T	PL B461 155	M. Acciarri <i>et al.</i>	(L3 Collab.)	REFID=47476
BAI	99B	PR D60 072001	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=47385
ABREU	98O	PL B441 479	P. Abreu <i>et al.</i>	(DELPHI Collab.)	REFID=46553
SHIRAI	98	PL B424 405	M. Shirai <i>et al.</i>	(AMY Collab.)	REFID=46381
ARMSTRONG	95F	PR D52 4839	T.A. Armstrong <i>et al.</i>	(FNAL, FERR, GENO+)	REFID=44623
ALBRECHT	94H	PL B338 390	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=44098
ADRIANI	93N	PL B318 575	O. Adriani <i>et al.</i>	(L3 Collab.)	REFID=43670
BISELLO	91	NP B350 1	D. Bisello <i>et al.</i>	(DM2 Collab.)	REFID=41668
BAI	90B	PRL 65 1309	Z. Bai <i>et al.</i>	(Mark III Collab.)	REFID=41354
CHEN	90B	PL B243 169	W.Y. Chen <i>et al.</i>	(CLEO Collab.)	REFID=41360
BAGLIN	89	PL B231 557	C. Baglin, S. Baird, G. Bassompierre	(R704 Collab.)	REFID=41015
BEHREND	89	ZPHY C42 367	H.J. Behrend <i>et al.</i>	(CELLO Collab.)	REFID=40732
BRAUNSCH...	89	ZPHY C41 533	W. Braunschweig <i>et al.</i>	(TASSO Collab.)	REFID=40728
AIHARA	88D	PRL 60 2355	H. Aihara <i>et al.</i>	(TPC Collab.)	REFID=40588
BAGLIN	87B	PL B187 191	C. Baglin <i>et al.</i>	(R704 Collab.)	REFID=40018
BALTRUSAIT...	86	PR D33 629	R.M. Baltrusaitis <i>et al.</i>	(Mark III Collab.)	REFID=22009
BERGER	86	PL 167B 120	C. Berger <i>et al.</i>	(PLUTO Collab.)	REFID=22010
GAISER	86	PR D34 711	J. Gaiser <i>et al.</i>	(Crystal Ball Collab.)	REFID=22012
ALTHOFF	85B	ZPHY C29 189	M. Althoff <i>et al.</i>	(TASSO Collab.)	REFID=21349
BALTRUSAIT...	84	PRL 52 2126	R.M. Baltrusaitis <i>et al.</i>	(CIT, UCSC+) JP	REFID=22006
BLOOM	83	ARNS 33 143	E.D. Bloom, C. Peck	(SLAC, CIT)	REFID=21682
HIMEL	80B	PRL 45 1146	T.M. Himel <i>et al.</i>	(SLAC, LBL, UCB)	REFID=22003
PARTRIDGE	80B	PRL 45 1150	R. Partridge <i>et al.</i>	(CIT, HARV, PRIN+)	REFID=22004

$J/\psi(1S)$

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

NODE=M070

 $J/\psi(1S)$ MASS

NODE=M070M

NODE=M070M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
3096.916±0.011 OUR AVERAGE				
3096.917±0.010±0.007		AULCHENKO 03	KEDR	$e^+e^- \rightarrow \text{hadrons}$
3096.89 ±0.09	502	¹ ARTAMONOV 00	OLYA	$e^+e^- \rightarrow \text{hadrons}$
3096.91 ±0.03 ±0.01		² 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. • • •				
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	³ ZHOLENTZ 80	REDE	e^+e^-
3097.0 ±1		⁴ BRANDELIK 79C	DASP	e^+e^-
¹ Reanalysis of ZHOLENTZ 80 using new electron mass (COHEN 87) and radiative corrections (KURAEV 85).				
² Mass central value and systematic error recalculated by us according to Eq.(16) in ARMSTRONG 93B, using the value for the $\psi(2S)$ mass from AULCHENKO 03.				
³ Superseded by ARTAMONOV 00.				
⁴ From a simultaneous fit to e^+e^- , $\mu^+\mu^-$ and hadronic channels assuming $\Gamma(e^+e^-) = \Gamma(\mu^+\mu^-)$.				

NODE=M070M;LINKAGE=AR

NODE=M070M;LINKAGE=NW

NODE=M070M;LINKAGE=RZ

NODE=M070M;LINKAGE=F

 $J/\psi(1S)$ WIDTH

NODE=M070W

NODE=M070W

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
92.9± 2.8 OUR AVERAGE Error includes scale factor of 1.1.				
96.1± 3.2	13k	¹ ADAMS 06A	CLEO	$e^+e^- \rightarrow \mu^+\mu^-\gamma$
84.4± 8.9		BAI 95B	BES	e^+e^-
91 ±11 ±6		² ARMSTRONG 93B	E760	$\bar{p}p \rightarrow e^+e^-$
85.5 ⁺ _{-6.1} 5.8		³ HSUEH 92	RVUE	See Υ mini-review
• • • We do not use the following data for averages, fits, limits, etc. • • •				
94.1± 2.7		⁴ ANASHIN 10	KEDR	$3.097 e^+e^- \rightarrow e^+e^-, \mu^+\mu^-$
93.7± 3.5	7.8k	¹ AUBERT 04	BABR	$e^+e^- \rightarrow \mu^+\mu^-\gamma$
¹ Calculated by us from the reported values of $\Gamma(e^+e^-) \times B(\mu^+\mu^-)$ using $B(e^+e^-) = (5.94 \pm 0.06)\%$ and $B(\mu^+\mu^-) = (5.93 \pm 0.06)\%$.				
² The initial-state radiation correction reevaluated by ANDREOTTI 07 in its Ref. [4].				
³ Using data from COFFMAN 92, BALDINI-CELIO 75, BOYARSKI 75, ESPOSITO 75B, BRANDELIK 79C.				
⁴ Assuming $\Gamma(e^+e^-) = \Gamma(\mu^+\mu^-)$ and using $\Gamma(e^+e^-)/\Gamma_{\text{total}} = (5.94 \pm 0.06)\%$.				

NODE=M070W;LINKAGE=AA

NODE=M070W;LINKAGE=AN

NODE=M070W;LINKAGE=A

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^-	(5.94 ±0.06) %	DESIG=1
Γ_6 $e^+e^-\gamma$	[a] (8.8 ±1.4) $\times 10^{-3}$	DESIG=5
Γ_7 $\mu^+\mu^-$	(5.93 ±0.06) %	DESIG=2

Decays involving hadronic resonances

NODE=M070;CLUMP=A

Γ ₈	$\rho\pi$	(1.69 ± 0.15) %	S=2.4	DESIG=20
Γ ₉	$\rho^0\pi^0$	(5.6 ± 0.7) × 10 ⁻³		DESIG=21
Γ ₁₀	$a_2(1320)\rho$	(1.09 ± 0.22) %		DESIG=43
Γ ₁₁	$\omega\pi^+\pi^+\pi^-\pi^-$	(8.5 ± 3.4) × 10 ⁻³		DESIG=26
Γ ₁₂	$\omega\pi^+\pi^-\pi^0$	(4.0 ± 0.7) × 10 ⁻³		DESIG=211
Γ ₁₃	$\omega\pi^+\pi^-$	(8.6 ± 0.7) × 10 ⁻³	S=1.1	DESIG=24
Γ ₁₄	$\omega f_2(1270)$	(4.3 ± 0.6) × 10 ⁻³		DESIG=28
Γ ₁₅	$K^*(892)^0\bar{K}^*(892)^0$	(2.3 ± 0.7) × 10 ⁻⁴		DESIG=46
Γ ₁₆	$K^*(892)^\pm\bar{K}^*(892)^\mp$	(1.00 ± 0.22) × 10 ⁻³		DESIG=256
Γ ₁₇	$K^*(892)^\pm\bar{K}^*(800)^\mp$	(1.1 ± 1.0) × 10 ⁻³		DESIG=257
Γ ₁₈	$\eta K^*(892)^0\bar{K}^*(892)^0$	(1.15 ± 0.26) × 10 ⁻³		DESIG=252
Γ ₁₉	$K^*(892)^0\bar{K}_2^*(1430)^0 + \text{c.c.}$	(6.0 ± 0.6) × 10 ⁻³		DESIG=48
Γ ₂₀	$K^*(892)^0\bar{K}_2^*(1770)^0 + \text{c.c.} \rightarrow K^*(892)^0 K^- \pi^+ + \text{c.c.}$	(6.9 ± 0.9) × 10 ⁻⁴		DESIG=235
Γ ₂₁	$\omega K^*(892)\bar{K} + \text{c.c.}$	(6.1 ± 0.9) × 10 ⁻³		DESIG=102
Γ ₂₂	$K^+\bar{K}^*(892)^- + \text{c.c.}$	(5.12 ± 0.30) × 10 ⁻³		DESIG=121
Γ ₂₃	$K^+\bar{K}^*(892)^- + \text{c.c.} \rightarrow K^+ K^- \pi^0$	(1.97 ± 0.20) × 10 ⁻³		DESIG=231
Γ ₂₄	$K^+\bar{K}^*(892)^- + \text{c.c.} \rightarrow K^0 K^\pm \pi^\mp$	(3.0 ± 0.4) × 10 ⁻³		DESIG=232
Γ ₂₅	$K^0\bar{K}^*(892)^0 + \text{c.c.}$	(4.39 ± 0.31) × 10 ⁻³		DESIG=122
Γ ₂₆	$K^0\bar{K}^*(892)^0 + \text{c.c.} \rightarrow K^0 K^\pm \pi^\mp$	(3.2 ± 0.4) × 10 ⁻³		DESIG=233
Γ ₂₇	$K_1(1400)^\pm K^\mp$	(3.8 ± 1.4) × 10 ⁻³		DESIG=132
Γ ₂₈	$\bar{K}^*(892)^0 K^+ \pi^- + \text{c.c.}$	seen		DESIG=214
Γ ₂₉	$\omega\pi^0\pi^0$	(3.4 ± 0.8) × 10 ⁻³		DESIG=140
Γ ₃₀	$b_1(1235)^\pm\pi^\mp$	[b] (3.0 ± 0.5) × 10 ⁻³		DESIG=49
Γ ₃₁	$\omega K^\pm K_S^0\pi^\mp$	[b] (3.4 ± 0.5) × 10 ⁻³		DESIG=101
Γ ₃₂	$b_1(1235)^0\pi^0$	(2.3 ± 0.6) × 10 ⁻³		DESIG=160
Γ ₃₃	$\eta K^\pm K_S^0\pi^\mp$	[b] (2.2 ± 0.4) × 10 ⁻³		DESIG=230
Γ ₃₄	$\phi K^*(892)\bar{K} + \text{c.c.}$	(2.18 ± 0.23) × 10 ⁻³		DESIG=104
Γ ₃₅	$\omega K\bar{K}$	(1.70 ± 0.32) × 10 ⁻³		DESIG=27
Γ ₃₆	$\omega f_0(1710) \rightarrow \omega K\bar{K}$	(4.8 ± 1.1) × 10 ⁻⁴		DESIG=130
Γ ₃₇	$\phi 2(\pi^+\pi^-)$	(1.66 ± 0.23) × 10 ⁻³		DESIG=35
Γ ₃₈	$\Delta(1232)^{++}\bar{p}\pi^-$	(1.6 ± 0.5) × 10 ⁻³		DESIG=70
Γ ₃₉	$\omega\eta$	(1.74 ± 0.20) × 10 ⁻³	S=1.6	DESIG=30
Γ ₄₀	$\phi K\bar{K}$	(1.83 ± 0.24) × 10 ⁻³	S=1.5	DESIG=36
Γ ₄₁	$\phi f_0(1710) \rightarrow \phi K\bar{K}$	(3.6 ± 0.6) × 10 ⁻⁴		DESIG=129
Γ ₄₂	$\phi f_2(1270)$	(7.2 ± 1.3) × 10 ⁻⁴		DESIG=39
Γ ₄₃	$\Delta(1232)^{++}\bar{\Delta}(1232)^{--}$	(1.10 ± 0.29) × 10 ⁻³		DESIG=66
Γ ₄₄	$\Sigma(1385)^-\bar{\Sigma}(1385)^+ (\text{or c.c.})$	[b] (1.10 ± 0.12) × 10 ⁻³		DESIG=67
Γ ₄₅	$\phi f_2'(1525)$	(8 ± 4) × 10 ⁻⁴	S=2.7	DESIG=40
Γ ₄₆	$\phi\pi^+\pi^-$	(9.4 ± 0.9) × 10 ⁻⁴	S=1.2	DESIG=34
Γ ₄₇	$\phi\pi^0\pi^0$	(5.6 ± 1.6) × 10 ⁻⁴		DESIG=76
Γ ₄₈	$\phi K^\pm K_S^0\pi^\mp$	[b] (7.2 ± 0.8) × 10 ⁻⁴		DESIG=103
Γ ₄₉	$\omega f_1(1420)$	(6.8 ± 2.4) × 10 ⁻⁴		DESIG=105
Γ ₅₀	$\phi\eta$	(7.5 ± 0.8) × 10 ⁻⁴	S=1.5	DESIG=37
Γ ₅₁	$\Xi^0\Xi^0$	(1.20 ± 0.24) × 10 ⁻³		DESIG=248
Γ ₅₂	$\Xi(1530)^-\Xi^+$	(5.9 ± 1.5) × 10 ⁻⁴		DESIG=107
Γ ₅₃	$pK^-\bar{\Sigma}(1385)^0$	(5.1 ± 3.2) × 10 ⁻⁴		DESIG=74
Γ ₅₄	$\omega\pi^0$	(4.5 ± 0.5) × 10 ⁻⁴	S=1.4	DESIG=32
Γ ₅₅	$\phi\eta'(958)$	(4.0 ± 0.7) × 10 ⁻⁴	S=2.1	DESIG=38
Γ ₅₆	$\phi f_0(980)$	(3.2 ± 0.9) × 10 ⁻⁴	S=1.9	DESIG=41
Γ ₅₇	$\phi f_0(980) \rightarrow \phi\pi^+\pi^-$	(1.8 ± 0.4) × 10 ⁻⁴		DESIG=236
Γ ₅₈	$\phi f_0(980) \rightarrow \phi\pi^0\pi^0$	(1.7 ± 0.7) × 10 ⁻⁴		DESIG=237
Γ ₅₉	$\eta\phi f_0(980) \rightarrow \eta\phi\pi^+\pi^-$	(3.2 ± 1.0) × 10 ⁻⁴		DESIG=229
Γ ₆₀	$\phi a_0(980)^0 \rightarrow \phi\eta\pi^0$	(5 ± 4) × 10 ⁻⁶		DESIG=258

Г ₆₁	$\Xi(1530)^0 \Xi^0$	(3.2 ±1.4) × 10 ⁻⁴		DESIG=108
Г ₆₂	$\Sigma(1385)^- \bar{\Sigma}^+$ (or c.c.)	[b] (3.1 ±0.5) × 10 ⁻⁴		DESIG=68
Г ₆₃	$\phi f_1(1285)$	(2.6 ±0.5) × 10 ⁻⁴	S=1.1	DESIG=106
Г ₆₄	$\eta \pi^+ \pi^-$	(4.0 ±1.7) × 10 ⁻⁴		DESIG=239
Г ₆₅	$\rho \eta$	(1.93 ±0.23) × 10 ⁻⁴		DESIG=22
Г ₆₆	$\omega \eta'(958)$	(1.82 ±0.21) × 10 ⁻⁴		DESIG=31
Г ₆₇	$\omega f_0(980)$	(1.4 ±0.5) × 10 ⁻⁴		DESIG=150
Г ₆₈	$\rho \eta'(958)$	(1.05 ±0.18) × 10 ⁻⁴		DESIG=23
Г ₆₉	$a_2(1320)^{\pm} \pi^{\mp}$	[b] < 4.3 × 10 ⁻³	CL=90%	DESIG=42
Г ₇₀	$K K_2^*(1430) + \text{c.c.}$	< 4.0 × 10 ⁻³	CL=90%	DESIG=45
Г ₇₁	$K_1(1270)^{\pm} K^{\mp}$	< 3.0 × 10 ⁻³	CL=90%	DESIG=131
Г ₇₂	$K_2^*(1430)^0 \bar{K}_2^*(1430)^0$	< 2.9 × 10 ⁻³	CL=90%	DESIG=47
Г ₇₃	$\phi \pi^0$	< 6.4 × 10 ⁻⁶	CL=90%	DESIG=33
Г ₇₄	$\phi \eta(1405) \rightarrow \phi \eta \pi \pi$	< 2.5 × 10 ⁻⁴	CL=90%	DESIG=128
Г ₇₅	$\omega f_2'(1525)$	< 2.2 × 10 ⁻⁴	CL=90%	DESIG=29
Г ₇₆	$\eta \phi(2170) \rightarrow$ $\eta K^*(892)^0 \bar{K}^*(892)^0$	< 2.52 × 10 ⁻⁴	CL=90%	DESIG=253
Г ₇₇	$\Sigma(1385)^0 \bar{\Lambda} + \text{c.c.}$	< 8.2 × 10 ⁻⁶	CL=90%	DESIG=111
Г ₇₈	$\Delta(1232)^+ \bar{p}$	< 1 × 10 ⁻⁴	CL=90%	DESIG=112
Г ₇₉	$\Lambda(1520) \bar{\Lambda} + \text{c.c.} \rightarrow \gamma \Lambda \bar{\Lambda}$	< 4.1 × 10 ⁻⁶	CL=90%	DESIG=260
Г ₈₀	$\Theta(1540) \bar{\Theta}(1540) \rightarrow$ $K_S^0 p K^- \bar{n} + \text{c.c.}$	< 1.1 × 10 ⁻⁵	CL=90%	DESIG=205
Г ₈₁	$\Theta(1540) K^- \bar{n} \rightarrow K_S^0 p K^- \bar{n}$	< 2.1 × 10 ⁻⁵	CL=90%	DESIG=206
Г ₈₂	$\Theta(1540) K_S^0 \bar{p} \rightarrow K_S^0 \bar{p} K^+ n$	< 1.6 × 10 ⁻⁵	CL=90%	DESIG=207
Г ₈₃	$\bar{\Theta}(1540) K^+ n \rightarrow K_S^0 \bar{p} K^+ n$	< 5.6 × 10 ⁻⁵	CL=90%	DESIG=208
Г ₈₄	$\bar{\Theta}(1540) K_S^0 p \rightarrow K_S^0 p K^- \bar{n}$	< 1.1 × 10 ⁻⁵	CL=90%	DESIG=209
Г ₈₅	$\Sigma^0 \bar{\Lambda}$	< 9 × 10 ⁻⁵	CL=90%	DESIG=110

Decays into stable hadrons

Г ₈₆	$2(\pi^+ \pi^-) \pi^0$	(4.1 ±0.5) %	S=2.4	DESIG=9
Г ₈₇	$3(\pi^+ \pi^-) \pi^0$	(2.9 ±0.6) %		DESIG=11
Г ₈₈	$\pi^+ \pi^- \pi^0$	(2.11 ±0.07) %	S=1.5	DESIG=7
Г ₈₉	$\pi^+ \pi^- \pi^0 K^+ K^-$	(1.79 ±0.29) %	S=2.2	DESIG=18
Г ₉₀	$4(\pi^+ \pi^-) \pi^0$	(9.0 ±3.0) × 10 ⁻³		DESIG=12
Г ₉₁	$\pi^+ \pi^- K^+ K^-$	(6.6 ±0.5) × 10 ⁻³		DESIG=16
Г ₉₂	$\pi^+ \pi^- K^+ K^- \eta$	(1.84 ±0.28) × 10 ⁻³		DESIG=238
Г ₉₃	$\pi^0 \pi^0 K^+ K^-$	(2.45 ±0.31) × 10 ⁻³		DESIG=234
Г ₉₄	$K \bar{K} \pi$	(6.1 ±1.0) × 10 ⁻³		DESIG=15
Г ₉₅	$2(\pi^+ \pi^-)$	(3.57 ±0.30) × 10 ⁻³		DESIG=8
Г ₉₆	$3(\pi^+ \pi^-)$	(4.3 ±0.4) × 10 ⁻³		DESIG=10
Г ₉₇	$2(\pi^+ \pi^- \pi^0)$	(1.62 ±0.21) %		DESIG=210
Г ₉₈	$2(\pi^+ \pi^-) \eta$	(2.29 ±0.24) × 10 ⁻³		DESIG=201
Г ₉₉	$3(\pi^+ \pi^-) \eta$	(7.2 ±1.5) × 10 ⁻⁴		DESIG=202
Г ₁₀₀	$\rho \bar{p}$	(2.120 ±0.029) × 10 ⁻³		DESIG=50
Г ₁₀₁	$\rho \bar{p} \pi^0$	(1.19 ±0.08) × 10 ⁻³	S=1.1	DESIG=52
Г ₁₀₂	$\rho \bar{p} \pi^+ \pi^-$	(6.0 ±0.5) × 10 ⁻³	S=1.3	DESIG=54
Г ₁₀₃	$\rho \bar{p} \pi^+ \pi^- \pi^0$	[c] (2.3 ±0.9) × 10 ⁻³	S=1.9	DESIG=55
Г ₁₀₄	$\rho \bar{p} \eta$	(2.00 ±0.12) × 10 ⁻³		DESIG=56
Г ₁₀₅	$\rho \bar{p} \rho$	< 3.1 × 10 ⁻⁴	CL=90%	DESIG=57
Г ₁₀₆	$\rho \bar{p} \omega$	(1.10 ±0.15) × 10 ⁻³	S=1.3	DESIG=58
Г ₁₀₇	$\rho \bar{p} \eta'(958)$	(2.1 ±0.4) × 10 ⁻⁴		DESIG=59
Г ₁₀₈	$\rho \bar{p} \phi$	(4.5 ±1.5) × 10 ⁻⁵		DESIG=127
Г ₁₀₉	$n \bar{n}$	(2.09 ±0.16) × 10 ⁻³		DESIG=64
Г ₁₁₀	$n \bar{n} \pi^+ \pi^-$	(4 ±4) × 10 ⁻³		DESIG=65
Г ₁₁₁	$\Sigma^+ \bar{\Sigma}^-$	(1.50 ±0.24) × 10 ⁻³		DESIG=247
Г ₁₁₂	$\Sigma^0 \bar{\Sigma}^0$	(1.29 ±0.09) × 10 ⁻³		DESIG=63

NODE=M070;CLUMP=B

Γ ₁₁₃	$2(\pi^+\pi^-)K^+K^-$	$(4.7 \pm 0.7) \times 10^{-3}$	S=1.3	DESIG=17
Γ ₁₁₄	$p\bar{n}\pi^-$	$(2.12 \pm 0.09) \times 10^{-3}$		DESIG=53
Γ ₁₁₅	$nN(1440)$	seen		DESIG=215;OUR EST;→ UNCHECKED ←
Γ ₁₁₆	$nN(1520)$	seen		DESIG=216;OUR EST;→ UNCHECKED ←
Γ ₁₁₇	$nN(1535)$	seen		DESIG=217;OUR EST;→ UNCHECKED ←
Γ ₁₁₈	$\Xi^-\Xi^+$	$(8.6 \pm 1.1) \times 10^{-4}$	S=1.2	DESIG=62
Γ ₁₁₉	$\Lambda\bar{\Lambda}$	$(1.61 \pm 0.15) \times 10^{-3}$	S=1.9	DESIG=60
Γ ₁₂₀	$\Lambda\bar{\Sigma}^-\pi^+$ (or c.c.)	[b] $(8.3 \pm 0.7) \times 10^{-4}$	S=1.2	DESIG=71
Γ ₁₂₁	$pK^-\bar{\Lambda}$	$(8.9 \pm 1.6) \times 10^{-4}$		DESIG=72
Γ ₁₂₂	$2(K^+K^-)$	$(7.6 \pm 0.9) \times 10^{-4}$		DESIG=19
Γ ₁₂₃	$pK^-\bar{\Sigma}^0$	$(2.9 \pm 0.8) \times 10^{-4}$		DESIG=73
Γ ₁₂₄	K^+K^-	$(2.70 \pm 0.17) \times 10^{-4}$		DESIG=13
Γ ₁₂₅	$K_S^0 K_L^0$	$(2.1 \pm 0.4) \times 10^{-4}$	S=3.2	DESIG=75
Γ ₁₂₆	$\Lambda\bar{\Lambda}\pi^+\pi^-$	$(4.3 \pm 1.0) \times 10^{-3}$		DESIG=261
Γ ₁₂₇	$\Lambda\bar{\Lambda}\eta$	$(1.62 \pm 0.17) \times 10^{-4}$		DESIG=228
Γ ₁₂₈	$\Lambda\bar{\Lambda}\pi^0$	$(3.8 \pm 0.4) \times 10^{-5}$		DESIG=109
Γ ₁₂₉	$\bar{\Lambda}nK_S^0 + \text{c.c.}$	$(6.5 \pm 1.1) \times 10^{-4}$		DESIG=225
Γ ₁₃₀	$\pi^+\pi^-$	$(1.47 \pm 0.14) \times 10^{-4}$		DESIG=6
Γ ₁₃₁	$\Lambda\bar{\Sigma} + \text{c.c.}$	$(2.83 \pm 0.23) \times 10^{-3}$		DESIG=61
Γ ₁₃₂	$K_S^0 K_S^0$	< 1 $\times 10^{-6}$	CL=95%	DESIG=14

Radiative decays

Γ ₁₃₃	3γ	$(1.16 \pm 0.22) \times 10^{-5}$		NODE=M070;CLUMP=C
Γ ₁₃₄	4γ	< 9 $\times 10^{-6}$	CL=90%	DESIG=81
Γ ₁₃₅	5γ	< 1.5 $\times 10^{-5}$	CL=90%	DESIG=244
Γ ₁₃₆	$\gamma\eta_c(1S)$	$(1.7 \pm 0.4) \%$	S=1.6	DESIG=245
Γ ₁₃₇	$\gamma\eta_c(1S) \rightarrow 3\gamma$	$(3.8 \pm 1.3 \pm 1.0) \times 10^{-6}$	S=1.1	DESIG=85
Γ ₁₃₈	$\gamma\pi^+\pi^-2\pi^0$	$(8.3 \pm 3.1) \times 10^{-3}$		DESIG=246
Γ ₁₃₉	$\gamma\eta\pi\pi$	$(6.1 \pm 1.0) \times 10^{-3}$		DESIG=99
Γ ₁₄₀	$\gamma\eta_2(1870) \rightarrow \gamma\eta\pi^+\pi^-$	$(6.2 \pm 2.4) \times 10^{-4}$		DESIG=96
Γ ₁₄₁	$\gamma\eta(1405/1475) \rightarrow \gamma K\bar{K}\pi$	[d] $(2.8 \pm 0.6) \times 10^{-3}$	S=1.6	DESIG=142
Γ ₁₄₂	$\gamma\eta(1405/1475) \rightarrow \gamma\gamma\rho^0$	$(7.8 \pm 2.0) \times 10^{-5}$	S=1.8	DESIG=89
Γ ₁₄₃	$\gamma\eta(1405/1475) \rightarrow \gamma\eta\pi^+\pi^-$	$(3.0 \pm 0.5) \times 10^{-4}$		DESIG=171
Γ ₁₄₄	$\gamma\eta(1405/1475) \rightarrow \gamma\gamma\phi$	< 8.2 $\times 10^{-5}$	CL=95%	DESIG=170
Γ ₁₄₅	$\gamma\rho\rho$	$(4.5 \pm 0.8) \times 10^{-3}$		DESIG=212
Γ ₁₄₆	$\gamma\rho\omega$	< 5.4 $\times 10^{-4}$	CL=90%	DESIG=94
Γ ₁₄₇	$\gamma\rho\phi$	< 8.8 $\times 10^{-5}$	CL=90%	DESIG=226
Γ ₁₄₈	$\gamma\eta'(958)$	$(5.15 \pm 0.16) \times 10^{-3}$	S=1.2	DESIG=227
Γ ₁₄₉	$\gamma 2\pi^+2\pi^-$	$(2.8 \pm 0.5) \times 10^{-3}$	S=1.9	DESIG=84
Γ ₁₅₀	$\gamma f_2(1270) f_2(1270)$	$(9.5 \pm 1.7) \times 10^{-4}$		DESIG=95
Γ ₁₅₁	$\gamma f_2(1270) f_2(1270)$ (non resonant)	$(8.2 \pm 1.9) \times 10^{-4}$		DESIG=203
Γ ₁₅₂	$\gamma K^+K^-\pi^+\pi^-$	$(2.1 \pm 0.6) \times 10^{-3}$		DESIG=204
Γ ₁₅₃	$\gamma f_4(2050)$	$(2.7 \pm 0.7) \times 10^{-3}$		DESIG=143
Γ ₁₅₄	$\gamma\omega\omega$	$(1.61 \pm 0.33) \times 10^{-3}$		DESIG=100
Γ ₁₅₅	$\gamma\eta(1405/1475) \rightarrow \gamma\rho^0\rho^0$	$(1.7 \pm 0.4) \times 10^{-3}$	S=1.3	DESIG=97
Γ ₁₅₆	$\gamma f_2(1270)$	$(1.43 \pm 0.11) \times 10^{-3}$		DESIG=124
Γ ₁₅₇	$\gamma f_0(1710) \rightarrow \gamma K\bar{K}$	$(8.5 \pm 1.2 \pm 0.9) \times 10^{-4}$	S=1.2	DESIG=86
Γ ₁₅₈	$\gamma f_0(1710) \rightarrow \gamma\pi\pi$	$(4.0 \pm 1.0) \times 10^{-4}$		DESIG=91
Γ ₁₅₉	$\gamma f_0(1710) \rightarrow \gamma\omega\omega$	$(3.1 \pm 1.0) \times 10^{-4}$		DESIG=135
Γ ₁₆₀	$\gamma\eta$	$(1.104 \pm 0.034) \times 10^{-3}$		DESIG=221
Γ ₁₆₁	$\gamma f_1(1420) \rightarrow \gamma K\bar{K}\pi$	$(7.9 \pm 1.3) \times 10^{-4}$		DESIG=83
Γ ₁₆₂	$\gamma f_1(1285)$	$(6.1 \pm 0.8) \times 10^{-4}$		DESIG=175
Γ ₁₆₃	$\gamma f_1(1510) \rightarrow \gamma\eta\pi^+\pi^-$	$(4.5 \pm 1.2) \times 10^{-4}$		DESIG=88
Γ ₁₆₄	$\gamma f_2'(1525)$	$(4.5 \pm 0.7 \pm 0.4) \times 10^{-4}$		DESIG=141
Γ ₁₆₅	$\gamma f_2(1640) \rightarrow \gamma\omega\omega$	$(2.8 \pm 1.8) \times 10^{-4}$		DESIG=87

Γ_{166}	$\gamma f_2(1910) \rightarrow \gamma \omega \omega$	$(2.0 \pm 1.4) \times 10^{-4}$		DESIG=223
Γ_{167}	$\gamma f_0(1800) \rightarrow \gamma \omega \phi$	$(2.5 \pm 0.6) \times 10^{-4}$		DESIG=262
Γ_{168}	$\gamma f_2(1950) \rightarrow \gamma K^*(892) \bar{K}^*(892)$	$(7.0 \pm 2.2) \times 10^{-4}$		DESIG=144
Γ_{169}	$\gamma K^*(892) \bar{K}^*(892)$	$(4.0 \pm 1.3) \times 10^{-3}$		DESIG=145
Γ_{170}	$\gamma \phi \phi$	$(4.0 \pm 1.2) \times 10^{-4}$	S=2.1	DESIG=98
Γ_{171}	$\gamma p \bar{p}$	$(3.8 \pm 1.0) \times 10^{-4}$		DESIG=90
Γ_{172}	$\gamma \eta(2225)$	$(3.3 \pm 0.5) \times 10^{-4}$		DESIG=126
Γ_{173}	$\gamma \eta(1760) \rightarrow \gamma \rho^0 \rho^0$	$(1.3 \pm 0.9) \times 10^{-4}$		DESIG=125
Γ_{174}	$\gamma \eta(1760) \rightarrow \gamma \omega \omega$	$(1.98 \pm 0.33) \times 10^{-3}$		DESIG=224
Γ_{175}	$\gamma X(1835) \rightarrow \gamma \pi^+ \pi^- \eta'$	$(2.6 \pm 0.4) \times 10^{-4}$		DESIG=213
Γ_{176}	$\gamma X(1835) \rightarrow \gamma p \bar{p}$	$(7.7 \pm 1.5) \times 10^{-5}$		DESIG=254
Γ_{177}	$\gamma(K \bar{K} \pi) [J^{PC} = 0^{-+}]$	$(7 \pm 4) \times 10^{-4}$	S=2.1	DESIG=176
Γ_{178}	$\gamma \pi^0$	$(3.49 \pm 0.33) \times 10^{-5}$		DESIG=82
Γ_{179}	$\gamma p \bar{p} \pi^+ \pi^-$	$< 7.9 \times 10^{-4}$	CL=90%	DESIG=93
Γ_{180}	$\gamma \Lambda \bar{\Lambda}$	$< 1.3 \times 10^{-4}$	CL=90%	DESIG=200
Γ_{181}	$\gamma f_0(2200)$			DESIG=123
Γ_{182}	$\gamma f_J(2220)$	$> 2.50 \times 10^{-3}$	CL=99.9%	DESIG=92
Γ_{183}	$\gamma f_J(2220) \rightarrow \gamma \pi \pi$	$(8 \pm 4) \times 10^{-5}$		DESIG=136
Γ_{184}	$\gamma f_J(2220) \rightarrow \gamma K \bar{K}$	$< 3.6 \times 10^{-5}$		DESIG=137
Γ_{185}	$\gamma f_J(2220) \rightarrow \gamma p \bar{p}$	$(1.5 \pm 0.8) \times 10^{-5}$		DESIG=138
Γ_{186}	$\gamma f_0(1500)$	$(1.01 \pm 0.32) \times 10^{-4}$		DESIG=172
Γ_{187}	$\gamma A \rightarrow \gamma \text{invisible}$	$[e] < 6.3 \times 10^{-6}$	CL=90%	DESIG=251
Γ_{188}	$\gamma A^0 \rightarrow \gamma \mu^+ \mu^-$	$[f] < 2.1 \times 10^{-5}$	CL=90%	DESIG=259

Weak decays

Γ_{189}	$D^- e^+ \nu_e + \text{c.c.}$	$< 1.2 \times 10^{-5}$	CL=90%	NODE=M070;CLUMP=E DESIG=218
Γ_{190}	$\bar{D}^0 e^+ e^- + \text{c.c.}$	$< 1.1 \times 10^{-5}$	CL=90%	DESIG=219
Γ_{191}	$D_s^- e^+ \nu_e + \text{c.c.}$	$< 3.6 \times 10^{-5}$	CL=90%	DESIG=220
Γ_{192}	$D^- \pi^+ + \text{c.c.}$	$< 7.5 \times 10^{-5}$	CL=90%	DESIG=241
Γ_{193}	$\bar{D}^0 K^0 + \text{c.c.}$	$< 1.7 \times 10^{-4}$	CL=90%	DESIG=242
Γ_{194}	$D_s^- \pi^+ + \text{c.c.}$	$< 1.3 \times 10^{-4}$	CL=90%	DESIG=243

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

Γ_{195}	$\gamma \gamma$	C	$< 5 \times 10^{-6}$	CL=90%	DESIG=80
Γ_{196}	$e^\pm \mu^\mp$	LF	$< 1.1 \times 10^{-6}$	CL=90%	DESIG=177
Γ_{197}	$e^\pm \tau^\mp$	LF	$< 8.3 \times 10^{-6}$	CL=90%	DESIG=178
Γ_{198}	$\mu^\pm \tau^\mp$	LF	$< 2.0 \times 10^{-6}$	CL=90%	DESIG=179

Other decays

Γ_{199}	invisible	$< 7 \times 10^{-4}$	CL=90%	NODE=M070;CLUMP=F DESIG=240

[a] For $E_\gamma > 100$ MeV.

[b] The value is for the sum of the charge states or particle/antiparticle states indicated.

[c] Includes $p \bar{p} \pi^+ \pi^- \gamma$ and excludes $p \bar{p} \eta$, $p \bar{p} \omega$, $p \bar{p} \eta'$.[d] See the "Note on the $\eta(1405)$ " in the $\eta(1405)$ Particle Listings.

[e] For a narrow state A with mass less than 960 MeV.

[f] For a narrow scalar or pseudoscalar A^0 with mass 0.21–3.0 GeV.

LINKAGE=Egm

LINKAGE=SG

LINKAGE=MF

LINKAGE=MG

LINKAGE=NSA

LINKAGE=NA0

 $J/\psi(1S)$ PARTIAL WIDTHS

NODE=M070220

 $\Gamma(\text{hadrons})$ **Γ_1**

VALUE (keV) DOCUMENT ID TECN COMMENT

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

74.1 ± 8.1	BAI	95B	BES	$e^+ e^-$
59 ± 24	BALDINI-...	75	FRAG	$e^+ e^-$
59 ± 14	BOYARSKI	75	MRK1	$e^+ e^-$
50 ± 25	ESPOSITO	75B	FRAM	$e^+ e^-$

NODE=M070W3
NODE=M070W3

$\Gamma(e^+e^-)$ Γ_5

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT

5.55±0.14±0.02 OUR EVALUATION

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

5.71±0.16	13k	¹ ADAMS	06A	CLEO	$e^+e^- \rightarrow \mu^+\mu^-\gamma$
5.57±0.19	7.8k	¹ AUBERT	04	BABR	$e^+e^- \rightarrow \mu^+\mu^-\gamma$
5.14±0.39		BAI	95B	BES	e^+e^-
5.36 ^{+0.29} _{-0.28}		² HSUEH	92	RVUE	See Υ mini-review
4.72±0.35		ALEXANDER	89	RVUE	See Υ mini-review
4.4 ±0.6		² BRANDELIK	79C	DASP	e^+e^-
4.6 ±0.8		³ BALDINI-...	75	FRAG	e^+e^-
4.8 ±0.6		BOYARSKI	75	MRK1	e^+e^-
4.6 ±1.0		ESPOSITO	75B	FRAM	e^+e^-

¹ Calculated by us from the reported values of $\Gamma(e^+e^-) \times B(\mu^+\mu^-)$ using $B(\mu^+\mu^-) = (5.93 \pm 0.06)\%$.

² From a simultaneous fit to e^+e^- , $\mu^+\mu^-$, and hadronic channels assuming $\Gamma(e^+e^-) = \Gamma(\mu^+\mu^-)$.

³ Assuming equal partial widths for e^+e^- and $\mu^+\mu^-$.

NODE=M070W1
 NODE=M070W1
 → UNCHECKED ←

NODE=M070W1;LINKAGE=AA

NODE=M070W1;LINKAGE=F

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_{195}

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 ±0.8	¹ BALDINI-...	75	FRAG	e^+e^-
3.9±0.8	¹ ESPOSITO	75B	FRAM	e^+e^-

¹ Data redundant with branching ratios or partial widths above.

NODE=M070G3
 NODE=M070G3

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

332.3± 6.4±4.8 ANASHIN 10 KEDR 3.097 $e^+e^- \rightarrow e^+e^-$

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

350 ± 20	BRANDELIK	79C	DASP	e^+e^-
320 ± 70	¹ BALDINI-...	75	FRAG	e^+e^-
340 ± 90	¹ ESPOSITO	75B	FRAM	e^+e^-
360 ±100	¹ FORD	75	SPEC	e^+e^-

¹ Data redundant with branching ratios or partial widths above.

NODE=M070G1
 NODE=M070G1

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

334 ± 5 OUR AVERAGE

331.8± 5.2±6.3		ANASHIN	10	KEDR	3.097 $e^+e^- \rightarrow \mu^+\mu^-$
338.4± 5.8±7.1	13k	ADAMS	06A	CLEO	$e^+e^- \rightarrow \mu^+\mu^-\gamma$
330.1± 7.7±7.3	7.8k	AUBERT	04	BABR	$e^+e^- \rightarrow \mu^+\mu^-\gamma$

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

510 ±90		DASP	75	DASP	e^+e^-
380 ±50		¹ ESPOSITO	75B	FRAM	e^+e^-

¹ Data redundant with branching ratios or partial widths above.

NODE=M070G2
 NODE=M070G2

NODE=M070G2;LINKAGE=S

$$\Gamma(\omega\pi^+\pi^-\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{12}\Gamma_5/\Gamma$$

VALUE (10 ⁻² keV)	EVTS	DOCUMENT ID	TECN	COMMENT
2.2±0.3±0.2	170	AUBERT	06D BABR	10.6 e ⁺ e ⁻ → ωπ ⁺ π ⁻ π ⁰ γ

NODE=M070G8
NODE=M070G8

$$\Gamma(\omega\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{13}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
53.6±5.0±0.4	788	¹ AUBERT	07AU BABR	10.6 e ⁺ e ⁻ → ωπ ⁺ π ⁻ γ

NODE=M070G24
NODE=M070G24

¹ AUBERT 07AU reports $[\Gamma(J/\psi(1S) \rightarrow \omega\pi^+\pi^-) \times \Gamma(J/\psi(1S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\omega(782) \rightarrow \pi^+\pi^-\pi^0)] = 47.8 \pm 3.1 \pm 3.2$ eV which we divide by our best value $B(\omega(782) \rightarrow \pi^+\pi^-\pi^0) = (89.2 \pm 0.7) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070G24;LINKAGE=AU

$$\Gamma(K^*(892)^0\bar{K}_2^*(1430)^0 + \text{c.c.}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{19}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
33±4±1	317 ± 23	^{1,2} AUBERT	07AK BABR	10.6 e ⁺ e ⁻ → π ⁺ π ⁻ K ⁺ K ⁻ γ

NODE=M070G02
NODE=M070G02

¹ Dividing by 2/3 to take into account that $B(K^{*0} \rightarrow K^+\pi^-) = 2/3$.

² 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;LINKAGE=AE

NODE=M070G02;LINKAGE=UB

$$\Gamma(K^*(892)^0\bar{K}_2(1770)^0 + \text{c.c.} \rightarrow K^*(892)^0K^-\pi^+ + \text{c.c.}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{20}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
3.8±0.4±0.3	110 ± 14	¹ AUBERT	07AK BABR	10.6 e ⁺ e ⁻ → π ⁺ π ⁻ K ⁺ K ⁻ γ

NODE=M070G03
NODE=M070G03

¹ Dividing by 2/3 to take into account that $B(K^{*0} \rightarrow K^+\pi^-) = 2/3$.

NODE=M070G03;LINKAGE=AE

$$\Gamma(K^+\bar{K}^*(892)^- + \text{c.c.}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{22}\Gamma_5/\Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
29.0±1.7±1.3	AUBERT	08S BABR	10.6 e ⁺ e ⁻ → K ⁺ K [*] (892) ⁻ γ

NODE=M070G18
NODE=M070G18

$$\Gamma(K^+\bar{K}^*(892)^- + \text{c.c.} \rightarrow K^+K^-\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{23}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
10.96±0.85±0.70	155	AUBERT	08S BABR	10.6 e ⁺ e ⁻ → K ⁺ K ⁻ π ⁰ γ

NODE=M070G20
NODE=M070G20

$$\Gamma(K^+\bar{K}^*(892)^- + \text{c.c.} \rightarrow K^0K^\pm\pi^\mp) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{24}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
16.76±1.70±1.00	89	AUBERT	08S BABR	10.6 e ⁺ e ⁻ → K _S ⁰ K [±] π [∓] γ

NODE=M070G21
NODE=M070G21

$$\Gamma(K^0\bar{K}^*(892)^0 + \text{c.c.}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{25}\Gamma_5/\Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
26.6±2.5±1.5	AUBERT	08S BABR	10.6 e ⁺ e ⁻ → K ⁰ $\bar{K}^*(892)^0$ γ

NODE=M070G19
NODE=M070G19

$$\Gamma(K^0\bar{K}^*(892)^0 + \text{c.c.} \rightarrow K^0K^\pm\pi^\mp) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{26}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
17.70±1.70±1.00	94	AUBERT	08S BABR	10.6 e ⁺ e ⁻ → K _S ⁰ K [±] π [∓] γ

NODE=M070G22
NODE=M070G22

$$\Gamma(\omega K\bar{K}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{35}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
3.70±1.98±0.03	24	¹ AUBERT	07AU BABR	10.6 e ⁺ e ⁻ → ωK ⁺ K ⁻ γ

NODE=M070G29
NODE=M070G29

¹ AUBERT 07AU reports $[\Gamma(J/\psi(1S) \rightarrow \omega K\bar{K}) \times \Gamma(J/\psi(1S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\omega(782) \rightarrow \pi^+\pi^-\pi^0)] = 3.3 \pm 1.3 \pm 1.2$ eV which we divide by our best value $B(\omega(782) \rightarrow \pi^+\pi^-\pi^0) = (89.2 \pm 0.7) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070G29;LINKAGE=AU

$$\Gamma(\phi 2(\pi^+\pi^-)) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{37}\Gamma_5/\Gamma$$

VALUE (10 ⁻² keV)	EVTS	DOCUMENT ID	TECN	COMMENT
0.96±0.19±0.01	35	¹ AUBERT	06D BABR	10.6 e ⁺ e ⁻ → φ2(π ⁺ π ⁻)γ

NODE=M070G10
NODE=M070G10

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 $B(\phi(1020) \rightarrow K^+K^-) = (48.9 \pm 0.5) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070G10;LINKAGE=AU

$$\Gamma(\phi\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{46}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
4.8 ± 0.4 OUR AVERAGE				
4.52 ± 0.48 ± 0.04	254 ± 23	¹ SHEN 09 BELL	10.6 e ⁺ e ⁻ → K ⁺ K ⁻ π ⁺ π ⁻ γ	
5.33 ± 0.71 ± 0.05	103	² AUBERT,BE 06D BABR	10.6 e ⁺ e ⁻ → K ⁺ K ⁻ π ⁺ π ⁻ γ	

NODE=M070G14
NODE=M070G14

- ¹ 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 $B(\phi(1020) \rightarrow K^+K^-) = (48.9 \pm 0.5) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.
- ² 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 $B(\phi(1020) \rightarrow K^+K^-) = (48.9 \pm 0.5) \times 10^{-2}$. 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

NODE=M070G14;LINKAGE=AU

$$\Gamma(\phi\pi^0\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{47}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
3.15 ± 0.88 ± 0.03	23	¹ AUBERT,BE 06D BABR	10.6 e ⁺ e ⁻ → K ⁺ K ⁻ π ⁰ π ⁰ γ	

NODE=M070G15
NODE=M070G15

- ¹ 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 $B(\phi(1020) \rightarrow K^+K^-) = (48.9 \pm 0.5) \times 10^{-2}$. 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

$$\Gamma(\phi\eta) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{50}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
6.1 ± 2.7 ± 0.4	6	¹ AUBERT 07AU BABR	10.6 e ⁺ e ⁻ → φηγ	

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

$$\Gamma(\phi f_0(980) \rightarrow \phi\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{57}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
1.21 ± 0.23 OUR AVERAGE				Error includes scale factor of 1.2.
1.48 ± 0.27 ± 0.09	60 ± 11	¹ SHEN 09 BELL	10.6 e ⁺ e ⁻ → K ⁺ K ⁻ π ⁺ π ⁻ γ	
1.02 ± 0.24 ± 0.01	20 ± 5	² AUBERT 07AK BABR	10.6 e ⁺ e ⁻ → π ⁺ π ⁻ K ⁺ K ⁻ γ	

NODE=M070G05
NODE=M070G05

- ¹ Multiplied by 2/3 to take into account the $\phi\pi^+\pi^-$ mode only. Using $B(\phi \rightarrow K^+K^-) = (49.2 \pm 0.6)\%$.
- ² 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 $B(\phi(1020) \rightarrow K^+K^-) = (48.9 \pm 0.5) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070G05;LINKAGE=SH

NODE=M070G05;LINKAGE=UB

$$\Gamma(\phi f_0(980) \rightarrow \phi\pi^0\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{58}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
0.96 ± 0.40 ± 0.01	7.0 ± 2.8	¹ AUBERT 07AK BABR	10.6 e ⁺ e ⁻ → π ⁰ π ⁰ K ⁺ K ⁻ γ	

NODE=M070G06
NODE=M070G06

- ¹ 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 $B(\phi(1020) \rightarrow K^+K^-) = (48.9 \pm 0.5) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070G06;LINKAGE=UB

$$\Gamma(\eta\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{64}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
2.23 ± 0.97 ± 0.03	9	¹ AUBERT 07AU BABR	10.6 e ⁺ e ⁻ → ηπ ⁺ π ⁻ γ	

NODE=M070G25
NODE=M070G25

- 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;LINKAGE=AU

$$\Gamma(K^*(892)^0 \bar{K}^*(892)^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{15}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
1.28 ± 0.40 ± 0.11	25 ± 8	¹ AUBERT 07AK BABR	10.6 e ⁺ e ⁻ → π ⁺ π ⁻ K ⁺ K ⁻ γ	

NODE=M070G01
NODE=M070G01

- ¹ Dividing by $(2/3)^2$ to take twice into account that $B(K^{*0} \rightarrow K^+\pi^-) = 2/3$.

NODE=M070G01;LINKAGE=AE

$$\Gamma(\phi f_2(1270)) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{42}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
4.0±0.7±0.1	44 ± 7	^{1,2} AUBERT	07AK BABR	10.6 e ⁺ e ⁻ → π ⁺ π ⁻ K ⁺ K ⁻ γ

NODE=M070G07
NODE=M070G07

¹ Using B(φ → (K⁺K⁻)) = (49.3 ± 0.6)%.

² AUBERT 07AK reports [Γ(J/ψ(1S) → φ f₂(1270)) × Γ(J/ψ(1S) → e⁺e⁻)/Γ_{total}] × [B(f₂(1270) → ππ)] = 3.41 ± 0.55 ± 0.28 eV which we divide by our best value B(f₂(1270) → ππ) = (84.8^{+2.4}_{-1.2}) × 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;LINKAGE=AE
NODE=M070G07;LINKAGE=UB

$$\Gamma(2(\pi^+\pi^-\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{86}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
303±5±18	4990	AUBERT	07AU BABR	10.6 e ⁺ e ⁻ → 2(π ⁺ π ⁻)π ⁰ γ

NODE=M070G23
NODE=M070G23

$$\Gamma(\pi^+\pi^-\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{88}\Gamma_5/\Gamma$$

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
0.122±0.005±0.008	AUBERT,B	04N BABR	10.6 e ⁺ e ⁻ → π ⁺ π ⁻ π ⁰ γ

NODE=M070G5
NODE=M070G5

$$\Gamma(\pi^+\pi^-\pi^0 K^+K^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{89}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
107.0±4.3±6.4	768	AUBERT	07AU BABR	10.6 e ⁺ e ⁻ → K ⁺ K ⁻ π ⁺ π ⁻ π ⁰ γ

NODE=M070G27
NODE=M070G27

$$\Gamma(\pi^+\pi^-K^+K^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{91}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
36.3±1.3±2.1	1586 ± 58	AUBERT	07AK BABR	10.6 e ⁺ e ⁻ → π ⁺ π ⁻ K ⁺ K ⁻ γ

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

33.6±2.7±2.7	233	¹ AUBERT	05D BABR	10.6 e ⁺ e ⁻ → K ⁺ K ⁻ π ⁺ π ⁻ γ

¹ Superseded by AUBERT 07AK.

NODE=M070G12
NODE=M070G12

NODE=M070G12;LINKAGE=AU

$$\Gamma(\pi^+\pi^-K^+K^-\eta) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{92}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
25.9±3.9±0.1	73	¹ AUBERT	07AU BABR	10.6 e ⁺ e ⁻ → K ⁺ K ⁻ π ⁺ π ⁻ ηγ

¹ AUBERT 07AU reports [Γ(J/ψ(1S) → π⁺π⁻K⁺K⁻η) × Γ(J/ψ(1S) → e⁺e⁻)/Γ_{total}] × [B(η → 2γ)] = 10.2 ± 1.3 ± 0.8 eV which we divide by our best value B(η → 2γ) = (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=M070G30
NODE=M070G30

NODE=M070G30;LINKAGE=AU

$$\Gamma(\pi^0\pi^0 K^+K^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{93}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
13.6±1.1±1.3	203 ± 16	AUBERT	07AK BABR	10.6 e ⁺ e ⁻ → π ⁰ π ⁰ K ⁺ K ⁻ γ

NODE=M070G04
NODE=M070G04

$$\Gamma(2(\pi^+\pi^-)) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{95}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
20.4±1.0 OUR AVERAGE	[19.5 ± 1.9 eV OUR 2012 AVERAGE]			

20.4±0.9±0.4	LEES	12E	BABR	10.6 e ⁺ e ⁻ → 2π ⁺ 2π ⁻ γ

19.5±1.4±1.3	270	¹ AUBERT	05D BABR	10.6 e ⁺ e ⁻ → 2(π ⁺ π ⁻)γ

¹ Superseded by LEES 12E.

NODE=M070G11
NODE=M070G11
NEW

NODE=M070G11;LINKAGE=AU

$$\Gamma(3(\pi^+\pi^-)) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{96}\Gamma_5/\Gamma$$

VALUE (10 ⁻² keV)	EVTS	DOCUMENT ID	TECN	COMMENT
2.37±0.16±0.14	496	AUBERT	06D BABR	10.6 e ⁺ e ⁻ → 3(π ⁺ π ⁻)γ

NODE=M070G6
NODE=M070G6

$$\Gamma(2(\pi^+\pi^-\pi^0)) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{97}\Gamma_5/\Gamma$$

VALUE (10 ⁻² keV)	EVTS	DOCUMENT ID	TECN	COMMENT
8.9±0.5±1.0	761	AUBERT	06D BABR	10.6 e ⁺ e ⁻ → 2(π ⁺ π ⁻ π ⁰)γ

NODE=M070G7
NODE=M070G7

$$\Gamma(2(\pi^+\pi^-\eta)) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{98}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
13.1±2.4±0.1	85	¹ AUBERT	07AU BABR	10.6 e ⁺ e ⁻ → 2(π ⁺ π ⁻)ηγ

¹ AUBERT 07AU reports [Γ(J/ψ(1S) → 2(π⁺π⁻)η) × Γ(J/ψ(1S) → e⁺e⁻)/Γ_{total}] × [B(η → 2γ)] = 5.16 ± 0.85 ± 0.39 eV which we divide by our best value B(η → 2γ) = (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=M070G26
NODE=M070G26

NODE=M070G26;LINKAGE=AU

$$\Gamma(p\bar{p}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{100}\Gamma_5/\Gamma$$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT
11.6±0.9 OUR AVERAGE	Error includes scale factor of 1.2.			
12.0±0.6±0.5	438	AUBERT	06B	$e^+e^- \rightarrow p\bar{p}\gamma$
9.7±1.7		¹ ARMSTRONG	93B E760	$\bar{p}p \rightarrow e^+e^-$

¹ Using $\Gamma_{\text{total}} = 85.5^{+6.1}_{-5.8}$ MeV.

NODE=M070G4
NODE=M070G4

NODE=M070G;LINKAGE=A

$$\Gamma(\Sigma^0\bar{\Sigma}^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{112}\Gamma_5/\Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
6.4±1.2±0.6	AUBERT	07BD BABR	10.6 $e^+e^- \rightarrow \Sigma^0\bar{\Sigma}^0\gamma$

NODE=M070G17
NODE=M070G17

$$\Gamma(2(\pi^+\pi^-)K^+K^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{113}\Gamma_5/\Gamma$$

VALUE (10 ⁻² keV)	EVTs	DOCUMENT ID	TECN	COMMENT
2.75±0.23±0.17	205	AUBERT	06D BABR	10.6 $e^+e^- \rightarrow K^+K^-2(\pi^+\pi^-)\gamma$

NODE=M070G9
NODE=M070G9

$$\Gamma(\Lambda\bar{\Lambda}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{119}\Gamma_5/\Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
10.7±0.9±0.7	AUBERT	07BD BABR	10.6 $e^+e^- \rightarrow \Lambda\bar{\Lambda}\gamma$

NODE=M070G16
NODE=M070G16

$$\Gamma(2(K^+K^-)) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{122}\Gamma_5/\Gamma$$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT
4.11±0.39±0.30	156 ± 15	AUBERT	07AK BABR	10.6 $e^+e^- \rightarrow 2(K^+K^-)\gamma$

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

4.0 ±0.7 ±0.6	38	¹ AUBERT	05D BABR	10.6 $e^+e^- \rightarrow 2(K^+K^-)\gamma$

¹ Superseded by AUBERT 07AK.

NODE=M070G13
NODE=M070G13

NODE=M070G13;LINKAGE=AU

J/ψ(1S) BRANCHING RATIOS

NODE=M070230

For the first four branching ratios, see also the partial widths, and (partial widths) × $\Gamma(e^+e^-)/\Gamma_{\text{total}}$ above.

NODE=M070300

$$\Gamma(\text{hadrons})/\Gamma_{\text{total}} \quad \Gamma_1/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
0.877±0.005 OUR AVERAGE			
0.878±0.005	BAI	95B BES	e^+e^-
0.86 ±0.02	BOYARSKI	75 MRK1	e^+e^-

NODE=M070R3
NODE=M070R3

$$\Gamma(\text{virtual } \gamma \rightarrow \text{hadrons})/\Gamma_{\text{total}} \quad \Gamma_2/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
0.135±0.003	^{1,2} SETH	04 RVUE	e^+e^-

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

0.17 ±0.02	¹ BOYARSKI	75 MRK1	e^+e^-

¹ 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
NODE=M070R4

NODE=M070R4;LINKAGE=C
NODE=M070R4;LINKAGE=SE

$$\Gamma(ggg)/\Gamma_{\text{total}} \quad \Gamma_3/\Gamma$$

VALUE (units 10 ⁻²)	EVTs	DOCUMENT ID	TECN	COMMENT
64.1±1.0	6 M	¹ BESSON	08 CLEO	$\psi(2S) \rightarrow \pi^+\pi^- + \text{hadrons}$

¹ Calculated using the value $\Gamma(\gamma gg)/\Gamma(ggg) = 0.137 \pm 0.001 \pm 0.016 \pm 0.004$ 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
NODE=M070S65

NODE=M070S65;LINKAGE=BE

$$\Gamma(\gamma gg)/\Gamma_{\text{total}} \quad \Gamma_4/\Gamma$$

VALUE (units 10 ⁻²)	EVTs	DOCUMENT ID	TECN	COMMENT
8.79±1.05	200 k	¹ BESSON	08 CLEO	$\psi(2S) \rightarrow \pi^+\pi^-\gamma + \text{hadrons}$

¹ Calculated using the value $\Gamma(\gamma gg)/\Gamma(ggg) = 0.137 \pm 0.001 \pm 0.016 \pm 0.004$ 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
NODE=M070S66

NODE=M070S66;LINKAGE=BE

$\Gamma(\gamma g g)/\Gamma(g g g)$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
13.7±0.1±0.7	6 M	BESSION	08	CLEO $\psi(2S) \rightarrow \pi^+ \pi^- J/\psi$

 Γ_4/Γ_3

NODE=M070S67
 NODE=M070S67

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

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
5.94 ±0.06 OUR AVERAGE				
5.945±0.067±0.042	15k	LI	05C	CLEO $\psi(2S) \rightarrow J/\psi \pi^+ \pi^-$
5.90 ±0.05 ±0.10		BAI	98D	BES $\psi(2S) \rightarrow J/\psi \pi^+ \pi^-$
6.09 ±0.33		BAI	95B	BES $e^+ e^-$
5.92 ±0.15 ±0.20		COFFMAN	92	MRK3 $\psi(2S) \rightarrow J/\psi \pi^+ \pi^-$
6.9 ±0.9		BOYARSKI	75	MRK1 $e^+ e^-$

 Γ_5/Γ

NODE=M070R1
 NODE=M070R1

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

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
8.8±1.3±0.4	¹ ARMSTRONG	96	E760 $\bar{p} p \rightarrow e^+ e^- \gamma$

 Γ_6/Γ

NODE=M070S33
 NODE=M070S33

¹ For $E_\gamma > 100$ MeV.

NODE=M070S33;LINKAGE=A

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

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
5.93 ±0.06 OUR AVERAGE				
5.960±0.065±0.050	17k	LI	05C	CLEO $\psi(2S) \rightarrow J/\psi \pi^+ \pi^-$
5.84 ±0.06 ±0.10		BAI	98D	BES $\psi(2S) \rightarrow J/\psi \pi^+ \pi^-$
6.08 ±0.33		BAI	95B	BES $e^+ e^-$
5.90 ±0.15 ±0.19		COFFMAN	92	MRK3 $\psi(2S) \rightarrow J/\psi \pi^+ \pi^-$
6.9 ±0.9		BOYARSKI	75	MRK1 $e^+ e^-$

 Γ_7/Γ

NODE=M070R2
 NODE=M070R2

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

VALUE	DOCUMENT ID	TECN	COMMENT
0.998±0.012 OUR AVERAGE			
1.002±0.021±0.013	¹ 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. • • •			
1.00 ±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 $e^+ e^-$

 Γ_5/Γ_7

NODE=M070R5
 NODE=M070R5

¹ 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=AN

HADRONIC DECAYS

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

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 $e^+ e^-$

 Γ_8/Γ

NODE=M070305

NODE=M070R20
 NODE=M070R20

OCCUR=2

¹ From the ratio of $\Gamma(e^+ e^-) B(\pi^+ \pi^- \pi^0)$ and $\Gamma(e^+ e^-) B(\mu^+ \mu^-)$ (AUBERT 04).

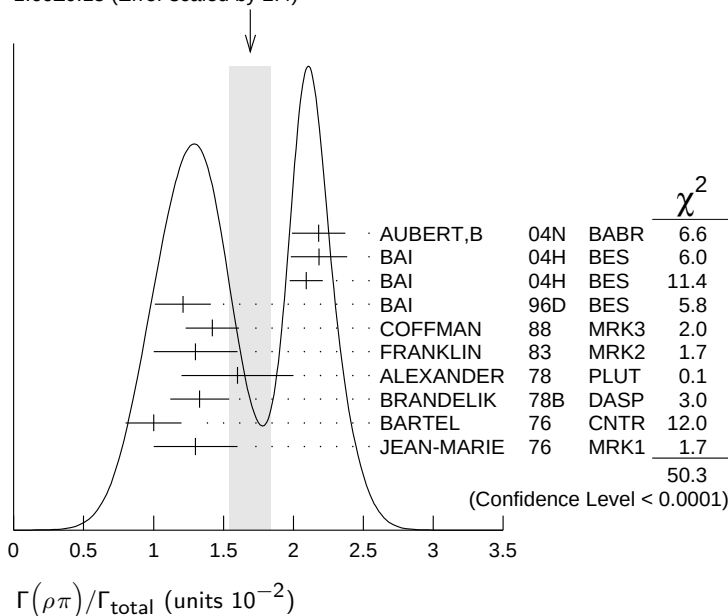
² Not independent of their $B(\pi^+ \pi^- \pi^0)$.

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=BI

WEIGHTED AVERAGE
1.69±0.15 (Error scaled by 2.4)



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

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_9/Γ_8
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

$\Gamma(a_2(1320)\rho)/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_{10}/Γ
10.9±2.2 OUR AVERAGE					
11.7±0.7±2.5	7584	AUGUSTIN	89	DM2 $J/\psi \rightarrow \rho^0\rho^\pm\pi^\mp$	
8.4±4.5	36	VANNUCCI	77	MRK1 $e^+e^- \rightarrow 2(\pi^+\pi^-)\pi^0$	

NODE=M070R43
NODE=M070R43

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

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_{11}/Γ
85±34	140	VANNUCCI	77	MRK1 $e^+e^- \rightarrow 3(\pi^+\pi^-)\pi^0$	

NODE=M070R26
NODE=M070R26

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

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_{12}/Γ
0.40±0.06±0.04	170	¹ AUBERT	06D	BABR 10.6 $e^+e^- \rightarrow \omega\pi^+\pi^-\pi^0\gamma$	

NODE=M070R76
NODE=M070R76

¹ Using $\Gamma(J/\psi \rightarrow e^+e^-) = 5.52 \pm 0.14 \pm 0.04$ keV.

NODE=M070R76;LINKAGE=EE

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

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_{13}/Γ
8.6±0.7 OUR AVERAGE				Error includes scale factor of 1.1.	
9.7±0.6±0.6	788	¹ AUBERT	07AU	BABR 10.6 $e^+e^- \rightarrow \omega\pi^+\pi^-\gamma$	
7.0±1.6	18058	AUGUSTIN	89	DM2 $J/\psi \rightarrow 2(\pi^+\pi^-)\pi^0$	
7.8±1.6	215	BURMESTER	77D	PLUT e^+e^-	
6.8±1.9	348	VANNUCCI	77	MRK1 $e^+e^- \rightarrow 2(\pi^+\pi^-)\pi^0$	

NODE=M070R24
NODE=M070R24

¹ AUBERT 07AU quotes $\Gamma_{ee}^{J/\psi} \cdot B(J/\psi \rightarrow \omega\pi^+\pi^-) \cdot B(\omega \rightarrow 3\pi) = 47.8 \pm 3.1 \pm 3.2$ eV.

NODE=M070R24;LINKAGE=AU

$\Gamma(\omega f_2(1270))/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_{14}/Γ
4.3±0.6 OUR AVERAGE					
4.3±0.2±0.6	5860	AUGUSTIN	89	DM2 e^+e^-	
4.0±1.6	70	BURMESTER	77D	PLUT e^+e^-	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1.9±0.8	81	VANNUCCI	77	MRK1 $e^+e^- \rightarrow 2(\pi^+\pi^-)\pi^0$	

NODE=M070R28
NODE=M070R28

$\Gamma(K^*(892)^0 \bar{K}^*(892)^0)/\Gamma_{\text{total}}$ Γ_{15}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
2.3±0.7±0.1	25 ± 8	1	AUBERT	07AK BABR	$10.6 e^+ e^- \rightarrow \pi^+ \pi^- K^+ K^- \gamma$

NODE=M070R46
 NODE=M070R46

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

<5 90 VANNUCCI 77 MRK1 $e^+ e^- \rightarrow \pi^+ \pi^- K^+ K^-$

¹ AUBERT 07AK reports $[\Gamma(J/\psi(1S) \rightarrow K^*(892)^0 \bar{K}^*(892)^0)/\Gamma_{\text{total}}] \times [\Gamma(J/\psi(1S) \rightarrow e^+ e^-)] = (1.28 \pm 0.40 \pm 0.11) \times 10^{-3}$ keV which we divide by our best value $\Gamma(J/\psi(1S) \rightarrow e^+ e^-) = 5.55 \pm 0.14 \pm 0.02$ keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070R46;LINKAGE=BE

 $\Gamma(K^*(892)^\pm \bar{K}^*(892)^\mp)/\Gamma_{\text{total}}$ Γ_{16}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.00±0.19^{+0.11}_{-0.32}	323	ABLIKIM	10E BES2	$J/\psi \rightarrow K^\pm K_S^0 \pi^\mp \pi^0$

NODE=M070S73
 NODE=M070S73

 $\Gamma(K^*(892)^\pm \bar{K}^*(800)^\mp)/\Gamma_{\text{total}}$ Γ_{17}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.09±0.18^{+0.94}_{-0.54}	655	ABLIKIM	10E BES2	$J/\psi \rightarrow K^\pm K_S^0 \pi^\mp \pi^0$

NODE=M070S74
 NODE=M070S74

 $\Gamma(\eta K^*(892)^0 \bar{K}^*(892)^0)/\Gamma_{\text{total}}$ Γ_{18}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.15±0.13±0.22	209	ABLIKIM	10C BES2	$J/\psi \rightarrow \eta K^+ \pi^- K^- \pi^+$

NODE=M070S69
 NODE=M070S69

 $\Gamma(K^*(892)^0 \bar{K}_2^*(1430)^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{19}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
6.0±0.6 OUR AVERAGE				

NODE=M070R48
 NODE=M070R48

5.9±0.6±0.2 317 ± 23 ^{1,2} AUBERT 07AK BABR $10.6 e^+ e^- \rightarrow \pi^+ \pi^- K^+ K^- \gamma$
 6.7±2.6 40 VANNUCCI 77 MRK1 $e^+ e^- \rightarrow \pi^+ \pi^- K^+ K^-$

¹ Using $B(K_2^*(1430)^0 \rightarrow K \pi) = (49.9 \pm 1.2)\%$.

² AUBERT 07AK reports $[\Gamma(J/\psi(1S) \rightarrow K^*(892)^0 \bar{K}_2^*(1430)^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [\Gamma(J/\psi(1S) \rightarrow e^+ e^-)] = (32.9 \pm 2.3 \pm 2.7) \times 10^{-3}$ keV which we divide by our best value $\Gamma(J/\psi(1S) \rightarrow e^+ e^-) = 5.55 \pm 0.14 \pm 0.02$ keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070R48;LINKAGE=AU
 NODE=M070R48;LINKAGE=BE

 $\Gamma(\omega K^*(892) \bar{K} + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{21}/Γ

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	$J/\psi \rightarrow \omega K^+ K^- \pi^0$
53 ± 14 ± 14	530 ± 140	BECKER	87 MRK3	$e^+ e^- \rightarrow \text{hadrons}$

NODE=M070S2
 NODE=M070S2

OCCUR=2

 $\Gamma(K^+ \bar{K}^*(892)^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{22}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
5.12±0.30 OUR AVERAGE				
5.2 ± 0.4 ± 0.1		¹ AUBERT	08S BABR	$10.6 e^+ e^- \rightarrow K^+ K^*(892)^- \gamma$
4.57 ± 0.17 ± 0.70	2285	JOUSSET	90 DM2	$J/\psi \rightarrow \text{hadrons}$
5.26 ± 0.13 ± 0.53		COFFMAN	88 MRK3	$J/\psi \rightarrow K^\pm K_S^0 \pi^\mp, K^+ K^- \pi^0$

NODE=M070S15
 NODE=M070S15

• • • 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 $J/\psi \rightarrow K^\pm X$

¹ AUBERT 08S reports $[\Gamma(J/\psi(1S) \rightarrow K^+ \bar{K}^*(892)^- + \text{c.c.})/\Gamma_{\text{total}}] \times [\Gamma(J/\psi(1S) \rightarrow e^+ e^-)] = (29.0 \pm 1.7 \pm 1.3) \times 10^{-3}$ keV which we divide by our best value $\Gamma(J/\psi(1S) \rightarrow e^+ e^-) = 5.55 \pm 0.14 \pm 0.02$ keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070S15;LINKAGE=AU

$$\Gamma(K^+ \bar{K}^*(892)^- + \text{c.c.} \rightarrow K^+ K^- \pi^0) / \Gamma_{\text{total}} \quad \Gamma_{23} / \Gamma$$

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
1.97±0.20±0.05	155	¹ AUBERT	08S BABR	10.6 $e^+ e^- \rightarrow K^+ K^- \pi^0 \gamma$
¹ AUBERT 08S reports $[\Gamma(J/\psi(1S) \rightarrow K^+ \bar{K}^*(892)^- + \text{c.c.} \rightarrow K^+ K^- \pi^0) / \Gamma_{\text{total}}] \times [\Gamma(J/\psi(1S) \rightarrow e^+ e^-)] = (10.96 \pm 0.85 \pm 0.70) \times 10^{-3}$ keV which we divide by our best value $\Gamma(J/\psi(1S) \rightarrow e^+ e^-) = 5.55 \pm 0.14 \pm 0.02$ keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M070R09
NODE=M070R09

NODE=M070R09;LINKAGE=AU

$$\Gamma(K^+ \bar{K}^*(892)^- + \text{c.c.} \rightarrow K^0 K^\pm \pi^\mp) / \Gamma_{\text{total}} \quad \Gamma_{24} / \Gamma$$

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
3.0±0.4±0.1	89	¹ AUBERT	08S BABR	10.6 $e^+ e^- \rightarrow K_S^0 K^\pm \pi^\mp \gamma$
¹ AUBERT 08S reports $[\Gamma(J/\psi(1S) \rightarrow K^+ \bar{K}^*(892)^- + \text{c.c.} \rightarrow K^0 K^\pm \pi^\mp) / \Gamma_{\text{total}}] \times [\Gamma(J/\psi(1S) \rightarrow e^+ e^-)] = (16.76 \pm 1.70 \pm 1.00) \times 10^{-3}$ keV which we divide by our best value $\Gamma(J/\psi(1S) \rightarrow e^+ e^-) = 5.55 \pm 0.14 \pm 0.02$ keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M070S58
NODE=M070S58

NODE=M070S58;LINKAGE=AU

$$\Gamma(K^0 \bar{K}^*(892)^0 + \text{c.c.}) / \Gamma_{\text{total}} \quad \Gamma_{25} / \Gamma$$

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
4.39±0.31 OUR AVERAGE				
4.8 ±0.5 ±0.1		¹ AUBERT	08S BABR	10.6 $e^+ e^- \rightarrow K^0 \bar{K}^*(892)^0 \gamma$
3.96±0.15±0.60	1192	JOUSSET	90 DM2	$J/\psi \rightarrow \text{hadrons}$
4.33±0.12±0.45		COFFMAN	88 MRK3	$J/\psi \rightarrow K^\pm K_S^0 \pi^\mp$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2.7 ±0.6	45	VANNUCCI	77 MRK1	$J/\psi \rightarrow K^\pm K_S^0 \pi^\mp$
¹ AUBERT 08S reports $[\Gamma(J/\psi(1S) \rightarrow K^0 \bar{K}^*(892)^0 + \text{c.c.}) / \Gamma_{\text{total}}] \times [\Gamma(J/\psi(1S) \rightarrow e^+ e^-)] = (26.6 \pm 2.5 \pm 1.5) \times 10^{-3}$ keV which we divide by our best value $\Gamma(J/\psi(1S) \rightarrow e^+ e^-) = 5.55 \pm 0.14 \pm 0.02$ keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M070S16
NODE=M070S16

NODE=M070S16;LINKAGE=AU

$$\Gamma(K^0 \bar{K}^*(892)^0 + \text{c.c.}) / \Gamma(K^+ \bar{K}^*(892)^- + \text{c.c.}) \quad \Gamma_{25} / \Gamma_{22}$$

VALUE	DOCUMENT ID	TECN	COMMENT
0.82±0.05±0.09	COFFMAN	88 MRK3	$J/\psi \rightarrow K \bar{K}^*(892) + \text{c.c.}$

NODE=M070S17
NODE=M070S17

$$\Gamma(K^0 \bar{K}^*(892)^0 + \text{c.c.} \rightarrow K^0 K^\pm \pi^\mp) / \Gamma_{\text{total}} \quad \Gamma_{26} / \Gamma$$

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
3.2±0.4±0.1	94	¹ AUBERT	08S BABR	10.6 $e^+ e^- \rightarrow K_S^0 K^\pm \pi^\mp \gamma$
¹ AUBERT 08S reports $[\Gamma(J/\psi(1S) \rightarrow K^0 \bar{K}^*(892)^0 + \text{c.c.} \rightarrow K^0 K^\pm \pi^\mp) / \Gamma_{\text{total}}] \times [\Gamma(J/\psi(1S) \rightarrow e^+ e^-)] = (17.70 \pm 1.70 \pm 1.00) \times 10^{-3}$ keV which we divide by our best value $\Gamma(J/\psi(1S) \rightarrow e^+ e^-) = 5.55 \pm 0.14 \pm 0.02$ keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M070S59
NODE=M070S59

NODE=M070S59;LINKAGE=AU

$$\Gamma(K_1(1400)^\pm K^\mp) / \Gamma_{\text{total}} \quad \Gamma_{27} / \Gamma$$

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
3.8±0.8±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

$$\Gamma(\bar{K}^*(892)^0 K^+ \pi^- + \text{c.c.}) / \Gamma_{\text{total}} \quad \Gamma_{28} / \Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
seen	¹ ABLIKIM	06C BES2	$J/\psi \rightarrow \bar{K}^*(892)^0 K^+ \pi^-$
¹ A $K_0^*(800)$ 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

$$\Gamma(\omega \pi^0 \pi^0) / \Gamma_{\text{total}} \quad \Gamma_{29} / \Gamma$$

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
3.4±0.3±0.7	509	AUGUSTIN	89 DM2	$J/\psi \rightarrow \pi^+ \pi^- 3\pi^0$

NODE=M070S26
NODE=M070S26

$$\Gamma(b_1(1235)^\pm \pi^\mp) / \Gamma_{\text{total}} \quad \Gamma_{30} / \Gamma$$

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
30±5 OUR AVERAGE				
31±6	4600	AUGUSTIN	89 DM2	$J/\psi \rightarrow 2(\pi^+ \pi^-) \pi^0$
29±7	87	BURMESTER	77D PLUT	$e^+ e^-$

NODE=M070R49
NODE=M070R49

$\Gamma(\omega K^\pm K_S^0 \pi^\mp)/\Gamma_{\text{total}}$ Γ_{31}/Γ VALUE (units 10^{-4}) EVTS**34 $\pm$ 5 OUR AVERAGE**37.7 $\pm$ 0.8 $\pm$ 5.8 1972 $\pm$ 4129.5 $\pm$ 1.4 $\pm$ 7.0 879 $\pm$ 41

DOCUMENT ID TECN COMMENT

ABLIKIM 08E BES2 $e^+ e^- \rightarrow J/\psi$ BECKER 87 MRK3 $e^+ e^- \rightarrow \text{hadrons}$ NODE=M070S1
NODE=M070S1 $\Gamma(b_1(1235)^0 \pi^0)/\Gamma_{\text{total}}$ Γ_{32}/Γ VALUE (units 10^{-4}) EVTS**23 $\pm$ 3 $\pm$ 5** 229

DOCUMENT ID TECN COMMENT

AUGUSTIN 89 DM2 $e^+ e^-$ NODE=M070S28
NODE=M070S28 $\Gamma(\eta K^\pm K_S^0 \pi^\mp)/\Gamma_{\text{total}}$ Γ_{33}/Γ VALUE (units 10^{-4}) EVTS**21.8 $\pm$ 2.2 $\pm$ 3.4** 232 $\pm$ 23

DOCUMENT ID TECN COMMENT

ABLIKIM 08E BES2 $e^+ e^- \rightarrow J/\psi$ NODE=M070S57
NODE=M070S57 $\Gamma(\phi K^*(892) \bar{K} + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{34}/Γ VALUE (units 10^{-4}) EVTS**21.8 $\pm$ 2.3 OUR AVERAGE**20.8 $\pm$ 2.7 $\pm$ 3.9 195 $\pm$ 2529.6 $\pm$ 3.7 $\pm$ 4.7 238 $\pm$ 3020.7 $\pm$ 2.4 $\pm$ 3.020 $\pm$ 3 $\pm$ 3 155 $\pm$ 20

DOCUMENT ID TECN COMMENT

ABLIKIM 08E BES2 $J/\psi \rightarrow \phi K_S^0 K^\pm \pi^\mp$ ABLIKIM 08E BES2 $J/\psi \rightarrow \phi K^+ K^- \pi^0$ FALVARD 88 DM2 $J/\psi \rightarrow \text{hadrons}$ BECKER 87 MRK3 $e^+ e^- \rightarrow \text{hadrons}$ NODE=M070S4
NODE=M070S4

OCCUR=2

 $\Gamma(\omega K \bar{K})/\Gamma_{\text{total}}$ Γ_{35}/Γ VALUE (units 10^{-4}) EVTS**17.0 $\pm$ 3.2 OUR AVERAGE**13.6 $\pm$ 5.0 $\pm$ 1.0 2419.8 $\pm$ 2.1 $\pm$ 3.916 $\pm$ 10 22¹ AUBERT 07AU BABR 10.6 $e^+ e^- \rightarrow \omega K^+ K^- \gamma$ ² FALVARD 88 DM2 $J/\psi \rightarrow \text{hadrons}$ FELDMAN 77 MRK1 $e^+ e^-$ ¹ AUBERT 07AU quotes $\Gamma_{ee}^{J/\psi} \cdot B(J/\psi \rightarrow \omega K^+ K^-) \cdot B(\eta \rightarrow 3\pi) = 3.3 \pm 1.3 \pm 0.2 \text{ eV}$.² Addition of $\omega K^+ K^-$ and $\omega K^0 \bar{K}^0$ branching ratios.NODE=M070R27
NODE=M070R27NODE=M070R27;LINKAGE=AU
NODE=M070R27;LINKAGE=B $\Gamma(\omega f_0(1710) \rightarrow \omega K \bar{K})/\Gamma_{\text{total}}$ Γ_{36}/Γ VALUE (units 10^{-4}) EVTS**4.8 $\pm$ 1.1 $\pm$ 0.3**^{1,2} FALVARD 88 DM2 $J/\psi \rightarrow \text{hadrons}$ ¹ Includes unknown branching fraction $f_0(1710) \rightarrow K \bar{K}$.² Addition of $f_0(1710) \rightarrow K^+ K^-$ and $f_0(1710) \rightarrow K^0 \bar{K}^0$ branching ratios.NODE=M070S25
NODE=M070S25NODE=M070S25;LINKAGE=F
NODE=M070S25;LINKAGE=G $\Gamma(\phi 2(\pi^+ \pi^-))/\Gamma_{\text{total}}$ Γ_{37}/Γ VALUE (units 10^{-4}) EVTS**16.6 $\pm$ 2.3 OUR AVERAGE**17.3 $\pm$ 3.3 $\pm$ 1.2 3516.0 $\pm$ 1.0 $\pm$ 3.0¹ AUBERT 06D BABR 10.6 $e^+ e^- \rightarrow \phi 2(\pi^+ \pi^-) \gamma$ FALVARD 88 DM2 $J/\psi \rightarrow \text{hadrons}$ ¹ Using $\Gamma(J/\psi \rightarrow e^+ e^-) = 5.52 \pm 0.14 \pm 0.04 \text{ keV}$.NODE=M070R35
NODE=M070R35

NODE=M070R35;LINKAGE=EE

 $\Gamma(\Delta(1232)^{++} \bar{p} \pi^-)/\Gamma_{\text{total}}$ Γ_{38}/Γ VALUE (units 10^{-3}) EVTS**1.58 $\pm$ 0.23 $\pm$ 0.40** 332

DOCUMENT ID TECN COMMENT

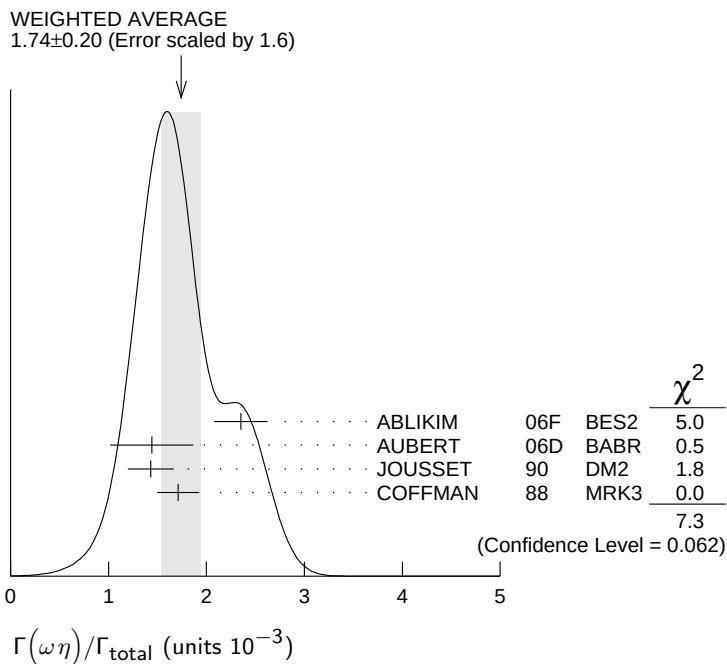
EATON 84 MRK2 $e^+ e^-$ NODE=M070R70
NODE=M070R70 $\Gamma(\omega \eta)/\Gamma_{\text{total}}$ Γ_{39}/Γ VALUE (units 10^{-3}) EVTS**1.74 $\pm$ 0.20 OUR AVERAGE**2.352 $\pm$ 0.273 5k1.44 $\pm$ 0.40 $\pm$ 0.14 131.43 $\pm$ 0.10 $\pm$ 0.21 3781.71 $\pm$ 0.08 $\pm$ 0.20

Error includes scale factor of 1.6. See the ideogram below.

¹ ABLIKIM 06F BES2 $J/\psi \rightarrow \omega \eta$ ² AUBERT 06D BABR 10.6 $e^+ e^- \rightarrow \omega \eta \gamma$ JOUSSET 90 DM2 $J/\psi \rightarrow \text{hadrons}$ COFFMAN 88 MRK3 $e^+ e^- \rightarrow 3\pi \eta$ 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
NODE=M070R30

NODE=M070R30;LINKAGE=BL

NODE=M070R30;LINKAGE=EE



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

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
18.3± 2.4 OUR AVERAGE		Error includes scale factor of 1.5. See the ideogram below.		
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	$e^+ e^-$

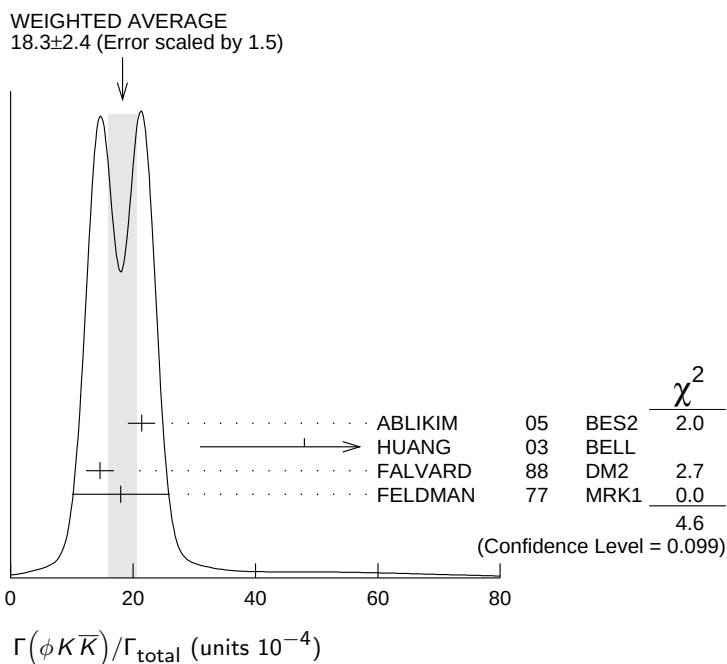
¹We have multiplied $K^+ K^-$ measurement by 2 to obtain $K \bar{K}$.

²Using $B(B^+ \rightarrow J/\psi K^+) = (1.01 \pm 0.05) \times 10^{-3}$.

³Addition of $\phi K^+ K^-$ 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



$\Gamma(\phi f_0(1710) \rightarrow \phi K \bar{K})/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
3.6±0.2±0.6	^{1,2} FALVARD	88 DM2	$J/\psi \rightarrow \text{hadrons}$

¹Including interference with $f_2'(1525)$.

²Includes 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_{42}/Γ

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
0.72±0.13±0.02	44 ± 7	1,2	AUBERT	07AK BABR	10.6 $e^+e^- \rightarrow \pi^+\pi^-K^+K^-\gamma$

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

¹ Using $B(f_2(1270) \rightarrow \pi\pi) = (84.8^{+2.4}_{-1.2})\%$

² AUBERT 07AK reports $[\Gamma(J/\psi(1S) \rightarrow \phi f_2(1270))/\Gamma_{\text{total}}] \times [\Gamma(J/\psi(1S) \rightarrow e^+e^-)] = (4.02 \pm 0.65 \pm 0.33) \times 10^{-3}$ keV which we divide by our best value $\Gamma(J/\psi(1S) \rightarrow e^+e^-) = 5.55 \pm 0.14 \pm 0.02$ keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070R39
NODE=M070R39

NODE=M070R39;LINKAGE=AU
NODE=M070R39;LINKAGE=BE

 $\Gamma(\Delta(1232)^{++}\bar{\Delta}(1232)^{--})/\Gamma_{\text{total}}$ Γ_{43}/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_{44}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.10±0.12 OUR AVERAGE				

$[(1.03 \pm 0.13) \times 10^{-3}$ OUR 2012 AVERAGE]

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

NEW

OCCUR=2

OCCUR=2

OCCUR=2

 $\Gamma(\phi f'_2(1525))/\Gamma_{\text{total}}$ Γ_{45}/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_{46}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
0.94±0.09 OUR AVERAGE				Error includes scale factor of 1.2.

0.96±0.13	103	¹ AUBERT,BE	06D	BABR	10.6 $e^+e^- \rightarrow K^+K^-\pi^+\pi^-\gamma$
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^-

¹ Derived by us. AUBERT,BE 06D measures $\Gamma(J/\psi \rightarrow e^+e^-) \times B(J/\psi \rightarrow \phi\pi^+\pi^-) \times B(\phi \rightarrow K^+K^-) = (2.61 \pm 0.30 \pm 0.18)$ eV

NODE=M070R34
NODE=M070R34

NODE=M070R34;LINKAGE=AU

 $\Gamma(\phi\pi^0\pi^0)/\Gamma_{\text{total}}$ Γ_{47}/Γ

<u>VALUE (units 10^{-3})</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.56±0.16	23	¹ AUBERT,BE	06D	BABR
10.6 $e^+e^- \rightarrow K^+K^-\pi^0\pi^0\gamma$				

¹ Derived by us. AUBERT,BE 06D measures $\Gamma(J/\psi \rightarrow e^+e^-) \times B(J/\psi \rightarrow \phi\pi^0\pi^0) \times B(\phi \rightarrow K^+K^-) = (1.54 \pm 0.40 \pm 0.16)$ eV

NODE=M070S44
NODE=M070S44

NODE=M070S44;LINKAGE=AU

 $\Gamma(\phi K^\pm K_S^0 \pi^\mp)/\Gamma_{\text{total}}$ Γ_{48}/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_{49}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$6.8^{+1.9}_{-1.6} \pm 1.7$	111^{+31}_{-26}	BECKER	87 MRK3	$e^+e^- \rightarrow \text{hadrons}$

NODE=M070S5
NODE=M070S5

$\Gamma(\phi\eta)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

EVTS

DOCUMENT ID

TECN

COMMENT

0.75 ± 0.08 OUR AVERAGE

Error includes scale factor of 1.5. See the ideogram below.

1.4 ± 0.6 ± 0.1

6

¹ AUBERT

07AU BABR

10.6 $e^+e^- \rightarrow \phi\eta\gamma$

0.898 ± 0.024 ± 0.089

ABLIKIM

05B BES2

 $e^+e^- \rightarrow J/\psi \rightarrow \text{hadr}$

0.64 ± 0.04 ± 0.11

JOUSSET

90 DM2

 $J/\psi \rightarrow \text{hadrons}$

0.661 ± 0.045 ± 0.078

COFFMAN

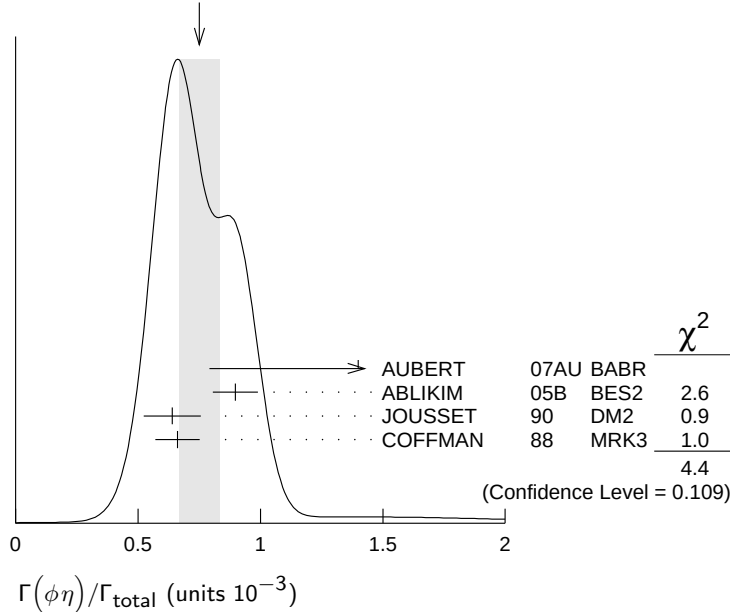
88 MRK3

 $e^+e^- \rightarrow K^+K^-\eta$
¹ AUBERT 07AU quotes $\Gamma_{ee}^{J/\psi} \cdot B(J/\psi \rightarrow \phi\eta) \cdot B(\phi \rightarrow K^+K^-) \cdot B(\eta \rightarrow \gamma\gamma) = 0.84 \pm 0.37 \pm 0.05 \text{ eV}$.

NODE=M070R37

NODE=M070R37

NODE=M070R37;LINKAGE=AU

 WEIGHTED AVERAGE
 0.75±0.08 (Error scaled by 1.5)
 $\Gamma(\Xi^0\Xi^0)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

EVTS

DOCUMENT ID

TECN

COMMENT

1.20 ± 0.12 ± 0.21

206

ABLIKIM

080 BES2

 $e^+e^- \rightarrow J/\psi$ Γ_{51}/Γ

NODE=M070S64

NODE=M070S64

 $\Gamma(\Xi(1530)^-\Xi^+)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

EVTS

DOCUMENT ID

TECN

COMMENT

0.59 ± 0.09 ± 0.12

75 ± 11

HENRARD

87 DM2

 e^+e^- Γ_{52}/Γ

NODE=M070S9

NODE=M070S9

 $\Gamma(pK^-\Sigma(1385)^0)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

EVTS

DOCUMENT ID

TECN

COMMENT

0.51 ± 0.26 ± 0.18

89

EATON

84 MRK2

 e^+e^- Γ_{53}/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

Error includes scale factor of 1.4. See the ideogram below.

0.538 ± 0.012 ± 0.065

2090

¹ ABLIKIM

06F BES2

 $J/\psi \rightarrow \omega\pi^0$

0.360 ± 0.028 ± 0.054

JOUSSET

90 DM2

 $J/\psi \rightarrow \text{hadrons}$

0.482 ± 0.019 ± 0.064

COFFMAN

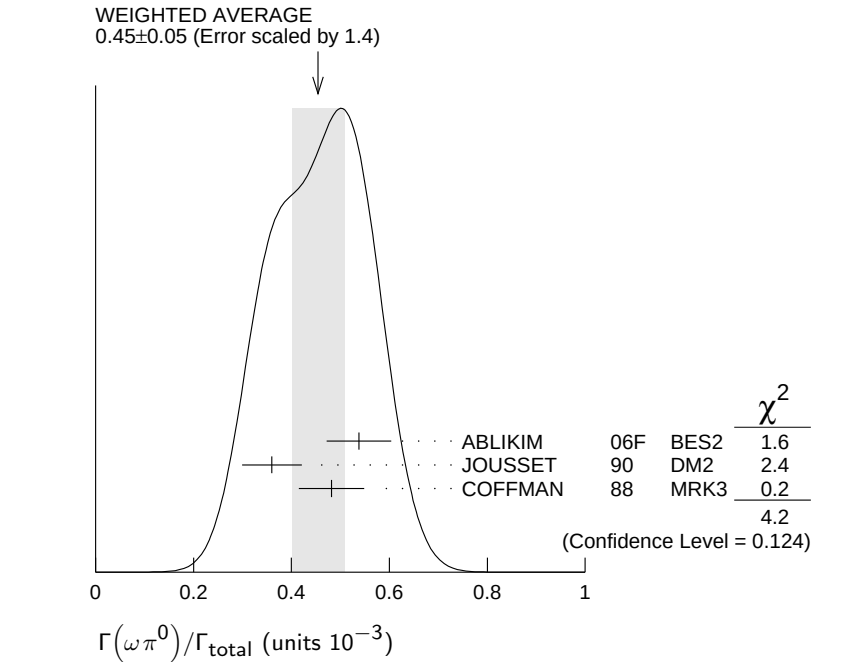
88 MRK3

 $e^+e^- \rightarrow \pi^0\pi^+\pi^-\pi^0$
¹ Using $B(\omega \rightarrow \pi^+\pi^-\pi^0) = (89.1 \pm 0.7)\%$.
 Γ_{54}/Γ

NODE=M070R32

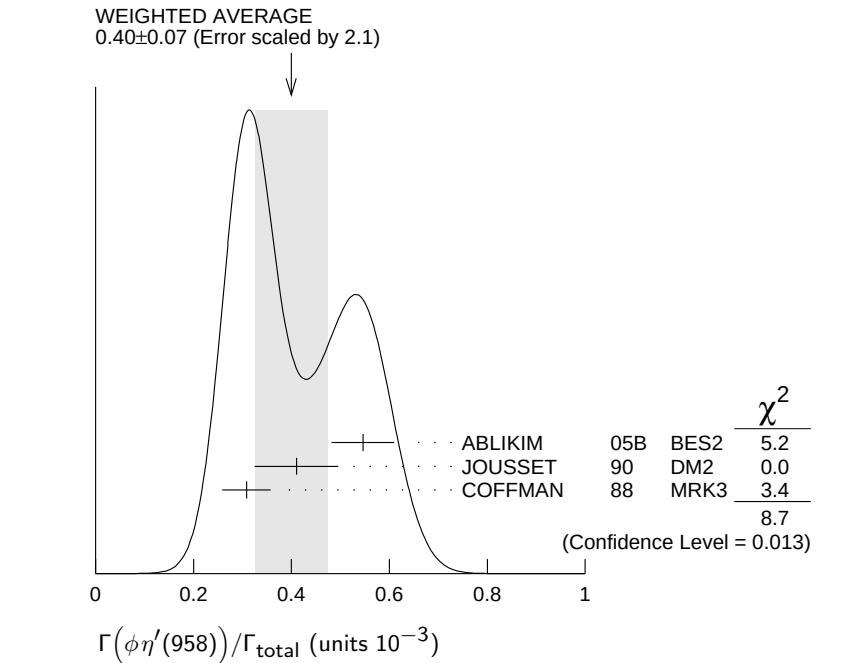
NODE=M070R32

NODE=M070R32;LINKAGE=BL



$\Gamma(\phi\eta'(958))/\Gamma_{\text{total}}$						Γ_{55}/Γ
<i>VALUE (units 10^{-3})</i>	<i>CL%</i>	<i>EVTs</i>	<i>DOCUMENT ID</i>	<i>TECN</i>	<i>COMMENT</i>	
0.40 ±0.07 OUR AVERAGE Error includes scale factor of 2.1. See the ideogram below.						
0.546±0.031±0.056			ABLIKIM	05B	BES2	$e^+e^- \rightarrow J/\psi \rightarrow \text{hadr}$
0.41 ±0.03 ±0.08	167		JOUSSET	90	DM2	$J/\psi \rightarrow \text{hadrons}$
0.308±0.034±0.036			COFFMAN	88	MRK3	$e^+e^- \rightarrow K^+K^-\eta'$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●						
< 1.3	90		VANNUCCI	77	MRK1	e^+e^-

NODE=M070R38
NODE=M070R38



$\Gamma(\phi f_0(980))/\Gamma_{\text{total}}$					Γ_{56}/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

$\Gamma(\phi f_0(980) \rightarrow \phi \pi^+ \pi^-) / \Gamma_{\text{total}}$ Γ_{57}/Γ

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
0.182±0.042±0.005	19.5 ± 4.5	1,2 AUBERT	07AK BABR	10.6 $e^+ e^- \rightarrow \pi^+ \pi^- K^+ K^- \gamma$

¹ Using $B(\phi \rightarrow K^+ K^-) = (49.3 \pm 0.6)\%$.

² AUBERT 07AK reports $[\Gamma(J/\psi(1S) \rightarrow \phi f_0(980) \rightarrow \phi \pi^+ \pi^-) / \Gamma_{\text{total}}] \times [\Gamma(J/\psi(1S) \rightarrow e^+ e^-)] = (1.01 \pm 0.22 \pm 0.08) \times 10^{-3}$ keV which we divide by our best value $\Gamma(J/\psi(1S) \rightarrow e^+ e^-) = 5.55 \pm 0.14 \pm 0.02$ keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070S02
NODE=M070S02

NODE=M070S02;LINKAGE=AU
NODE=M070S02;LINKAGE=BE

 $\Gamma(\phi f_0(980) \rightarrow \phi \pi^0 \pi^0) / \Gamma_{\text{total}}$ Γ_{58}/Γ

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
0.171±0.073±0.004	7.0 ± 2.8	1,2 AUBERT	07AK BABR	10.6 $e^+ e^- \rightarrow \pi^0 \pi^0 K^+ K^- \gamma$

¹ Using $B(\phi \rightarrow K^+ K^-) = (49.3 \pm 0.6)\%$.

² AUBERT 07AK reports $[\Gamma(J/\psi(1S) \rightarrow \phi f_0(980) \rightarrow \phi \pi^0 \pi^0) / \Gamma_{\text{total}}] \times [\Gamma(J/\psi(1S) \rightarrow e^+ e^-)] = (0.95 \pm 0.39 \pm 0.10) \times 10^{-3}$ keV which we divide by our best value $\Gamma(J/\psi(1S) \rightarrow e^+ e^-) = 5.55 \pm 0.14 \pm 0.02$ keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070S03
NODE=M070S03

NODE=M070S03;LINKAGE=AU
NODE=M070S03;LINKAGE=BE

 $\Gamma(\eta \phi f_0(980) \rightarrow \eta \phi \pi^+ \pi^-) / \Gamma_{\text{total}}$ Γ_{59}/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_{60}/Γ

VALUE (units 10^{-6})	DOCUMENT ID	TECN	COMMENT
5.0±2.7±2.5	1 ABLIKIM	11D BES3	$J/\psi \rightarrow \phi \eta \pi^0$

¹ Assuming $a_0(980) - f_0(980)$ mixing and isospin breaking via γ^* and $K^* K$ loops.

NODE=M070S75
NODE=M070S75

NODE=M070S75;LINKAGE=AB

 $\Gamma(\Xi(1530)^0 \Xi^0) / \Gamma_{\text{total}}$ Γ_{61}/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_{62}/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_{63}/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
2.6±0.5 OUR AVERAGE	Error includes scale factor of 1.1.			
3.2±0.6±0.4		JOUSSET	90 DM2	$J/\psi \rightarrow \phi 2(\pi^+ \pi^-)$
2.1±0.5±0.4	25	¹ JOUSSET	90 DM2	$J/\psi \rightarrow \phi \eta \pi^+ \pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.6±0.2±0.1	16 ± 6	BECKER	87 MRK3	$J/\psi \rightarrow \phi K \bar{K} \pi$

NODE=M070S6
NODE=M070S6

OCCUR=2

¹ We attribute to the $f_1(1285)$ the signal observed in the $\pi^+ \pi^- \eta$ invariant mass distribution at 1297 MeV.

NODE=M070S6;LINKAGE=Q

 $\Gamma(\eta \pi^+ \pi^-) / \Gamma_{\text{total}}$ Γ_{64}/Γ

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
0.40±0.17±0.03	9	¹ AUBERT	07AU BABR	10.6 $e^+ e^- \rightarrow \eta \pi^+ \pi^- \gamma$

¹ AUBERT 07AU quotes $\Gamma_{ee}^{J/\psi} \cdot B(J/\psi \rightarrow \eta \pi^+ \pi^-) \cdot B(\eta \rightarrow 3\pi) = 0.51 \pm 0.22 \pm 0.03$ eV.

NODE=M070S05
NODE=M070S05

NODE=M070S05;LINKAGE=AU

 $\Gamma(\rho \eta) / \Gamma_{\text{total}}$ Γ_{65}/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

$\Gamma(\omega\eta'(958))/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
0.182±0.021 OUR AVERAGE				
0.226±0.043	218	¹ ABLIKIM	06F BES2	$J/\psi \rightarrow \omega\eta'$
0.18 $^{+0.10}_{-0.08}$ ±0.03	6	JOUSSET	90 DM2	$J/\psi \rightarrow \text{hadrons}$
0.166±0.017±0.019		COFFMAN	88 MRK3	$e^+e^- \rightarrow 3\pi\eta'$

¹ 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=BL

 $\Gamma(\omega f_0(980))/\Gamma_{\text{total}}$

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

 $\Gamma(\rho\eta'(958))/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
0.105±0.018 OUR AVERAGE				
0.083±0.030±0.012	19	JOUSSET	90 DM2	$J/\psi \rightarrow \text{hadrons}$
0.114±0.014±0.016		COFFMAN	88 MRK3	$J/\psi \rightarrow \pi^+\pi^-\eta'$

NODE=M070R23
NODE=M070R23

 $\Gamma(a_2(1320)^\pm\pi^\mp)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<43	90	BRAUNSCH...	76 DASP	e^+e^-

NODE=M070R42
NODE=M070R42

 $\Gamma(K\bar{K}_2^*(1430)+\text{c.c.})/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<40	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	90	BRAUNSCH...	76 DASP	$e^+e^- \rightarrow K^\pm\bar{K}_2^{*\mp}$

NODE=M070R45
NODE=M070R45

 $\Gamma(K_1(1270)^\pm K^\mp)/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<3.0	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

 $\Gamma(K_2^*(1430)^0\bar{K}_2^*(1430)^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<29	90	VANNUCCI	77 MRK1	$e^+e^- \rightarrow \pi^+\pi^-\bar{K}^+K^-$

NODE=M070R47
NODE=M070R47

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

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<6.4	90	ABLIKIM	05B BES2	$e^+e^- \rightarrow J/\psi \rightarrow \phi\gamma\gamma$

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

<6.8	90	COFFMAN	88 MRK3	$e^+e^- \rightarrow K^+K^-\pi^0$

NODE=M070R33
NODE=M070R33

 $\Gamma(\phi\eta(1405) \rightarrow \phi\eta\pi\pi)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<2.5	90	¹ FALVARD	88 DM2	$J/\psi \rightarrow \text{hadrons}$

¹ Includes unknown branching fraction $\eta(1405) \rightarrow \eta\pi\pi$.

NODE=M070S23
NODE=M070S23

NODE=M070S23;LINKAGE=A

 $\Gamma(\omega f'_2(1525))/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<2.2	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	90	¹ FALVARD	88 DM2	$J/\psi \rightarrow \text{hadrons}$

¹ Re-evaluated assuming $B(f'_2(1525) \rightarrow K\bar{K}) = 0.713$.

NODE=M070R29
NODE=M070R29

NODE=M070R29;LINKAGE=C

 $\Gamma(\eta\phi(2170) \rightarrow \eta K^*(892)^0\bar{K}^*(892)^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<2.52	90	ABLIKIM	10C BES2	$J/\psi \rightarrow \eta K^+\pi^- K^-\pi^+$

NODE=M070S70
NODE=M070S70

$\Gamma(\Sigma(1385)^0 \bar{\Lambda} + \text{c.c.})/\Gamma_{\text{total}}$
 Γ_{77}/Γ

 NODE=M070S13
 NODE=M070S13

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
< 0.82 (CL = 90%) [$< 0.2 \times 10^{-3}$ (CL = 90%) OUR 2012 BEST LIMIT]				
< 0.82	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. • • •				
<20	90	HENRARD	87 DM2	$e^+ e^-$

 $\Gamma(\Delta(1232)^+ \bar{p})/\Gamma_{\text{total}}$
 Γ_{78}/Γ

 NODE=M070S14
 NODE=M070S14

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<0.1	90	HENRARD	87 DM2	$e^+ e^-$

 $\Gamma(\Lambda(1520) \bar{\Lambda} + \text{c.c.} \rightarrow \gamma \Lambda \bar{\Lambda})/\Gamma_{\text{total}}$
 Γ_{79}/Γ

 NODE=M070S77
 NODE=M070S77

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<4.1	90	ABLIKIM	12B BES3	$J/\psi \rightarrow \Lambda \bar{\Lambda} \gamma$

 $\Gamma(\Theta(1540) \bar{\Theta}(1540) \rightarrow K_S^0 p K^- \bar{n} + \text{c.c.})/\Gamma_{\text{total}}$
 Γ_{80}/Γ

 NODE=M070S47
 NODE=M070S47

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<1.1	90	BAI	04G BES2	$e^+ e^-$

 $\Gamma(\Theta(1540) K^- \bar{n} \Rightarrow K_S^0 p K^- \bar{n})/\Gamma_{\text{total}}$
 Γ_{81}/Γ

 NODE=M070S48
 NODE=M070S48

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<2.1	90	BAI	04G BES2	$e^+ e^-$

 $\Gamma(\Theta(1540) K_S^0 \bar{p} \rightarrow K_S^0 \bar{p} K^+ n)/\Gamma_{\text{total}}$
 Γ_{82}/Γ

 NODE=M070S49
 NODE=M070S49

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<1.6	90	BAI	04G BES2	$e^+ e^-$

 $\Gamma(\bar{\Theta}(1540) K^+ n \rightarrow K_S^0 \bar{p} K^+ n)/\Gamma_{\text{total}}$
 Γ_{83}/Γ

 NODE=M070S50
 NODE=M070S50

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<5.6	90	BAI	04G BES2	$e^+ e^-$

 $\Gamma(\bar{\Theta}(1540) K_S^0 p \rightarrow K_S^0 p K^- \bar{n})/\Gamma_{\text{total}}$
 Γ_{84}/Γ

 NODE=M070S51
 NODE=M070S51

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<1.1	90	BAI	04G BES2	$e^+ e^-$

 $\Gamma(\Sigma^0 \bar{\Lambda})/\Gamma_{\text{total}}$
 Γ_{85}/Γ

 NODE=M070S12
 NODE=M070S12

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<0.9	90	HENRARD	87 DM2	$e^+ e^-$

STABLE HADRONS

NODE=M070307

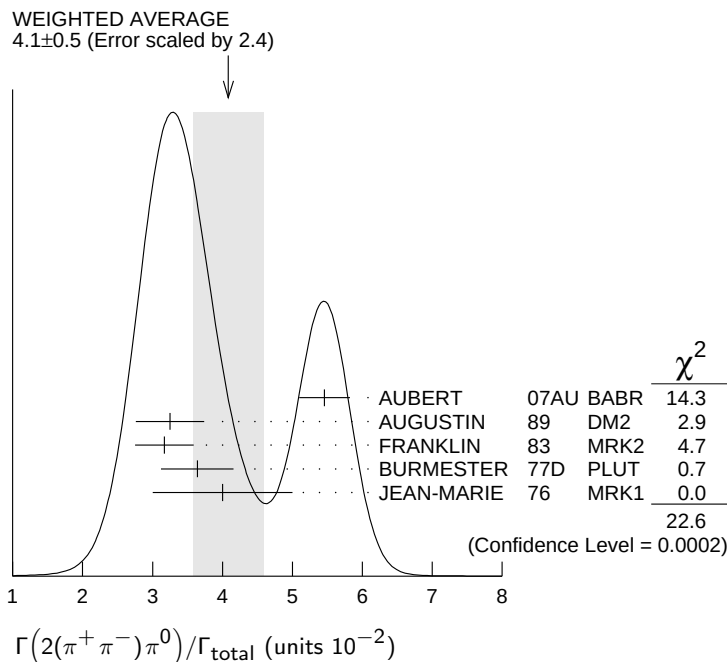
 $\Gamma(2(\pi^+ \pi^-) \pi^0)/\Gamma_{\text{total}}$
 Γ_{86}/Γ

 NODE=M070R9
 NODE=M070R9

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
4.1 ± 0.5 OUR AVERAGE Error includes scale factor of 2.4. See the ideogram below.				
$5.46 \pm 0.34 \pm 0.14$	4990	¹ AUBERT	07AU BABR	$10.6 e^+ e^- \rightarrow 2(\pi^+ \pi^-) \pi^0 \gamma$
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	$e^+ e^-$

¹ AUBERT 07AU reports $[\Gamma(J/\psi(1S) \rightarrow 2(\pi^+ \pi^-) \pi^0)/\Gamma_{\text{total}}] \times [\Gamma(J/\psi(1S) \rightarrow e^+ e^-)] = 0.303 \pm 0.005 \pm 0.018 \text{ keV}$ which we divide by our best value $\Gamma(J/\psi(1S) \rightarrow e^+ e^-) = 5.55 \pm 0.14 \pm 0.02 \text{ keV}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070R9;LINKAGE=AU



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

Γ_{13}/Γ_{86}

VALUE DOCUMENT ID TECN COMMENT

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

0.3 ¹ JEAN-MARIE 76 MRK1 e^+e^-

¹ Final state $(\pi^+\pi^-\pi^0)$ under the assumption that $\pi\pi$ is isospin 0.

NODE=M070R25
NODE=M070R25

NODE=M070R25;LINKAGE=J

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

Γ_{87}/Γ

VALUE EVTS DOCUMENT ID TECN COMMENT

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

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

Γ_{88}/Γ

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

21.1 ±0.7 OUR AVERAGE Error includes scale factor of 1.5. See the ideogram below.
[(20.7 ± 1.2) × 10⁻³ OUR 2012 AVERAGE Scale factor = 1.6]

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 $e^+e^- \rightarrow J/\psi\pi^+\pi^-\gamma$
21.8 ±1.9		^{4,5} AUBERT,B	04N	BABR	10.6 $e^+e^- \rightarrow \pi^+\pi^-\pi^0\gamma$
21.84±0.05±2.01	220k	^{1,5} BAI	04H	BES	e^+e^-
20.91±0.21±1.16		^{5,6} BAI	04H	BES	e^+e^-
15 ±2	168	FRANKLIN	83	MRK2	e^+e^-

NODE=M070R7
NODE=M070R7

NEW

OCCUR=2

¹ 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 $\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) \times \Gamma(\psi(2S) \rightarrow e^+e^-)/\Gamma_{\text{total}} = 0.807 \pm 0.014$ keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.

⁴ From the ratio of $\Gamma(e^+e^-) B(\pi^+\pi^-\pi^0)$ and $\Gamma(e^+e^-) B(\mu^+\mu^-)$ (AUBERT 04).

⁵ Mostly $\rho\pi$, see also $\rho\pi$ subsection.

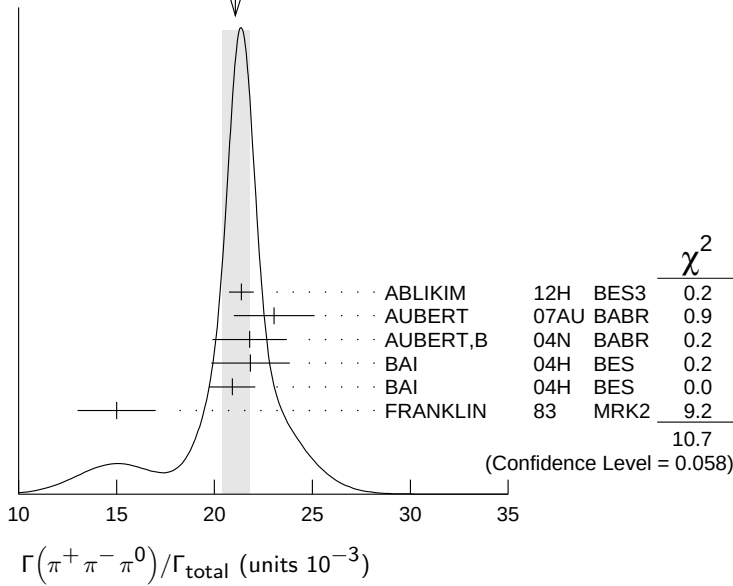
⁶ Obtained comparing the rates for $\pi^+\pi^-\pi^0$ and $\mu^+\mu^-$, using J/ψ events produced via $\psi(2S) \rightarrow \pi^+\pi^- J/\psi$ and with $B(J/\psi \rightarrow \mu^+\mu^-) = 5.88 \pm 0.10\%$.

NODE=M070R;LINKAGE=BA
NODE=M070R7;LINKAGE=AB

NODE=M070R7;LINKAGE=AU

NODE=M070R;LINKAGE=AU
NODE=M070R;LINKAGE=BU
NODE=M070R;LINKAGE=BI

WEIGHTED AVERAGE
21.1±0.7 (Error scaled by 1.5)



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

Γ_{89}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
1.79±0.29 OUR AVERAGE		Error includes scale factor of 2.2.		
1.93±0.14±0.05	768	¹ AUBERT	07AU BABR	10.6 $e^+e^- \rightarrow K^+K^-\pi^+\pi^-\pi^0\gamma$
1.2 ±0.3	309	VANNUCCI	77 MRK1	e^+e^-

¹ AUBERT 07AU reports $[\Gamma(J/\psi(1S) \rightarrow \pi^+\pi^-\pi^0 K^+K^-)/\Gamma_{\text{total}}] \times [\Gamma(J/\psi(1S) \rightarrow e^+e^-)] = 0.1070 \pm 0.0043 \pm 0.0064$ keV which we divide by our best value $\Gamma(J/\psi(1S) \rightarrow e^+e^-) = 5.55 \pm 0.14 \pm 0.02$ keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070R18
NODE=M070R18

NODE=M070R18;LINKAGE=AU

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

Γ_{90}/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_{91}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
6.6±0.5 OUR AVERAGE				
6.5±0.4±0.2	1.6k	¹ AUBERT	07AK BABR	10.6 $e^+e^- \rightarrow \pi^+\pi^-K^+K^-\gamma$
7.2±2.3	205	VANNUCCI	77 MRK1	e^+e^-

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

6.1±0.7±0.2 233 ² AUBERT 05D BABR 10.6 $e^+e^- \rightarrow K^+K^-\pi^+\pi^-\gamma$

¹ AUBERT 07AK reports $[\Gamma(J/\psi(1S) \rightarrow \pi^+\pi^-K^+K^-)/\Gamma_{\text{total}}] \times [\Gamma(J/\psi(1S) \rightarrow e^+e^-)] = (36.3 \pm 1.3 \pm 2.1) \times 10^{-3}$ keV which we divide by our best value $\Gamma(J/\psi(1S) \rightarrow e^+e^-) = 5.55 \pm 0.14 \pm 0.02$ keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² Superseded by AUBERT 07AK. AUBERT 05D reports $[\Gamma(J/\psi(1S) \rightarrow \pi^+\pi^-K^+K^-)/\Gamma_{\text{total}}] \times [\Gamma(J/\psi(1S) \rightarrow e^+e^-)] = (33.6 \pm 2.7 \pm 2.7) \times 10^{-3}$ keV which we divide by our best value $\Gamma(J/\psi(1S) \rightarrow e^+e^-) = 5.55 \pm 0.14 \pm 0.02$ keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070R16
NODE=M070R16

NODE=M070R16;LINKAGE=BE

NODE=M070R16;LINKAGE=AU

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

Γ_{92}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.84±0.28±0.05	73	¹ AUBERT	07AU BABR	10.6 $e^+e^- \rightarrow K^+K^-\pi^+\pi^-\eta\gamma$

¹ AUBERT 07AU reports $[\Gamma(J/\psi(1S) \rightarrow \pi^+\pi^-K^+K^-\eta)/\Gamma_{\text{total}}] \times [\Gamma(J/\psi(1S) \rightarrow e^+e^-)] = (10.2 \pm 1.3 \pm 0.8) \times 10^{-3}$ keV which we divide by our best value $\Gamma(J/\psi(1S) \rightarrow e^+e^-) = 5.55 \pm 0.14 \pm 0.02$ keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070S04
NODE=M070S04

NODE=M070S04;LINKAGE=AU

$\Gamma(\pi^0\pi^0 K^+ K^-)/\Gamma_{\text{total}}$ Γ_{93}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
2.45±0.31±0.06	203 ± 16	¹ AUBERT 07AK BABR	10.6	$e^+e^- \rightarrow \pi^0\pi^0 K^+ K^- \gamma$
¹ AUBERT 07AK reports $[\Gamma(J/\psi(1S) \rightarrow \pi^0\pi^0 K^+ K^-)/\Gamma_{\text{total}}] \times [\Gamma(J/\psi(1S) \rightarrow e^+e^-)] = (13.6 \pm 1.1 \pm 1.3) \times 10^{-3}$ keV which we divide by our best value $\Gamma(J/\psi(1S) \rightarrow e^+e^-) = 5.55 \pm 0.14 \pm 0.02$ keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M070S01
 NODE=M070S01

NODE=M070S01;LINKAGE=BE

 $\Gamma(K\bar{K}\pi)/\Gamma_{\text{total}}$ Γ_{94}/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

 $\Gamma(2(\pi^+\pi^-))/\Gamma_{\text{total}}$ Γ_{95}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
3.57±0.30 OUR AVERAGE				
[(3.55 ± 0.23) × 10 ⁻³ OUR 2012 AVERAGE]				

NODE=M070R8
 NODE=M070R8

NEW

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

3.51±0.34±0.09	270	² AUBERT 05D BABR	10.6	$e^+e^- \rightarrow 2(\pi^+\pi^-)\gamma$
¹ Computed using $B(J/\psi \rightarrow \mu^+\mu^-) = 0.0588 \pm 0.0010$.				
² AUBERT 05D reports $[\Gamma(J/\psi(1S) \rightarrow 2(\pi^+\pi^-))/\Gamma_{\text{total}}] \times [\Gamma(J/\psi(1S) \rightarrow e^+e^-)] = (19.5 \pm 1.4 \pm 1.3) \times 10^{-3}$ keV which we divide by our best value $\Gamma(J/\psi(1S) \rightarrow e^+e^-) = 5.55 \pm 0.14 \pm 0.02$ keV. 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=M070R8;LINKAGE=AB
 NODE=M070R8;LINKAGE=AU

 $\Gamma(3(\pi^+\pi^-))/\Gamma_{\text{total}}$ Γ_{96}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
43 ± 4 OUR AVERAGE				
43.0± 2.9±2.8	496	¹ AUBERT 06D BABR	10.6	$e^+e^- \rightarrow 3(\pi^+\pi^-)\gamma$
40 ± 20	32	JEAN-MARIE 76	MRK1	e^+e^-
¹ Using $\Gamma(J/\psi \rightarrow e^+e^-) = 5.52 \pm 0.14 \pm 0.04$ keV.				

NODE=M070R10
 NODE=M070R10

NODE=M070R10;LINKAGE=EE

 $\Gamma(2(\pi^+\pi^-\pi^0))/\Gamma_{\text{total}}$ Γ_{97}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
1.62±0.09±0.19	761	¹ AUBERT 06D BABR	10.6	$e^+e^- \rightarrow 2(\pi^+\pi^-\pi^0)\gamma$
¹ Using $\Gamma(J/\psi \rightarrow e^+e^-) = 5.52 \pm 0.14 \pm 0.04$ keV.				

NODE=M070R69
 NODE=M070R69

NODE=M070R69;LINKAGE=EE

 $\Gamma(2(\pi^+\pi^-)\eta)/\Gamma_{\text{total}}$ Γ_{98}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
2.29±0.24 OUR AVERAGE				
2.35±0.39±0.20	85	¹ AUBERT 07AU BABR	10.6	$e^+e^- \rightarrow 2(\pi^+\pi^-)\eta\gamma$
2.26±0.08±0.27	4839	ABLIKIM 05C BES2		$e^+e^- \rightarrow 2(\pi^+\pi^-)\eta$
¹ AUBERT 07AU quotes $\Gamma_{ee}^{J/\psi} \cdot B(J/\psi \rightarrow 2(\pi^+\pi^-)\eta) \cdot B(\eta \rightarrow \gamma\gamma) = 5.16 \pm 0.85 \pm 0.39$ eV.				

NODE=M070S42
 NODE=M070S42

NODE=M070S42;LINKAGE=AU

 $\Gamma(3(\pi^+\pi^-)\eta)/\Gamma_{\text{total}}$ Γ_{99}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
7.24±0.96±1.11	616	ABLIKIM 05C BES2		$e^+e^- \rightarrow 3(\pi^+\pi^-)\eta$

NODE=M070S43
 NODE=M070S43

 $\Gamma(p\bar{p})/\Gamma_{\text{total}}$ Γ_{100}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
2.120±0.029 OUR AVERAGE				
[(2.17 ± 0.07) × 10 ⁻³ OUR 2012 AVERAGE]				
2.112±0.004±0.031	314k	ABLIKIM 12C BES3		e^+e^-
2.15 ± 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^-

NODE=M070R50
 NODE=M070R50
 NEW

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 $B(B^+ \rightarrow J/\psi(1S)K^+) = (1.028 \pm 0.031) \times 10^{-3}$. 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_{101}/Γ

<u>VALUE (units 10⁻³)</u>	<u>EVTs</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
1.19±0.08 OUR AVERAGE	Error includes scale factor of 1.1.				
1.33±0.02±0.11	11k	ABLIKIM	09B	BES2	e ⁺ e ⁻
1.13±0.09±0.09	685	EATON	84	MRK2	e ⁺ e ⁻
1.4 ±0.4		BRANDELIK	79C	DASP	e ⁺ e ⁻
1.00±0.15	109	PERUZZI	78	MRK1	e ⁺ e ⁻

NODE=M070R52
NODE=M070R52

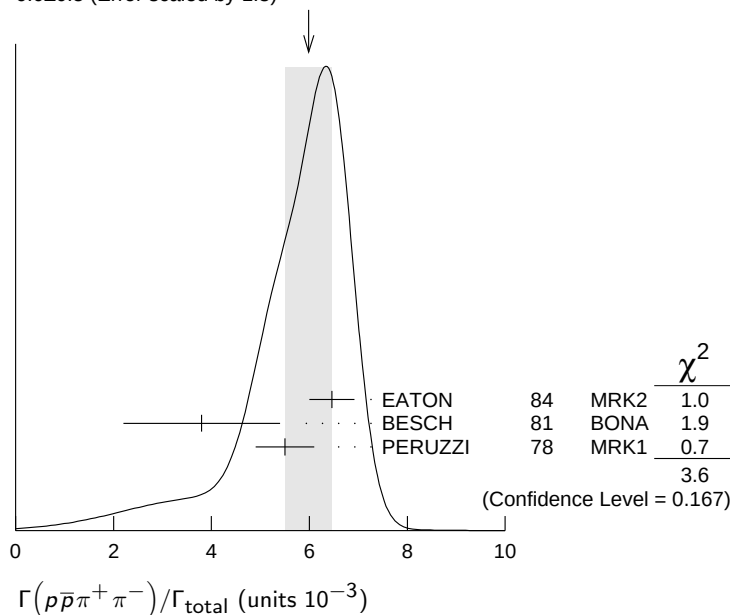
$\Gamma(p\bar{p}\pi^+\pi^-)/\Gamma_{\text{total}}$

Γ_{102}/Γ

VALUE (units 10 ⁻³)	EVTs	DOCUMENT ID	TECN	COMMENT
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 ⁻

NODE=M070R54
NODE=M070R54

WEIGHTED AVERAGE
6.0±0.5 (Error scaled by 1.3)



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

Γ_{103}/Γ

Including $p\bar{p}\pi^+\pi^-\gamma$ and excluding ω, η, η'

<u>VALUE (units 10^{-3})</u>	<u>EVTs</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
2.3 $\pm$0.9 OUR AVERAGE	Error includes scale factor of 1.9.			
3.36 $\pm$ 0.65 $\pm$ 0.28	364	EATON	84	MRK2 e^+e^-
1.6 $\pm$ 0.6	39	PERUZZI	78	MRK1 e^+e^-

NODE=M070R55
NODE=M070R55
NODE=M070R55

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

Γ_{104}/Γ

<u>VALUE (units 10⁻³)</u>	<u>EVTs</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
2.00±0.12 OUR AVERAGE					
1.91±0.02±0.17	13k	¹ ABLIKIM	09	BES2	e ⁺ e ⁻
2.03±0.13±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 ⁻

NODE=M070R56
NODE=M070R56

¹From 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_{105}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<0.31	90	EATON	84	MRK2 $e^+e^- \rightarrow \text{hadrons}\gamma$

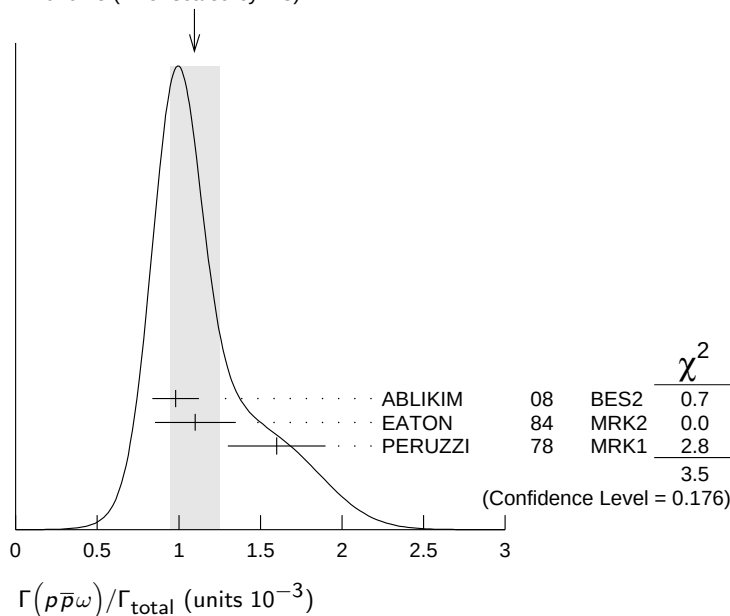
NODE=M070R57
 NODE=M070R57

 $\Gamma(p\bar{p}\omega)/\Gamma_{\text{total}}$ Γ_{106}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.10 ± 0.15 OUR AVERAGE	Error includes scale factor of 1.3. See the ideogram below.			
$0.98 \pm 0.03 \pm 0.14$	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^-

NODE=M070R58
 NODE=M070R58

WEIGHTED AVERAGE
 1.10 ± 0.15 (Error scaled by 1.3)

 $\Gamma(p\bar{p}\eta(958))/\Gamma_{\text{total}}$ Γ_{107}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
0.21 ± 0.04 OUR AVERAGE				
$0.200 \pm 0.023 \pm 0.028$	265 ± 31	¹ ABLIKIM	09	BES2 e^+e^-
$0.68 \pm 0.23 \pm 0.17$	19	EATON	84	MRK2 e^+e^-
1.8 ± 0.6	19	PERUZZI	78	MRK1 e^+e^-

NODE=M070R59
 NODE=M070R59

¹ From the combination of $p\bar{p}\eta' \rightarrow p\bar{p}\pi^+\pi^-\eta$ and $p\bar{p}\eta' \rightarrow p\bar{p}\gamma\rho^0$ channels.

NODE=M070R59;LINKAGE=AB

 $\Gamma(p\bar{p}\phi)/\Gamma_{\text{total}}$ Γ_{108}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
$0.45 \pm 0.13 \pm 0.07$	FALVARD	88	DM2 $J/\psi \rightarrow \text{hadrons}$

NODE=M070S22
 NODE=M070S22

 $\Gamma(n\bar{n})/\Gamma_{\text{total}}$ Γ_{109}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
2.09 ± 0.16 OUR AVERAGE				
[(0.22 ± 0.04) $\times 10^{-2}$ OUR 2012 AVERAGE]				
$2.07 \pm 0.01 \pm 0.17$	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
 NEW

 $\Gamma(n\bar{n}\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{110}/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_{111}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.50 \pm 0.10 \pm 0.22$	399	ABLIKIM	080	BES2 $e^+e^- \rightarrow J/\psi$

NODE=M070S09
 NODE=M070S09

$\Gamma(\Sigma^0 \bar{\Sigma}^0)/\Gamma_{\text{total}}$ Γ_{112}/Γ VALUE (units 10^{-3}) EVTS

DOCUMENT ID

TECN

COMMENT

1.29±0.09 OUR AVERAGE

1.15±0.24±0.03		¹ AUBERT	07BD BABR	10.6 $e^+e^- \rightarrow \Sigma^0 \bar{\Sigma}^0 \gamma$
1.33±0.04±0.11	1779	ABLIKIM	06 BES2	$J/\psi \rightarrow \Sigma^0 \bar{\Sigma}^0$
1.06±0.04±0.23	884 ± 30	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	$e^+e^- \rightarrow \Sigma^+ \bar{\Sigma}^-$

¹ AUBERT 07BD reports $[\Gamma(J/\psi(1S) \rightarrow \Sigma^0 \bar{\Sigma}^0)/\Gamma_{\text{total}}] \times [\Gamma(J/\psi(1S) \rightarrow e^+e^-)] = (6.4 \pm 1.2 \pm 0.6) \times 10^{-3}$ keV which we divide by our best value $\Gamma(J/\psi(1S) \rightarrow e^+e^-) = 5.55 \pm 0.14 \pm 0.02$ keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070R63
NODE=M070R63

NODE=M070R63;LINKAGE=AU

 $\Gamma(2(\pi^+ \pi^-) K^+ K^-)/\Gamma_{\text{total}}$ Γ_{113}/Γ VALUE (units 10^{-4}) EVTS

DOCUMENT ID

TECN

COMMENT

47 ± 7 OUR AVERAGE

Error includes scale factor of 1.3.

49.8 ± 4.2 ± 3.4	205	¹ AUBERT	06D BABR	10.6 $e^+e^- \rightarrow \omega K^+ K^- 2(\pi^+ \pi^-) \gamma$
31 ± 13	30	VANNUCCI	77 MRK1	e^+e^-

¹ Using $\Gamma(J/\psi \rightarrow e^+e^-) = 5.52 \pm 0.14 \pm 0.04$ keV.

NODE=M070R17
NODE=M070R17

NODE=M070R17;LINKAGE=EE

 $\Gamma(p \bar{n} \pi^-)/\Gamma_{\text{total}}$ Γ_{114}/Γ VALUE (units 10^{-3}) EVTS

DOCUMENT ID

TECN

COMMENT

2.12±0.09 OUR AVERAGE

2.36±0.02±0.21	59k	ABLIKIM	06K BES2	$J/\psi \rightarrow p \pi^- \bar{n}$
2.47±0.02±0.24	55k	ABLIKIM	06K BES2	$J/\psi \rightarrow \bar{p} \pi^+ n$
2.02±0.07±0.16	1288	EATON	84 MRK2	$e^+e^- \rightarrow p \pi^-$
1.93±0.07±0.16	1191	EATON	84 MRK2	$e^+e^- \rightarrow \bar{p} \pi^+$
1.7 ±0.7	32	BESCH	81 BONA	$e^+e^- \rightarrow p \pi^-$
1.6 ±1.2	5	BESCH	81 BONA	$e^+e^- \rightarrow \bar{p} \pi^+$
2.16±0.29	194	PERUZZI	78 MRK1	$e^+e^- \rightarrow p \pi^-$
2.04±0.27	204	PERUZZI	78 MRK1	$e^+e^- \rightarrow \bar{p} \pi^+$

NODE=M070R53
NODE=M070R53

OCCUR=2

OCCUR=2

OCCUR=2

OCCUR=2

 $\Gamma(\Xi^- \bar{\Xi}^+)/\Gamma_{\text{total}}$ Γ_{118}/Γ VALUE (units 10^{-3}) EVTS

DOCUMENT ID

TECN

COMMENT

0.86±0.11 OUR AVERAGE

Error includes scale factor of 1.2. $[(0.85 \pm 0.16) \times 10^{-3}]$
OUR 2012 AVERAGE Scale factor = 1.5]

0.90±0.03±0.18	961 ± 35	ABLIKIM	12P BES2	$J/\psi \rightarrow \Xi^- \bar{\Xi}^+$
0.70±0.06±0.12	132 ± 11	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	$e^+e^- \rightarrow \Xi^- \bar{\Xi}^+$

NODE=M070R62
NODE=M070R62

NEW

 $\Gamma(\Lambda \bar{\Lambda})/\Gamma_{\text{total}}$ Γ_{119}/Γ VALUE (units 10^{-3}) EVTS

DOCUMENT ID

TECN

COMMENT

1.61±0.15 OUR AVERAGE

Error includes scale factor of 1.9. See the ideogram below.

1.93±0.21±0.05		¹ AUBERT	07BD BABR	10.6 $e^+e^- \rightarrow \Lambda \bar{\Lambda} \gamma$
2.03±0.03±0.15	8887	ABLIKIM	06 BES2	$J/\psi \rightarrow \Lambda \bar{\Lambda}$
1.9 ^{+0.5} _{-0.4} ±0.1	46	² WU	06 BELL	$B^+ \rightarrow \Lambda \bar{\Lambda} K^+$
1.08±0.06±0.24	631	BAI	98G BES	e^+e^-
1.38±0.05±0.20	1847	PALLIN	87 DM2	e^+e^-
1.58±0.08±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^-

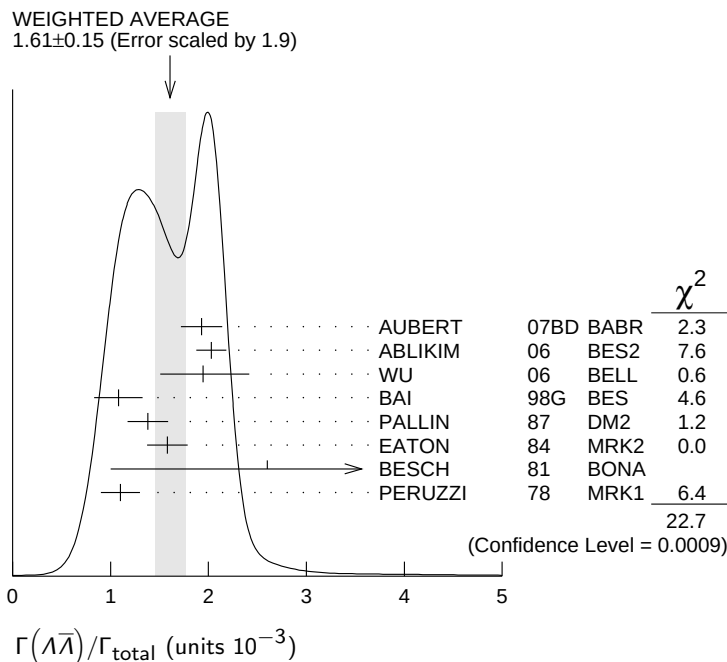
NODE=M070R60
NODE=M070R60

¹ AUBERT 07BD reports $[\Gamma(J/\psi(1S) \rightarrow \Lambda \bar{\Lambda})/\Gamma_{\text{total}}] \times [\Gamma(J/\psi(1S) \rightarrow e^+e^-)] = (10.7 \pm 0.9 \pm 0.7) \times 10^{-3}$ keV which we divide by our best value $\Gamma(J/\psi(1S) \rightarrow e^+e^-) = 5.55 \pm 0.14 \pm 0.02$ keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070R60;LINKAGE=AU

² WU 06 reports $[\Gamma(J/\psi(1S) \rightarrow \Lambda \bar{\Lambda})/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow J/\psi(1S) K^+)] = (2.00 ^{+0.34} _{-0.29} ± 0.34) \times 10^{-6}$ which we divide by our best value $B(B^+ \rightarrow J/\psi(1S) K^+) = (1.028 \pm 0.031) \times 10^{-3}$. 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

 $\Gamma(\Lambda\bar{\Lambda})/\Gamma(p\bar{p})$ $\Gamma_{119}/\Gamma_{100}$

VALUE	DOCUMENT ID	TECN	COMMENT
$0.90^{+0.15}_{-0.14} \pm 0.10$	¹ WU	06 BELL	$B^+ \rightarrow \rho\bar{p}K^+, \Lambda\bar{\Lambda}K^+$

NODE=M070R79
NODE=M070R79

¹ Not independent of other $J/\psi \rightarrow \Lambda\bar{\Lambda}, \rho\bar{p}$ branching ratios reported by WU 06.

NODE=M070R79;LINKAGE=WU

 $\Gamma(\Lambda\bar{\Sigma}^-\pi^+ \text{ (or c.c.)})/\Gamma_{\text{total}}$ Γ_{120}/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 ± 0.051 ± 0.083	335	¹ ABLIKIM	07H BES2	$e^+e^- \rightarrow \Lambda\bar{\Sigma}^+\pi^-$
0.747 ± 0.056 ± 0.076	254	¹ ABLIKIM	07H BES2	$e^+e^- \rightarrow \Lambda\bar{\Sigma}^-\pi^+$
0.90 ± 0.06 ± 0.16	225 ± 15	HENRARD	87 DM2	$e^+e^- \rightarrow \Lambda\bar{\Sigma}^+\pi^-$
1.11 ± 0.06 ± 0.20	342 ± 18	HENRARD	87 DM2	$e^+e^- \rightarrow \Lambda\bar{\Sigma}^-\pi^+$
1.53 ± 0.17 ± 0.38	135	EATON	84 MRK2	$e^+e^- \rightarrow \Lambda\bar{\Sigma}^+\pi^-$
1.38 ± 0.21 ± 0.35	118	EATON	84 MRK2	$e^+e^- \rightarrow \Lambda\bar{\Sigma}^-\pi^+$

NODE=M070R71
NODE=M070R71

OCCUR=2

OCCUR=2

OCCUR=2

¹ Using $B(\Lambda \rightarrow \pi^- p) = 63.9\%$ and $B(\Sigma^+ \rightarrow \pi^0 p) = 51.6\%$.

NODE=M070R71;LINKAGE=AB

 $\Gamma(pK^-\bar{\Lambda})/\Gamma_{\text{total}}$ Γ_{121}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
0.89 ± 0.07 ± 0.14	307	EATON	84 MRK2	e^+e^-

NODE=M070R72
NODE=M070R72

 $\Gamma(2(K^+K^-))/\Gamma_{\text{total}}$ Γ_{122}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
0.76 ± 0.09 OUR AVERAGE				
0.74 ± 0.09 ± 0.02	156 ± 15	¹ AUBERT	07AK BABR	10.6 $e^+e^- \rightarrow 2(K^+K^-)\gamma$
1.4 $^{+0.5}_{-0.4} \pm 0.2$	11.0 $^{+4.3}_{-3.5}$	² HUANG	03 BELL	$B^+ \rightarrow 2(K^+K^-)K^+$
0.7 ± 0.3		VANNUCCI	77 MRK1	e^+e^-

NODE=M070R19
NODE=M070R19

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

0.72 ± 0.17 ± 0.02	38	³ AUBERT	05D BABR	10.6 $e^+e^- \rightarrow 2(K^+K^-)\gamma$

NODE=M070R19;LINKAGE=BE

¹ AUBERT 07AK reports $[\Gamma(J/\psi(1S) \rightarrow 2(K^+K^-))/\Gamma_{\text{total}}] \times [\Gamma(J/\psi(1S) \rightarrow e^+e^-)] = (4.11 \pm 0.39 \pm 0.30) \times 10^{-3}$ keV which we divide by our best value $\Gamma(J/\psi(1S) \rightarrow e^+e^-) = 5.55 \pm 0.14 \pm 0.02$ keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² Using $B(B^+ \rightarrow J/\psi K^+) = (1.01 \pm 0.05) \times 10^{-3}$.

NODE=M070R19;LINKAGE=CC
NODE=M070R19;LINKAGE=AU

³ Superseded by AUBERT 07AK. AUBERT 05D reports $[\Gamma(J/\psi(1S) \rightarrow 2(K^+K^-))/\Gamma_{\text{total}}] \times [\Gamma(J/\psi(1S) \rightarrow e^+e^-)] = (4.0 \pm 0.7 \pm 0.6) \times 10^{-3}$ keV which we divide by our best value $\Gamma(J/\psi(1S) \rightarrow e^+e^-) = 5.55 \pm 0.14 \pm 0.02$ keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(pK^- \bar{\Sigma}^0)/\Gamma_{\text{total}}$ Γ_{123}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
0.29±0.06±0.05	90	EATON	84	MRK2 e^+e^-

NODE=M070R73
 NODE=M070R73

 $\Gamma(K^+ K^-)/\Gamma_{\text{total}}$ Γ_{124}/Γ

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

2.70±0.17 OUR AVERAGE[(2.37 ± 0.31) × 10⁻⁴ OUR 2012 AVERAGE]

2.86±0.09±0.19	1k	¹ METREVELI	12	$\psi(2S) \rightarrow \pi^+ \pi^- K^+ K^-$
2.39±0.24±0.22	107	BALTRUSAIT..85D	MRK3	e^+e^-
2.2 ±0.9	6	BRANDELIK	79c	DASP e^+e^-

¹ Obtained by analyzing CLEO-c data but not authored by the CLEO Collaboration.

NODE=M070R13
 NODE=M070R13
 NEW

 $\Gamma(K_S^0 K_L^0)/\Gamma_{\text{total}}$ Γ_{125}/Γ

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

2.1 ±0.4 OUR AVERAGE Error includes scale factor of 3.2. [(1.46 ± 0.26) × 10⁻⁴ OUR 2012 AVERAGE Scale factor = 2.7]

2.62±0.15±0.14	0.3k	¹ METREVELI	12	$\psi(2S) \rightarrow \pi^+ \pi^- K_S^0 K_L^0$
1.82±0.04±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±0.12±0.18		JOUSSET	90	DM2 $J/\psi \rightarrow \text{hadrons}$
1.01±0.16±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
 NEW

 $\Gamma(\Lambda \bar{\Lambda} \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{126}/Γ

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

4.30±0.13±0.99 2.4k ABLIKIM 12P BES2 J/ψ

NODE=M070S78
 NODE=M070S78

 $\Gamma(\Lambda \bar{\Lambda} \eta)/\Gamma_{\text{total}}$ Γ_{127}/Γ

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

16.2±1.7 OUR AVERAGE[(2.6 ± 0.7) × 10⁻⁴ OUR 2012 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=M070R07
 NEW

 $\Gamma(\Lambda \bar{\Lambda} \pi^0)/\Gamma_{\text{total}}$ Γ_{128}/Γ

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

3.8 ±0.4 OUR AVERAGE [(0.22 ± 0.06) × 10⁻³ OUR 2007 AVERAGE]**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=M070S11

NEW

 $\Gamma(\bar{\Lambda} n K_S^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{129}/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_{130}/Γ

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

1.47±0.14 OUR AVERAGE[(1.47 ± 0.23) × 10⁻⁴ OUR 2012 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
 NEW

NODE=M070R6;LINKAGE=ME

$\Gamma(\Lambda\bar{\Sigma} + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{131}/Γ

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

2.83±0.23 OUR AVERAGE2.74±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. • • •

<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 quotes $B(J/\psi \rightarrow \bar{\Lambda}\Sigma^0)$ 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_{132}/Γ

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

<0.01 95 ¹ BAI 04D BES e^+e^-

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

<0.052 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_{133}/Γ

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

11.6±2.2 OUR AVERAGE[(12 ± 4) × 10⁻⁶ OUR 2012 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
NEW $\Gamma(4\gamma)/\Gamma_{\text{total}}$ Γ_{134}/Γ

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

<9 90 ADAMS 08 CLEO $\psi(2S) \rightarrow \pi^+\pi^- J/\psi$ NODE=M070S06
NODE=M070S06 $\Gamma(5\gamma)/\Gamma_{\text{total}}$ Γ_{135}/Γ

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

<15 90 ADAMS 08 CLEO $\psi(2S) \rightarrow \pi^+\pi^- J/\psi$ NODE=M070S07
NODE=M070S07 $\Gamma(\gamma\eta_c(1S))/\Gamma_{\text{total}}$ Γ_{136}/Γ

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

1.7 ± 0.4 OUR AVERAGE Error includes scale factor of 1.6. [(1.7 ± 0.4) × 10⁻² OUR 2012 AVERAGE Scale factor = 1.6]2.04±0.32±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. • • •

0.79±0.20 273 ± 43 ² AUBERT 06E BABR $B^\pm \rightarrow K^\pm X_{c\bar{c}}$
seen 16 BALTRUSAIT..84 MRK3 $J/\psi \rightarrow 2\phi\gamma$ NODE=M070R85
NODE=M070R85

NEW

NODE=M070R85;LINKAGE=MI

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 $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (34.0 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.² 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=AU

 $\Gamma(\gamma\eta_c(1S) \rightarrow 3\gamma)/\Gamma_{\text{total}}$ Γ_{137}/Γ

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

3.8^{+1.3}_{-1.0} OUR AVERAGE Error includes scale factor of 1.1. [(1.2^{+2.7}_{-1.1}) × 10⁻⁶ OUR 2012 AVERAGE]4.5±1.2±0.6 33 ± 9 ABLIKIM 13I BES3 $\psi(2S) \rightarrow \pi^+\pi^- J/\psi$ 1.2^{+2.7}_{-1.1} ± 0.3 1.2^{+2.8}_{-1.1} ADAMS 08 CLEO $\psi(2S) \rightarrow \pi^+\pi^- J/\psi$ NODE=M070S08
NODE=M070S08

NEW

$\Gamma(\gamma\pi^+\pi^-2\pi^0)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})**8.3±0.2±3.1**¹ 4π mass less than 2.0 GeV.

DOCUMENT ID TECN COMMENT

¹ BALTRUSAIT...86B MRK3 $J/\psi \rightarrow 4\pi\gamma$ Γ_{138}/Γ NODE=M070R99
NODE=M070R99

NODE=M070R99;LINKAGE=M

 $\Gamma(\gamma\eta\pi\pi)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})**6.1 ±1.0 OUR AVERAGE**

5.85±0.3±1.05

7.8 ±1.2±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_{139}/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±2.2±0.9**

DOCUMENT ID TECN COMMENT

BAI 99 BES $J/\psi \rightarrow \gamma\eta\pi^+\pi^-$ Γ_{140}/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**

Error includes scale factor of 1.6. See the ideogram below.

1.66±0.1 ±0.58

3.8 ±0.3 ±0.6

4.0 ±0.7 ±1.0

4.3 ±1.7

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

1.78±0.21±0.33

0.83±0.13±0.18

0.66^{+0.17+0.24}_{-0.16-0.15}1.03^{+0.21+0.26}_{-0.18-0.19}^{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_{141}/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

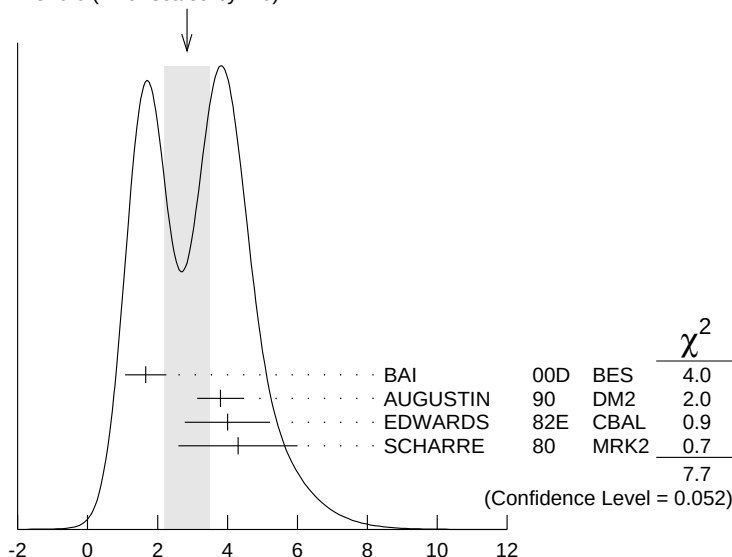
NODE=M070R89;LINKAGE=J

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) $\Gamma(\gamma\eta(1405/1475) \rightarrow \gamma K \bar{K} \pi)/\Gamma_{\text{total}}$ (units 10^{-3})

$\Gamma(\gamma\eta(1405/1475) \rightarrow \gamma\gamma\rho^0)/\Gamma_{\text{total}}$ Γ_{142}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
0.78±0.20 OUR AVERAGE	Error includes scale factor of 1.8.		
1.07±0.17±0.11	¹ BAI	04J BES2	$J/\psi \rightarrow \gamma\gamma\pi^+\pi^-$
0.64±0.12±0.07	¹ COFFMAN	90 MRK3	$J/\psi \rightarrow \gamma\gamma\pi^+\pi^-$

¹ Includes unknown branching fraction $\eta(1405) \rightarrow \gamma\rho^0$.NODE=M070S30
NODE=M070S30

NODE=M070S30;LINKAGE=C

 $\Gamma(\gamma\eta(1405/1475) \rightarrow \gamma\eta\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{143}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
3.0 ±0.5 OUR AVERAGE				
2.6 ±0.7 ±0.4		BAI	99 BES	$J/\psi \rightarrow \gamma\eta\pi^+\pi^-$
3.38±0.33±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 ±0.6 ±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=M070S29NODE=M070S29;LINKAGE=RR
NODE=M070S29;LINKAGE=R $\Gamma(\gamma\eta(1405/1475) \rightarrow \gamma\gamma\phi)/\Gamma_{\text{total}}$ Γ_{144}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<0.82	95	BAI	04J BES2	$J/\psi \rightarrow \gamma\gamma K^+ K^-$

NODE=M070R77
NODE=M070R77 $\Gamma(\gamma\rho\rho)/\Gamma_{\text{total}}$ Γ_{145}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
4.5 ±0.8 OUR AVERAGE				
4.7 ±0.3 ±0.9		¹ BALTRUSAIT..86B	MRK3	$J/\psi \rightarrow 4\pi\gamma$
3.75±1.05±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=M070R94NODE=M070R94;LINKAGE=N
NODE=M070R94;LINKAGE=M
NODE=M070R94;LINKAGE=A $\Gamma(\gamma\rho\omega)/\Gamma_{\text{total}}$ Γ_{146}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<5.4	90	ABLIKIM	08A BES2	$e^+e^- \rightarrow J/\psi$

NODE=M070R05
NODE=M070R05 $\Gamma(\gamma\rho\phi)/\Gamma_{\text{total}}$ Γ_{147}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<8.8	90	ABLIKIM	08A BES2	$e^+e^- \rightarrow J/\psi$

NODE=M070R06
NODE=M070R06 $\Gamma(\eta'(958))/\Gamma_{\text{total}}$ Γ_{148}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
5.15±0.16 OUR AVERAGE				[(5.16 ± 0.15) × 10 ⁻³
OUR 2012 AVERAGE Scale factor = 1.1]				

NODE=M070R84
NODE=M070R84

NEW

4.82±0.23±0.08		¹ ABLIKIM	11 BES3	$J/\psi \rightarrow \eta'\gamma$
5.24±0.12±0.11		PEDLAR	09 CLE3	$J/\psi \rightarrow \eta'\gamma$
5.55±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±0.14±0.53		BOLTON	92B MRK3	$J/\psi \rightarrow \gamma\pi^+\pi^-\eta, \eta \rightarrow \gamma\gamma$

4.30±0.31±0.71		BOLTON	92B MRK3	$J/\psi \rightarrow \gamma\pi^+\pi^-\eta, \eta \rightarrow \pi^+\pi^-\pi^0$

OCCUR=2

4.04±0.16±0.85	622	AUGUSTIN	90 DM2	$J/\psi \rightarrow \gamma\eta\pi^+\pi^-$
4.39±0.09±0.66	2420	AUGUSTIN	90 DM2	$J/\psi \rightarrow \gamma\gamma\pi^+\pi^-$

OCCUR=2

4.1 ±0.3 ±0.6		BLOOM	83 CBAL	$e^+e^- \rightarrow 3\gamma + \text{hadrons}$
2.9 ±1.1	6	BRANDELIK	79C DASP	$e^+e^- \rightarrow 3\gamma$
2.4 ±0.7	57	BARTEL	76 CNTR	$e^+e^- \rightarrow 2\gamma\rho$

¹ 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 $B(\eta'(958) \rightarrow \pi^+\pi^-\eta) = (42.9 \pm 0.7) \times 10^{-2}$, $B(\eta \rightarrow 2\gamma) = (39.41 \pm 0.20) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best values.

NODE=M070R84;LINKAGE=AB

$\Gamma(\gamma 2\pi^+ 2\pi^-)/\Gamma_{\text{total}}$ 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 $J/\psi \rightarrow 4\pi\gamma$

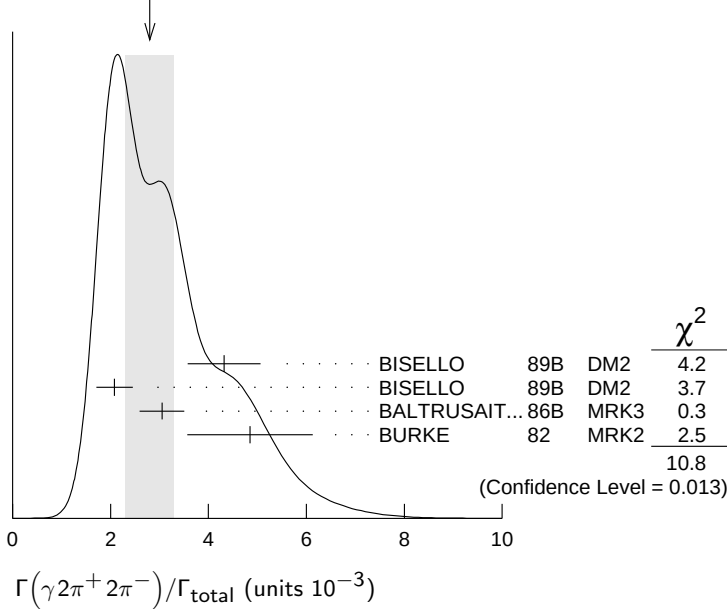
2.08 ± 0.13 ± 0.35

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.WEIGHTED AVERAGE
2.8 ± 0.5 (Error scaled by 1.9) Γ_{149}/Γ NODE=M070R95
NODE=M070R95

OCCUR=2

NODE=M070R95;LINKAGE=A
NODE=M070R95;LINKAGE=B
NODE=M070R95;LINKAGE=M $\Gamma(\gamma f_2(1270) f_2(1270))/\Gamma_{\text{total}}$ VALUE (units 10^{-4})

EVTS

DOCUMENT ID

TECN

COMMENT

9.5 ± 0.7 ± 1.6 646 ± 45 ABLIKIM 04M BES $J/\psi \rightarrow \gamma 2\pi^+ 2\pi^-$ Γ_{150}/Γ NODE=M070S45
NODE=M070S45 $\Gamma(\gamma f_2(1270) f_2(1270) (\text{non resonant}))/\Gamma_{\text{total}}$ VALUE (units 10^{-4})

DOCUMENT ID

TECN

COMMENT

8.2 ± 0.8 ± 1.7 ¹ ABLIKIM 04M BES $J/\psi \rightarrow \gamma 2\pi^+ 2\pi^-$ ¹ Subtracting contribution from intermediate $\eta_c(1S)$ decays. Γ_{151}/Γ NODE=M070S46
NODE=M070S46

NODE=M070S46;LINKAGE=AB

 $\Gamma(\gamma K^+ K^- \pi^+ \pi^-)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

EVTS

DOCUMENT ID

TECN

COMMENT

2.1 ± 0.1 ± 0.6 1516 BAI 00B BES $J/\psi \rightarrow \gamma K^+ K^0 \pi^+ \pi^-$ Γ_{152}/Γ NODE=M070B05
NODE=M070B05 $\Gamma(\gamma f_4(2050))/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

DOCUMENT ID

TECN

COMMENT

2.7 ± 0.5 ± 0.5 ¹ BALTRUSAIT...87 MRK3 $J/\psi \rightarrow \gamma \pi^+ \pi^-$ ¹ Assuming branching fraction $f_4(2050) \rightarrow \pi\pi/\text{total} = 0.167$. Γ_{153}/Γ NODE=M070S7
NODE=M070S7

NODE=M070S7;LINKAGE=V

 $\Gamma(\gamma \omega \omega)/\Gamma_{\text{total}}$ 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 $e^+e^- \rightarrow \text{hadrons } \gamma$ Γ_{154}/Γ NODE=M070R97
NODE=M070R97

$\Gamma(\gamma\eta(1405/1475) \rightarrow \gamma\rho^0\rho^0)/\Gamma_{\text{total}}$ Γ_{155}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
1.7 $\pm$ 0.4 OUR AVERAGE	Error includes scale factor of 1.3.		
2.1 $\pm$ 0.4	BUGG	95 MRK3	$J/\psi \rightarrow \gamma\pi^+\pi^-\pi^+\pi^-$
1.36 $\pm$ 0.38	1,2 BISELLO	89B DM2	$J/\psi \rightarrow 4\pi\gamma$

¹ Estimated by us from various fits.² Includes unknown branching fraction to $\rho^0\rho^0$.

NODE=M070S19
 NODE=M070S19

NODE=M070S19;LINKAGE=A
 NODE=M070S19;LINKAGE=B

 $\Gamma(\gamma f_2(1270))/\Gamma_{\text{total}}$ Γ_{156}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.43 $\pm$ 0.11 OUR AVERAGE				
1.62 $\pm$ 0.26 $^{+0.02}_{-0.05}$		1 ABLIKIM	06V BES2	$e^+e^- \rightarrow J/\psi \rightarrow \gamma\pi^+\pi^-$
1.42 $\pm$ 0.21 $^{+0.02}_{-0.04}$		2 ABLIKIM	06V BES2	$e^+e^- \rightarrow J/\psi \rightarrow \gamma\pi^0\pi^0$
1.33 $\pm$ 0.05 $\pm$ 0.20		3 AUGUSTIN	87 DM2	$J/\psi \rightarrow \gamma\pi^+\pi^-$
1.36 $\pm$ 0.09 $\pm$ 0.23		3 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 $\pm$ 0.7	35	ALEXANDER	78 PLUT	e^+e^-
1.2 $\pm$ 0.6	30	4 BRANDELIK	78B DASP	$e^+e^- \rightarrow \pi^+\pi^-\gamma$

NODE=M070R86
 NODE=M070R86

OCCUR=2

¹ 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 $B(f_2(1270) \rightarrow \pi\pi) = (84.8^{+2.4}_{-1.2}) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² 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 $B(f_2(1270) \rightarrow \pi\pi) = (84.8^{+2.4}_{-1.2}) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

³ 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.

⁴ Restated by us to take account of spread of E1, M2, E3 transitions.

NODE=M070R86;LINKAGE=AI

NODE=M070R86;LINKAGE=AL

NODE=M070R86;LINKAGE=X

NODE=M070R86;LINKAGE=T

 $\Gamma(\gamma f_0(1710) \rightarrow \gamma K\bar{K})/\Gamma_{\text{total}}$ Γ_{157}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
8.5 $\pm$ 1.2 OUR AVERAGE		Error includes scale factor of 1.2.		
9.62 $\pm$ 0.29 $^{+3.51}_{-1.86}$		1 BAI	03G BES	$J/\psi \rightarrow \gamma K\bar{K}$
5.0 $\pm$ 0.8 $^{+1.8}_{-0.4}$		2,3 BAI	96C BES	$J/\psi \rightarrow \gamma K^+K^-$
9.2 $\pm$ 1.4 $\pm$ 1.4		3 AUGUSTIN	88 DM2	$J/\psi \rightarrow \gamma K^+K^-$
10.4 $\pm$ 1.2 $\pm$ 1.6		3 AUGUSTIN	88 DM2	$J/\psi \rightarrow \gamma K_S^0 K_S^0$
9.6 $\pm$ 1.2 $\pm$ 1.8		3 BALTRUSAIT..87	MRK3	$J/\psi \rightarrow \gamma K^+K^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1.6 $\pm$ 0.2 $^{+0.6}_{-0.2}$		3,4 BAI	96C BES	$J/\psi \rightarrow \gamma K^+K^-$
< 0.8	90	5 BISELLO	89B	$J/\psi \rightarrow 4\pi\gamma$
1.6 $\pm$ 0.4 $\pm$ 0.3		6 BALTRUSAIT..87	MRK3	$J/\psi \rightarrow \gamma\pi^+\pi^-$
3.8 $\pm$ 1.6		7 EDWARDS	82D CBAL	$e^+e^- \rightarrow \eta\eta\gamma$

¹ Includes unknown branching ratio to K^+K^- or $K_S^0 K_S^0$.

² Assuming $J^P = 2^+$ for $f_0(1710)$.

³ 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.

⁴ Assuming $J^P = 0^+$ for $f_0(1710)$.

⁵ Includes unknown branching fraction to $\rho^0\rho^0$.

⁶ Includes unknown branching fraction to $\pi^+\pi^-$.

⁷ Includes unknown branching fraction to $\eta\eta$.

NODE=M070R91
 NODE=M070R91

OCCUR=2

OCCUR=2

OCCUR=2

NODE=M070R91;LINKAGE=K9
 NODE=M070R91;LINKAGE=A1
 NODE=M070R91;LINKAGE=B

NODE=M070R91;LINKAGE=A2
 NODE=M070R91;LINKAGE=C
 NODE=M070R91;LINKAGE=Z
 NODE=M070R91;LINKAGE=A

 $\Gamma(\gamma f_0(1710) \rightarrow \gamma\pi\pi)/\Gamma_{\text{total}}$ Γ_{158}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
4.0 $\pm$ 1.0 OUR AVERAGE			
3.96 $\pm$ 0.06 $\pm$ 1.12	1 ABLIKIM	06V BES2	$e^+e^- \rightarrow J/\psi \rightarrow \gamma\pi^+\pi^-$
3.99 $\pm$ 0.15 $\pm$ 2.64	1 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. • • •			
2.5 $\pm$ 1.6 $\pm$ 0.8	BAI	98H BES	$J/\psi \rightarrow \gamma\pi^0\pi^0$

¹ Including unknown branching fraction to $\pi\pi$.

NODE=M070B01
 NODE=M070B01

OCCUR=2

NODE=M070B01;LINKAGE=AB

$\Gamma(\gamma f_0(1710) \rightarrow \gamma \omega \omega) / \Gamma_{\text{total}}$ Γ_{159}/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=M070R01
 NODE=M070R01

 $\Gamma(\gamma \eta) / \Gamma_{\text{total}}$ Γ_{160}/Γ

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
1.104 ± 0.034 OUR AVERAGE				
$1.101 \pm 0.029 \pm 0.022$		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

 $\Gamma(\gamma f_1(1420) \rightarrow \gamma K \bar{K} \pi) / \Gamma_{\text{total}}$ Γ_{161}/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_{162}/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_{163}/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_{164}/Γ

VALUE (units 10^{-4})	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
$4.5^{+0.7}_{-0.4}$ OUR AVERAGE					
$3.85 \pm 0.17^{+1.91}_{-0.73}$			¹ BAI	03G BES	$J/\psi \rightarrow \gamma K \bar{K}$
$3.6 \pm 0.4^{+1.4}_{-0.4}$			¹ BAI	96C BES	$J/\psi \rightarrow \gamma K^+ K^-$
$5.6 \pm 1.4 \pm 0.9$			¹ AUGUSTIN	88 DM2	$J/\psi \rightarrow \gamma K^+ K^-$
$4.5 \pm 0.4 \pm 0.9$			¹ AUGUSTIN	88 DM2	$J/\psi \rightarrow \gamma K_S^0 K_S^0$
$6.8 \pm 1.6 \pm 1.4$			¹ BALTRUSAIT..87	MRK3	$J/\psi \rightarrow \gamma K^+ K^-$

NODE=M070R87
 NODE=M070R87

OCCUR=3

OCCUR=4

OCCUR=2

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

 <3.4 90 4 ² BRANDELIK 79C DASP $e^+ e^- \rightarrow \pi^+ \pi^- \gamma$ <2.3 90 3 ALEXANDER 78 PLUT $e^+ e^- \rightarrow K^+ K^- \gamma$ ¹ Using $B(f'_2(1525) \rightarrow K \bar{K}) = 0.888$.² Assuming isotropic production and decay of the $f'_2(1525)$ and isospin.

NODE=M070R87;LINKAGE=A1
 NODE=M070R87;LINKAGE=I

$\Gamma(\gamma f_2(1640) \rightarrow \gamma \omega \omega) / \Gamma_{\text{total}}$ Γ_{165} / 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_{166} / 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

 $\Gamma(\gamma f_0(1800) \rightarrow \gamma \omega \phi) / \Gamma_{\text{total}}$ Γ_{167} / 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

 $\Gamma(\gamma f_2(1950) \rightarrow \gamma K^*(892) \bar{K}^*(892)) / \Gamma_{\text{total}}$ Γ_{168} / 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_{169} / Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$4.0 \pm 0.3 \pm 1.3$	320	¹ BAI	00B BES	$J/\psi \rightarrow \gamma K^+ K^0 \pi^+ \pi^-$

¹ Summed over all charges.

NODE=M070B07
 NODE=M070B07

NODE=M070R;LINKAGE=B7

 $\Gamma(\gamma \phi \phi) / \Gamma_{\text{total}}$ Γ_{170} / Γ

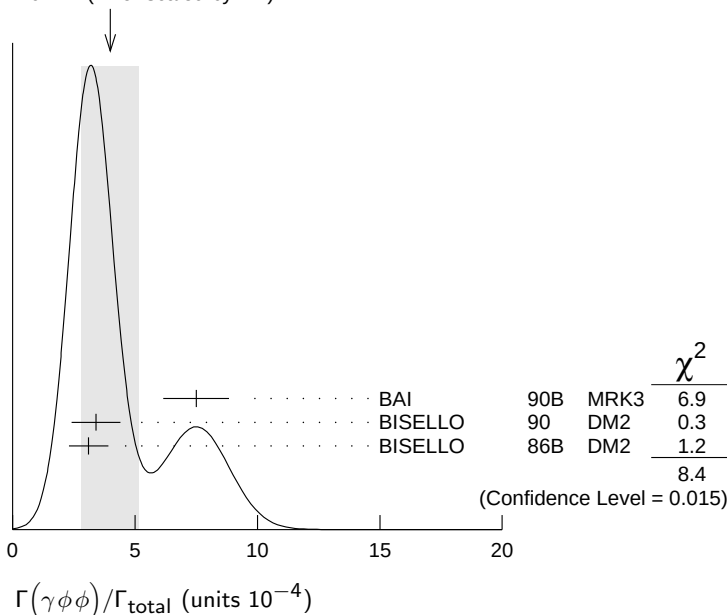
VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
4.0 ± 1.2 OUR AVERAGE				Error includes scale factor of 2.1. See the ideogram below.
$7.5 \pm 0.6 \pm 1.2$	168	BAI	90B MRK3	$J/\psi \rightarrow \gamma 4K$
$3.4 \pm 0.8 \pm 0.6$	33 ± 7	¹ BISELLO	90 DM2	$J/\psi \rightarrow \gamma K^+ K^- K_S^0 K_L^0$
$3.1 \pm 0.7 \pm 0.4$		¹ BISELLO	86B DM2	$J/\psi \rightarrow \gamma K^+ K^- K^+ K^-$

¹ $\phi \phi$ mass less than 2.9 GeV, η_c excluded.

NODE=M070R98
 NODE=M070R98

NODE=M070R98;LINKAGE=C

WEIGHTED AVERAGE
 4.0 ± 1.2 (Error scaled by 2.1)

 $\Gamma(\gamma \rho \rho) / \Gamma_{\text{total}}$ Γ_{171} / Γ

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$0.38 \pm 0.07 \pm 0.07$		49	EATON	84 MRK2	$e^+ e^-$

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

< 0.11	90	PERUZZI	78 MRK1	$e^+ e^-$

NODE=M070R90
 NODE=M070R90

$\Gamma(\gamma\eta(2225))/\Gamma_{\text{total}}$ Γ_{172}/Γ VALUE (units 10^{-3}) EVTS

DOCUMENT ID TECN COMMENT

0.33±0.05 OUR AVERAGE

0.44±0.04±0.08 196 ± 19

1 ABLIKIM

08I

BES

 $J/\psi \rightarrow \gamma K^+ K^- K_S^0 K_L^0$

0.33±0.08±0.05

1 BAI

90B

MRK3

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

0.27±0.06±0.06

1 BAI

90B

MRK3

 $J/\psi \rightarrow \gamma K^+ K^- K_S^0 K_L^0$ 0.24^{+0.15}_{-0.10}

2,3 BISELLO

89B

DM2

 $J/\psi \rightarrow 4\pi\gamma$ ¹ Includes unknown branching fraction to $\phi\phi$.² Estimated by us from various fits.³ Includes unknown branching fraction to $\rho^0\rho^0$.NODE=M070S21
NODE=M070S21

OCCUR=2

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_{173}/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=M070S20NODE=M070S20;LINKAGE=A
NODE=M070S20;LINKAGE=B $\Gamma(\gamma\eta(1760) \rightarrow \gamma\omega\omega)/\Gamma_{\text{total}}$ Γ_{174}/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 $\Gamma(\gamma X(1835) \rightarrow \gamma\pi^+\pi^-\eta')/\Gamma_{\text{total}}$ Γ_{175}/Γ VALUE (units 10^{-4})

EVTS

DOCUMENT ID

TECN

COMMENT

2.6 ±0.4 OUR AVERAGE2.87±0.09^{+0.49}_{-0.52}

4265

1 ABLIKIM

11C

BES3

 $J/\psi \rightarrow \gamma\pi^+\pi^-\eta'$

2.2 ±0.4 ±0.4

264

ABLIKIM

05R

BES2

 $J/\psi \rightarrow \gamma\pi^+\pi^-\eta'$ ¹ From a fit of the $\pi^+\pi^-\eta'$ mass distribution to a combination of $\gamma f_1(1510)$, $\gamma X(1835)$, and two unconfirmed states $\gamma X(2120)$, and $\gamma X(2370)$, for $M(p\bar{p}) < 2.8$ GeV, and accounting for backgrounds from non- η' events and $J/\psi \rightarrow \pi^0\pi^+\pi^-\eta'$.NODE=M070R78
NODE=M070R78

NODE=M070R78;LINKAGE=AI

 $\Gamma(\gamma X(1835) \rightarrow \gamma p\bar{p})/\Gamma_{\text{total}}$ Γ_{176}/Γ VALUE (units 10^{-4})

EVTS

DOCUMENT ID

TECN

COMMENT

0.77^{+0.15}_{-0.09} OUR AVERAGE[(0.75^{+0.19}_{-0.09}) × 10^{-4} OUR 2012 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.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
NODE=M070S71

NEW

NODE=M070S71;LINKAGE=AK

NODE=M070S71;LINKAGE=AL

 $\Gamma(\gamma(K\bar{K}\pi)[J^{PC}=0^{-+}])/\Gamma_{\text{total}}$ Γ_{177}/Γ VALUE (units 10^{-3})

DOCUMENT ID

TECN

COMMENT

0.7 ±0.4 OUR AVERAGE Error includes scale factor of 2.1.

0.58±0.03±0.20

1 BAI

00D

BES

 $J/\psi \rightarrow \gamma K^\pm K_S^0 \pi^\mp$

2.1 ±0.1 ±0.7

2 BAI

00D

BES

 $J/\psi \rightarrow \gamma K^\pm K_S^0 \pi^\mp$ ¹ For a broad structure around 1800 MeV.² For a broad structure around 2040 MeV.NODE=M070S38
NODE=M070S38

OCCUR=2

NODE=M070S38;LINKAGE=BD
NODE=M070S38;LINKAGE=BE $\Gamma(\gamma\pi^0)/\Gamma_{\text{total}}$ Γ_{178}/Γ VALUE (units 10^{-5})

EVTS

DOCUMENT ID

TECN

COMMENT

3.49^{+0.33}_{-0.30} OUR AVERAGE

3.63±0.36±0.13

PEDLAR

09

CLE3

 $J/\psi \rightarrow \pi^0\gamma$ 3.13^{+0.65}_{-0.47}

586

ABLIKIM

06E

BES2

 $J/\psi \rightarrow \pi^0\gamma$

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

3.6 ±1.1 ±0.7

BLOOM

83

CBAL

 e^+e^-

7.3 ±4.7

10

BRANDELIK

79C

DASP

 e^+e^- NODE=M070R82
NODE=M070R82

$\Gamma(\gamma p \bar{p} \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{179}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<0.79	90	EATON	84	MRK2 $e^+ e^-$

NODE=M070R93
 NODE=M070R93

 $\Gamma(\gamma \Lambda \bar{\Lambda})/\Gamma_{\text{total}}$ Γ_{180}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<0.13	90	HENRARD	87	DM2 $e^+ e^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.16	90	BAI	98G	BES $e^+ e^-$

NODE=M070S8
 NODE=M070S8

 $\Gamma(\gamma f_0(2200))/\Gamma_{\text{total}}$ Γ_{181}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
1.5	¹ AUGUSTIN	88	DM2 $J/\psi \rightarrow \gamma K_S^0 K_S^0$
¹ Includes unknown branching fraction to $K_S^0 K_S^0$.			

NODE=M070S18
 NODE=M070S18

NODE=M070S18;LINKAGE=A

 $\Gamma(\gamma f_J(2220))/\Gamma_{\text{total}}$ Γ_{182}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
>250	99.9		¹ HASAN	96	SPEC $\bar{p} p \rightarrow \pi^+ \pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
>300			² BAI	96B	BES $e^+ e^- \rightarrow \gamma \bar{p} p, K \bar{K}$
< 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	$J/\psi \rightarrow \gamma K^+ K^-$
¹ Using BAI 96B.					
² Using BARNES 93.					
³ Includes unknown branching fraction to $K^+ K^-$ or $K_S^0 K_S^0$.					

NODE=M070R92
 NODE=M070R92

OCCUR=2

OCCUR=2

NODE=M070R92;LINKAGE=M
 NODE=M070R92;LINKAGE=A
 NODE=M070R92;LINKAGE=W

 $\Gamma(\gamma f_J(2220) \rightarrow \gamma \pi \pi)/\Gamma_{\text{total}}$ Γ_{183}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
$0.84 \pm 0.26 \pm 0.30$	BAI	96B	BES $e^+ e^- \rightarrow J/\psi \rightarrow \gamma \pi^+ \pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$1.4 \pm 0.8 \pm 0.4$	BAI	98H	BES $J/\psi \rightarrow \gamma \pi^0 \pi^0$

NODE=M070B02
 NODE=M070B02

 $\Gamma(\gamma f_J(2220) \rightarrow \gamma K \bar{K})/\Gamma_{\text{total}}$ Γ_{184}/Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
< 3.6	¹ DEL-AMO-SA..100	BABR	$e^+ e^- \rightarrow J/\psi \rightarrow \gamma K^+ K^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
< 2.9	¹ 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 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=DE

 $\Gamma(\gamma f_J(2220) \rightarrow \gamma p \bar{p})/\Gamma_{\text{total}}$ Γ_{185}/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

 $\Gamma(\gamma f_0(1500))/\Gamma_{\text{total}}$ Γ_{186}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
1.01 ± 0.32 OUR AVERAGE			
$1.00 \pm 0.03 \pm 0.45$	¹ ABLIKIM	06v	BES2 $e^+ e^- \rightarrow J/\psi \rightarrow \gamma \pi^+ \pi^-$
$1.02 \pm 0.09 \pm 0.45$	¹ 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. • • •			
$>5.7 \pm 0.8$	^{2,3} BUGG	95	MRK3 $J/\psi \rightarrow \gamma \pi^+ \pi^- \pi^+ \pi^-$
¹ Including unknown branching fraction to $\pi \pi$.			
² Including unknown branching ratio for $f_0(1500) \rightarrow \pi^+ \pi^- \pi^+ \pi^-$.			
³ Assuming that $f_0(1500)$ decays only to two S-wave dipions.			

NODE=M070S32
 NODE=M070S32

OCCUR=2

NODE=M070S32;LINKAGE=AB
 NODE=M070S32;LINKAGE=A
 NODE=M070S32;LINKAGE=B

$\Gamma(\gamma A \rightarrow \gamma \text{invisible})/\Gamma_{\text{total}}$
 (narrow state A with $m_A < 960$ MeV)
 Γ_{187}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<6.3	90	¹ INSLE	10 CLEO	$e^+e^- \rightarrow \pi^+\pi^- J/\psi$

¹ The limit varies with mass m_A of a narrow state A and is 4.3×10^{-6} for $m_A = 0$ MeV, 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=IN

 $\Gamma(\gamma A^0 \rightarrow \gamma \mu^+ \mu^-)/\Gamma_{\text{total}}$
 (narrow state A^0 with $0.2 \text{ GeV} < m_{A^0} < 3 \text{ GeV}$)
 Γ_{188}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<2.1	90	¹ ABLIKIM	12 BES3	$J/\psi \rightarrow \gamma \mu^+ \mu^-$

¹ For a narrow scalar or pseudoscalar, A^0 , with a mass in the range 0.21–3.00 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=AB

WEAK DECAYS

 $\Gamma(D^- e^+ \nu_e + \text{c.c.})/\Gamma_{\text{total}}$
 Γ_{189}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<1.2	90	ABLIKIM	06M BES2	$e^+e^- \rightarrow J/\psi$

 NODE=M070S53
 NODE=M070S53

 $\Gamma(\bar{D}^0 e^+ e^- + \text{c.c.})/\Gamma_{\text{total}}$
 Γ_{190}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<1.1	90	ABLIKIM	06M BES2	$e^+e^- \rightarrow J/\psi$

 NODE=M070S54
 NODE=M070S54

 $\Gamma(D_s^- e^+ \nu_e + \text{c.c.})/\Gamma_{\text{total}}$
 Γ_{191}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<3.6	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

 $\Gamma(D^- \pi^+ + \text{c.c.})/\Gamma_{\text{total}}$
 Γ_{192}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
< 7.5×10^{-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_{193}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
< 1.7×10^{-4}	90	ABLIKIM	08J BES2	$e^+e^- \rightarrow J/\psi$

 NODE=M070S62
 NODE=M070S62

 $\Gamma(D_s^- \pi^+ + \text{c.c.})/\Gamma_{\text{total}}$
 Γ_{194}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
< 1.3×10^{-4}	90	ABLIKIM	08J BES2	$e^+e^- \rightarrow J/\psi$

 NODE=M070S63
 NODE=M070S63

 $\Gamma(\gamma\gamma)/\Gamma_{\text{total}}$
 Γ_{195}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
< 0.5	90	ADAMS	08 CLEO	$\psi(2S) \rightarrow \pi^+\pi^- J/\psi$

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

<16	90	¹ WICHT	08 BELL	$B^\pm \rightarrow K^\pm \gamma\gamma$
< 2.2	90	ABLIKIM	07J BES2	$\psi(2S) \rightarrow J/\psi \pi^+ \pi^-$
<50	90	BARTEL	77 CNTR	e^+e^-

¹ WICHT 08 reports $[\Gamma(J/\psi(1S) \rightarrow \gamma\gamma)/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow J/\psi(1S) K^+)] < 0.16 \times 10^{-6}$ which we divide by our best value $B(B^+ \rightarrow J/\psi(1S) K^+) = 1.028 \times 10^{-3}$.

 NODE=M070R80
 NODE=M070R80

NODE=M070R80;LINKAGE=WI

LEPTON FAMILY NUMBER (LF) VIOLATING MODES

 $\Gamma(e^\pm \mu^\mp)/\Gamma_{\text{total}}$
 Γ_{196}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<1.1	90	BAI	03D BES	$e^+e^- \rightarrow J/\psi$

 NODE=M070S39
 NODE=M070S39

 $\Gamma(e^\pm \tau^\mp)/\Gamma_{\text{total}}$
 Γ_{197}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<8.3	90	ABLIKIM	04 BES	$e^+e^- \rightarrow J/\psi$

 NODE=M070S40
 NODE=M070S40

$\Gamma(\mu^\pm \tau^\mp)/\Gamma_{\text{total}}$

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<2.0	90	ABLIKIM	04	BES $e^+ e^- \rightarrow J/\psi$

 Γ_{198}/Γ

NODE=M070S41
 NODE=M070S41

OTHER DECAYS

NODE=M070325

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

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<1.2 $\times 10^{-2}$	90	ABLIKIM	08G	BES2 $\psi(2S) \rightarrow \pi^+ \pi^- J/\psi$

 Γ_{199}/Γ_7

NODE=M070S60
 NODE=M070S60

 $J/\psi(1S)$ REFERENCES

NODE=M070

ABLIKIM	13F	arXiv:1211.4682 (PR D)	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=54920
ABLIKIM	13I	PR D87 032003	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=54954
ABLIKIM	13J	PR D87 032008	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=54955
ABLIKIM	12	PR D85 092012	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=54265
ABLIKIM	12B	PR D86 032008	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=54267
ABLIKIM	12C	PR D86 032014	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=54268
ABLIKIM	12D	PRL 108 112003	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=54269
ABLIKIM	12H	PL B710 594	M. Ablikim <i>et al.</i>	(BES III 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
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>	(BES III Collab.)	REFID=53646
ABLIKIM	11C	PRL 106 072002	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=53684
ABLIKIM	11D	PR D83 032003	M. Ablikim <i>et al.</i>	(BES III 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 (err.)	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52266
AUBERT	07BD	PR D76 092006	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52050
ABLIKIM	06	PL B632 181	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50986
ABLIKIM	06C	PL B633 681	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51037
ABLIKIM	06E	PR D73 052008	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51057
ABLIKIM	06F	PR D73 052007	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51058
ABLIKIM	06H	PR D73 112007	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51125
ABLIKIM	06J	PRL 96 162002	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51127
ABLIKIM	06K	PRL 97 062001	M. Ablikim <i>et al.</i>	(BES II Collab.)	REFID=51128
ABLIKIM	06M	PL B639 418	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51130
ABLIKIM	06V	PL B642 441	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51507
ADAMS	06A	PR D73 051103	G.S. Adams <i>et al.</i>	(CLEO Collab.)	REFID=51036
AUBERT	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 Collab., E706 Collab.)	REFID=44739
HASAN	96	PL B388 376	A. Hasan, D.V. Bugg	(BRUN, LOQM)	REFID=45197
BAI	95B	PL B355 374	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=44434
BUGG	95	PL B353 378	D.V. Bugg <i>et al.</i>	(LOQM, PNPI, WASH)	REFID=44438
ANTONELLI	93	PL B301 317	A. Antonelli <i>et al.</i>	(FENICE Collab.)	REFID=43314
ARMSTRONG	93B	PR D47 772	T.A. Armstrong <i>et al.</i>	(FNAL E760 Collab.)	REFID=43307
BARNES	93	PL B309 469	P.D. Barnes <i>et al.</i>	(PS185 Collab.)	REFID=43601
AUGUSTIN	92	PR D46 1951	J.E. Augustin, G. Cosme	(DM2 Collab.)	REFID=41584
BOLTON	92	PL B278 495	T. Bolton <i>et al.</i>	(Mark III Collab.)	REFID=42175
BOLTON	92B	PRL 69 1328	T. Bolton <i>et al.</i>	(Mark III Collab.)	REFID=42176
COFFMAN	92	PRL 68 282	D.M. Coffman <i>et al.</i>	(Mark III Collab.)	REFID=41866
HSUEH	92	PR D45 R2181	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
BALTRUSAITIS...	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
BALTRUSAITIS...	86	PR D33 629	R.M. Baltrusaitis <i>et al.</i>	(Mark III Collab.)	REFID=22009
BALTRUSAITIS...	86B	PR D33 1222	R.M. Baltrusaitis <i>et al.</i>	(Mark III Collab.)	REFID=22100
BALTRUSAITIS...	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
BALTRUSAITIS...	85C	PRL 55 1723	R.M. Baltrusaitis <i>et al.</i>	(CIT, UCSC+)	REFID=22095
BALTRUSAITIS...	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.					
BALTRUSAITIS...	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		ARNS 33 143	E.D. Bloom, C. Peck	(SLAC, CIT)	REFID=21682
EDWARDS	82E	PRL 49 259	C. Edwards <i>et al.</i>	(CIT, HARV, PRIN+)	REFID=21314
LEMOIGNE	82	PL 113B 509	Y. Lemoigne <i>et al.</i>	(SACL, LOIC, SHMP+)	REFID=22084
BESCH	81	ZPHY C8 1	H.J. Besch <i>et al.</i>	(BONN, DESY, MANZ)	REFID=22077
GIDAL	81	PL 107B 153	G. Gidal <i>et al.</i>	(SLAC, LBL)	REFID=20386
PARTRIDGE	80	PRL 44 712	R. Partridge <i>et al.</i>	(CIT, HARV, PRIN+)	REFID=22073
SCHARRE	80	PL 97B 329	D.L. Scharre <i>et al.</i>	(SLAC, LBL)	REFID=21329
ZHOLENTZ	80	PL 96B 214	A.A. Zholents <i>et al.</i>	(NOVO)	REFID=10320
Also		SJNP 34 814	A.A. Zholents <i>et al.</i>	(NOVO)	REFID=10321
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, MANZ)	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
BRAUNSCHWEIG...	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

$\chi_{c0}(1P)$

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

NODE=M056

 $\chi_{c0}(1P)$ MASS

NODE=M056M

NODE=M056M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
3414.75 ± 0.31 OUR AVERAGE				
3414.2 ± 0.5 ± 2.3	5.4k	UEHARA	08	BELL $\gamma\gamma \rightarrow \chi_{c0} \rightarrow \text{hadrons}$
3406 ± 7 ± 6	230	¹ 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		² ANDREOTTI	03	E835 $\bar{p}p \rightarrow \chi_{c0} \rightarrow \pi^0\pi^0$
3415.5 ± 0.4 ± 0.4	392	³ BAGNASCO	02	E835 $\bar{p}p \rightarrow \chi_{c0} \rightarrow J/\psi\gamma$
3417.4 $^{+1.8}_{-1.9}$ ± 0.2		² 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		² GAISER	86	CBAL $\psi(2S) \rightarrow \gamma X$
3416 ± 3 ± 4		⁴ TANENBAUM	78	MRK1 e^+e^-
• • • We do not use the following data for averages, fits, limits, etc. • • •				
3416.5 ± 3.0		EISENSTEIN	01	CLE2 $e^+e^- \rightarrow e^+e^-\chi_{c0}$
3422 ± 10		⁴ BARTEL	78B	CNTR $e^+e^- \rightarrow J/\psi 2\gamma$
3415 ± 9		⁴ BIDDICK	77	CNTR $e^+e^- \rightarrow \gamma X$

¹ From a fit of the J/ψ recoil mass spectrum. Supersedes ABE,K 02 and ABE 04G.

² Using mass of $\psi(2S) = 3686.0$ MeV.

³ Recalculated by ANDREOTTI 05A, using the value of $\psi(2S)$ mass from AULCHENKO 03.

⁴ Mass value shifted by us by amount appropriate for $\psi(2S)$ mass = 3686 MeV and $J/\psi(1S)$ mass = 3097 MeV.

NODE=M056M;LINKAGE=EB
 NODE=M056M;LINKAGE=C
 NODE=M056M;LINKAGE=NW
 NODE=M056M;LINKAGE=D

 $\chi_{c0}(1P)$ WIDTH

NODE=M056W

NODE=M056W
 NEW

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
10.3 ± 0.6 OUR FIT				
[10.4 ± 0.6 MeV OUR 2012 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	⁵ 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 $\psi(2S) \rightarrow \gamma X, \gamma\pi^0\pi^0$
⁵ 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 $2(\pi^+\pi^-)$	(2.25 ± 0.19) %	
Γ_2 $\rho^0\pi^+\pi^-$	(8.8 ± 2.8) × 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 $\rho^+\pi^-\pi^0 + \text{c.c.}$	(2.8 ± 0.4) %	
Γ_7 $4\pi^0$	(3.3 ± 0.4) × 10 ⁻³	
Γ_8 $\pi^+\pi^-K^+K^-$	(1.77 ± 0.15) %	
Γ_9 $K_0^*(1430)^0\bar{K}_0^*(1430)^0 \rightarrow \pi^+\pi^-K^+K^-$	(9.8 $^{+4.0}_{-2.8}$) × 10 ⁻⁴	
Γ_{10} $K_0^*(1430)^0\bar{K}_2^*(1430)^0 + \text{c.c.} \rightarrow \pi^+\pi^-K^+K^-$	(8.0 $^{+2.0}_{-2.4}$) × 10 ⁻⁴	
Γ_{11} $K_1(1270)^+K^- + \text{c.c.} \rightarrow \pi^+\pi^-K^+K^-$	(6.2 ± 1.9) × 10 ⁻³	

NODE=M056;CLUMP=A
 DESIG=3

DESIG=9

DESIG=54

DESIG=20

DESIG=61

DESIG=62

DESIG=70

DESIG=5

DESIG=31

DESIG=32

DESIG=33

Г ₁₂	$K_1(1400)^+ K^- + \text{c.c.} \rightarrow \pi^+ \pi^- K^+ K^-$	$< 2.7 \times 10^{-3}$	CL=90%	DESIG=34
Г ₁₃	$f_0(980) f_0(980)$	$(1.6 \pm_{-0.9}^{+1.0}) \times 10^{-4}$		DESIG=23
Г ₁₄	$f_0(980) f_0(2200)$	$(7.9 \pm_{-2.5}^{+2.0}) \times 10^{-4}$		DESIG=24
Г ₁₅	$f_0(1370) f_0(1370)$	$< 2.7 \times 10^{-4}$	CL=90%	DESIG=25
Г ₁₆	$f_0(1370) f_0(1500)$	$< 1.7 \times 10^{-4}$	CL=90%	DESIG=26
Г ₁₇	$f_0(1370) f_0(1710)$	$(6.7 \pm_{-2.3}^{+3.5}) \times 10^{-4}$		DESIG=27
Г ₁₈	$f_0(1500) f_0(1370)$	$< 1.3 \times 10^{-4}$	CL=90%	DESIG=28
Г ₁₉	$f_0(1500) f_0(1500)$	$< 5 \times 10^{-5}$	CL=90%	DESIG=29
Г ₂₀	$f_0(1500) f_0(1710)$	$< 7 \times 10^{-5}$	CL=90%	DESIG=30
Г ₂₁	$K^+ K^- \pi^+ \pi^- \pi^0$	$(1.12 \pm 0.27) \%$		DESIG=75
Г ₂₂	$K^+ K^- \pi^0 \pi^0$	$(5.5 \pm 0.9) \times 10^{-3}$		DESIG=63
Г ₂₃	$K^+ \pi^- K^0 \pi^0 + \text{c.c.}$	$(2.47 \pm 0.33) \%$		DESIG=65
Г ₂₄	$\rho^+ K^- K^0 + \text{c.c.}$	$(1.20 \pm 0.21) \%$		DESIG=66
Г ₂₅	$K^*(892)^- K^+ \pi^0 \rightarrow K^+ \pi^- K^0 \pi^0 + \text{c.c.}$	$(4.6 \pm 1.2) \times 10^{-3}$		DESIG=67
Г ₂₆	$K_S^0 K_S^0 \pi^+ \pi^-$	$(5.7 \pm 1.1) \times 10^{-3}$		DESIG=41
Г ₂₇	$K^+ K^- \eta \pi^0$	$(3.0 \pm 0.7) \times 10^{-3}$		DESIG=68
Г ₂₈	$3(\pi^+ \pi^-)$	$(1.20 \pm 0.18) \%$		DESIG=4
Г ₂₉	$K^+ \bar{K}^*(892)^0 \pi^- + \text{c.c.}$	$(7.3 \pm 1.6) \times 10^{-3}$		DESIG=10
Г ₃₀	$K^*(892)^0 \bar{K}^*(892)^0$	$(1.7 \pm 0.6) \times 10^{-3}$		DESIG=21
Г ₃₁	$\pi \pi$	$(8.5 \pm 0.4) \times 10^{-3}$		DESIG=18
Г ₃₂	$\pi^0 \eta$	$< 1.9 \times 10^{-4}$		DESIG=35
Г ₃₃	$\pi^0 \eta'$	$< 1.2 \times 10^{-3}$		DESIG=36
Г ₃₄	$\eta \eta$	$(3.01 \pm 0.20) \times 10^{-3}$		DESIG=13
Г ₃₅	$\eta \eta'$	$< 2.3 \times 10^{-4}$	CL=90%	DESIG=37
Г ₃₆	$\eta' \eta'$	$(1.99 \pm 0.22) \times 10^{-3}$		DESIG=46
Г ₃₇	$\omega \omega$	$(9.6 \pm 1.1) \times 10^{-4}$		DESIG=22
Г ₃₈	$\omega \phi$	$(1.17 \pm 0.22) \times 10^{-4}$		DESIG=76
Г ₃₉	$K^+ K^-$	$(5.98 \pm 0.34) \times 10^{-3}$		DESIG=2
Г ₄₀	$K_S^0 K_S^0$	$(3.10 \pm 0.18) \times 10^{-3}$		DESIG=15
Г ₄₁	$\pi^+ \pi^- \eta$	$< 2.0 \times 10^{-4}$	CL=90%	DESIG=50
Г ₄₂	$\pi^+ \pi^- \eta'$	$< 4 \times 10^{-4}$	CL=90%	DESIG=53
Г ₄₃	$\bar{K}^0 K^+ \pi^- + \text{c.c.}$	$< 9 \times 10^{-5}$	CL=90%	DESIG=17
Г ₄₄	$K^+ K^- \pi^0$	$< 6 \times 10^{-5}$	CL=90%	DESIG=47
Г ₄₅	$K^+ K^- \eta$	$< 2.2 \times 10^{-4}$	CL=90%	DESIG=51
Г ₄₆	$K^+ K^- K_S^0 K_S^0$	$(1.4 \pm 0.5) \times 10^{-3}$		DESIG=42
Г ₄₇	$K^+ K^- K^+ K^-$	$(2.77 \pm 0.29) \times 10^{-3}$		DESIG=14
Г ₄₈	$K^+ K^- \phi$	$(9.6 \pm 2.5) \times 10^{-4}$		DESIG=44
Г ₄₉	$\phi \phi$	$(7.9 \pm 0.8) \times 10^{-4}$		DESIG=16
Г ₅₀	$p \bar{p}$	$(2.13 \pm 0.12) \times 10^{-4}$		DESIG=11
Г ₅₁	$p \bar{p} \pi^0$	$(6.9 \pm 0.7) \times 10^{-4}$	S=1.2	DESIG=48
Г ₅₂	$p \bar{p} \eta$	$(3.5 \pm 0.4) \times 10^{-4}$		DESIG=52
Г ₅₃	$p \bar{p} \omega$	$(5.2 \pm 0.6) \times 10^{-4}$		DESIG=69
Г ₅₄	$p \bar{p} \phi$	$(6.0 \pm 1.4) \times 10^{-5}$		DESIG=74
Г ₅₅	$p \bar{p} \pi^+ \pi^-$	$(2.1 \pm 0.7) \times 10^{-3}$	S=1.4	DESIG=8
Г ₅₆	$p \bar{p} \pi^0 \pi^0$	$(1.03 \pm 0.28) \times 10^{-3}$		DESIG=64
Г ₅₇	$p \bar{p} K^+ K^- (\text{non-resonant})$	$(1.21 \pm 0.26) \times 10^{-4}$		DESIG=71
Г ₅₈	$p \bar{p} K_S^0 K_S^0$	$< 8.8 \times 10^{-4}$	CL=90%	DESIG=40
Г ₅₉	$p \bar{n} \pi^-$	$(1.12 \pm 0.31) \times 10^{-3}$		DESIG=43
Г ₆₀	$\Lambda \bar{\Lambda}$	$(3.3 \pm 0.4) \times 10^{-4}$		DESIG=19
Г ₆₁	$\Lambda \bar{\Lambda} \pi^+ \pi^-$	$< 4.0 \times 10^{-3}$	CL=90%	DESIG=38
Г ₆₂	$K^+ \bar{p} \Lambda + \text{c.c.}$	$(1.24 \pm 0.12) \times 10^{-3}$	S=1.3	DESIG=49
Г ₆₃	$K^+ p \Lambda(1520) + \text{c.c.}$	$(2.9 \pm 0.7) \times 10^{-4}$		DESIG=72
Г ₆₄	$\Lambda(1520) \bar{\Lambda}(1520)$	$(3.1 \pm 1.2) \times 10^{-4}$		DESIG=73
Г ₆₅	$\Sigma^0 \bar{\Sigma}^0$	$(4.1 \pm 0.7) \times 10^{-4}$		DESIG=58
Г ₆₆	$\Sigma^+ \bar{\Sigma}^-$	$(3.0 \pm 0.7) \times 10^{-4}$		DESIG=59
Г ₆₇	$\Xi^0 \bar{\Xi}^0$	$(3.1 \pm 0.8) \times 10^{-4}$		DESIG=60
Г ₆₈	$\Xi^- \bar{\Xi}^+$	$(4.8 \pm 0.7) \times 10^{-4}$		DESIG=39

Radiative decays

Γ_{69}	$\gamma J/\psi(1S)$	$(1.30 \pm 0.07) \%$		
Γ_{70}	$\gamma \rho^0$	< 9	$\times 10^{-6}$	CL=90%
Γ_{71}	$\gamma \omega$	< 8	$\times 10^{-6}$	CL=90%
Γ_{72}	$\gamma \phi$	< 6	$\times 10^{-6}$	CL=90%
Γ_{73}	$\gamma \gamma$	$(2.25 \pm 0.17) \times 10^{-4}$		

NODE=M056;CLUMP=B
 DESIG=6
 DESIG=55
 DESIG=56
 DESIG=57
 DESIG=7

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 227 measurements to determine 49 parameters. The overall fit has a $\chi^2 = 325.4$ for 178 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, $x_i \equiv \Gamma_i / \Gamma_{\text{total}}$.

x_2	26									
x_8	19	5								
x_{29}	9	2	30							
x_{31}	22	6	23	8						
x_{34}	13	3	14	5	28					
x_{39}	19	5	20	7	35	23				
x_{40}	21	6	21	8	34	22	29			
x_{47}	12	3	12	5	19	12	16	16		
x_{49}	14	4	13	5	20	13	17	17	10	
x_{50}	-1	0	-1	0	-11	-10	-3	-2	-1	-1
x_{60}	8	2	9	3	17	11	14	13	7	8
x_{69}	10	3	11	4	26	18	19	18	10	10
x_{73}	-24	-6	-17	-10	-9	-4	-10	-14	-8	-12
Γ	-14	-4	-11	-5	-13	-8	-11	-13	-7	-9
	x_1	x_2	x_8	x_{29}	x_{31}	x_{34}	x_{39}	x_{40}	x_{47}	x_{49}

x_{60}	-1			
x_{69}	-40	9		
x_{73}	-2	-3	3	
Γ	3	-5	-11	-59
	x_{50}	x_{60}	x_{69}	x_{73}

 $\chi_{c0}(1P)$ PARTIAL WIDTHS

$\chi_{c0}(1P) \Gamma(i) \Gamma(\gamma J/\psi(1S)) / \Gamma(\text{total})$

$\Gamma(p\bar{p}) \times \Gamma(\gamma J/\psi(1S)) / \Gamma_{\text{total}}$

$\Gamma_{50} \Gamma_{69} / \Gamma$

VALUE (eV) EVTS DOCUMENT ID TECN COMMENT

28.6 ± 2.4 OUR FIT

[27.1 ± 2.4 eV OUR 2012 FIT]

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

26.6 ± 2.6 ± 1.4 392 ^{6,7} BAGNASCO 02 E835 $\bar{p}p \rightarrow \chi_{c0} \rightarrow J/\psi \gamma$

48.7 ^{+11.3} _{-8.9} ± 2.4 ^{6,7} AMBROGIANI 99B E835 $\bar{p}p \rightarrow \gamma J/\psi$

⁶ Calculated by us using $B(J/\psi(1S) \rightarrow e^+ e^-) = 0.0593 \pm 0.0010$.

⁷ 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=M056217

NODE=M056223

NODE=M056G1

NODE=M056G1

NEW

NODE=M056G;LINKAGE=7A

NODE=M056G;LINKAGE=KS

$\chi_{c0}(1P) \Gamma(i) \Gamma(\gamma\gamma) / \Gamma(\text{total})$					
$\Gamma(2(\pi^+\pi^-)) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$					
<u>VALUE (eV)</u>	<u>CL%</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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 $e^+e^- \rightarrow e^+e^- \chi_{c0}$
$\Gamma(\rho^0\rho^0) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$					
<u>VALUE (eV)</u>	<u>CL%</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. • • •					
<12		90	UEHARA	08	BELL $\gamma\gamma \rightarrow \chi_{c0} \rightarrow 2(\pi^+\pi^-)$
$\Gamma(\pi^+\pi^-K^+K^-) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$					
<u>VALUE (eV)</u>	<u>CL%</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
41 ± 4 OUR FIT					
38.8 ± 3.7 ± 4.7		1.7k	UEHARA	08	BELL $\gamma\gamma \rightarrow \chi_{c0} \rightarrow K^+K^-\pi^+\pi^-$
$\Gamma(K^+K^-\pi^+\pi^-\pi^0) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$					
<u>VALUE (eV)</u>	<u>CL%</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
26 ± 4 ± 4		1094	DEL-AMO-SA..11M	BABR	$\gamma\gamma \rightarrow K^+K^-\pi^+\pi^-\pi^0$
$\Gamma(K^+\bar{K}^*(892)^0\pi^- + \text{c.c.}) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$					
<u>VALUE (eV)</u>	<u>CL%</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
17 ± 4 OUR FIT					
16.7 ± 6.1 ± 3.0		495 ± 182	UEHARA	08	BELL $\gamma\gamma \rightarrow \chi_{c0} \rightarrow K^+K^-\pi^+\pi^-$
$\Gamma(K^*(892)^0\bar{K}^*(892)^0) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$					
<u>VALUE (eV)</u>	<u>CL%</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. • • •					
<6		90	UEHARA	08	BELL $\gamma\gamma \rightarrow \chi_{c0} \rightarrow K^+K^-\pi^+\pi^-$
$\Gamma(\pi\pi) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$					
<u>VALUE (eV)</u>	<u>CL%</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
19.6 ± 1.4 OUR FIT					
[19.7 ± 1.4 eV OUR 2012 FIT]					
23 ± 5 OUR AVERAGE					
29.7 +17.4 -12.0 ± 4.8		103 +60 -42	8 UEHARA	09	BELL 10.6 $e^+e^- \rightarrow e^+e^-\pi^0\pi^0$
22.7 ± 3.2 ± 3.5		129 ± 18	9 NAKAZAWA	05	BELL 10.6 $e^+e^- \rightarrow e^+e^-\pi^+\pi^-$
⁸ We multiplied the measurement by 3 to convert from $\pi^0\pi^0$ to $\pi\pi$. Interference with the continuum included.					
⁹ We have multiplied $\pi^+\pi^-$ measurement by 3/2 to obtain $\pi\pi$.					
$\Gamma(\eta\eta) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$					
<u>VALUE (eV)</u>	<u>CL%</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
9.4 ± 2.3 ± 1.2		22	10 UEHARA	10A	BELL 10.6 $e^+e^- \rightarrow e^+e^-\eta\eta$
¹⁰ Interference with the continuum not included.					
$\Gamma(\omega\omega) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$					
<u>VALUE (eV)</u>	<u>CL%</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. • • •					
<3.9		90	11 LIU	12B	BELL $\gamma\gamma \rightarrow 2(\pi^+\pi^-\pi^0)$
¹¹ Using $B(\omega \rightarrow \pi^+\pi^-\pi^0) = (89.2 \pm 0.7)\%$.					
$\Gamma(\omega\phi) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$					
<u>VALUE (eV)</u>	<u>CL%</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. • • •					
<0.34		90	12 LIU	12B	BELL $\gamma\gamma \rightarrow K^+K^-\pi^+\pi^-\pi^0$
¹² Using $B(\phi \rightarrow K^+K^-) = (48.9 \pm 0.5)\%$ and $B(\omega \rightarrow \pi^+\pi^-\pi^0) = (89.2 \pm 0.7)\%$.					
$\Gamma(K^+K^-) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$					
<u>VALUE (eV)</u>	<u>CL%</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
13.9 ± 1.1 OUR FIT					
[14.0 ± 1.1 eV OUR 2012 FIT]					
14.3 ± 1.6 ± 2.3		153 ± 17	NAKAZAWA	05	BELL 10.6 $e^+e^- \rightarrow e^+e^-K^+K^-$

NODE=M056224

NODE=M056G2
NODE=M056G2NODE=M056G07
NODE=M056G07NODE=M056G08
NODE=M056G08NODE=M056G01
NODE=M056G01NODE=M056G09
NODE=M056G09NODE=M056G10
NODE=M056G10NODE=M056G3
NODE=M056G3
NEW

NODE=M056G3;LINKAGE=UE

NODE=M056G;LINKAGE=NA

NODE=M056G06
NODE=M056G06

NODE=M056G06;LINKAGE=UE

NODE=M056G02
NODE=M056G02

NODE=M056G02;LINKAGE=LI

NODE=M056G03
NODE=M056G03

NODE=M056G03;LINKAGE=LI

NODE=M056G4
NODE=M056G4
NEW

$\Gamma(K_S^0 K_S^0) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$	$\Gamma_{40}\Gamma_{73}/\Gamma$
VALUE (eV) EVTS DOCUMENT ID TECN COMMENT	
7.2 ± 0.5 OUR FIT [7.3 ± 0.5 eV OUR 2012 FIT]	
7.00 ± 0.65 ± 0.71 134 ± 12 CHEN 07B BELL $e^+ e^- \rightarrow e^+ e^- \chi_{c0}$	

NODE=M056G5
NODE=M056G5
NEW

$\Gamma(K^+ K^- K^+ K^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$	$\Gamma_{47}\Gamma_{73}/\Gamma$
VALUE (eV) EVTS DOCUMENT ID TECN COMMENT	
6.4 ± 0.7 OUR FIT	
7.9 ± 1.3 ± 1.1 215 ± 36 UEHARA 08 BELL $\gamma\gamma \rightarrow \chi_{c0} \rightarrow 2(K^+ K^-)$	

NODE=M056G11
NODE=M056G11

$\Gamma(\phi\phi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$	$\Gamma_{49}\Gamma_{73}/\Gamma$
VALUE (eV) EVTS DOCUMENT ID TECN COMMENT	
1.82 ± 0.19 OUR FIT [1.89 ± 0.22 eV OUR 2012 FIT]	
1.7 ± 0.4 OUR AVERAGE [2.3 ± 1.0 eV OUR 2012 AVERAGE]	
1.72 ± 0.33 ± 0.14 56 ± 11 ¹³ 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 $\gamma\gamma \rightarrow \chi_{c0} \rightarrow 2(K^+ K^-)$	
¹³ Supersedes UEHARA 08. Using $B(\phi \rightarrow K^+ K^-) = (48.9 \pm 0.5)\%$.	

NODE=M056G12
NODE=M056G12
NEW

NEW

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	
0.0225 ± 0.0019 OUR FIT [0.0226 ± 0.0019 OUR 2012 FIT]	

NODE=M056R2
NODE=M056R2
NEW

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

$\Gamma(\rho^0 \pi^+ \pi^-)/\Gamma_{\text{total}}$	Γ_2/Γ
VALUE DOCUMENT ID	
0.0088 ± 0.0028 OUR FIT	

NODE=M056R9
NODE=M056R9

$\Gamma(f_0(980) f_0(980))/\Gamma_{\text{total}}$	Γ_4/Γ
VALUE (units 10 ⁻⁴) EVTS DOCUMENT ID TECN COMMENT	
6.6 ± 2.1 OUR AVERAGE [(6.7 ± 2.1) × 10 ⁻⁴ OUR 2012 AVERAGE]	
6.6 ± 2.1 ± 0.2 36 ± 9 ¹⁴ ABLIKIM 04G BES $\psi(2S) \rightarrow \gamma 2\pi^+ 2\pi^-$	
¹⁴ ABLIKIM 04G reports $[\Gamma(\chi_{c0}(1P) \rightarrow f_0(980) f_0(980))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ = (6.5 ± 1.6 ± 1.3) × 10 ⁻⁵ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.84 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.	

NODE=M056R24
NODE=M056R24

NEW

NODE=M056R24;LINKAGE=AB

$\Gamma(\pi^+ \pi^- \pi^0 \pi^0)/\Gamma_{\text{total}}$	Γ_5/Γ
VALUE (%) EVTS DOCUMENT ID TECN COMMENT	
3.3 ± 0.4 OUR AVERAGE [(3.4 ± 0.4)% OUR 2012 AVERAGE]	
3.3 ± 0.4 ± 0.1 1751.4 ¹⁵ HE 08B CLEO $e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$	

NODE=M056R62
NODE=M056R62
NEW

¹⁵ HE 08B reports $3.54 \pm 0.10 \pm 0.43 \pm 0.18$ % from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \pi^+ \pi^- \pi^0 \pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.84 \pm 0.31) \times 10^{-2}$. 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	
2.8 ± 0.4 OUR AVERAGE [(2.9 ± 0.4)% OUR 2012 AVERAGE]	
2.8 ± 0.4 ± 0.1 1358.5 ^{16,17} HE 08B CLEO $e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$	

NODE=M056R63
NODE=M056R63
NEW

¹⁶ HE 08B reports $3.04 \pm 0.18 \pm 0.42 \pm 0.16$ % from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \rho^+ \pi^- \pi^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.84 \pm 0.31) \times 10^{-2}$. 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

¹⁷ 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

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
3.3±0.4±0.1	3296	¹⁸ ABLIKIM	11A BES3	$e^+e^- \rightarrow \psi(2S) \rightarrow \gamma\chi_{c0}$
¹⁸ ABLIKIM 11A reports $(3.34 \pm 0.06 \pm 0.44) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow 4\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.62 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.84 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M056R71
 NODE=M056R71

NODE=M056R71;LINKAGE=AB

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

VALUE (units 10^{-3})	DOCUMENT ID
17.7±1.5 OUR FIT	
[(17.9 ± 1.5) × 10 ⁻³ OUR 2012 FIT]	

NODE=M056R3
 NODE=M056R3
 NEW

 $\Gamma(K^+\bar{K}^*(892)^0\pi^- + \text{c.c.})/\Gamma(\pi^+\pi^-K^+K^-)$ Γ_{29}/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^{+4.0}_{-2.8} OUR AVERAGE	[(9.9 ^{+4.0} _{-2.9}) × 10 ⁻⁴ OUR 2012 AVERAGE]			

NODE=M056R36
 NODE=M056R36

NEW

9.8^{+3.6}_{-2.8} ± 0.3	83	¹⁹ ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma\pi^+\pi^-K^+K^-$
¹⁹ 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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.84 \pm 0.31) \times 10^{-2}$. 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} OUR AVERAGE	[(8.1 ^{+2.0} _{-2.4}) × 10 ⁻⁴ OUR 2012 AVERAGE]			

NODE=M056R37
 NODE=M056R37

NEW

8.0^{+1.9}_{-2.4} ± 0.2	62	²⁰ ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma\pi^+\pi^-K^+K^-$
²⁰ 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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.84 \pm 0.31) \times 10^{-2}$. 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
6.2±1.9 OUR AVERAGE	[(6.3 ± 1.9) × 10 ⁻³ OUR 2012 AVERAGE]			

NODE=M056R38
 NODE=M056R38

NEW

6.2^{+1.9}_{-1.8} ± 0.2	68	²¹ ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma\pi^+\pi^-K^+K^-$
²¹ 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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.84 \pm 0.31) \times 10^{-2}$. 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	²² ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma\pi^+\pi^-K^+K^-$

NODE=M056R39
 NODE=M056R39

NODE=M056R39;LINKAGE=AB

²² 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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = 9.84 \times 10^{-2}$. The measurement assumes $B(K_1(1400) \rightarrow K^*(892)\pi) = 94 \pm 6\%$.

$\Gamma(f_0(980)f_0(980))/\Gamma_{\text{total}}$ Γ_{13}/Γ

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

16^{+10}_{-9} OUR AVERAGE				$[(16^{+11}_{-9}) \times 10^{-5}$ OUR 2012 AVERAGE]

NODE=M056R28
NODE=M056R28

NEW

$16^{+10}_{-9} \pm 1$	28	23 ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$

23 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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.84 \pm 0.31) \times 10^{-2}$. 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

$7.9^{+2.0}_{-2.5}$ OUR AVERAGE				$[(8.0^{+2.0}_{-2.5}) \times 10^{-4}$ OUR 2012 AVERAGE]

NODE=M056R29
NODE=M056R29

NEW

$7.9^{+2.0}_{-2.5} \pm 0.2$	77	24 ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$

24 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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.84 \pm 0.31) \times 10^{-2}$. 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 (CL = 90%)				$[<2.8 \times 10^{-4}$ (CL = 90%) OUR 2012 BEST LIMIT]

<2.7	90	25 ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$

25 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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = 9.84 \times 10^{-2}$. 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
NODE=M056R30

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	26 ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$

26 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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = 9.84 \times 10^{-2}$. 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
NODE=M056R31

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

$6.7^{+3.5}_{-2.3}$ OUR AVERAGE				$[(6.8^{+4.0}_{-2.4}) \times 10^{-4}$ OUR 2012 AVERAGE]

NODE=M056R32
NODE=M056R32

NEW

$6.7^{+3.5}_{-2.3} \pm 0.2$	61	27 ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$

27 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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.84 \pm 0.31) \times 10^{-2}$. 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	28 ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$
28 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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = 9.84 \times 10^{-2}$. 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
 NODE=M056R33

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	29 ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$
29 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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = 9.84 \times 10^{-2}$. One of the $f_0(1500)$ is identified via decay to $\pi^+ \pi^-$ while the other via $K^+ K^-$ decay. Both branching fractions for these f_0 decays are implicitly included in the quoted result.				

NODE=M056R34
 NODE=M056R34

NODE=M056R34;LINKAGE=AB

 $\Gamma(f_0(1500)f_0(1710))/\Gamma_{\text{total}}$ Γ_{20}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<0.7	90	30 ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$
30 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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = 9.84 \times 10^{-2}$. The f_0 mesons are identified via $f_0(1500) \rightarrow \pi^+ \pi^-$ and $f_0(1710) \rightarrow K^+ K^-$ decays. Both branching fractions for these f_0 decays are implicitly included in the quoted result.				

NODE=M056R35
 NODE=M056R35

NODE=M056R35;LINKAGE=AB

 $\Gamma(K^+ K^- \pi^0 \pi^0)/\Gamma_{\text{total}}$ Γ_{22}/Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.55±0.09 OUR AVERAGE		[(0.56 ± 0.09)% OUR 2012 AVERAGE]		
0.55±0.09±0.02	213.5	31 HE	08B CLEO	$e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$
31 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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.84 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M056R64
 NODE=M056R64

NEW

NODE=M056R64;LINKAGE=HE

 $\Gamma(K^+ \pi^- K^0 \pi^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{23}/Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
2.47±0.33 OUR AVERAGE		[(2.52 ± 0.34)% OUR 2012 AVERAGE]		
2.47±0.32±0.08	401.7	32 HE	08B CLEO	$e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$
32 HE 08B reports $2.64 \pm 0.15 \pm 0.31 \pm 0.14$ % from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow K^+ \pi^- K^0 \pi^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.84 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M056R66
 NODE=M056R66

NEW

NODE=M056R66;LINKAGE=HE

 $\Gamma(\rho^+ K^- K^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{24}/Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
1.20±0.21 OUR AVERAGE		[(1.22 ± 0.21)% OUR 2012 AVERAGE]		
1.20±0.21±0.04	179.7	33 HE	08B CLEO	$e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$
33 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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.84 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M056R67
 NODE=M056R67

NEW

NODE=M056R67;LINKAGE=HE

$$\Gamma(K^*(892)^- K^+ \pi^0 \rightarrow K^+ \pi^- K^0 \pi^0 + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_{25}/\Gamma$$

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.46±0.12 OUR AVERAGE	[(0.47 ± 0.12)% OUR 2012 AVERAGE]			
0.46±0.12±0.01	64.1	³⁴ HE	08B CLEO	$e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$

³⁴ HE 08B reports $0.49 \pm 0.10 \pm 0.07 \pm 0.03$ % from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow K^*(892)^- K^+ \pi^0 \rightarrow K^+ \pi^- K^0 \pi^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.84 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R68
NODE=M056R68

NEW

NODE=M056R68;LINKAGE=HE

$$\Gamma(K_S^0 K_S^0 \pi^+ \pi^-)/\Gamma_{\text{total}} \quad \Gamma_{26}/\Gamma$$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
5.7±1.1 OUR AVERAGE	[(5.8 ± 1.1) × 10 ⁻³ OUR 2012 AVERAGE]			
5.7±1.0±0.2	152 ± 14	³⁵ ABLIKIM	05o BES2	$\psi(2S) \rightarrow \gamma \chi_{c0}$

³⁵ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.84 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R47
NODE=M056R47

NEW

NODE=M056R47;LINKAGE=AB

$$\Gamma(K^+ K^- \eta \pi^0)/\Gamma_{\text{total}} \quad \Gamma_{27}/\Gamma$$

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.30±0.07±0.01	56.4	³⁶ HE	08B CLEO	$e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$

³⁶ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.84 \pm 0.31) \times 10^{-2}$. 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

$$\Gamma(3(\pi^+ \pi^-))/\Gamma_{\text{total}} \quad \Gamma_{28}/\Gamma$$

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	³⁷ BAI	99B BES	$\psi(2S) \rightarrow \gamma \chi_{c0}$
12.5±2.9±0.5	³⁷ TANENBAUM	78 MRK1	$\psi(2S) \rightarrow \gamma \chi_{c0}$

³⁷ 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

$$\Gamma(K^+ \bar{K}^*(892)^0 \pi^- + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_{29}/\Gamma$$

VALUE	DOCUMENT ID
0.0073±0.0016 OUR FIT	

NODE=M056R10
NODE=M056R10

$$\Gamma(K^*(892)^0 \bar{K}^*(892)^0)/\Gamma_{\text{total}} \quad \Gamma_{30}/\Gamma$$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.7 $\begin{smallmatrix} +0.6 \\ -0.5 \end{smallmatrix} \pm 0.1$	64	³⁸ 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±0.05 30.1±5.7 ^{39,40} ABLIKIM 04H BES Repl. by ABLIKIM 05Q

³⁸ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.84 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

³⁹ Assumes $B(K^*(892)^0 \rightarrow K^- \pi^+) = 2/3$.

⁴⁰ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.84 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R26
NODE=M056R26

NODE=M056R26;LINKAGE=AI

NODE=M056R;LINKAGE=AL
NODE=M056R26;LINKAGE=AB

$$\Gamma(\pi\pi)/\Gamma_{\text{total}} \quad \Gamma_{31}/\Gamma$$

VALUE (units 10^{-3})	DOCUMENT ID
8.5±0.4 OUR FIT	

NODE=M056R22
NODE=M056R22

$$\Gamma(\eta\eta)/\Gamma_{\text{total}} \quad \Gamma_{34}/\Gamma$$

VALUE (units 10^{-3})	DOCUMENT ID
3.01±0.20 OUR FIT	
[(3.03 ± 0.21) × 10 ⁻³ OUR 2012 FIT]	

NODE=M056R13
NODE=M056R13

NEW

$\Gamma(\eta\eta)/\Gamma(\pi\pi)$ Γ_{34}/Γ_{31}

VALUE	DOCUMENT ID	TECN	COMMENT

0.356±0.025 OUR FIT

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

0.26 ±0.09 +0.03 -0.02	⁴¹ ANDREOTTI	05C E835	$\bar{p}p \rightarrow 2 \text{ mesons}$
0.24 ±0.10 ±0.08	⁴¹ BAI	03C BES	$\psi(2S) \rightarrow 5\gamma$

⁴¹ 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_{35}/Γ

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

<0.23 (CL = 90%) [$<0.24 \times 10^{-3}$ (CL = 90%) OUR 2012 BEST LIMIT]**<0.23** 90 35 ± 13 ⁴² ASNER 09 CLEO $\psi(2S) \rightarrow \gamma\eta'\eta$

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

<0.5 90 ⁴³ ADAMS 07 CLEO $\psi(2S) \rightarrow \gamma\chi_{c0}$ ⁴² 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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = 9.84 \times 10^{-2}$.

NODE=M056R03;LINKAGE=AS

⁴³ 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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = 9.84 \times 10^{-2}$.

NODE=M056R03;LINKAGE=AD

 $\Gamma(\eta'\eta')/\Gamma_{\text{total}}$ Γ_{36}/Γ

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

1.99±0.22 OUR AVERAGE [$(2.02 \pm 0.22) \times 10^{-3}$ OUR 2012 AVERAGE]**1.99±0.21±0.06** 0.4k ⁴⁴ ASNER 09 CLEO $\psi(2S) \rightarrow \gamma\eta'\eta'$

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

1.59±0.41±0.05 23 ⁴⁵ ADAMS 07 CLEO $\psi(2S) \rightarrow \gamma\chi_{c0}$ ⁴⁴ 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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.84 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R04;LINKAGE=AS

⁴⁵ 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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.84 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R04;LINKAGE=AD

 $\Gamma(\omega\omega)/\Gamma_{\text{total}}$ Γ_{37}/Γ

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

0.96±0.11 OUR AVERAGE[(0.98 ± 0.11) $\times 10^{-3}$ OUR 2012 AVERAGE]0.93±0.11±0.03 991 ⁴⁶ ABLIKIM 11K BES3 $\psi(2S) \rightarrow \gamma \text{ hadrons}$ 2.2 ±0.7 ±0.1 38.1 ±9.6 ⁴⁷ ABLIKIM 05N BES2 $\psi(2S) \rightarrow \gamma\chi_{c0} \rightarrow \gamma 6\pi$ ⁴⁶ 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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.84 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R27;LINKAGE=AL

⁴⁷ 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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.84 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R27;LINKAGE=AB

 $\Gamma(\omega\phi)/\Gamma_{\text{total}}$ Γ_{38}/Γ

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

1.17±0.22 OUR AVERAGE [(1.19 ± 0.22) $\times 10^{-4}$ OUR 2012 AVERAGE]**1.17±0.22±0.04** 76 ⁴⁸ ABLIKIM 11K BES3 $\psi(2S) \rightarrow \gamma \text{ hadrons}$ ⁴⁸ 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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.84 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.NODE=M056R76
NODE=M056R76

NEW

NODE=M056R76;LINKAGE=AL

$\Gamma(K^+ K^-)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})**5.98±0.34 OUR FIT**[(6.06 ± 0.35) × 10^{-3} OUR 2012 FIT]

DOCUMENT ID

 Γ_{39}/Γ

NODE=M056R6

NODE=M056R6

NEW

 $\Gamma(K_S^0 K_S^0)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})**3.10±0.18 OUR FIT**[(3.14 ± 0.18) × 10^{-3} OUR 2012 FIT]

DOCUMENT ID

 Γ_{40}/Γ

NODE=M056R15

NODE=M056R15

NEW

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

VALUE

0.367±0.022 OUR FIT

[0.369 ± 0.022 OUR 2012 FIT]

DOCUMENT ID

TECN

COMMENT

 Γ_{40}/Γ_{31}

NODE=M056R53

NODE=M056R53

NEW

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

0.31 ± 0.05 ± 0.05 ^{49,50} CHEN 07B BELL $e^+ e^- \rightarrow e^+ e^- \chi_{c0}$ ⁴⁹ 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 $\pi\pi$.⁵⁰ Not independent from other measurements.

NODE=M056R53;LINKAGE=CH

NODE=M056R53;LINKAGE=NI

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

VALUE

0.519±0.035 OUR FIT

DOCUMENT ID

TECN

COMMENT

 Γ_{40}/Γ_{39}

NODE=M056R52

NODE=M056R52

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

0.49 ± 0.07 ± 0.08 ^{51,52} CHEN 07B BELL $e^+ e^- \rightarrow e^+ e^- \chi_{c0}$ ⁵¹ Using $\Gamma(K^+ K^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ from NAKAZAWA 05.⁵² Not independent from other measurements.

NODE=M056R52;LINKAGE=CH

NODE=M056R52;LINKAGE=NI

 $\Gamma(\pi^+ \pi^- \eta)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})**<0.20**

CL%

90

DOCUMENT ID

⁵³ ATHAR

TECN

07 CLEO

COMMENT

 $\psi(2S) \rightarrow \gamma h^+ h^- h^0$ Γ_{41}/Γ

NODE=M056R08

NODE=M056R08

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

<1.0 90 ⁵⁴ ABLIKIM 06R BES2 $\psi(2S) \rightarrow \gamma \chi_{c0}$ ⁵³ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = 9.84 \times 10^{-2}$.⁵⁴ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = 9.84 \times 10^{-2}$.

NODE=M056R08;LINKAGE=AT

NODE=M056R08;LINKAGE=AB

 $\Gamma(\pi^+ \pi^- \eta')/\Gamma_{\text{total}}$ VALUE (units 10^{-3})**<0.4**

CL%

90

DOCUMENT ID

⁵⁵ ATHAR

TECN

07 CLEO

COMMENT

 $\psi(2S) \rightarrow \gamma h^+ h^- h^0$ Γ_{42}/Γ

NODE=M056R51

NODE=M056R51

⁵⁵ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = 9.84 \times 10^{-2}$.

NODE=M056R51;LINKAGE=AT

 $\Gamma(\bar{K}^0 K^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}}$ VALUE (units 10^{-3})**<0.09 (CL = 90%)** [$< 0.10 \times 10^{-3}$ (CL = 90%) OUR 2012 BEST LIMIT]

CL%

90

DOCUMENT ID

⁵⁶ ATHAR

TECN

07 CLEO

COMMENT

 $\psi(2S) \rightarrow \gamma h^+ h^- h^0$ Γ_{43}/Γ

NODE=M056R17

NODE=M056R17

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

<0.7 90 ^{57,58} ABLIKIM 06R BES2 $\psi(2S) \rightarrow \gamma \chi_{c0}$ <0.7 90 ^{58,59} BAI 99B BES $\psi(2S) \rightarrow \gamma \chi_{c0}$ ⁵⁶ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = 9.84 \times 10^{-2}$.⁵⁷ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = 9.84 \times 10^{-2}$.⁵⁸ We have multiplied the $K_S^0 K^+ \pi^-$ measurement by a factor of 2 to convert to $K^0 K^+ \pi^-$.⁵⁹ Rescaled by us using $B(\psi(2S) \rightarrow \gamma \chi_{c0}) = (9.4 \pm 0.4)\%$ and $B(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-) = (32.6 \pm 0.5)\%$.

NODE=M056R17;LINKAGE=AT

NODE=M056R17;LINKAGE=AB

NODE=M056R17;LINKAGE=BA

NODE=M056R17;LINKAGE=X1

$\Gamma(K^+ K^- \pi^0)/\Gamma_{\text{total}}$ Γ_{44}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<0.06	90	⁶⁰ ATHAR	07	CLEO $\psi(2S) \rightarrow \gamma h^+ h^- h^0$
⁶⁰ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = 9.84 \times 10^{-2}$.				

NODE=M056R05
 NODE=M056R05

NODE=M056R05;LINKAGE=AT

 $\Gamma(K^+ K^- \eta)/\Gamma_{\text{total}}$ Γ_{45}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<0.22 (CL = 90%)				[$< 0.23 \times 10^{-3}$ (CL = 90%) OUR 2012 BEST LIMIT]
<0.22	90	⁶¹ ATHAR	07	CLEO $\psi(2S) \rightarrow \gamma h^+ h^- h^0$
⁶¹ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = 9.84 \times 10^{-2}$.				

NODE=M056R09
 NODE=M056R09

NODE=M056R09;LINKAGE=AT

 $\Gamma(K^+ K^- K_S^0 K_S^0)/\Gamma_{\text{total}}$ Γ_{46}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.40 \pm 0.47 \pm 0.04$	16.8 ± 4.8	⁶² ABLIKIM	050	BES2 $\psi(2S) \rightarrow \gamma \chi_{c0}$
⁶² 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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.84 \pm 0.31) \times 10^{-2}$. 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

 $\Gamma(K^+ K^- K^+ K^-)/\Gamma_{\text{total}}$ Γ_{47}/Γ

VALUE (units 10^{-3})	DOCUMENT ID
2.77 ± 0.29 OUR FIT	
[(2.79 ± 0.29) $\times 10^{-3}$ OUR 2012 FIT]	

NODE=M056R14
 NODE=M056R14

NEW

 $\Gamma(K^+ K^- \phi)/\Gamma_{\text{total}}$ Γ_{48}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
0.96 ± 0.25 OUR AVERAGE				[(0.98 ± 0.25) $\times 10^{-3}$ OUR 2012 AVERAGE]
$0.96 \pm 0.25 \pm 0.03$	38	⁶³ ABLIKIM	06T	BES2 $\psi(2S) \rightarrow \gamma 2K^+ 2K^-$
⁶³ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.84 \pm 0.31) \times 10^{-2}$. 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

NEW

NODE=M056R01;LINKAGE=AB

 $\Gamma(\phi\phi)/\Gamma_{\text{total}}$ Γ_{49}/Γ

VALUE (units 10^{-3})	DOCUMENT ID
0.79 ± 0.08 OUR FIT	
[(0.82 ± 0.08) $\times 10^{-3}$ OUR 2012 FIT]	

NODE=M056R16
 NODE=M056R16

NEW

 $\Gamma(p\bar{p})/\Gamma_{\text{total}}$ Γ_{50}/Γ

VALUE (units 10^{-4})	DOCUMENT ID
2.13 ± 0.12 OUR FIT	
[(2.23 ± 0.13) $\times 10^{-4}$ OUR 2012 FIT]	

NODE=M056R11
 NODE=M056R11

NEW

 $\Gamma(p\bar{p}\pi^0)/\Gamma_{\text{total}}$ Γ_{51}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
0.69 ± 0.07 OUR AVERAGE	Error includes scale factor of 1.2. [(0.70 ± 0.07) $\times 10^{-3}$ OUR 2012 AVERAGE Scale factor = 1.2]		
$0.73 \pm 0.06 \pm 0.02$	⁶⁴ ONYISI	10	CLE3 $\psi(2S) \rightarrow \gamma p\bar{p}X$
$0.55 \pm 0.12 \pm 0.02$	⁶⁵ ATHAR	07	CLEO $\psi(2S) \rightarrow \gamma h^+ h^- h^0$
⁶⁴ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.84 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.			
⁶⁵ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.84 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.			

NODE=M056R06
 NODE=M056R06

NEW

NODE=M056R06;LINKAGE=ON

NODE=M056R06;LINKAGE=AT

$\Gamma(p\bar{p}\eta)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

DOCUMENT ID

TECN

COMMENT

0.35±0.04 OUR AVERAGE[(0.36 ± 0.04) × 10⁻³ OUR 2012 AVERAGE]

0.35±0.04±0.01

66 ONYISI

10

CLE3

 $\psi(2S) \rightarrow \gamma p \bar{p} X$

0.37±0.11±0.01

67 ATHAR

07

CLEO

 $\psi(2S) \rightarrow \gamma h^+ h^- h^0$

66 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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.84 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

67 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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.84 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

 Γ_{52}/Γ

NODE=M056R50

NODE=M056R50

NEW

NODE=M056R50;LINKAGE=ON

NODE=M056R50;LINKAGE=AT

 $\Gamma(p\bar{p}\omega)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

DOCUMENT ID

TECN

COMMENT

0.52±0.06 OUR AVERAGE [(0.53 ± 0.06) × 10⁻³ OUR 2012 AVERAGE]**0.52±0.06±0.02**

68 ONYISI

10

CLE3

 $\psi(2S) \rightarrow \gamma p \bar{p} X$

68 ONYISI 10 reports $(5.57 \pm 0.48 \pm 0.42 \pm 0.14) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow p\bar{p}\omega)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.84 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

 Γ_{53}/Γ

NODE=M056R70

NODE=M056R70

NEW

NODE=M056R70;LINKAGE=ON

 $\Gamma(p\bar{p}\phi)/\Gamma_{\text{total}}$ VALUE (units 10^{-5})

EVTS

DOCUMENT ID

TECN

COMMENT

6.0±1.4 OUR AVERAGE [(6.1 ± 1.5) × 10⁻⁵ OUR 2012 AVERAGE]**6.0±1.4±0.2**

42 ± 8

69 ABLIKIM

11F

BES3

 $\psi(2S) \rightarrow \gamma p \bar{p} K^+ K^-$

69 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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.84 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

 Γ_{54}/Γ

NODE=M056R75

NODE=M056R75

NEW

NODE=M056R75;LINKAGE=AB

 $\Gamma(p\bar{p}\pi^+\pi^-)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

DOCUMENT ID

TECN

COMMENT

2.1 ± 0.7 OUR EVALUATION Error includes scale factor of 1.4. Treating systematic error as correlated.**2.1 ± 1.0 OUR AVERAGE** Error includes scale factor of 2.0.

1.57±0.21±0.53

70 BAI

99B

BES

 $\psi(2S) \rightarrow \gamma\chi_{c0}$

4.20±1.15±0.18

70 TANENBAUM

78

MRK1

 $\psi(2S) \rightarrow \gamma\chi_{c0}$

70 Rescaled by us using $B(\psi(2S) \rightarrow \gamma\chi_{c0}) = (9.4 \pm 0.4)\%$ and $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (32.6 \pm 0.5)\%$.

 Γ_{55}/Γ

NODE=M056R7

NODE=M056R7

→ UNCHECKED ←

NODE=M056R7;LINKAGE=X1

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

VALUE (%)

EVTS

DOCUMENT ID

TECN

COMMENT

0.103±0.028 OUR AVERAGE [(0.105 ± 0.028)% OUR 2012 AVERAGE]**0.103±0.028±0.003**

39.5

71 HE

08B

CLEO

 $e^+e^- \rightarrow \gamma h^+ h^- h^0 h^0$

71 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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.84 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

 Γ_{56}/Γ

NODE=M056R65

NODE=M056R65

NEW

NODE=M056R65;LINKAGE=HE

 $\Gamma(p\bar{p}K^+K^- \text{ (non-resonant)})/\Gamma_{\text{total}}$ VALUE (units 10^{-4})

EVTS

DOCUMENT ID

TECN

COMMENT

1.21±0.26 OUR AVERAGE [(1.23 ± 0.27) × 10⁻⁴ OUR 2012 AVERAGE]**1.21±0.26±0.04**

48 ± 8

72 ABLIKIM

11F

BES3

 $\psi(2S) \rightarrow \gamma p \bar{p} K^+ K^-$

72 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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.84 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

 Γ_{57}/Γ

NODE=M056R72

NODE=M056R72

NEW

NODE=M056R72;LINKAGE=AB

$\Gamma(p\bar{p}K_S^0 K_S^0)/\Gamma_{\text{total}}$ Γ_{58}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<8.8	90	⁷³ ABLIKIM	06D BES2	$\psi(2S) \rightarrow \chi_{c0}\gamma$

⁷³ Using $B(\psi(2S) \rightarrow \chi_{c0}\gamma) = (9.2 \pm 0.5)\%$

NODE=M056R46
NODE=M056R46

NODE=M056R;LINKAGE=AB

 $\Gamma(p\bar{n}\pi^-)/\Gamma_{\text{total}}$ Γ_{59}/Γ

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

11.2±3.1 OUR AVERAGE $[(11.4 \pm 3.1) \times 10^{-4}]$ OUR 2012 AVERAGE]

11.2±3.0±0.3 ⁷⁴ ABLIKIM 06I BES2 $\psi(2S) \rightarrow \gamma p\pi^- X$

⁷⁴ 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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.84 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R49
NODE=M056R49

NEW

NODE=M056R49;LINKAGE=AB

 $\Gamma(\Lambda\bar{\Lambda})/\Gamma_{\text{total}}$ Γ_{60}/Γ

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

3.3±0.4 OUR FIT

NODE=M056R23
NODE=M056R23

 $\Gamma(\Lambda\bar{\Lambda}\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{61}/Γ

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

<4.0 90 ⁷⁵ ABLIKIM 06D BES2 $\psi(2S) \rightarrow \chi_{c0}\gamma$

⁷⁵ Using $B(\psi(2S) \rightarrow \chi_{c0}\gamma) = (9.2 \pm 0.5)\%$

NODE=M056R44
NODE=M056R44

NODE=M056R44;LINKAGE=AB

 $\Gamma(K^+\bar{p}\Lambda + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{62}/Γ

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

1.24±0.12 OUR AVERAGE Error includes scale factor of 1.3. $[(1.02 \pm 0.19) \times 10^{-3}]$ OUR 2012 AVERAGE]

1.30±0.09±0.04 9k ^{76,77} ABLIKIM 13D BES3 $\psi(2S) \rightarrow \gamma\Lambda\bar{p}K^+$

1.00±0.19±0.03 ⁷⁸ ATHAR 07 CLEO $\psi(2S) \rightarrow \gamma h^+ h^- h^0$

⁷⁶ ABLIKIM 13D reports $(1.32 \pm 0.03 \pm 0.10) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow K^+\bar{p}\Lambda + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.68 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.84 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

⁷⁷ Using $B(\Lambda \rightarrow p\pi^-) = 63.9\%$.

⁷⁸ ATHAR 07 reports $(1.07 \pm 0.17 \pm 0.12) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow K^+\bar{p}\Lambda + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.84 \pm 0.31) \times 10^{-2}$. 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

NEW

NODE=M056R07;LINKAGE=AB

NODE=M056R07;LINKAGE=LB
NODE=M056R07;LINKAGE=AT

 $\Gamma(K^+p\Lambda(1520) + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{63}/Γ

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

2.9±0.7 OUR AVERAGE $[(3.0 \pm 0.8) \times 10^{-4}]$ OUR 2012 AVERAGE]

2.9±0.7±0.1 62 ± 12 ⁷⁹ ABLIKIM 11F BES3 $\psi(2S) \rightarrow \gamma p\bar{p}K^+ K^-$

⁷⁹ ABLIKIM 11F reports $(3.00 \pm 0.58 \pm 0.50) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow K^+p\Lambda(1520) + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.62 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.84 \pm 0.31) \times 10^{-2}$. 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

NEW

NODE=M056R73;LINKAGE=AB

 $\Gamma(\Lambda(1520)\bar{\Lambda}(1520))/\Gamma_{\text{total}}$ Γ_{64}/Γ

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

3.1±1.2 OUR AVERAGE $[(3.2 \pm 1.2) \times 10^{-4}]$ OUR 2012 AVERAGE]

3.1±1.2±0.1 28 ± 10 ⁸⁰ ABLIKIM 11F BES3 $\psi(2S) \rightarrow \gamma p\bar{p}K^+ K^-$

⁸⁰ 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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.84 \pm 0.31) \times 10^{-2}$. 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

NEW

NODE=M056R74;LINKAGE=AB

$\Gamma(\Sigma^0 \bar{\Sigma}^0)/\Gamma_{\text{total}}$ Γ_{65}/Γ

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

4.1±0.7 OUR AVERAGE $[(4.2 \pm 0.7) \times 10^{-4}$ OUR 2012 AVERAGE]**4.1±0.7±0.1** 78 ± 10 ⁸¹ NAIK 08 CLEO $\psi(2S) \rightarrow \gamma \Sigma^0 \bar{\Sigma}^0$

⁸¹ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.84 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R59
 NODE=M056R59

NEW

NODE=M056R59;LINKAGE=NA

 $\Gamma(\Sigma^+ \bar{\Sigma}^-)/\Gamma_{\text{total}}$ Γ_{66}/Γ

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

3.0±0.7 OUR AVERAGE $[(3.1 \pm 0.7) \times 10^{-4}$ OUR 2012 AVERAGE]**3.0±0.7±0.1** 39 ± 7 ⁸² NAIK 08 CLEO $\psi(2S) \rightarrow \gamma \Sigma^+ \bar{\Sigma}^-$

⁸² 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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.84 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R60
 NODE=M056R60

NEW

NODE=M056R60;LINKAGE=NA

 $\Gamma(\Xi^0 \bar{\Xi}^0)/\Gamma_{\text{total}}$ Γ_{67}/Γ

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

3.1±0.8 OUR AVERAGE $[(3.2 \pm 0.8) \times 10^{-4}$ OUR 2012 AVERAGE]**3.1±0.8±0.1** 23.3 ± 4.9 ⁸³ NAIK 08 CLEO $\psi(2S) \rightarrow \gamma \Xi^0 \bar{\Xi}^0$

⁸³ NAIK 08 reports $(3.34 \pm 0.70 \pm 0.48) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \Xi^0 \bar{\Xi}^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.84 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R61
 NODE=M056R61

NEW

NODE=M056R61;LINKAGE=NA

 $\Gamma(\Xi^- \bar{\Xi}^+)/\Gamma_{\text{total}}$ Γ_{68}/Γ

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

4.8±0.7 OUR AVERAGE $[(4.9 \pm 0.7) \times 10^{-4}$ OUR 2012 AVERAGE]**4.8±0.7±0.1** 95 ± 11 ⁸⁴ NAIK 08 CLEO $\psi(2S) \rightarrow \gamma \Xi^- \bar{\Xi}^+$

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

⁸⁵ ABLIKIM 06D BES2 $\psi(2S) \rightarrow \chi_{c0} \gamma$

⁸⁴ NAIK 08 reports $(5.14 \pm 0.60 \pm 0.47) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \Xi^- \bar{\Xi}^+)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.84 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

⁸⁵ Using $B(\psi(2S) \rightarrow \chi_{c0} \gamma) = (9.2 \pm 0.5)\%$

NODE=M056R45
 NODE=M056R45

NEW

NODE=M056R45;LINKAGE=NA

NODE=M056R45;LINKAGE=AB

 $\Gamma(p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\pi\pi)/\Gamma_{\text{total}}$ $\Gamma_{50}/\Gamma \times \Gamma_{31}/\Gamma$

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

18.0±1.2 OUR FIT $[(19.0 \pm 1.4) \times 10^{-7}$ OUR 2012 FIT]**15.3±2.4±0.8** ⁸⁶ ANDREOTTI 03 E835 $\bar{p}p \rightarrow \chi_{c0} \rightarrow \pi^0 \pi^0$ ⁸⁶ We have multiplied $B(p\bar{p}) \cdot B(\pi^0 \pi^0)$ measurement by 3 to obtain $B(p\bar{p}) \cdot B(\pi\pi)$.

NODE=M056R21
 NODE=M056R21

NEW

NODE=M056R;LINKAGE=AD

 $\Gamma(p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\pi^0 \eta)/\Gamma_{\text{total}}$ $\Gamma_{50}/\Gamma \times \Gamma_{32}/\Gamma$

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

<0.4ANDREOTTI 05C E835 $\bar{p}p \rightarrow \pi^0 \eta$

NODE=M056R41
 NODE=M056R41

 $\Gamma(p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\pi^0 \eta')/\Gamma_{\text{total}}$ $\Gamma_{50}/\Gamma \times \Gamma_{33}/\Gamma$

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

<2.5ANDREOTTI 05C E835 $\bar{p}p \rightarrow \pi^0 \eta$

NODE=M056R42
 NODE=M056R42

 $\Gamma(p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\eta\eta)/\Gamma_{\text{total}}$ $\Gamma_{50}/\Gamma \times \Gamma_{34}/\Gamma$

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

6.4±0.5 OUR FIT $[(6.8 \pm 0.6) \times 10^{-7}$ OUR 2012 FIT]**4.0±1.2^{+0.5}_{-0.3}** ANDREOTTI 05C E835 $\bar{p}p \rightarrow \eta\eta$

NODE=M056R40
 NODE=M056R40

NEW

$$\Gamma(p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\eta\eta')/\Gamma_{\text{total}}$$

$$\Gamma_{50}/\Gamma \times \Gamma_{35}/\Gamma$$

VALUE (units 10^{-6})

DOCUMENT ID

TECN

COMMENT

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

$$2.1^{+2.3}_{-1.5}$$

ANDREOTTI 05C E835 $\bar{p}p \rightarrow \pi^0\eta$

NODE=M056R43
NODE=M056R43

RADIATIVE DECAYS

$$\Gamma(\gamma J/\psi(1S))/\Gamma_{\text{total}}$$

$$\Gamma_{69}/\Gamma$$

VALUE (units 10^{-4})

DOCUMENT ID

TECN

COMMENT

130 ± 7 OUR FIT[(117 ± 8) × 10⁻⁴ OUR 2012 FIT]

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

200 ± 20 ± 20

87 ADAM

05A

CLEO

 $e^+e^- \rightarrow \psi(2S) \rightarrow \gamma\chi_{c0}$

87 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=M056310

NODE=M056R8
NODE=M056R8

NEW

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

$$\Gamma_{70}/\Gamma$$

VALUE (units 10^{-6})

CL%

EVTS

DOCUMENT ID

TECN

COMMENT

< 9 90 1.2 ± 4.5 88 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

89 ABLIKIM

11E

BES3

 $\psi(2S) \rightarrow \gamma\gamma\rho^0$

88 BENNETT 08A reports < 9.6 × 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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = 9.84 \times 10^{-2}$.

89 ABLIKIM 11E reports < 10.5 × 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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = 9.84 \times 10^{-2}$.

NODE=M056R56;LINKAGE=BE

NODE=M056R56;LINKAGE=AB

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

$$\Gamma_{71}/\Gamma$$

VALUE (units 10^{-6})

CL%

EVTS

DOCUMENT ID

TECN

COMMENT

< 8 90 0.0 ± 2.8 90 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

91 ABLIKIM

11E

BES3

 $\psi(2S) \rightarrow \gamma\gamma\omega$

90 BENNETT 08A reports < 8.8 × 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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = 9.84 \times 10^{-2}$.

91 ABLIKIM 11E reports < 12.9 × 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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = 9.84 \times 10^{-2}$.

NODE=M056R57;LINKAGE=BE

NODE=M056R57;LINKAGE=AB

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

$$\Gamma_{72}/\Gamma$$

VALUE (units 10^{-6})

CL%

EVTS

DOCUMENT ID

TECN

COMMENT

< 6 90 0.1 ± 1.6 92 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

93 ABLIKIM

11E

BES3

 $\psi(2S) \rightarrow \gamma\gamma\phi$

92 BENNETT 08A reports < 6.4 × 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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = 9.84 \times 10^{-2}$.

93 ABLIKIM 11E reports < 16.2 × 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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = 9.84 \times 10^{-2}$.

NODE=M056R58;LINKAGE=BE

NODE=M056R58;LINKAGE=AB

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

$$\Gamma_{73}/\Gamma$$

VALUE (units 10^{-4})

CL%

DOCUMENT ID

TECN

COMMENT

2.25 ± 0.17 OUR FIT[(2.23 ± 0.17) × 10⁻⁴ OUR 2012 FIT]

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

<7

90

94 WICHT

08

BELL

 $B^\pm \rightarrow K^\pm\gamma\gamma$

94 WICHT 08 reports $[\Gamma(\chi_{c0}(1P) \rightarrow \gamma\gamma)/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \chi_{c0}(1P)K^+)] < 0.11 \times 10^{-6}$ which we divide by our best value $B(B^+ \rightarrow \chi_{c0}(1P)K^+) = 1.49 \times 10^{-4}$.

NODE=M056R1
NODE=M056R1

NEW

NODE=M056R1;LINKAGE=WI

$\Gamma(\gamma\gamma)/\Gamma(\gamma J/\psi(1S))$ Γ_{73}/Γ_{69} VALUE (units 10^{-2})

DOCUMENT ID TECN COMMENT

1.73±0.16 OUR FIT[(1.90 ± 0.19) × 10⁻² OUR 2012 FIT]**2.0 ±0.4 OUR AVERAGE**2.2 ±0.4^{+0.1}_{-0.2}⁹⁵ ANDREOTTI 04 E835 $p\bar{p} \rightarrow \chi_{c0} \rightarrow \gamma\gamma$

1.45±0.74

⁹⁶ AMBROGIANI 00B E835 $\bar{p}p \rightarrow \chi_{c2} \rightarrow \gamma\gamma, \gamma J/\psi$ ⁹⁵ 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.⁹⁶ Calculated by us using $B(J/\psi(1S) \rightarrow e^+e^-) = 0.0593 \pm 0.0010$.

NODE=M056R18

NODE=M056R18

NEW

NODE=M056R;LINKAGE=AN

NODE=M056R;LINKAGE=7A

 $\Gamma(p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\gamma J/\psi(1S))/\Gamma_{\text{total}}$ $\Gamma_{50}/\Gamma \times \Gamma_{69}/\Gamma$ VALUE (units 10^{-7})

EVTS

DOCUMENT ID

TECN

COMMENT

27.8±1.7 OUR FIT[(26.2 ± 1.7) × 10⁻⁷ OUR 2012 FIT]**28.2±2.1 OUR AVERAGE**

28.0±1.9±1.3

³⁹² ^{97,98,99} BAGNASCO 02 E835 $\bar{p}p \rightarrow \chi_{c0} \rightarrow J/\psi\gamma$ 29.3^{+5.7}_{-4.7} ±1.5⁸⁹ ^{97,98} AMBROGIANI 99B $\bar{p}p \rightarrow \chi_{c0} \rightarrow J/\psi\gamma$ ⁹⁷ 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.⁹⁸ Calculated by us using $B(J/\psi(1S) \rightarrow e^+e^-) = 0.0593 \pm 0.0010$.⁹⁹ Recalculated by ANDREOTTI 05A.

NODE=M056R19

NODE=M056R19

NEW

NODE=M056R;LINKAGE=KS

NODE=M056R19;LINKAGE=7A

NODE=M056R19;LINKAGE=AN

 $\Gamma(p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_{50}/\Gamma \times \Gamma_{73}/\Gamma$ VALUE (units 10^{-8})

DOCUMENT ID

TECN

COMMENT

4.8 ±0.5 OUR FIT[(5.0 ± 0.5) × 10⁻⁸ OUR 2012 FIT]

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

6.52±1.18^{+0.48}_{-0.72}¹⁰⁰ ANDREOTTI 04 E835 $p\bar{p} \rightarrow \chi_{c0} \rightarrow \gamma\gamma$ ¹⁰⁰ 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

NEW

NODE=M056R25;LINKAGE=AN

 $\chi_{c0}(1P)$ CROSS-PARTICLE BRANCHING RATIOS

NODE=M056230

 $\Gamma(\chi_{c0}(1P) \rightarrow p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))/\Gamma_{\text{total}}$ $\Gamma_{50}/\Gamma \times \Gamma_{118}^{\psi(2S)}/\Gamma_{\psi(2S)}$ VALUE (units 10^{-6})

EVTS

DOCUMENT ID

TECN

COMMENT

21.0±1.4 OUR FIT[(21.6 ± 1.4) × 10⁻⁶ OUR 2012 FIT]**23.7±1.8 OUR AVERAGE**

23.7±1.4±1.4

³⁸³ ± 22 ¹⁰¹ 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 $\psi(2S) \rightarrow \gamma\chi_{c0}(1P) \rightarrow \gamma p\bar{p}$ ¹⁰¹ Calculated by us. NAIK 08 reports $B(\chi_c^0 \rightarrow p\bar{p}) = (25.7 \pm 1.5 \pm 1.5 \pm 1.3) \times 10^{-5}$ using $B(\psi(2S) \rightarrow \gamma\chi_c^0) = (9.22 \pm 0.11 \pm 0.46)\%$.

NODE=M056B6

NODE=M056B6

NEW

NODE=M056B6;LINKAGE=NA

 $\Gamma(\chi_{c0}(1P) \rightarrow p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)$ $\Gamma_{50}/\Gamma \times \Gamma_{118}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}$ VALUE (units 10^{-5})

DOCUMENT ID

TECN

COMMENT

6.2±0.4 OUR FIT[(6.4 ± 0.4) × 10⁻⁵ OUR 2012 FIT]**4.6±1.9**¹⁰² BAI 98i BES $\psi(2S) \rightarrow \gamma\chi_{c0} \rightarrow \gamma p\bar{p}$ ¹⁰² Calculated by us. The value for $B(\chi_{c0} \rightarrow p\bar{p})$ reported in BAI 98i is derived using $B(\psi(2S) \rightarrow \gamma\chi_{c0}) = (9.3 \pm 0.8)\%$ and $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (32.4 \pm 2.6)\%$ [BAI 98D].

NODE=M056B1

NODE=M056B1

NEW

NODE=M056B;LINKAGE=B1

 $\Gamma(\chi_{c0}(1P) \rightarrow \Lambda\bar{\Lambda})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))/\Gamma_{\text{total}}$ $\Gamma_{60}/\Gamma \times \Gamma_{118}^{\psi(2S)}/\Gamma_{\psi(2S)}$ VALUE (units 10^{-6})

EVTS

DOCUMENT ID

TECN

COMMENT

32 ±4 OUR FIT**31.2±3.3±2.0**¹³¹ ± 12 ¹⁰³ NAIK 08 CLEO $\psi(2S) \rightarrow \gamma\Lambda\bar{\Lambda}$ ¹⁰³ Calculated by us. NAIK 08 reports $B(\chi_c^0 \rightarrow \Lambda\bar{\Lambda}) = (33.8 \pm 3.6 \pm 2.2 \pm 1.7) \times 10^{-5}$ using $B(\psi(2S) \rightarrow \gamma\chi_c^0) = (9.22 \pm 0.11 \pm 0.46)\%$.

NODE=M056B20

NODE=M056B20

NODE=M056B20;LINKAGE=NA

$$\Gamma(\chi_{c0}(1P) \rightarrow \Lambda \bar{\Lambda}) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) / \Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)$$

$$\Gamma_{60} / \Gamma \times \Gamma_{118}^{\psi(2S)} / \Gamma_{11}^{\psi(2S)}$$

VALUE (units 10^{-5}) EVTS DOCUMENT ID TECN COMMENT
9.4±1.1 OUR FIT
 [(9.5 ± 1.1) × 10⁻⁵ OUR 2012 FIT]

13.0^{+3.6}_{-3.5} ± 2.5 15.2^{+4.2}_{-4.0} 104 BAI 03E BES $\psi(2S) \rightarrow \gamma \Lambda \bar{\Lambda}$

104 BAI 03E reports [$B(\chi_c^0 \rightarrow \Lambda \bar{\Lambda}) B(\psi(2S) \rightarrow \gamma \chi_c^0) / B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-)] \times [B^2(\Lambda \rightarrow \pi^- p) / B(J/\psi \rightarrow p \bar{p})] = (2.45^{+0.68}_{-0.65} \pm 0.46)\%$. 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
 NEW

NODE=M056B21;LINKAGE=BA

$$\Gamma(\chi_{c0}(1P) \rightarrow \gamma J/\psi(1S)) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) / \Gamma_{\text{total}}$$

$$\Gamma_{69} / \Gamma \times \Gamma_{118}^{\psi(2S)} / \Gamma_{11}^{\psi(2S)}$$

VALUE (units 10^{-2}) EVTS DOCUMENT ID TECN COMMENT
0.128±0.007 OUR FIT
 [(0.113 ± 0.008) × 10⁻² OUR 2012 FIT]

0.131±0.035 OUR AVERAGE Error includes scale factor of 3.9. [(0.073±0.018)×10⁻² OUR 2012 AVERAGE]

0.151±0.003±0.010 4.3k ABLIKIM 120 BES3 $\psi(2S) \rightarrow \gamma \chi_{c0}$
 0.069±0.018 105 OREGIA 82 CBAL $\psi(2S) \rightarrow \gamma \chi_{c0}$
 0.4 ± 0.3 106 BRANDELIK 79B DASP $\psi(2S) \rightarrow \gamma \chi_{c0}$
 0.16 ± 0.11 106 BARTEL 78B CNTR $\psi(2S) \rightarrow \gamma \chi_{c0}$
 3.3 ± 1.7 107 BIDDICK 77 CNTR $e^+ e^- \rightarrow \gamma X$

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

0.125±0.007±0.013 560 108 MENDEZ 08 CLEO $\psi(2S) \rightarrow \gamma \chi_{c0}$
 0.18 ± 0.01 ± 0.02 172 109 ADAM 05A CLEO Repl. by MENDEZ 08

105 Recalculated by us using $B(J/\psi(1S) \rightarrow \ell^+ \ell^-) = 0.1181 \pm 0.0020$.

106 Recalculated by us using $B(J/\psi(1S) \rightarrow \mu^+ \mu^-) = 0.0588 \pm 0.0010$.

107 Assumes isotropic gamma distribution.

108 Not independent from other measurements of MENDEZ 08.

109 Not independent from other values reported by ADAM 05A.

NODE=M056B2
 NODE=M056B2
 NEW

NEW

NODE=M056B;LINKAGE=3Q
 NODE=M056B;LINKAGE=2Q
 NODE=M056B;LINKAGE=EA
 NODE=M056B2;LINKAGE=ME
 NODE=M056B2;LINKAGE=AD

$$\Gamma(\chi_{c0}(1P) \rightarrow \gamma J/\psi(1S)) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) / \Gamma(\psi(2S) \rightarrow J/\psi(1S) \text{ anything})$$

$$\Gamma_{69} / \Gamma \times \Gamma_{118}^{\psi(2S)} / \Gamma_9^{\psi(2S)}$$

$$\Gamma_{69} / \Gamma \times \Gamma_{118}^{\psi(2S)} / \Gamma_9^{\psi(2S)} = \Gamma_{69} / \Gamma \times \Gamma_{118}^{\psi(2S)} / (\Gamma_{11}^{\psi(2S)} + \Gamma_{12}^{\psi(2S)} + \Gamma_{13}^{\psi(2S)} + \Gamma_{19}^{\psi(2S)} + 0.198 \Gamma_{120}^{\psi(2S)})$$

VALUE (units 10^{-2}) EVTS DOCUMENT ID TECN COMMENT
0.213±0.011 OUR FIT
 [(0.191 ± 0.014) × 10⁻² OUR 2012 FIT]

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

0.201±0.011±0.021 560 110 MENDEZ 08 CLEO $\psi(2S) \rightarrow \gamma \chi_{c0}$
 0.31 ± 0.02 ± 0.03 172 ADAM 05A CLEO Repl. by MENDEZ 08

110 Not independent from other measurements of MENDEZ 08.

NODE=M056B7
 NODE=M056B7

NODE=M056B7
 NEW

NODE=M056B7;LINKAGE=ME

$$\Gamma(\chi_{c0}(1P) \rightarrow \gamma J/\psi(1S)) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) / \Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)$$

$$\Gamma_{69} / \Gamma \times \Gamma_{118}^{\psi(2S)} / \Gamma_{11}^{\psi(2S)}$$

VALUE (units 10^{-2}) EVTS DOCUMENT ID TECN COMMENT
0.376±0.020 OUR FIT
 [(0.338 ± 0.024) × 10⁻² OUR 2012 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 ± 0.06 172 111 ADAM 05A CLEO Repl. by MENDEZ 08

111 Not independent from other values reported by ADAM 05A.

NODE=M056B8
 NODE=M056B8
 NEW

NODE=M056B;LINKAGE=AD

$$\Gamma(\chi_{c0}(1P) \rightarrow \gamma \gamma) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) / \Gamma_{\text{total}}$$

$$\Gamma_{73} / \Gamma \times \Gamma_{118}^{\psi(2S)} / \Gamma_{11}^{\psi(2S)}$$

VALUE (units 10^{-5}) EVTS DOCUMENT ID TECN COMMENT
2.21±0.19 OUR FIT
 [(2.16 ± 0.19) × 10⁻⁵ OUR 2012 FIT]

2.21±0.33 OUR AVERAGE

2.17±0.32±0.10 207 ± 31 ECKLUND 08A CLEO $\psi(2S) \rightarrow \gamma \chi_{c0} \rightarrow 3\gamma$
 3.7 ± 1.8 ± 1.0 LEE 85 CBAL $\psi(2S) \rightarrow \gamma \chi_{c0}$

NODE=M056B3
 NODE=M056B3
 NEW

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow \pi\pi)}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))}{\Gamma_{\text{total}}} \times \frac{\Gamma_{31}/\Gamma \times \Gamma_{118}^{\psi(2S)}/\Gamma_{\psi(2S)}}{\Gamma_{118}^{\psi(2S)}/\Gamma_{\psi(2S)}}$$

VALUE (units 10 ⁻⁴)	EVTS	DOCUMENT ID	TECN	COMMENT
8.32±0.29 OUR FIT				
[(8.25 ± 0.29) × 10 ⁻⁴ OUR 2012 FIT]				
8.80±0.34 OUR AVERAGE				
9.11±0.08±0.65	17k	112 ABLIKIM	10A BES3	e ⁺ e ⁻ → ψ(2S) → γχ _{c0}
8.81±0.11±0.43	8.9k	113 ASNER	09 CLEO	ψ(2S) → γπ ⁺ π ⁻
8.13±0.19±0.89	2.8k	114 ASNER	09 CLEO	ψ(2S) → γπ ⁰ π ⁰
112 Calculated by us. ABLIKIM 10A reports B(χ _{c0} → π ⁰ π ⁰) = (3.23 ± 0.03 ± 0.23 ± 0.14) × 10 ⁻³ using B(ψ(2S) → γχ _{c0}) = (9.4 ± 0.4)%. We have multiplied the π ⁰ π ⁰ measurement by 3 to obtain ππ.				
113 Calculated by us. ASNER 09 reports B(χ _{c0} → π ⁺ π ⁻) = (6.37 ± 0.08 ± 0.31 ± 0.32) × 10 ⁻³ using B(ψ(2S) → γχ _{c0}) = (9.22 ± 0.11 ± 0.46)%. We have multiplied the π ⁺ π ⁻ measurement by 3/2 to obtain ππ.				
114 Calculated by us. ASNER 09 reports B(χ _{c0} → π ⁰ π ⁰) = (2.94 ± 0.07 ± 0.32 ± 0.15) × 10 ⁻³ using B(ψ(2S) → γχ _{c0}) = (9.22 ± 0.11 ± 0.46)%. We have multiplied the π ⁰ π ⁰ measurement by 3 to obtain ππ.				

NODE=M056B22
 NODE=M056B22
 NEW

OCCUR=2

NODE=M056B22;LINKAGE=AB

NODE=M056B22;LINKAGE=AS

NODE=M056B22;LINKAGE=AN

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow \pi\pi)}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))}{\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)} \times \frac{\Gamma_{31}/\Gamma \times \Gamma_{118}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}{\Gamma_{118}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10 ⁻⁴)	EVTS	DOCUMENT ID	TECN	COMMENT
24.4±0.9 OUR FIT				
[(24.5 ± 0.9) × 10 ⁻⁴ OUR 2012 FIT]				
20.7±1.7 OUR AVERAGE				
23.9±2.7±4.1	97 ± 11	115 BAI	03C BES	ψ(2S) → γχ _{c0} → γπ ⁰ π ⁰
20.2±1.1±1.5	720 ± 32	116 BAI	98I BES	ψ(2S) → γχ _{c0} → γπ ⁺ π ⁻
115 We have multiplied π ⁰ π ⁰ measurement by 3 to obtain ππ.				
116 Calculated by us. The value for B(χ _{c0} → π ⁺ π ⁻) reported in BAI 98I is derived using B(ψ' → γχ _{c0}) = (9.3 ± 0.8)% and B(ψ' → J/ψπ ⁺ π ⁻) = (32.4 ± 2.6)% [BAI 98D]. We have multiplied π ⁺ π ⁻ measurement by 3/2 to obtain ππ.				

NODE=M056B5
 NODE=M056B5
 NEW

NODE=M056B;LINKAGE=D1
 NODE=M056B;LINKAGE=D2

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow \eta\eta)}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))}{\Gamma_{\text{total}}} \times \frac{\Gamma_{34}/\Gamma \times \Gamma_{118}^{\psi(2S)}/\Gamma_{118}^{\psi(2S)}}{\Gamma_{118}^{\psi(2S)}/\Gamma_{118}^{\psi(2S)}}$$

VALUE (units 10 ⁻⁴)	EVTS	DOCUMENT ID	TECN	COMMENT
2.96±0.18 OUR FIT				
[(2.93 ± 0.18) × 10 ⁻⁴ OUR 2012 FIT]				
3.12±0.19 OUR AVERAGE				
3.23±0.09±0.23	2132	117 ABLIKIM	10A BES3	e ⁺ e ⁻ → ψ(2S) → γχ _{c0}
2.93±0.12±0.29	0.9k	118 ASNER	09 CLEO	ψ(2S) → γηη
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2.86±0.46±0.37	48	119 ADAMS	07 CLEO	ψ(2S) → γχ _{c0}
117 Calculated by us. ABLIKIM 10A reports B(χ _{c0} → ηη) = (3.44 ± 0.10 ± 0.24 ± 0.13) × 10 ⁻³ using B(ψ(2S) → γχ _{c0}) = (9.4 ± 0.4)%.				
118 Calculated by us. ASNER 09 reports B(χ _{c0} → ηη) = (3.18 ± 0.13 ± 0.31 ± 0.16) × 10 ⁻³ using B(ψ(2S) → γχ _{c0}) = (9.22 ± 0.11 ± 0.46)%.				
119 Superseded by ASNER 09. Calculated by us. The value of B(χ _{c0} (1P) → ηη) reported by ADAMS 07 was derived using B(ψ(2S) → γχ _{c0} (1P)) = (9.22 ± 0.11 ± 0.46)% (ATHAR 04).				

NODE=M056B11
 NODE=M056B11
 NEW

NODE=M056B11;LINKAGE=AB

NODE=M056B11;LINKAGE=AS

NODE=M056B11;LINKAGE=AD

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow \eta\eta)}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))}{\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)} \times \frac{\Gamma_{34}/\Gamma \times \Gamma_{118}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}{\Gamma_{118}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10 ⁻³)	DOCUMENT ID	TECN	COMMENT
0.87 ± 0.05 OUR FIT			
0.578±0.241±0.158			
	BAI	03C BES	ψ(2S) → γηη

NODE=M056B10
 NODE=M056B10

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow K^+K^-)}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))}{\Gamma_{\text{total}}} \times \frac{\Gamma_{39}/\Gamma \times \Gamma_{118}^{\psi(2S)}/\Gamma_{118}^{\psi(2S)}}{\Gamma_{118}^{\psi(2S)}/\Gamma_{118}^{\psi(2S)}}$$

VALUE (units 10 ⁻⁴)	EVTS	DOCUMENT ID	TECN	COMMENT
5.89±0.28 OUR FIT				
[(5.87 ± 0.28) × 10 ⁻⁴ OUR 2012 FIT]				
5.97±0.07±0.32				
	8.1k	120 ASNER	09 CLEO	ψ(2S) → γK ⁺ K ⁻
120 Calculated by us. ASNER 09 reports B(χ _{c0} → K ⁺ K ⁻) = (6.47 ± 0.08 ± 0.35 ± 0.32) × 10 ⁻³ using B(ψ(2S) → γχ _{c0}) = (9.22 ± 0.11 ± 0.46)%.				

NODE=M056B23
 NODE=M056B23
 NEW

NODE=M056B23;LINKAGE=AS

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow K^+ K^-)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)}{\Gamma_{39}/\Gamma \times \Gamma_{118}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10⁻³) EVTS DOCUMENT ID TECN COMMENT

1.73±0.08 OUR FIT

[(1.75 ± 0.09) × 10⁻³ OUR 2012 FIT]

1.63±0.10±0.15 774 ± 38 121 BAI 98I BES $\psi(2S) \rightarrow \gamma K^+ K^-$

¹²¹ 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 ± 0.8)% and B($\psi(2S) \rightarrow J/\psi \pi^+ \pi^-$) = (32.4 ± 2.6)% [BAI 98D].

NODE=M056B9

NODE=M056B9

NEW

NODE=M056B9;LINKAGE=BA

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow K_S^0 K_S^0)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))/\Gamma_{\text{total}}}{\Gamma_{40}/\Gamma \times \Gamma_{118}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10⁻⁴) EVTS DOCUMENT ID TECN COMMENT

3.05±0.15 OUR FIT

[(3.04 ± 0.15) × 10⁻⁴ OUR 2012 FIT]

3.18±0.17 OUR AVERAGE

3.22±0.07±0.17 2.1k 122 ASNER 09 CLEO $\psi(2S) \rightarrow \gamma K_S^0 K_S^0$

3.02±0.19±0.33 322 ABLIKIM 05O BES2 $\psi(2S) \rightarrow \gamma K_S^0 K_S^0$

¹²² Calculated by us. ASNER 09 reports B($\chi_{c0} \rightarrow K_S^0 K_S^0$) = (3.49 ± 0.08 ± 0.18 ± 0.17) × 10⁻³ using B($\psi(2S) \rightarrow \gamma \chi_{c0}$) = (9.22 ± 0.11 ± 0.46)%.

NODE=M056B12

NODE=M056B12

NEW

NODE=M056B12;LINKAGE=AS

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow K_S^0 K_S^0)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)}{\Gamma_{40}/\Gamma \times \Gamma_{118}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10⁻⁴) DOCUMENT ID TECN COMMENT

9.0±0.4 OUR FIT

[(9.1 ± 0.5) × 10⁻⁴ OUR 2012 FIT]

5.6±0.8±1.3 123 BAI 99B BES $\psi(2S) \rightarrow \gamma K_S^0 K_S^0$

¹²³ 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 ± 0.8)% and B($\psi(2S) \rightarrow J/\psi \pi^+ \pi^-$) = (32.4 ± 2.6)% [BAI 98D].

NODE=M056B13

NODE=M056B13

NEW

NODE=M056B13;LINKAGE=BA

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow 2(\pi^+ \pi^-))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)}{\Gamma_1/\Gamma \times \Gamma_{118}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10⁻³) DOCUMENT ID TECN COMMENT

6.5±0.5 OUR FIT

6.9±2.4 OUR AVERAGE Error includes scale factor of 3.8.

4.4±0.1±0.9 124 BAI 99B BES $\psi(2S) \rightarrow \gamma \chi_{c0}$

9.3±0.9 125 TANENBAUM 78 MRK1 $\psi(2S) \rightarrow \gamma \chi_{c0}$

¹²⁴ 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 ± 0.8)% and B($\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-$) = (32.4 ± 2.6)% [BAI 98D].

¹²⁵ The value B($\psi(1S) \rightarrow \gamma \chi_{c0}$) × B($\chi_{c0} \rightarrow 2\pi^+ 2\pi^-$) reported in TANENBAUM 78 is derived using B($\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-$) × B($J/\psi(1S) \rightarrow \ell^+ \ell^-$) = (4.6 ± 0.7)%. Calculated by us using B($J/\psi(1S) \rightarrow \ell^+ \ell^-$) = 0.1181 ± 0.0020.

NODE=M056B4

NODE=M056B4

NODE=M056B;LINKAGE=B2

NODE=M056B;LINKAGE=J1

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow \pi^+ \pi^- K^+ K^-)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))/\Gamma_{\text{total}}}{\Gamma_8/\Gamma \times \Gamma_{118}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10⁻³) DOCUMENT ID TECN COMMENT

1.74±0.14 OUR FIT

[(1.73 ± 0.13) × 10⁻³ OUR 2012 FIT]

1.64±0.05±0.2 ABLIKIM 05Q BES2 $\psi(2S) \rightarrow \gamma \chi_{c0}$

NODE=M056B18

NODE=M056B18

NEW

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow \pi^+ \pi^- K^+ K^-)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)}{\Gamma_8/\Gamma \times \Gamma_{118}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10⁻³) DOCUMENT ID TECN COMMENT

5.1 ±0.4 OUR FIT

[(5.2 ± 0.4) × 10⁻³ OUR 2012 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 ±1.0 126 TANENBAUM 78 MRK1 $\psi(2S) \rightarrow \gamma \chi_{c0}$

¹²⁶ The reported value is derived using B($\psi(2S) \rightarrow \pi^+ \pi^- J/\psi$) × B($J/\psi \rightarrow \ell^+ \ell^-$) = (4.6 ± 0.7)%. Calculated by us using B($J/\psi \rightarrow \ell^+ \ell^-$) = 0.1181 ± 0.0020.

NODE=M056B19

NODE=M056B19

NEW

NODE=M056B19;LINKAGE=TA

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow K^+ K^- K^+ K^-)}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))}{\Gamma_{\text{total}}} \times \frac{\Gamma_{47}/\Gamma \times \Gamma_{118}^{\psi(2S)}/\Gamma_{\psi(2S)}}{\Gamma_{118}^{\psi(2S)}/\Gamma_{\psi(2S)}}$$

VALUE (units 10^{-4}) EVTS DOCUMENT ID TECN COMMENT
2.72±0.27 OUR FIT
 [(2.70 ± 0.27) × 10⁻⁴ OUR 2012 FIT]

3.20±0.11±0.41 278 127 ABLIKIM 06T BES2 $\psi(2S) \rightarrow \gamma 2K^+ 2K^-$
 127 Calculated by us. The value of $B(\chi_{c0} \rightarrow 2K^+ 2K^-)$ reported by ABLIKIM 06T was derived using $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.2 \pm 0.4)\%$.

NODE=M056B14
 NODE=M056B14
 NEW

NODE=M056B14;LINKAGE=AB

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow K^+ K^- K^+ K^-)}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))}{\Gamma_{\text{total}}} \times \frac{\Gamma_{47}/\Gamma \times \Gamma_{118}^{\psi(2S)}/\Gamma_{\psi(2S)}}{\Gamma_{118}^{\psi(2S)}/\Gamma_{\psi(2S)}}$$

VALUE (units 10^{-4}) DOCUMENT ID TECN COMMENT
8.0±0.8 OUR FIT
6.1±0.8±0.9 128 BAI 99B BES $\psi(2S) \rightarrow \gamma 2K^+ 2K^-$

128 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
 NODE=M056B15

NODE=M056B15;LINKAGE=BA

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow \phi\phi)}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))}{\Gamma_{\text{total}}} \times \frac{\Gamma_{49}/\Gamma \times \Gamma_{118}^{\psi(2S)}/\Gamma_{\psi(2S)}}{\Gamma_{118}^{\psi(2S)}/\Gamma_{\psi(2S)}}$$

VALUE (units 10^{-4}) EVTS DOCUMENT ID TECN COMMENT
0.77±0.07 OUR FIT
 [(0.79 ± 0.08) × 10⁻⁴ OUR 2012 FIT]

0.78±0.08 OUR AVERAGE
 0.77±0.03±0.08 612 129 ABLIKIM 11K BES3 $\psi(2S) \rightarrow \gamma$ hadrons
 0.86±0.19±0.12 26 130 ABLIKIM 06T BES2 $\psi(2S) \rightarrow \gamma 2K^+ 2K^-$

129 Calculated by us. The value of $B(\chi_{c0} \rightarrow \phi\phi)$ reported by ABLIKIM 11K was derived using $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.62 \pm 0.31)\%$.

130 Calculated by us. The value of $B(\chi_{c0} \rightarrow \phi\phi)$ reported by ABLIKIM 06T was derived using $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.2 \pm 0.4)\%$.

NODE=M056B16
 NODE=M056B16
 NEW

NODE=M056B16;LINKAGE=AL

NODE=M056B16;LINKAGE=AB

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow \phi\phi)}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))}{\Gamma_{\text{total}}} \times \frac{\Gamma_{49}/\Gamma \times \Gamma_{118}^{\psi(2S)}/\Gamma_{\psi(2S)}}{\Gamma_{118}^{\psi(2S)}/\Gamma_{\psi(2S)}}$$

VALUE (units 10^{-4}) DOCUMENT ID TECN COMMENT
2.27±0.21 OUR FIT
 [(2.35 ± 0.23) × 10⁻⁴ OUR 2012 FIT]

2.6 ±1.0 ±1.1 131 BAI 99B BES $\psi(2S) \rightarrow \gamma 2K^+ 2K^-$

131 Calculated by us. The value of $B(\chi_{c0} \rightarrow \phi\phi)$ reported by BAI 99B was derived using $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.3 \pm 0.8)\%$ and $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = (32.4 \pm 2.6)\%$ [BAI 98D].

NODE=M056B17
 NODE=M056B17
 NEW

NODE=M056B17;LINKAGE=BA

$\chi_{c0}(1P)$ REFERENCES

ABLIKIM	13D	PR D87 012007	M. Ablikim <i>et al.</i>	(BES III Collab.)
ABLIKIM	120	PRL 109 172002	M. Ablikim <i>et al.</i>	(BES III Collab.)
LIU	12B	PRL 108 232001	Z.Q. Liu <i>et al.</i>	(BES III Collab.)
ABLIKIM	11A	PR D83 012006	M. Ablikim <i>et al.</i>	(BES III Collab.)
ABLIKIM	11E	PR D83 112005	M. Ablikim <i>et al.</i>	(BES III Collab.)
ABLIKIM	11F	PR D83 112009	M. Ablikim <i>et al.</i>	(BES III Collab.)
ABLIKIM	11K	PRL 107 092001	M. Ablikim <i>et al.</i>	(BES III Collab.)
DEL-AMO-SA...	11M	PR D84 012004	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)
ABLIKIM	10A	PR D81 052005	M. Ablikim <i>et al.</i>	(BES III Collab.)
ONYISI	10	PR D82 011103	P.U.E. Onyisi <i>et al.</i>	(CLEO Collab.)
UEHARA	10A	PR D82 114031	S. Uehara <i>et al.</i>	(BES III Collab.)
ASNER	09	PR D79 072007	D.M. Asner <i>et al.</i>	(CLEO Collab.)
UEHARA	09	PR D79 052009	S. Uehara <i>et al.</i>	(BES III Collab.)
BENNETT	08A	PRL 101 151801	J.V. Bennett <i>et al.</i>	(CLEO Collab.)
ECKLUND	08A	PR D78 091501	K.M. Ecklund <i>et al.</i>	(CLEO Collab.)
HE	08B	PR D78 092004	Q. He <i>et al.</i>	(CLEO Collab.)
MENDEZ	08	PR D78 011102	H. Mendez <i>et al.</i>	(CLEO Collab.)
NAIK	08	PR D78 031101	P. Naik <i>et al.</i>	(CLEO Collab.)
UEHARA	08	EPJ C53 1	S. Uehara <i>et al.</i>	(BES III Collab.)
WICHT	08	PL B662 323	J. Wicht <i>et al.</i>	(BES III Collab.)
ABE	07	PRL 98 082001	K. Abe <i>et al.</i>	(BES III Collab.)
ADAMS	07	PR D75 071101	G.S. Adams <i>et al.</i>	(CLEO Collab.)
ATHAR	07	PR D75 032002	S.B. Athar <i>et al.</i>	(CLEO Collab.)
CHEN	07B	PL B651 15	W.T. Chen <i>et al.</i>	(BES III Collab.)
ABLIKIM	06D	PR D73 052006	M. Ablikim <i>et al.</i>	(BES III Collab.)
ABLIKIM	06I	PR D74 012004	M. Ablikim <i>et al.</i>	(BES III Collab.)
ABLIKIM	06R	PR D74 072001	M. Ablikim <i>et al.</i>	(BES III Collab.)
ABLIKIM	06T	PL B642 197	M. Ablikim <i>et al.</i>	(BES III Collab.)
ABLIKIM	05G	PR D71 092002	M. Ablikim <i>et al.</i>	(BES III Collab.)
ABLIKIM	05N	PL B630 7	M. Ablikim <i>et al.</i>	(BES III Collab.)
ABLIKIM	05O	PL B630 21	M. Ablikim <i>et al.</i>	(BES III Collab.)

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 REFID=51049
 REFID=51126
 REFID=51447
 REFID=51453
 REFID=50756
 REFID=50847
 REFID=50846

ABLIKIM	05Q	PR D72 092002	M. Ablikim <i>et al.</i>	(BES Collab.)
ADAM	05A	PRL 94 232002	N.E. Adam <i>et al.</i>	(CLEO Collab.)
ANDREOTTI	05A	NP B717 34	M. Andreotti <i>et al.</i>	(FNAL E835 Collab.)
ANDREOTTI	05C	PR D72 112002	M. Andreotti <i>et al.</i>	(FNAL E835 Collab.)
NAKAZAWA	05	PL B615 39	H. Nakazawa <i>et al.</i>	(BELLE Collab.)
ABE	04G	PR D70 071102	K. Abe <i>et al.</i>	(BELLE Collab.)
ABLIKIM	04G	PR D70 092002	M. Ablikim <i>et al.</i>	(BES Collab.)
ABLIKIM	04H	PR D70 092003	M. Ablikim <i>et al.</i>	(BES Collab.)
ANDREOTTI	04	PL B584 16	M. Andreotti <i>et al.</i>	(E835 Collab.)
ATHAR	04	PR D70 112002	S.B. Athar <i>et al.</i>	(CLEO Collab.)
BAI	04F	PR D69 092001	J.Z. Bai <i>et al.</i>	(BES Collab.)
ANDREOTTI	03	PRL 91 091801	M. Andreotti <i>et al.</i>	(FNAL E835 Collab.)
AULCHENKO	03	PL B573 63	V.M. Aulchenko <i>et al.</i>	(KEDR Collab.)
BAI	03C	PR D67 032004	J.Z. Bai <i>et al.</i>	(BES Collab.)
BAI	03E	PR D67 112001	J.Z. Bai <i>et al.</i>	(BES Collab.)
ABE,K	02	PRL 89 142001	K. Abe <i>et al.</i>	(BELLE Collab.)
BAGNASCO	02	PL B533 237	S. Bagnasco <i>et al.</i>	(FNAL E835 Collab.)
EISENSTEIN	01	PRL 87 061801	B.I. Eisenstein <i>et al.</i>	(CLEO Collab.)
AMBROGIANI	00B	PR D62 052002	M. Ambrogiani <i>et al.</i>	(FNAL E835 Collab.)
AMBROGIANI	99B	PRL 83 2902	M. Ambrogiani <i>et al.</i>	(FNAL E835 Collab.)
BAI	99B	PR D60 072001	J.Z. Bai <i>et al.</i>	(BES Collab.)
BAI	98D	PR D58 092006	J.Z. Bai <i>et al.</i>	(BES Collab.)
BAI	98I	PRL 81 3091	J.Z. Bai <i>et al.</i>	(BES Collab.)
GAISER	86	PR D34 711	J. Gaiser <i>et al.</i>	(Crystal Ball Collab.)
LEE	85	SLAC 282	R.A. Lee	(SLAC)
OREGLIA	82	PR D25 2259	M.J. Oreglia <i>et al.</i>	(SLAC, CIT, HARV+)
BRANDELIK	79B	NP B160 426	R. Brandelik <i>et al.</i>	(DASP Collab.)
BARTEL	78B	PL 79B 492	W. Bartel <i>et al.</i>	(DESY, HEIDP)
TANENBAUM	78	PR D17 1731	W.M. Tanenbaum <i>et al.</i>	(SLAC, LBL)
Also		Private Comm.	G. Trilling	(LBL, UCB)
BIDDICK	77	PRL 38 1324	C.J. Biddick <i>et al.</i>	(UCSD, UMD, PAVI+)

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REFID=22012
REFID=40589
REFID=22120
REFID=22115
REFID=22111
REFID=22112
REFID=22113
REFID=22059

NODE=M055

$\chi_{c1}(1P)$

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

See the Review on " $\psi(2S)$ and χ_c branching ratios" before the $\chi_{c0}(1P)$ Listings.

NODE=M055

$\chi_{c1}(1P)$ MASS

NODE=M055M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
3510.66 ± 0.07 OUR AVERAGE		Error includes scale factor of 1.5. See the ideogram below.		
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	¹ 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		² GAISER	86 CBAL	$\psi(2S) \rightarrow \gamma X$
3507.4 ± 1.7	91	³ LEMOIGNE	82 GOLI	$185 \pi^{-} Be \rightarrow \gamma \mu^{+} \mu^{-} A$
3510.4 ± 0.6		OREGLIA	82 CBAL	$e^{+}e^{-} \rightarrow J/\psi 2\gamma$
3510.1 ± 1.1	254	⁴ 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		⁴ BARTEL	78B CNTR	$e^{+}e^{-} \rightarrow J/\psi 2\gamma$
3505.0 ± 4 ± 4		^{4,5} TANENBAUM	78 MRK1	$e^{+}e^{-}$
3513 ± 7	367	⁴ 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

¹ Recalculated by ANDREOTTI 05A, using the value of $\psi(2S)$ mass from AULCHENKO 03.

² Using mass of $\psi(2S) = 3686.0$ MeV.

³ $J/\psi(1S)$ mass constrained to 3097 MeV.

⁴ Mass value shifted by us by amount appropriate for $\psi(2S)$ mass = 3686 MeV and $J/\psi(1S)$ mass = 3097 MeV.

⁵ From a simultaneous fit to radiative and hadronic decay channels.

OCCUR=2

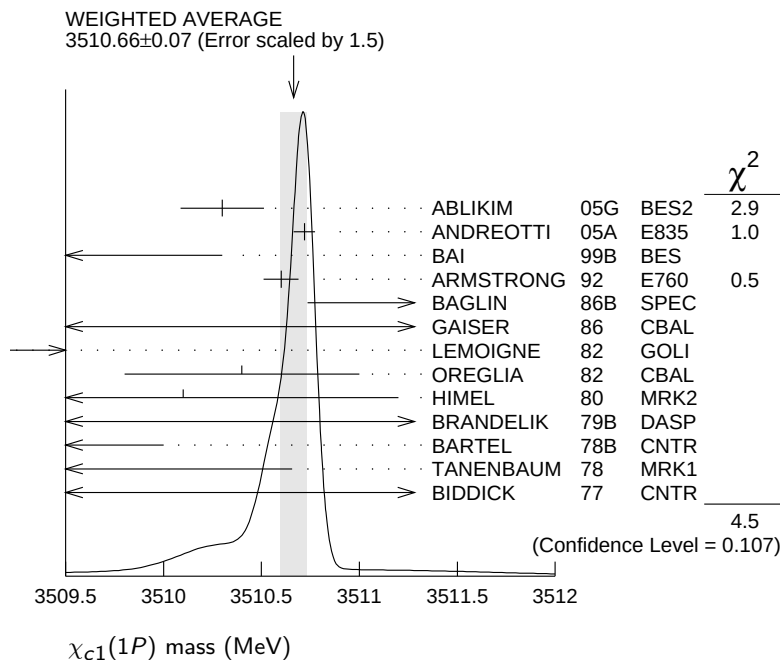
NODE=M055M;LINKAGE=NW

NODE=M055M;LINKAGE=C

NODE=M055M;LINKAGE=P

NODE=M055M;LINKAGE=D

NODE=M055M;LINKAGE=M



$\chi_{c1}(1P)$ WIDTH

VALUE (MeV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
0.86 ±0.05 OUR FIT					
0.88 ±0.05 OUR AVERAGE					
1.39 +0.40 +0.26 -0.38 -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	6	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		$\psi(2S) \rightarrow \gamma X$
⁶ 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
Hadronic decays		
Γ_1 $3(\pi^+\pi^-)$	$(5.8 \pm 1.4) \times 10^{-3}$	S=1.2
Γ_2 $2(\pi^+\pi^-)$	$(7.6 \pm 2.6) \times 10^{-3}$	
Γ_3 $\pi^+\pi^-\pi^0\pi^0$	$(1.25 \pm 0.17) \%$	
Γ_4 $\rho^+\pi^-\pi^0 + \text{c.c.}$	$(1.53 \pm 0.26) \%$	
Γ_5 $\rho^0\pi^+\pi^-$	$(3.9 \pm 3.5) \times 10^{-3}$	
Γ_6 $4\pi^0$	$(5.7 \pm 0.8) \times 10^{-4}$	
Γ_7 $\pi^+\pi^-K^+K^-$	$(4.5 \pm 1.0) \times 10^{-3}$	
Γ_8 $K^+K^-\pi^0\pi^0$	$(1.17 \pm 0.29) \times 10^{-3}$	
Γ_9 $K^+\pi^-K^0\pi^0 + \text{c.c.}$	$(9.0 \pm 1.4) \times 10^{-3}$	
Γ_{10} $\rho^+K^-K^0 + \text{c.c.}$	$(5.3 \pm 1.3) \times 10^{-3}$	
Γ_{11} $K^*(892)^0K^0\pi^0 \rightarrow$ $K^+\pi^-K^0\pi^0 + \text{c.c.}$	$(2.4 \pm 0.7) \times 10^{-3}$	
Γ_{12} $K^+K^-\eta\pi^0$	$(1.2 \pm 0.4) \times 10^{-3}$	
Γ_{13} $\pi^+\pi^-K_S^0K_S^0$	$(7.2 \pm 3.1) \times 10^{-4}$	
Γ_{14} $K^+K^-\eta$	$(3.3 \pm 1.0) \times 10^{-4}$	
Γ_{15} $K^0K^+\pi^- + \text{c.c.}$	$(7.3 \pm 0.6) \times 10^{-3}$	
Γ_{16} $K^*(892)^0\bar{K}^0 + \text{c.c.}$	$(1.0 \pm 0.4) \times 10^{-3}$	
Γ_{17} $K^*(892)^+K^- + \text{c.c.}$	$(1.5 \pm 0.7) \times 10^{-3}$	
Γ_{18} $K_J^*(1430)^0\bar{K}^0 + \text{c.c.} \rightarrow$ $K_S^0K^+\pi^- + \text{c.c.}$	$< 8 \times 10^{-4}$	CL=90%

NODE=M055215;NODE=M055

NODE=M055;CLUMP=A

DESIG=6

DESIG=5

DESIG=51

DESIG=52

DESIG=9

DESIG=60

DESIG=7

DESIG=53

DESIG=55

DESIG=56

DESIG=57

DESIG=58

DESIG=28

DESIG=42

DESIG=17

DESIG=32

DESIG=33

DESIG=34

Γ ₁₉	$K_J^*(1430)^+ K^- + \text{c.c.} \rightarrow K_S^0 K^+ \pi^- + \text{c.c.}$	$< 2.3 \times 10^{-3}$	CL=90%	DESIG=35
Γ ₂₀	$K^+ K^- \pi^0$	$(1.91 \pm 0.26) \times 10^{-3}$		DESIG=38
Γ ₂₁	$\eta \pi^+ \pi^-$	$(5.0 \pm 0.5) \times 10^{-3}$		DESIG=31
Γ ₂₂	$a_0(980)^+ \pi^- + \text{c.c.} \rightarrow \eta \pi^+ \pi^-$	$(1.9 \pm 0.7) \times 10^{-3}$		DESIG=36
Γ ₂₃	$f_2(1270) \eta$	$(2.8 \pm 0.8) \times 10^{-3}$		DESIG=37
Γ ₂₄	$\pi^+ \pi^- \eta'$	$(2.3 \pm 0.5) \times 10^{-3}$		DESIG=44
Γ ₂₅	$\pi^0 f_0(980) \rightarrow \pi^0 \pi^+ \pi^-$	$< 6 \times 10^{-6}$	CL=90%	DESIG=61
Γ ₂₆	$K^+ K^*(892)^0 \pi^- + \text{c.c.}$	$(3.2 \pm 2.1) \times 10^{-3}$		DESIG=10
Γ ₂₇	$K^*(892)^0 \bar{K}^*(892)^0$	$(1.5 \pm 0.4) \times 10^{-3}$		DESIG=21
Γ ₂₈	$K^+ K^- K_S^0 K_S^0$	$< 5 \times 10^{-4}$	CL=90%	DESIG=29
Γ ₂₉	$K^+ K^- K^+ K^-$	$(5.6 \pm 1.2) \times 10^{-4}$		DESIG=14
Γ ₃₀	$K^+ K^- \phi$	$(4.3 \pm 1.6) \times 10^{-4}$		DESIG=30
Γ ₃₁	$\omega \omega$	$(6.0 \pm 0.7) \times 10^{-4}$		DESIG=66
Γ ₃₂	$\omega \phi$	$(2.2 \pm 0.6) \times 10^{-5}$		DESIG=67
Γ ₃₃	$\phi \phi$	$(4.4 \pm 0.6) \times 10^{-4}$		DESIG=68
Γ ₃₄	$p \bar{p}$	$(7.3 \pm 0.4) \times 10^{-5}$		DESIG=11
Γ ₃₅	$p \bar{p} \pi^0$	$(1.63 \pm 0.20) \times 10^{-4}$		DESIG=39
Γ ₃₆	$p \bar{p} \eta$	$(1.53 \pm 0.26) \times 10^{-4}$		DESIG=43
Γ ₃₇	$p \bar{p} \omega$	$(2.23 \pm 0.33) \times 10^{-4}$		DESIG=59
Γ ₃₈	$p \bar{p} \phi$	$< 1.8 \times 10^{-5}$	CL=90%	DESIG=65
Γ ₃₉	$p \bar{p} \pi^+ \pi^-$	$(5.0 \pm 1.9) \times 10^{-4}$		DESIG=8
Γ ₄₀	$p \bar{p} \pi^0 \pi^0$			DESIG=54
Γ ₄₁	$p \bar{p} K^+ K^- (\text{non-resonant})$	$(1.34 \pm 0.24) \times 10^{-4}$		DESIG=62
Γ ₄₂	$p \bar{p} K_S^0 K_S^0$	$< 4.5 \times 10^{-4}$	CL=90%	DESIG=25
Γ ₄₃	$\Lambda \bar{\Lambda}$	$(1.18 \pm 0.19) \times 10^{-4}$		DESIG=19
Γ ₄₄	$\Lambda \bar{\Lambda} \pi^+ \pi^-$	$< 1.5 \times 10^{-3}$	CL=90%	DESIG=24
Γ ₄₅	$K^+ \bar{p} \Lambda$	$(4.3 \pm 0.4) \times 10^{-4}$	S=1.1	DESIG=40
Γ ₄₆	$K^+ p \Lambda(1520) + \text{c.c.}$	$(1.8 \pm 0.5) \times 10^{-4}$		DESIG=63
Γ ₄₇	$\Lambda(1520) \bar{\Lambda}(1520)$	$< 1.0 \times 10^{-4}$	CL=90%	DESIG=64
Γ ₄₈	$\Sigma^0 \bar{\Sigma}^0$	$< 4 \times 10^{-5}$	CL=90%	DESIG=48
Γ ₄₉	$\Sigma^+ \bar{\Sigma}^-$	$< 6 \times 10^{-5}$	CL=90%	DESIG=49
Γ ₅₀	$\Xi^0 \bar{\Xi}^0$	$< 6 \times 10^{-5}$	CL=90%	DESIG=50
Γ ₅₁	$\Xi^- \bar{\Xi}^+$	$(8.4 \pm 2.3) \times 10^{-5}$		DESIG=26
Γ ₅₂	$\pi^+ \pi^- + K^+ K^-$	$< 2.1 \times 10^{-3}$		DESIG=23
Γ ₅₃	$K_S^0 K_S^0$	$< 6 \times 10^{-5}$	CL=90%	DESIG=27

Radiative decays

Γ ₅₄	$\gamma J/\psi(1S)$	$(34.8 \pm 1.5) \%$		DESIG=1
Γ ₅₅	$\gamma \rho^0$	$(2.27 \pm 0.19) \times 10^{-4}$		DESIG=45
Γ ₅₆	$\gamma \omega$	$(7.1 \pm 0.9) \times 10^{-5}$		DESIG=46
Γ ₅₇	$\gamma \phi$	$(2.6 \pm 0.6) \times 10^{-5}$		DESIG=47
Γ ₅₈	$\gamma \gamma$			DESIG=4

NODE=M055;CLUMP=B

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 227 measurements to determine 49 parameters. The overall fit has a $\chi^2 = 325.4$ for 178 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_{29}	8				
x_{34}	-9	-4			
x_{43}	11	5	-5		
x_{54}	38	16	-31	21	
Γ	-13	-5	-60	-7	-29
	x_{15}	x_{29}	x_{34}	x_{43}	x_{54}

$\chi_{c1}(1P)$ PARTIAL WIDTHS $\chi_{c1}(1P) \Gamma(i) \Gamma(\gamma J/\psi(1S)) / \Gamma(\text{total})$ $\Gamma(p\bar{p}) \times \Gamma(\gamma J/\psi(1S)) / \Gamma_{\text{total}}$ $\Gamma_{34} \Gamma_{54} / \Gamma$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT

21.7±0.8 OUR FIT**21.4±0.9 OUR AVERAGE**

21.5±0.5±0.8

⁷ ANDREOTTI 05A E835 $p\bar{p} \rightarrow e^+ e^- \gamma$

21.4±1.5±2.2

^{7,8} ARMSTRONG 92 E760 $\bar{p}p \rightarrow e^+ e^- \gamma$ 19.9^{+4.4}_{-4.0}⁷ BAGLIN 86B SPEC $\bar{p}p \rightarrow e^+ e^- X$ ⁷ Calculated by us using $B(J/\psi(1S) \rightarrow e^+ e^-) = 0.0593 \pm 0.0010$.⁸ 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

 $\Gamma(3(\pi^+ \pi^-)) / \Gamma_{\text{total}}$ Γ_1 / Γ

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

⁹ BAI 99B BES $\psi(2S) \rightarrow \gamma \chi_{c1}$

16.0±5.9±0.8

⁹ TANENBAUM 78 MRK1 $\psi(2S) \rightarrow \gamma \chi_{c1}$ ⁹ 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

 $\Gamma(2(\pi^+ \pi^-)) / \Gamma_{\text{total}}$ Γ_2 / Γ

VALUE (units 10 ⁻³)	DOCUMENT ID	TECN	COMMENT

7.6±2.6 OUR EVALUATION Treating systematic error as correlated.**8 ±4 OUR AVERAGE** Error includes scale factor of 1.5.

4.6±2.1±2.6

¹⁰ BAI 99B BES $\psi(2S) \rightarrow \gamma \chi_{c1}$

12.5±4.2±0.6

¹⁰ TANENBAUM 78 MRK1 $\psi(2S) \rightarrow \gamma \chi_{c1}$ ¹⁰ 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

 $\Gamma(\pi^+ \pi^- \pi^0 \pi^0) / \Gamma_{\text{total}}$ Γ_3 / Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT

1.25±0.17 OUR AVERAGE [(1.26 ± 0.17)% OUR 2012 AVERAGE]**1.25±0.16±0.05** 604.7 ¹¹ HE 08B CLEO $e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$ ¹¹ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.3 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.NODE=M055R35
NODE=M055R35

NEW

NODE=M055R35;LINKAGE=HE

 $\Gamma(\rho^+ \pi^- \pi^0 + \text{c.c.}) / \Gamma_{\text{total}}$ Γ_4 / Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT

1.53±0.25±0.06 712.3 ^{12,13} HE 08B CLEO $e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$ ¹² 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 $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.3 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.¹³ 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

 $\Gamma(\rho^0 \pi^+ \pi^-) / \Gamma_{\text{total}}$ Γ_5 / Γ

VALUE (units 10 ⁻⁴)	DOCUMENT ID	TECN	COMMENT

39±35¹⁴ TANENBAUM 78 MRK1 $\psi(2S) \rightarrow \gamma \chi_{c1}$ ¹⁴ 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^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
0.57±0.08±0.02	608	¹⁵ ABLIKIM	11A BES3	$e^+e^- \rightarrow \psi(2S) \rightarrow \gamma\chi_{c1}$
¹⁵ 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 $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.3 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=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	¹⁶ BAI	99B BES	$\psi(2S) \rightarrow \gamma\chi_{c1}$
7.3±3.0±0.4	¹⁶ TANENBAUM	78 MRK1	$\psi(2S) \rightarrow \gamma\chi_{c1}$
¹⁶ 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 (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.117±0.029 OUR AVERAGE	[(0.118 ± 0.029)% OUR 2012 AVERAGE]			
0.117±0.028±0.005	45.1	¹⁷ HE	08B CLEO	$e^+e^- \rightarrow \gamma h^+ h^- h^0 h^0$
¹⁷ HE 08B reports $0.12 \pm 0.02 \pm 0.02 \pm 0.01\%$ 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 $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.3 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M055R37
 NODE=M055R37

NEW

NODE=M055R37;LINKAGE=HE

 $\Gamma(K^+\pi^-K^0\pi^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.90±0.14 OUR AVERAGE	[(0.90 ± 0.15)% OUR 2012 AVERAGE]			
0.90±0.14±0.03	141.3	¹⁸ HE	08B CLEO	$e^+e^- \rightarrow \gamma h^+ h^- h^0 h^0$
¹⁸ HE 08B reports $0.92 \pm 0.09 \pm 0.11 \pm 0.06\%$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K^+\pi^-K^0\pi^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ 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 $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.3 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M055R39
 NODE=M055R39

NEW

NODE=M055R39;LINKAGE=HE

 $\Gamma(\rho^+K^-K^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{10}/Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.53±0.13±0.02	141.3	¹⁹ HE	08B CLEO	$e^+e^- \rightarrow \gamma h^+ h^- h^0 h^0$
¹⁹ HE 08B reports $0.54 \pm 0.11 \pm 0.07 \pm 0.03\%$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \rho^+K^-K^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ 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 $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.3 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M055R40
 NODE=M055R40

NODE=M055R40;LINKAGE=HE

 $\Gamma(K^*(892)^0K^0\pi^0 \rightarrow K^+\pi^-K^0\pi^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{11}/Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.24±0.07 OUR AVERAGE	[(0.25 ± 0.07)% OUR 2012 AVERAGE]			
0.24±0.07±0.01	141.3	²⁰ HE	08B CLEO	$e^+e^- \rightarrow \gamma h^+ h^- h^0 h^0$
²⁰ HE 08B reports $0.25 \pm 0.06 \pm 0.03 \pm 0.02\%$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K^*(892)^0K^0\pi^0 \rightarrow K^+\pi^-K^0\pi^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ 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 $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.3 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M055R41
 NODE=M055R41

NEW

NODE=M055R41;LINKAGE=HE

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

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.117±0.036±0.005	141.3	²¹ HE	08B CLEO	$e^+e^- \rightarrow \gamma h^+ h^- h^0 h^0$
²¹ 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 $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.3 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M055R42
 NODE=M055R42

NODE=M055R42;LINKAGE=HE

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

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
7.2±3.0±0.3	19.8±7.7	22 ABLIKIM	050 BES2	$\psi(2S) \rightarrow \chi_{c1}\gamma$
22 ABLIKIM 050 reports $[\Gamma(\chi_{c1}(1P) \rightarrow \pi^+\pi^-K_S^0K_S^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ = $(0.67 \pm 0.26 \pm 0.11) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.3 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M055R05
 NODE=M055R05

NODE=M055R05;LINKAGE=AB

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

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
0.33±0.10±0.01	23 ATHAR	07 CLEO	$\psi(2S) \rightarrow \gamma h^+ h^- h^0$
23 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 $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.3 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.			

NODE=M055R25
 NODE=M055R25

NODE=M055R25;LINKAGE=AT

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

VALUE (units 10^{-3})	DOCUMENT ID
7.3±0.6 OUR FIT	

NODE=M055R17
 NODE=M055R17

 $\Gamma(K^*(892)^0\bar{K}^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{16}/Γ

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
1.03±0.38±0.04	22	24 ABLIKIM	06R BES2	$\psi(2S) \rightarrow \gamma\chi_{c1}$
24 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 $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.3 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M055R09
 NODE=M055R09

NODE=M055R09;LINKAGE=AB

 $\Gamma(K^*(892)^+K^-\pi^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{17}/Γ

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
1.5±0.7±0.1	27	25 ABLIKIM	06R BES2	$\psi(2S) \rightarrow \gamma\chi_{c1}$
25 ABLIKIM 06R reports $(1.6 \pm 0.7 \pm 0.2) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K^*(892)^+K^-\pi^- + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (8.7 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.3 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M055R10
 NODE=M055R10

NODE=M055R10;LINKAGE=AB

 $\Gamma(K_J^*(1430)^0\bar{K}^0 + \text{c.c.} \rightarrow K_S^0K^+\pi^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{18}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<0.8	90	26 ABLIKIM	06R BES2	$\psi(2S) \rightarrow \gamma\chi_{c1}$
26 ABLIKIM 06R reports $< 0.9 \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K_J^*(1430)^0\bar{K}^0 + \text{c.c.} \rightarrow K_S^0K^+\pi^- + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (8.7 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = 9.3 \times 10^{-2}$.				

NODE=M055R12
 NODE=M055R12

NODE=M055R12;LINKAGE=AB

 $\Gamma(K_J^*(1430)^+K^-\pi^- + \text{c.c.} \rightarrow K_S^0K^+\pi^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{19}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<2.3	90	27 ABLIKIM	06R BES2	$\psi(2S) \rightarrow \gamma\chi_{c1}$
27 ABLIKIM 06R reports $< 2.4 \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K_J^*(1430)^+K^-\pi^- + \text{c.c.} \rightarrow K_S^0K^+\pi^- + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (8.7 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = 9.3 \times 10^{-2}$.				

NODE=M055R13
 NODE=M055R13

NODE=M055R13;LINKAGE=AB

 $\Gamma(K^+K^-\pi^0)/\Gamma_{\text{total}}$ Γ_{20}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
1.91±0.25±0.07	28 ATHAR	07 CLEO	$\psi(2S) \rightarrow \gamma h^+ h^- h^0$
28 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 $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.3 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.			

NODE=M055R20
 NODE=M055R20

NODE=M055R20;LINKAGE=AT

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

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

5.0±0.5 OUR AVERAGE

4.9±0.5±0.2		29 ATHAR	07 CLEO	$\psi(2S) \rightarrow \gamma h^+ h^- h^0$
5.5±1.0±0.2	222	30 ABLIKIM	06R BES2	$\psi(2S) \rightarrow \gamma \chi_{c1}$

29 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 $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.3 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

30 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 $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.3 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R08
NODE=M055R08

NODE=M055R08;LINKAGE=AT

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

1.9±0.7±0.1	58	31 ABLIKIM	06R BES2	$\psi(2S) \rightarrow \gamma \chi_{c1}$

31 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 $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.3 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R15
NODE=M055R15

NODE=M055R15;LINKAGE=AB

 $\Gamma(f_2(1270)\eta)/\Gamma_{\text{total}}$

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

2.8±0.8±0.1	53	32 ABLIKIM	06R BES2	$\psi(2S) \rightarrow \gamma \chi_{c1}$

32 ABLIKIM 06R reports $(3.0 \pm 0.7 \pm 0.5) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow f_2(1270)\eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (8.7 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.3 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R16
NODE=M055R16

NODE=M055R16;LINKAGE=AB

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

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

2.3±0.5 OUR AVERAGE	[(2.4 ± 0.5) × 10 ⁻³ OUR 2012 AVERAGE]		

2.3±0.5±0.1	33 ATHAR	07 CLEO	$\psi(2S) \rightarrow \gamma h^+ h^- h^0$

33 ATHAR 07 reports $(2.4 \pm 0.4 \pm 0.3) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \pi^+\pi^-\eta')/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = 0.0907 \pm 0.0011 \pm 0.0054$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.3 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R28
NODE=M055R28

NEW

NODE=M055R28;LINKAGE=AT

 $\Gamma(\pi^0 f_0(980) \rightarrow \pi^0 \pi^+ \pi^-)/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<6 × 10⁻⁶	90	34 ABLIKIM	11D BES3	$\psi(2S) \rightarrow \gamma \pi^0 \pi^+ \pi^-$

34 ABLIKIM 11D reports $[\Gamma(\chi_{c1}(1P) \rightarrow \pi^0 f_0(980) \rightarrow \pi^0 \pi^+ \pi^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ < 6.0×10^{-7} which we divide by our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = 9.3 \times 10^{-2}$.

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	35 TANENBAUM	78 MRK1	$\psi(2S) \rightarrow \gamma \chi_{c1}$

35 Estimated using $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = 0.087$. The errors do not contain the uncertainty in the $\psi(2S)$ decay.

NODE=M055R9
NODE=M055R9

NODE=M055R9;LINKAGE=T

 $\Gamma(K^*(892)^0 \bar{K}^*(892)^0)/\Gamma_{\text{total}}$

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

1.5±0.4±0.1	28.4 ± 5.5	36,37 ABLIKIM	04H BES	$\psi(2S) \rightarrow \gamma K^+ K^- \pi^+ \pi^-$

36 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 $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.3 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

37 Assumes $B(K^*(892)^0 \rightarrow K^- \pi^+) = 2/3$.

NODE=M055R26
NODE=M055R26

NODE=M055R26;LINKAGE=AB

NODE=M055R26;LINKAGE=AL

$\Gamma(K^+ K^- K_S^0 K_S^0)/\Gamma_{\text{total}}$ Γ_{28}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<5	90	3.2 ± 2.4	³⁸ ABLIKIM	050 BES2	$\psi(2S) \rightarrow \chi_{c1} \gamma$
³⁸ ABLIKIM 050 reports $[\Gamma(\chi_{c1}(1P) \rightarrow K^+ K^- K_S^0 K_S^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))] < 4.2 \times 10^{-5}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 9.3 \times 10^{-2}$.					

NODE=M055R06
NODE=M055R06

NODE=M055R06;LINKAGE=AB

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

VALUE (units 10^{-3})	DOCUMENT ID
0.56±0.12 OUR FIT	

NODE=M055R14
NODE=M055R14

$\Gamma(K^+ K^- \phi)/\Gamma_{\text{total}}$ Γ_{30}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
0.43±0.16±0.02	17	³⁹ ABLIKIM	06T BES2	$\psi(2S) \rightarrow \gamma 2K^+ 2K^-$
³⁹ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.3 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M055R07
NODE=M055R07

NODE=M055R07;LINKAGE=AB

$\Gamma(\omega\omega)/\Gamma_{\text{total}}$ Γ_{31}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
6.0±0.7±0.2	597	⁴⁰ ABLIKIM	11K BES3	$\psi(2S) \rightarrow \gamma \text{ hadrons}$
⁴⁰ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.3 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M055R49
NODE=M055R49

NODE=M055R49;LINKAGE=AL

$\Gamma(\omega\phi)/\Gamma_{\text{total}}$ Γ_{32}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
0.22±0.06±0.01	15	⁴¹ ABLIKIM	11K BES3	$\psi(2S) \rightarrow \gamma \text{ hadrons}$
⁴¹ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.3 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M055R50
NODE=M055R50

NODE=M055R50;LINKAGE=AL

$\Gamma(\phi\phi)/\Gamma_{\text{total}}$ Γ_{33}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
4.4±0.5±0.2	366	⁴² ABLIKIM	11K BES3	$\psi(2S) \rightarrow \gamma \text{ hadrons}$
⁴² 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 $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.3 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M055R51
NODE=M055R51

NODE=M055R51;LINKAGE=AL

$\Gamma(p\bar{p})/\Gamma_{\text{total}}$ Γ_{34}/Γ

VALUE (units 10^{-4})	DOCUMENT ID
0.73±0.04 OUR FIT	

NODE=M055R11
NODE=M055R11

$\Gamma(p\bar{p}\pi^0)/\Gamma_{\text{total}}$ Γ_{35}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
0.163±0.020 OUR AVERAGE			
[(0.164 ± 0.020) × 10 ⁻³ OUR 2012 AVERAGE]			
0.171±0.020±0.007	⁴³ ONYISI	10 CLE3	$\psi(2S) \rightarrow \gamma p\bar{p}X$
0.117±0.049±0.005	⁴⁴ ATHAR	07 CLEO	$\psi(2S) \rightarrow \gamma h^+ h^- h^0$
⁴³ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.3 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.			
⁴⁴ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) =$			

NODE=M055R21
NODE=M055R21
NEW

NODE=M055R21;LINKAGE=ON

NODE=M055R21;LINKAGE=AT

$(9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.3 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

 $\Gamma(p\bar{p}\eta)/\Gamma_{\text{total}}$ **Γ_{36}/Γ**

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

$0.153 \pm 0.026 \pm 0.006$		45 ONYISI	10 CLE3	$\psi(2S) \rightarrow \gamma p \bar{p} X$

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

< 0.16	90	46 ATHAR	07 CLEO	$\psi(2S) \rightarrow \gamma h^+ h^- h^0$

45 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 $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.3 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

46 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 $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 9.3 \times 10^{-2}$.

NODE=M055R27
NODE=M055R27

NODE=M055R27;LINKAGE=ON

NODE=M055R27;LINKAGE=AT

 $\Gamma(p\bar{p}\omega)/\Gamma_{\text{total}}$ **Γ_{37}/Γ**

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

0.223 ± 0.033 OUR AVERAGE	$[(0.224 \pm 0.033) \times 10^{-3}]$	OUR 2012 AVERAGE]	

$0.223 \pm 0.032 \pm 0.009$	47 ONYISI	10 CLE3	$\psi(2S) \rightarrow \gamma p \bar{p} X$

47 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 $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.3 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R43
NODE=M055R43

NEW

NODE=M055R43;LINKAGE=ON

 $\Gamma(p\bar{p}\phi)/\Gamma_{\text{total}}$ **Γ_{38}/Γ**

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

< 1.8	90	48 ABLIKIM	11F BES3	$\psi(2S) \rightarrow \gamma p \bar{p} K^+ K^-$

48 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 $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 9.3 \times 10^{-2}$.

NODE=M055R48
NODE=M055R48

NODE=M055R48;LINKAGE=AB

 $\Gamma(p\bar{p}\pi^+\pi^-)/\Gamma_{\text{total}}$ **Γ_{39}/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			

$0.46 \pm 0.12 \pm 0.15$	49 BAI	99B BES	$\psi(2S) \rightarrow \gamma \chi_{c1}$

$1.08 \pm 0.77 \pm 0.05$	49 TANENBAUM	78 MRK1	$\psi(2S) \rightarrow \gamma \chi_{c1}$

49 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
NODE=M055R7

→ UNCHECKED ←

NODE=M055R7;LINKAGE=X2

 $\Gamma(p\bar{p}\pi^0\pi^0)/\Gamma_{\text{total}}$ **Γ_{40}/Γ**

VALUE (%)	CL%	DOCUMENT ID	TECN	COMMENT

< 0.05	90	50 HE	08B CLEO	$e^+e^- \rightarrow \gamma h^+ h^- h^0 h^0$

50 HE 08B reports $< 0.05\%$ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 9.3 \times 10^{-2}$.

NODE=M055R38
NODE=M055R38

NODE=M055R38;LINKAGE=HE

 $\Gamma(p\bar{p}K^+K^- \text{ (non-resonant)})/\Gamma_{\text{total}}$ **Γ_{41}/Γ**

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

$1.34 \pm 0.23 \pm 0.05$	82 ± 9	51 ABLIKIM	11F BES3	$\psi(2S) \rightarrow \gamma p \bar{p} K^+ K^-$

51 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 $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.3 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R45
NODE=M055R45

NODE=M055R45;LINKAGE=AB

 $\Gamma(p\bar{p}K_S^0 K_S^0)/\Gamma_{\text{total}}$ **Γ_{42}/Γ**

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

< 4.5	90	52 ABLIKIM	06D BES2	$\psi(2S) \rightarrow \gamma \chi_{c1}$

52 Using $B(\psi(2S) \rightarrow \chi_{c1}\gamma) = (9.1 \pm 0.6)\%$.

NODE=M055R02
NODE=M055R02

NODE=M055R;LINKAGE=AB

$\Gamma(\Lambda\bar{\Lambda})/\Gamma_{\text{total}}$ VALUE (units 10^{-4})

DOCUMENT ID

1.18±0.19 OUR FIT Γ_{43}/Γ NODE=M055R23
NODE=M055R23 $\Gamma(\Lambda\bar{\Lambda}\pi^+\pi^-)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

CL%

DOCUMENT ID

TECN

COMMENT

<1.5

90

53

ABLIKIM

06D

BES2

 $\psi(2S) \rightarrow \gamma\chi_{c1}$ ⁵³ Using $B(\psi(2S) \rightarrow \chi_{c1}\gamma) = (9.1 \pm 0.6)\%$. Γ_{44}/Γ NODE=M055R01
NODE=M055R01

NODE=M055R01;LINKAGE=AB

 $\Gamma(K^+\bar{p}\Lambda)/\Gamma_{\text{total}}$ VALUE (units 10^{-4})

EVTS

DOCUMENT ID

TECN

COMMENT

4.3±0.4 OUR AVERAGEError includes scale factor of 1.1. $[(0.32 \pm 0.10) \times 10^{-3} \text{ OUR 2012 AVERAGE}]$

4.5±0.4±0.2

3k

54,55

ABLIKIM

13D

BES3

 $\psi(2S) \rightarrow \gamma\Lambda\bar{p}K^+$

3.2±0.9±0.1

56

ATHAR

07

CLEO

 $\psi(2S) \rightarrow \gamma h^+ h^- h^0$ ⁵⁴ ABLIKIM 13D reports $(4.5 \pm 0.2 \pm 0.4) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K^+\bar{p}\Lambda)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.3 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.⁵⁵ Using $B(\Lambda \rightarrow p\pi^-) = 63.9\%$.⁵⁶ ATHAR 07 reports $(3.3 \pm 0.9 \pm 0.4) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K^+\bar{p}\Lambda)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ 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 $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.3 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value. Γ_{45}/Γ NODE=M055R22
NODE=M055R22

NEW

NODE=M055R22;LINKAGE=AB

NODE=M055R22;LINKAGE=LB
NODE=M055R22;LINKAGE=AT $\Gamma(K^+p\Lambda(1520)+c.c.)/\Gamma_{\text{total}}$ VALUE (units 10^{-4})

EVTS

DOCUMENT ID

TECN

COMMENT

1.8±0.5±0.1

48 ± 10

57

ABLIKIM

11F

BES3

 $\psi(2S) \rightarrow \gamma p\bar{p}K^+K^-$ ⁵⁷ ABLIKIM 11F reports $(1.81 \pm 0.38 \pm 0.28) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K^+p\Lambda(1520)+c.c.)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.3 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value. Γ_{46}/Γ NODE=M055R46
NODE=M055R46

NODE=M055R46;LINKAGE=AB

 $\Gamma(\Lambda(1520)\bar{\Lambda}(1520))/\Gamma_{\text{total}}$ VALUE (units 10^{-4})

CL%

DOCUMENT ID

TECN

COMMENT

<1.0

90

58

ABLIKIM

11F

BES3

 $\psi(2S) \rightarrow \gamma p\bar{p}K^+K^-$ ⁵⁸ 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 $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = 9.3 \times 10^{-2}$. Γ_{47}/Γ NODE=M055R47
NODE=M055R47

NODE=M055R47;LINKAGE=AB

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

CL%

EVTS

DOCUMENT ID

TECN

COMMENT

<0.4

90

3.8 ± 2.5

59

NAIK

08

CLEO

 $\psi(2S) \rightarrow \gamma\Sigma^0\bar{\Sigma}^0$ ⁵⁹ 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 $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = 9.3 \times 10^{-2}$. Γ_{48}/Γ NODE=M055R32
NODE=M055R32

NODE=M055R32;LINKAGE=NA

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

CL%

EVTS

DOCUMENT ID

TECN

COMMENT

<0.6

90

4.3 ± 2.3

60

NAIK

08

CLEO

 $\psi(2S) \rightarrow \gamma\Sigma^+\bar{\Sigma}^-$ ⁶⁰ 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 $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = 9.3 \times 10^{-2}$. Γ_{49}/Γ NODE=M055R33
NODE=M055R33

NODE=M055R33;LINKAGE=NA

$\Gamma(\Xi^0 \Xi^0)/\Gamma_{\text{total}}$
 Γ_{50}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<0.6	90	1.7 $\pm$ 2.4	⁶¹ NAIK	08 CLEO	$\psi(2S) \rightarrow \gamma \Xi^0 \Xi^0$
⁶¹ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 9.3 \times 10^{-2}$.					

NODE=M055R34
NODE=M055R34

NODE=M055R34;LINKAGE=NA

 $\Gamma(\Xi^- \Xi^+)/\Gamma_{\text{total}}$
 Γ_{51}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
0.84 $\pm$ 0.22 $\pm$ 0.03	16.4 $\pm$ 4.3		⁶² NAIK	08 CLEO	$\psi(2S) \rightarrow \gamma \Xi^- \Xi^+$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 3.4	90		⁶³ ABLIKIM	06D BES2	$\psi(2S) \rightarrow \gamma \chi_{c1}$
⁶² 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 $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.3 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.					
⁶³ Using $B(\psi(2S) \rightarrow \chi_{c1} \gamma) (9.1 \pm 0.6)\%$.					

NODE=M055R03
NODE=M055R03

NODE=M055R03;LINKAGE=NA

NODE=M055R03;LINKAGE=AB

 $[\Gamma(\pi^+ \pi^-) + \Gamma(K^+ K^-)]/\Gamma_{\text{total}}$
 Γ_{52}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<21		⁶⁴ FELDMAN	77 MRK1	$\psi(2S) \rightarrow \gamma \chi_{c1}$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<38	90	⁶⁴ BRANDELIK	79B DASP	$\psi(2S) \rightarrow \gamma \chi_{c1}$
⁶⁴ Estimated using $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 0.087$. The errors do not contain the uncertainty in the $\psi(2S)$ decay.				

NODE=M055R2
NODE=M055R2

NODE=M055R2;LINKAGE=T

 $\Gamma(K_S^0 K_S^0)/\Gamma_{\text{total}}$
 Γ_{53}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<0.6	90	⁶⁵ ABLIKIM	050 BES2	$\psi(2S) \rightarrow \chi_{c1} \gamma$
⁶⁵ ABLIKIM 050 reports $[\Gamma(\chi_{c1}(1P) \rightarrow K_S^0 K_S^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ $< 0.6 \times 10^{-5}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 9.3 \times 10^{-2}$.				

NODE=M055R04
NODE=M055R04

NODE=M055R04;LINKAGE=AB

————— RADIATIVE DECAYS —————

 $\Gamma(\gamma J/\psi(1S))/\Gamma_{\text{total}}$
 Γ_{54}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
0.348 $\pm$ 0.015 OUR FIT			
[0.344 $\pm$ 0.015 OUR 2012 FIT]			
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.379 $\pm$ 0.008 $\pm$ 0.021	⁶⁶ ADAM	05A CLEO	$e^+ e^- \rightarrow \psi(2S) \rightarrow \gamma \chi_{c1}$
⁶⁶ 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=M055310

NODE=M055R1
NODE=M055R1
NEW

NODE=M055R1;LINKAGE=AD

 $\Gamma(\gamma \rho^0)/\Gamma_{\text{total}}$
 Γ_{55}/Γ

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
227 $\pm$ 19 OUR AVERAGE				
[(228 $\pm$ 19) $\times 10^{-6}$ OUR 2012 AVERAGE]				
226 $\pm$ 23 $\pm$ 9	432 $\pm$ 25	⁶⁷ ABLIKIM	11E BES3	$\psi(2S) \rightarrow \gamma \gamma \rho^0$
228 $\pm$ 25 $\pm$ 9	186 $\pm$ 15	⁶⁸ BENNETT	08A CLEO	$\psi(2S) \rightarrow \gamma \gamma \rho^0$
⁶⁷ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.3 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				
⁶⁸ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.3 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M055R29
NODE=M055R29

NEW

NODE=M055R29;LINKAGE=AB

NODE=M055R29;LINKAGE=BE

$\Gamma(\gamma\omega)/\Gamma_{\text{total}}$ Γ_{56}/Γ

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

71± 9 OUR AVERAGE

69± 9±3 136 ± 14 69 ABLIKIM 11E BES3 $\psi(2S) \rightarrow \gamma\gamma\omega$
 78±18±3 39 ± 7 70 BENNETT 08A CLEO $\psi(2S) \rightarrow \gamma\gamma\omega$

69 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 $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.3 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

70 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 $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.3 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R30
 NODE=M055R30

NODE=M055R30;LINKAGE=AB

NODE=M055R30;LINKAGE=BE

$\Gamma(\gamma\phi)/\Gamma_{\text{total}}$ Γ_{57}/Γ

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

26±6±1 43 ± 9 71 ABLIKIM 11E BES3 $\psi(2S) \rightarrow \gamma\gamma\phi$

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

<24 90 5.2 ± 3.1 72 BENNETT 08A CLEO $\psi(2S) \rightarrow \gamma\gamma\phi$

71 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 $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.3 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

72 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 $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = 9.3 \times 10^{-2}$.

NODE=M055R31
 NODE=M055R31

NODE=M055R31;LINKAGE=AB

NODE=M055R31;LINKAGE=BE

$\Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ Γ_{58}/Γ

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

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

< 3.5 90 ECKLUND 08A CLEO $\psi(2S) \rightarrow \gamma\chi_{c1} \rightarrow 3\gamma$

<150 90 73 YAMADA 77 DASP $e^+e^- \rightarrow 3\gamma$

73 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

$\chi_{c1}(1P)$ CROSS-PARTICLE BRANCHING RATIOS

NODE=M055230

$\Gamma(\chi_{c1}(1P) \rightarrow p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)$ $\Gamma_{34}/\Gamma \times \Gamma_{119}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}$

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

1.98±0.16 OUR FIT

[(2.02 ± 0.16) × 10⁻⁵ OUR 2012 FIT]

1.1 ± 1.0 74 BAI 98i BES $\psi(2S) \rightarrow \gamma\chi_{c1} \rightarrow \gamma\bar{p}p$

74 Calculated by us. The value for $B(\chi_{c1} \rightarrow p\bar{p})$ reported in BAI 98i is derived using $B(\psi(2S) \rightarrow \gamma\chi_{c1}) = (8.7 \pm 0.8)\%$ and $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (32.4 \pm 2.6)\%$ [BAI 98d].

NODE=M055B1
 NODE=M055B1
 NEW

NODE=M055B;LINKAGE=J2

$\Gamma(\chi_{c1}(1P) \rightarrow \Lambda\bar{\Lambda})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))/\Gamma_{\text{total}}$ $\Gamma_{43}/\Gamma \times \Gamma_{119}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}$

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

10.9±1.7 OUR FIT

10.5±1.6±0.6 46 ± 7 75 NAIK 08 CLEO $\psi(2S) \rightarrow \gamma\Lambda\bar{\Lambda}$

75 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
 NODE=M055B10

NODE=M055B10;LINKAGE=NA

$$\frac{\Gamma(\chi_{c1}(1P) \rightarrow \Lambda \bar{\Lambda})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)}{\Gamma_{43}/\Gamma \times \Gamma_{119}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

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

3.2 ± 0.5 OUR FIT

[(3.3 ± 0.5) × 10^{-5} OUR 2012 FIT]

7.1^{+2.8}_{-2.4} ± 1.3 9.0^{+3.5}_{-3.1} 76 BAI 03E BES $\psi(2S) \rightarrow \gamma \Lambda \bar{\Lambda}$

⁷⁶BAI 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

NODE=M055B11

NEW

NODE=M055B11;LINKAGE=BA

$$\frac{\Gamma(\chi_{c1}(1P) \rightarrow \gamma J/\psi(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))/\Gamma_{\text{total}}}{\Gamma_{54}/\Gamma \times \Gamma_{119}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

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

3.23 ± 0.07 OUR FIT

[(3.18 ± 0.08) × 10^{-2} OUR 2012 FIT]

2.93 ± 0.15 OUR AVERAGE Error includes scale factor of 1.4. See the ideogram below.
[(2.70 ± 0.13) × 10^{-2} OUR 2012 AVERAGE]

3.377 ± 0.009 ± 0.183	142k	ABLIKIM	120	BES3	$\psi(2S) \rightarrow \gamma \chi_{c1}$
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		⁷⁷ OREGLIA	82	CBAL	$\psi(2S) \rightarrow \gamma \chi_{c1}$
2.2 ± 0.5		⁷⁸ BRANDELIK	79B	DASP	$\psi(2S) \rightarrow \gamma \chi_{c1}$
2.9 ± 0.5		⁷⁸ BARTEL	78B	CNTR	$\psi(2S) \rightarrow \gamma \chi_{c1}$
5.0 ± 1.5		⁷⁹ BIDDICK	77	CNTR	$e^+ e^- \rightarrow \gamma X$
2.8 ± 0.9		⁷⁷ WHITAKER	76	MRK1	$e^+ e^-$

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

3.56 ± 0.03 ± 0.12	24.9k	⁸⁰ MENDEZ	08	CLEO	$\psi(2S) \rightarrow \gamma \chi_{c1}$
3.44 ± 0.06 ± 0.13	3.7k	⁸¹ ADAM	05A	CLEO	Repl. by MENDEZ 08

⁷⁷ Recalculated by us using $B(J/\psi(1S) \rightarrow \ell^+ \ell^-) = 0.1181 \pm 0.0020$.

⁷⁸ Recalculated by us using $B(J/\psi(1S) \rightarrow \mu^+ \mu^-) = 0.0588 \pm 0.0010$.

⁷⁹ Assumes isotropic gamma distribution.

⁸⁰ Not independent from other measurements of MENDEZ 08.

⁸¹ Not independent from other values reported by ADAM 05A.

NODE=M055B2

NODE=M055B2

NEW

NEW

NODE=M055B;LINKAGE=3Q

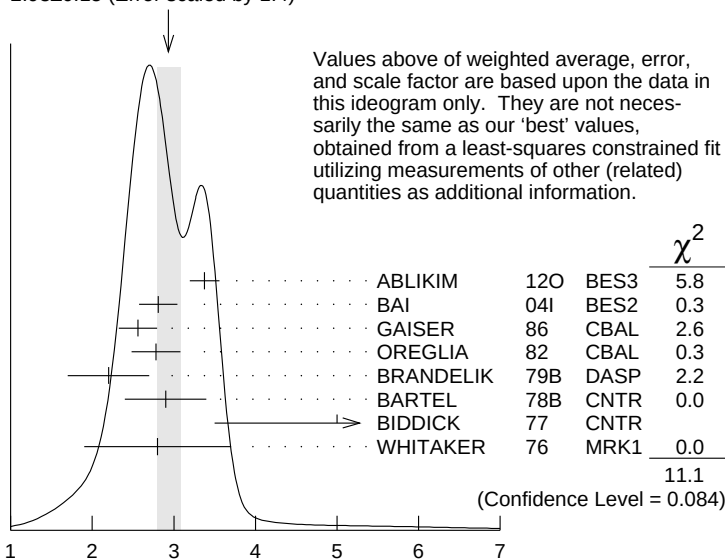
NODE=M055B;LINKAGE=2Q

NODE=M055B;LINKAGE=EA

NODE=M055B2;LINKAGE=ME

NODE=M055B;LINKAGE=AD

WEIGHTED AVERAGE
2.93 ± 0.15 (Error scaled by 1.4)



$$\frac{\Gamma(\chi_{c1}(1P) \rightarrow \gamma J/\psi(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))/\Gamma_{\text{total}}}{10^{-2}}$$

$$\frac{\Gamma(\chi_{c1}(1P) \rightarrow \gamma J/\psi(1S))}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))}{\Gamma(\psi(2S) \rightarrow J/\psi(1S) \text{ anything})} = \frac{\Gamma_{54}/\Gamma \times \Gamma_{119}^{\psi(2S)}/\Gamma_9^{\psi(2S)}}{\Gamma_{119}^{\psi(2S)} + 0.348\Gamma_{119}^{\psi(2S)} + 0.198\Gamma_{120}^{\psi(2S)}}$$

NODE=M055B7

NODE=M055B7

VALUE (units 10^{-2}) EVTS DOCUMENT ID TECN COMMENT
5.36±0.12 OUR FIT
 [(5.34 ± 0.12) × 10^{-2} OUR 2012 FIT]

NODE=M055B7

NEW

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

5.70±0.04±0.15	24.9k	⁸² MENDEZ	08	CLEO	$\psi(2S) \rightarrow \gamma \chi_{c1}$
5.77±0.10±0.12	3.7k	ADAM	05A	CLEO	Repl. by MENDEZ 08

⁸² Not independent from other measurements of MENDEZ 08.

NODE=M055B7;LINKAGE=ME

$$\frac{\Gamma(\chi_{c1}(1P) \rightarrow \gamma J/\psi(1S))}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))}{\Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)} = \frac{\Gamma_{54}/\Gamma \times \Gamma_{119}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}{\Gamma_{119}^{\psi(2S)} + 0.348\Gamma_{119}^{\psi(2S)} + 0.198\Gamma_{120}^{\psi(2S)}}$$

NODE=M055B3

NODE=M055B3

NEW

VALUE (units 10^{-2}) EVTS DOCUMENT ID TECN COMMENT
9.49±0.21 OUR FIT
 [(9.46 ± 0.23) × 10^{-2} OUR 2012 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	⁸³ ABLIKIM	04B	BES	$\psi(2S) \rightarrow J/\psi X$
8.5 ± 2.1		⁸⁴ 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	⁸⁵ ADAM	05A	CLEO	Repl. by MENDEZ 08

⁸³ From a fit to the J/ψ recoil mass spectra.

⁸⁴ 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 $B(J/\psi(1S) \rightarrow \ell^+ \ell^-) = 0.1181 \pm 0.0020$.

⁸⁵ Not independent from other values reported by ADAM 05A.

NODE=M055B;LINKAGE=AB

NODE=M055B;LINKAGE=J3

NODE=M055B3;LINKAGE=AD

$$\frac{\Gamma(\chi_{c1}(1P) \rightarrow K^0 K^+ \pi^- + \text{c.c.})}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))}{\Gamma_{\text{total}}} = \frac{\Gamma_{15}/\Gamma \times \Gamma_{119}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}{\Gamma_{119}^{\psi(2S)} + 0.348\Gamma_{119}^{\psi(2S)} + 0.198\Gamma_{120}^{\psi(2S)}}$$

NODE=M055B16

NODE=M055B16

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	⁸⁶ ATHAR	07	CLEO	$\psi(2S) \rightarrow \gamma K_S^0 K^+ \pi^-$
7.0±0.5±0.9	⁸⁷ ABLIKIM	06R	BES2	$\psi(2S) \rightarrow \gamma \chi_{c1}$

⁸⁶ Calculated by us. The value of $B(\chi_{c1} \rightarrow K^0 K^+ \pi^- + \text{c.c.})$ reported by ATHAR 07 was derived using $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54)\%$.

⁸⁷ 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;LINKAGE=AT

NODE=M055B16;LINKAGE=AB

$$\frac{\Gamma(\chi_{c1}(1P) \rightarrow K^0 K^+ \pi^- + \text{c.c.})}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))}{\Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)} = \frac{\Gamma_{15}/\Gamma \times \Gamma_{119}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}{\Gamma_{119}^{\psi(2S)} + 0.348\Gamma_{119}^{\psi(2S)} + 0.198\Gamma_{120}^{\psi(2S)}}$$

NODE=M055B17

NODE=M055B17

NEW

VALUE (units 10^{-4}) DOCUMENT ID TECN COMMENT
19.9±1.6 OUR FIT
 [(20.1 ± 1.6) × 10^{-4} OUR 2012 FIT]

13.2±2.4±3.2	⁸⁸ BAI	99B	BES	$\psi(2S) \rightarrow \gamma K_S^0 K^+ \pi^-$

⁸⁸ 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;LINKAGE=BA

$$\frac{\Gamma(\chi_{c1}(1P) \rightarrow K^+ K^- K^+ K^-)}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))}{\Gamma_{\text{total}}} = \frac{\Gamma_{29}/\Gamma \times \Gamma_{119}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}{\Gamma_{119}^{\psi(2S)} + 0.348\Gamma_{119}^{\psi(2S)} + 0.198\Gamma_{120}^{\psi(2S)}}$$

NODE=M055B14

NODE=M055B14

VALUE (units 10^{-4}) EVTS DOCUMENT ID TECN COMMENT
0.52±0.11 OUR FIT
0.61±0.11±0.08 54 ⁸⁹ ABLIKIM 06T BES2 $\psi(2S) \rightarrow \gamma K^+ K^+ K^- K^-$

⁸⁹ 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;LINKAGE=AB

$$\frac{\Gamma(\chi_{c1}(1P) \rightarrow K^+ K^- K^+ K^-)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))/\Gamma_{29}/\Gamma \times \Gamma_{119}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}{\Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)}$$

VALUE (units 10^{-4})

DOCUMENT ID

TECN

COMMENT

1.53±0.31 OUR FIT[(1.54 ± 0.31) × 10⁻⁴ OUR 2012 FIT]**1.13±0.40±0.29**

90 BAI

99B BES

 $\psi(2S) \rightarrow \gamma K^+ K^- K^- K^-$

⁹⁰ 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

NEW

NODE=M055B15;LINKAGE=BA

$$\frac{\Gamma(\chi_{c1}(1P) \rightarrow p \bar{p})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))/\Gamma_{\text{total}}}{\Gamma_{34}/\Gamma \times \Gamma_{119}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10^{-6})

EVTS

DOCUMENT ID

TECN

COMMENT

6.7±0.5 OUR FIT[(6.8 ± 0.5) × 10⁻⁶ OUR 2012 FIT]**7.5±1.4 OUR AVERAGE** Error includes scale factor of 2.0.8.2±0.7±0.4 141 ± 13 ⁹¹ NAIK 08 CLEO $\psi(2S) \rightarrow \gamma p \bar{p}$ 4.8^{+1.4}_{-1.3}±0.6 18.2^{+5.5}_{-4.9} BAI 04F BES $\psi(2S) \rightarrow \gamma \chi_{c1}(1P) \rightarrow \gamma \bar{p} p$

⁹¹ 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

NEW

NODE=M055B6;LINKAGE=NA

MULTIPOLE AMPLITUDES IN $\chi_{c1}(1P) \rightarrow \gamma J/\psi(1S)$

NODE=M055240

$a_2 = M_2/\sqrt{E_1^2 + M_2^2}$ Magnetic quadrupole fractional transition amplitude

VALUE (units 10^{-2})

EVTS

DOCUMENT ID

TECN

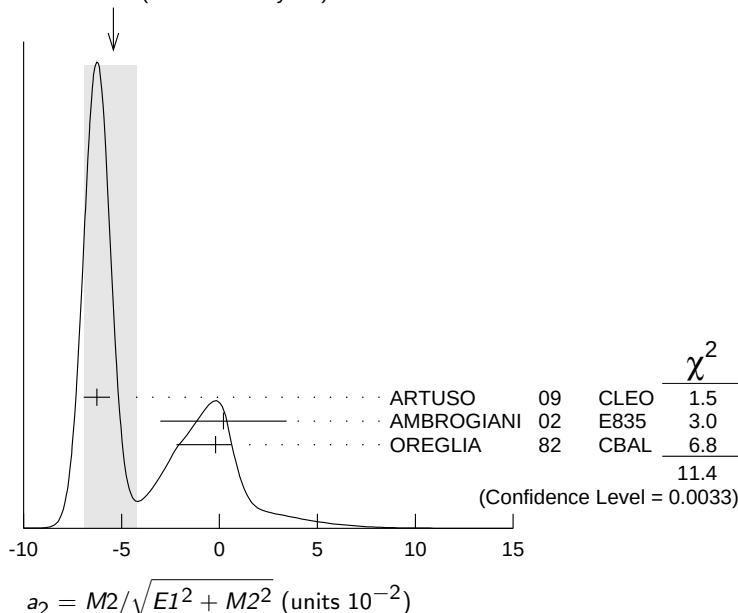
COMMENT

-5.4^{+1.2}_{-1.5} OUR AVERAGE

Error includes scale factor of 2.4. See the ideogram below.

-6.26±0.63±0.24 39k ARTUSO 09 CLEO $\psi(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$ 0.2 ± 3.2 ± 0.4 2090 AMBROGIANI 02 E835 $p \bar{p} \rightarrow \chi_{c1} \rightarrow J/\psi \gamma$ -0.2^{+0.8}_{-2.0} 921 OREGLIA 82 CBAL $\psi(2S) \rightarrow \chi_{c1} \gamma \rightarrow J/\psi \gamma \gamma$

WEIGHTED AVERAGE
-5.4±1.2-1.5 (Error scaled by 2.4)



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

VALUE (units 10^{-2})

EVTS

DOCUMENT ID

TECN

COMMENT

2.9 ± 0.8 OUR AVERAGE2.76±0.73±0.23 39k ARTUSO 09 CLEO $\psi(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$ 7.7^{+5.0}_{-4.5} 921 OREGLIA 82 CBAL $\psi(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$

NODE=M055QB2

NODE=M055QB2

MULTIPOLE AMPLITUDE RATIOS IN RADIATIVE DECAYS

$$\psi(2S) \rightarrow \gamma \chi_{c1}(1S) \text{ and } \chi_{c1} \rightarrow \gamma J/\psi(1S)$$

NODE=M055260

 a_2/b_2 Magnetic quadrupole transition amplitude ratio

NODE=M055QAR

NODE=M055QAR

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
$-2.27^{+0.57}_{-0.99}$	39k	⁹² ARTUSO	09	CLEO $\psi(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$

⁹² 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	13D	PR D87 012007	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=54879
ABLIKIM	12O	PRL 109 172002	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=54742
ABLIKIM	11A	PR D83 012006	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=53647
ABLIKIM	11D	PR D83 032003	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=16715
ABLIKIM	11E	PR D83 112005	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=16717
ABLIKIM	11F	PR D83 112009	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=16719
ABLIKIM	11K	PRL 107 092001	M. Ablikim <i>et al.</i>	(BES III 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

$h_c(1P)$

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

Quantum numbers are quark model prediction, $C = -$ established by $\eta_c \gamma$ decay.

NODE=M144

NODE=M144

$h_c(1P)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
3525.38±0.11 OUR AVERAGE				
[3525.41 ± 0.16 MeV OUR 2012 AVERAGE Scale factor = 1.2]				
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	$\bar{p} p \rightarrow J/\psi X$

¹ With floating width.

² Combination of exclusive and inclusive analyses for the reaction $\psi(2S) \rightarrow \pi^0 h_c \rightarrow \pi^0 \eta_c \gamma$. This result is the average of DOBBS 08A and ROSNER 05.

³ Superseded by DOBBS 08A.

⁴ Mass central value and systematic error recalculated by us according to Eq. (16) in ARMSTRONG 93B, using the value for the $\psi(2S)$ mass from AULCHENKO 03.

NODE=M144M

NODE=M144M

NEW

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	⁵ ABLIKIM	12N BES3	$\psi(2S) \rightarrow \pi^0 \gamma$ hadrons
< 1		13	ABLIKIM	10B BES3	$\psi(2S) \rightarrow \pi^0 \gamma \eta_c$
			ANDREOTTI	05B E835	$\bar{p} p \rightarrow \eta_c \gamma$
< 1.1	90	59	ARMSTRONG	92D E760	$\bar{p} p \rightarrow J/\psi \pi^0$

⁵ With floating mass.

⁶ The 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)
Γ_1 $J/\psi(1S)\pi^0$	
Γ_2 $J/\psi(1S)\pi\pi$	not seen
Γ_3 $p\bar{p}$	
Γ_4 $\eta_c(1S)\gamma$	(51 ± 6) %
Γ_5 $\pi^+ \pi^- \pi^0$	< 2.2 × 10 ⁻³
Γ_6 $2\pi^+ 2\pi^- \pi^0$	(2.2 ^{+0.8} _{-0.7}) %
Γ_7 $3\pi^+ 3\pi^- \pi^0$	< 2.9 %

NODE=M144215;NODE=M144

DESIG=1

DESIG=2;OUR EST;→ UNCHECKED ←

DESIG=3

DESIG=4

DESIG=5

DESIG=6

DESIG=7

$h_c(1P)$ PARTIAL WIDTHS

NODE=M144220

$h_c(1P) \Gamma(i)\Gamma(\bar{p}p)/\Gamma(\text{total})$

NODE=M144223

$\Gamma(\eta_c(1S)\gamma) \times \Gamma(p\bar{p})/\Gamma_{\text{total}}$					$\Gamma_4\Gamma_3/\Gamma$
VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
12.0±4.5	13	⁷ ANDREOTTI	05B E835	$\bar{p} p \rightarrow \eta_c \gamma$	

⁷ Assuming $\Gamma = 1$ MeV.

NODE=M144G1

NODE=M144G1

NODE=M144G1;LINKAGE=AN

$h_c(1P)$ BRANCHING RATIOS

$\Gamma(J/\psi(1S)\pi\pi)/\Gamma(J/\psi(1S)\pi^0)$

 Γ_2/Γ_1

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.18	90	ARMSTRONG 92D	E760	$\bar{p}p \rightarrow J/\psi\pi^0$

NODE=M144225

NODE=M144R1
NODE=M144R1

$\Gamma(\eta_c(1S)\gamma)/\Gamma_{\text{total}}$

 Γ_4/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
51 ± 6 OUR AVERAGE				

NODE=M144R2
NODE=M144R2

54.3 ± 6.7 ± 5.2	3679	ABLIKIM	10B BES3	$\psi(2S) \rightarrow \pi^0\gamma\eta_c$
48 ± 6 ± 7		⁸ DOBBS	08A CLEO	$\psi(2S) \rightarrow \pi^0\eta_c\gamma$

OCCUR=2

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

48 ± 6 ± 7	1282	⁹ DOBBS	08A CLEO	$\psi(2S) \rightarrow \pi^0\eta_c\gamma$
46 ± 12 ± 7	168	¹⁰ ROSNER	05 CLEO	$\psi(2S) \rightarrow \pi^0\eta_c\gamma$

NODE=M144R2;LINKAGE=DB

⁸ Average of DOBBS 08A and ROSNER 05. DOBBS 08A reports $[\Gamma(h_c(1P) \rightarrow \eta_c(1S)\gamma)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \pi^0 h_c(1P))] = (4.16 \pm 0.30 \pm 0.37) \times 10^{-4}$ 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.

⁹ DOBBS 08A reports $[\Gamma(h_c(1P) \rightarrow \eta_c(1S)\gamma)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \pi^0 h_c(1P))] = (4.19 \pm 0.32 \pm 0.45) \times 10^{-4}$ 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.

NODE=M144R2;LINKAGE=DO

¹⁰ ROSNER 05 reports $[\Gamma(h_c(1P) \rightarrow \eta_c(1S)\gamma)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \pi^0 h_c(1P))] = (4.0 \pm 0.8 \pm 0.7) \times 10^{-4}$ 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=RO

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

 Γ_5/Γ

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

<2.2	¹¹ ADAMS	09 CLEO	$\psi(2S) \rightarrow \pi^0\gamma\eta_c$

NODE=M144R01
NODE=M144R01

¹¹ 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

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

 Γ_6/Γ

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

2.2^{+0.8}_{-0.6} ± 0.3	92	¹² ADAMS	09 CLEO	$\psi(2S) \rightarrow \pi^0\gamma\eta_c$

NODE=M144R02
NODE=M144R02

¹² 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

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

 Γ_7/Γ

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

<2.9	¹³ ADAMS	09 CLEO	$\psi(2S) \rightarrow \pi^0\gamma\eta_c$

NODE=M144R03
NODE=M144R03

¹³ 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

$\Gamma(h_c(1P) \rightarrow \eta_c(1S)\gamma)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}}$

$\Gamma_4/\Gamma \times \Gamma_{15}^{\psi(2S)}/\Gamma^{\psi(2S)}$

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

4.3 ± 0.4 OUR AVERAGE

4.58 ± 0.40 ± 0.50	3679	¹⁴ ABLIKIM	10B BES3	$\psi(2S) \rightarrow \pi^0\gamma X$
4.16 ± 0.30 ± 0.37	1430	¹⁵ DOBBS	08A CLEO	$\psi(2S) \rightarrow \pi^0\gamma\eta_c$

NODE=M144R04
NODE=M144R04

¹⁴ Not independent of other branching fractions in ABLIKIM 10B.

¹⁵ Not independent of other branching fractions in DOBBS 08A.

NODE=M144R04;LINKAGE=AB
NODE=M144R04;LINKAGE=DO **$h_c(1P)$ REFERENCES**

NODE=M144

ABLIKIM 12N	PR D86 092009	M. Ablikim <i>et al.</i>	(BES III Collab.)
ABLIKIM 10B	PRL 104 132002	M. Ablikim <i>et al.</i>	(BES III 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+)

 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

NODE=M057M

NODE=M057M

 $\chi_{c2}(1P)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
3556.20 $\pm$ 0.09 OUR AVERAGE				
3555.3 $\pm$ 0.6 $\pm$ 2.2	2.5k	UEHARA	08 BELL	$\gamma\gamma \rightarrow$ 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	¹ 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		² GAISER	86 CBAL	$\psi(2S) \rightarrow \gamma X$
3553.4 $\pm$ 2.2	66	³ LEMOIGNE	82 GOLJ	$185 \pi^- Be \rightarrow \gamma\mu^+\mu^- A$
3555.9 $\pm$ 0.7		⁴ OREGLIA	82 CBAL	$e^+e^- \rightarrow J/\psi 2\gamma$
3557 $\pm$ 1.5	69	⁵ 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		⁵ BARTEL	78B CNTR	$e^+e^- \rightarrow J/\psi 2\gamma$
3553 $\pm$ 4 $\pm$ 4		^{5,6} TANENBAUM	78 MRK1	e^+e^-
3563 $\pm$ 7	360	⁵ BIDDICK	77 CNTR	$e^+e^- \rightarrow \gamma X$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
3543 $\pm$ 10	4	WHITAKER	76 MRK1	$e^+e^- \rightarrow J/\psi 2\gamma$

¹ Recalculated by ANDREOTTI 05A, using the value of $\psi(2S)$ mass from AULCHENKO 03.

² Using mass of $\psi(2S) = 3686.0$ MeV.

³ $J/\psi(1S)$ mass constrained to 3097 MeV.

⁴ Assuming $\psi(2S)$ mass = 3686 MeV and $J/\psi(1S)$ mass = 3097 MeV.

⁵ Mass value shifted by us by amount appropriate for $\psi(2S)$ mass = 3686 MeV and $J/\psi(1S)$ mass = 3097 MeV.

⁶ From a simultaneous fit to radiative and hadronic decay channels.

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 $\pm$ 0.11 OUR FIT				
[1.98 $\pm$ 0.11 MeV OUR 2012 FIT]				
1.95 $\pm$ 0.13 OUR AVERAGE				
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	⁷ ARMSTRONG	92 E760	$\bar{p}p \rightarrow e^+e^-\gamma$
2.6 $^{+1.4}_{-1.0}$	50	BAGLIN	86B SPEC	$\bar{p}p \rightarrow e^+e^-X$
2.8 $^{+2.1}_{-2.0}$		⁸ GAISER	86 CBAL	$\psi(2S) \rightarrow \gamma X$

⁷ Recalculated by ANDREOTTI 05A.

⁸ Errors correspond to 90% confidence level; authors give only width range.

NODE=M057W

NODE=M057W

NEW

NODE=M057W;LINKAGE=AN

NODE=M057W;LINKAGE=E

 $\chi_{c2}(1P)$ DECAY MODES

NODE=M057215;NODE=M057

Mode	Fraction (Γ_i/Γ)	Confidence level

Hadronic decays

Γ_1	$2(\pi^+\pi^-)$	(1.10 $\pm$ 0.11) %
Γ_2	$\rho\rho$	
Γ_3	$\pi^+\pi^-\pi^0\pi^0$	(1.99 $\pm$ 0.26) %
Γ_4	$\rho^+\pi^-\pi^0 + \text{c.c.}$	(2.4 $\pm$ 0.4) %
Γ_5	$4\pi^0$	(1.21 $\pm$ 0.17) $\times 10^{-3}$
Γ_6	$K^+K^-\pi^0\pi^0$	(2.2 $\pm$ 0.4) $\times 10^{-3}$
Γ_7	$K^+\pi^-K^0\pi^0 + \text{c.c.}$	(1.50 $\pm$ 0.22) %
Γ_8	$\rho^+K^-K^0 + \text{c.c.}$	(4.5 $\pm$ 1.4) $\times 10^{-3}$

NODE=M057;CLUMP=A

DESIG=3

DESIG=43

DESIG=50

DESIG=51

DESIG=62

DESIG=52

DESIG=54

DESIG=55

Г ₉	$K^*(892)^0 K^+ \pi^- \rightarrow K^+ \pi^- K^0 \pi^0 + \text{c.c.}$	$(3.2 \pm 0.9) \times 10^{-3}$		DESIG=60
Г ₁₀	$K^*(892)^0 K^0 \pi^0 \rightarrow K^+ \pi^- K^0 \pi^0 + \text{c.c.}$	$(4.2 \pm 0.9) \times 10^{-3}$		DESIG=56
Г ₁₁	$K^*(892)^- K^+ \pi^0 \rightarrow K^+ \pi^- K^0 \pi^0 + \text{c.c.}$	$(4.0 \pm 0.9) \times 10^{-3}$		DESIG=57
Г ₁₂	$K^*(892)^+ K^0 \pi^- \rightarrow K^+ \pi^- K^0 \pi^0 + \text{c.c.}$	$(3.2 \pm 0.9) \times 10^{-3}$		DESIG=58
Г ₁₃	$K^+ K^- \eta \pi^0$	$(1.4 \pm 0.5) \times 10^{-3}$		DESIG=59
Г ₁₄	$K^+ K^- \pi^+ \pi^-$	$(9.1 \pm 1.1) \times 10^{-3}$		DESIG=5
Г ₁₅	$K^+ K^- \pi^+ \pi^- \pi^0$	$(1.3 \pm 0.4) \%$		DESIG=67
Г ₁₆	$K^+ \bar{K}^*(892)^0 \pi^- + \text{c.c.}$	$(2.3 \pm 1.2) \times 10^{-3}$		DESIG=10
Г ₁₇	$K^*(892)^0 \bar{K}^*(892)^0$	$(2.5 \pm 0.5) \times 10^{-3}$		DESIG=21
Г ₁₈	$3(\pi^+ \pi^-)$	$(8.6 \pm 1.8) \times 10^{-3}$		DESIG=4
Г ₁₉	$\phi \phi$	$(1.16 \pm 0.10) \times 10^{-3}$		DESIG=16
Г ₂₀	$\omega \omega$	$(9.2 \pm 1.1) \times 10^{-4}$		DESIG=25
Г ₂₁	$\omega \phi$			DESIG=68
Г ₂₂	$\pi \pi$	$(2.42 \pm 0.13) \times 10^{-3}$		DESIG=22
Г ₂₃	$\rho^0 \pi^+ \pi^-$	$(4.0 \pm 1.7) \times 10^{-3}$		DESIG=9
Г ₂₄	$\pi^+ \pi^- \eta$	$(5.2 \pm 1.4) \times 10^{-4}$		DESIG=39
Г ₂₅	$\pi^+ \pi^- \eta'$	$(5.4 \pm 2.0) \times 10^{-4}$		DESIG=42
Г ₂₆	$\eta \eta$	$(5.9 \pm 0.5) \times 10^{-4}$		DESIG=14
Г ₂₇	$K^+ K^-$	$(1.09 \pm 0.08) \times 10^{-3}$		DESIG=2
Г ₂₈	$K_S^0 K_S^0$	$(5.8 \pm 0.5) \times 10^{-4}$		DESIG=15
Г ₂₉	$\bar{K}^0 K^+ \pi^- + \text{c.c.}$	$(1.39 \pm 0.20) \times 10^{-3}$		DESIG=17
Г ₃₀	$K^+ K^- \pi^0$	$(3.3 \pm 0.8) \times 10^{-4}$		DESIG=36
Г ₃₁	$K^+ K^- \eta$	$< 3.5 \times 10^{-4}$	90%	DESIG=40
Г ₃₂	$\eta \eta'$	$< 6 \times 10^{-5}$	90%	DESIG=34
Г ₃₃	$\eta' \eta'$	$< 1.1 \times 10^{-4}$	90%	DESIG=35
Г ₃₄	$\pi^+ \pi^- K_S^0 K_S^0$	$(2.4 \pm 0.6) \times 10^{-3}$		DESIG=29
Г ₃₅	$K^+ K^- K_S^0 K_S^0$	$< 4 \times 10^{-4}$	90%	DESIG=30
Г ₃₆	$K^+ K^- K^+ K^-$	$(1.78 \pm 0.22) \times 10^{-3}$		DESIG=24
Г ₃₇	$K^+ K^- \phi$	$(1.54 \pm 0.32) \times 10^{-3}$		DESIG=32
Г ₃₈	$\rho \bar{\rho}$	$(7.1 \pm 0.4) \times 10^{-5}$		DESIG=11
Г ₃₉	$\rho \bar{\rho} \pi^0$	$(5.1 \pm 0.5) \times 10^{-4}$		DESIG=37
Г ₄₀	$\rho \bar{\rho} \eta$	$(1.89 \pm 0.28) \times 10^{-4}$		DESIG=41
Г ₄₁	$\rho \bar{\rho} \omega$	$(3.9 \pm 0.5) \times 10^{-4}$		DESIG=61
Г ₄₂	$\rho \bar{\rho} \phi$	$(3.0 \pm 1.0) \times 10^{-5}$		DESIG=66
Г ₄₃	$\rho \bar{\rho} \pi^+ \pi^-$	$(1.32 \pm 0.34) \times 10^{-3}$		DESIG=8
Г ₄₄	$\rho \bar{\rho} \pi^0 \pi^0$	$(8.5 \pm 2.6) \times 10^{-4}$		DESIG=53
Г ₄₅	$\rho \bar{\rho} K^+ K^- (\text{non-resonant})$	$(2.08 \pm 0.35) \times 10^{-4}$		DESIG=63
Г ₄₆	$\rho \bar{\rho} K_S^0 K_S^0$	$< 7.9 \times 10^{-4}$	90%	DESIG=28
Г ₄₇	$\rho \bar{\rho} \pi^-$	$(1.1 \pm 0.4) \times 10^{-3}$		DESIG=31
Г ₄₈	$\Lambda \bar{\Lambda}$	$(1.86 \pm 0.27) \times 10^{-4}$		DESIG=19
Г ₄₉	$\Lambda \bar{\Lambda} \pi^+ \pi^-$	$< 3.5 \times 10^{-3}$	90%	DESIG=27
Г ₅₀	$K^+ \bar{p} \Lambda + \text{c.c.}$	$(8.4 \pm 0.6) \times 10^{-4}$		DESIG=38
Г ₅₁	$K^+ p \Lambda(1520) + \text{c.c.}$	$(3.1 \pm 0.7) \times 10^{-4}$		DESIG=64
Г ₅₂	$\Lambda(1520) \bar{\Lambda}(1520)$	$(5.0 \pm 1.6) \times 10^{-4}$		DESIG=65
Г ₅₃	$\Sigma^0 \bar{\Sigma}^0$	$< 8 \times 10^{-5}$	90%	DESIG=47
Г ₅₄	$\Sigma^+ \bar{\Sigma}^-$	$< 7 \times 10^{-5}$	90%	DESIG=48
Г ₅₅	$\Xi^0 \bar{\Xi}^0$	$< 1.1 \times 10^{-4}$	90%	DESIG=49
Г ₅₆	$\Xi^- \bar{\Xi}^+$	$(1.55 \pm 0.35) \times 10^{-4}$		DESIG=26
Г ₅₇	$J/\psi(1S) \pi^+ \pi^- \pi^0$	$< 1.5 \%$	90%	DESIG=12
Г ₅₈	$\eta_c(1S) \pi^+ \pi^-$	$< 2.3 \%$	90%	DESIG=69

Radiative decays

Г ₅₉	$\gamma J/\psi(1S)$	$(19.8 \pm 0.8) \%$		NODE=M057;CLUMP=B DESIG=6
Г ₆₀	$\gamma \rho^0$	$< 2.1 \times 10^{-5}$	90%	DESIG=44
Г ₆₁	$\gamma \omega$	$< 6 \times 10^{-6}$	90%	DESIG=45
Г ₆₂	$\gamma \phi$	$< 8 \times 10^{-6}$	90%	DESIG=46
Г ₆₃	$\gamma \gamma$	$(2.61 \pm 0.16) \times 10^{-4}$		DESIG=7

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 227 measurements to determine 49 parameters. The overall fit has a $\chi^2 = 325.4$ for 178 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, $x_i \equiv \Gamma_i / \Gamma_{\text{total}}$.

x_{14}	17									
x_{16}	4	22								
x_{17}	10	8	2							
x_{19}	18	15	3	9						
x_{22}	24	20	4	12	29					
x_{23}	20	4	1	2	4	5				
x_{26}	14	12	3	7	17	32	3			
x_{27}	18	16	3	9	22	39	4	24		
x_{28}	17	15	3	9	20	34	4	21	25	
x_{29}	9	8	2	5	11	19	2	12	14	12
x_{36}	12	10	2	6	13	22	3	13	16	14
x_{38}	7	5	1	3	4	1	2	0	1	2
x_{48}	8	7	2	4	11	19	2	12	14	13
x_{59}	29	25	5	15	34	61	6	37	45	40
x_{63}	-17	-14	-3	-8	-9	2	-5	2	0	-3
Γ	-25	-21	-5	-12	-25	-36	-6	-22	-28	-25
	x_1	x_{14}	x_{16}	x_{17}	x_{19}	x_{22}	x_{23}	x_{26}	x_{27}	x_{28}

x_{36}	8									
x_{38}	1	2								
x_{48}	7	8	0							
x_{59}	22	26	-10	23						
x_{63}	0	-3	29	1	8					
Γ	-14	-17	-50	-13	-50	-50				
	x_{29}	x_{36}	x_{38}	x_{48}	x_{59}	x_{63}				

$\chi_{c2}(1P)$ PARTIAL WIDTHS

$$\chi_{c2}(1P) \Gamma(i) \Gamma(\gamma J/\psi(1S)) / \Gamma(\text{total})$$

NODE=M057220

NODE=M057223

$$\Gamma(p\bar{p}) \times \Gamma(\gamma J/\psi(1S)) / \Gamma_{\text{total}}$$

$$\Gamma_{38} \Gamma_{59} / \Gamma$$

VALUE (eV)

DOCUMENT ID

TECN

COMMENT

27.8±1.4 OUR FIT

[27.7 ± 1.4 eV OUR 2012 FIT]

27.5±1.5 OUR AVERAGE

27.0±1.5±1.1

⁹ ANDREOTTI 05A E835 $p\bar{p} \rightarrow e^+ e^- \gamma$

27.7±1.5±2.0

^{9,10} ARMSTRONG 92 E760 $p\bar{p} \rightarrow e^+ e^- \gamma$

36 ± 8

⁹ BAGLIN 86B SPEC $p\bar{p} \rightarrow e^+ e^- X$ ⁹ Calculated by us using $B(J/\psi(1S) \rightarrow e^+ e^-) = 0.0593 \pm 0.0010$.¹⁰ Recalculated by ANDREOTTI 05A.

NODE=M057G1

NODE=M057G1

NEW

NODE=M057G;LINKAGE=7A

NODE=M057G;LINKAGE=AN

$$\Gamma(\gamma\gamma) \times \Gamma(\gamma J/\psi(1S)) / \Gamma_{\text{total}}$$

$$\Gamma_{63} \Gamma_{59} / \Gamma$$

VALUE (eV)

EVTs

DOCUMENT ID

TECN

COMMENT

102± 6 OUR FIT

[100 ± 6 eV OUR 2012 FIT]

117± 10 OUR AVERAGE111± 12± 9 147 ± 15 ¹¹ DOBBS06 CLE3 10.4 $e^+ e^- \rightarrow$ $e^+ e^- \chi_{c2}$ 114± 11± 9 136 ± 13.3 ^{11,12} ABE02T BELL $e^+ e^- \rightarrow e^+ e^- \chi_{c2}$ 139± 55± 21 ^{11,13} ACCIARRI99E L3 $e^+ e^- \rightarrow e^+ e^- \chi_{c2}$

NODE=M057G2

NODE=M057G2

NEW

242 ± 65 ± 51	11,14 ACKER.,K...	98 OPAL	$e^+e^- \rightarrow e^+e^-\chi_{c2}$
150 ± 42 ± 36	11,15 DOMINICK	94 CLE2	$e^+e^- \rightarrow e^+e^-\chi_{c2}$
470 ± 240 ± 120	11,16 BAUER	93 TPC	$e^+e^- \rightarrow e^+e^-\chi_{c2}$

¹¹ Calculated by us using $B(J/\psi \rightarrow \ell^+\ell^-) = 0.1187 \pm 0.0008$.

¹² All systematic errors added in quadrature.

¹³ The value for $\Gamma(\chi_{c2} \rightarrow \gamma\gamma)$ reported in ACCIARRI 99E is derived using $B(\chi_{c2} \rightarrow \gamma J/\psi(1S)) \times B(J/\psi(1S) \rightarrow \ell^+\ell^-) = 0.0162 \pm 0.0014$.

¹⁴ 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 $B(J/\psi(1S) \rightarrow \ell^+\ell^-) = 0.1203 \pm 0.0038$.

¹⁵ 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 $B(J/\psi(1S) \rightarrow \mu^+\mu^-) = 0.0597 \pm 0.0025$.

¹⁶ 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

$\Gamma(2(\pi^+\pi^-)) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$					$\Gamma_1\Gamma_{63}/\Gamma$
VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT	
5.7 ±0.5 OUR FIT					
[5.6 ± 0.5 eV OUR 2012 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	$e^+e^- \rightarrow e^+e^-\chi_{c2}$	

NODE=M057G3
NODE=M057G3
NEW

$\Gamma(\rho\rho) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$			$\Gamma_2 \Gamma_{63} / \Gamma$		
VALUE (eV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<7.8	90	<598	UEHARA	08 BELL	$\gamma\gamma \rightarrow \chi_{c2} \rightarrow 2(\pi^+\pi^-)$

NODE=M057G08
NODE=M057G08

$\Gamma(K^+K^-\pi^+\pi^-) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$			$\Gamma_{14} \Gamma_{63} / \Gamma$		
VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT	
4.7 ± 0.5 OUR FIT					
4.42 ± 0.42 ± 0.53	780 ± 74	UEHARA	08 BELL	$\gamma\gamma \rightarrow \chi_{c2} \rightarrow K^+K^-\pi^+\pi^-$	

NODE=M057G09
NODE=M057G09

$\Gamma(K^+K^-\pi^+\pi^-\pi^0) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$			$\Gamma_{15} \Gamma_{63} / \Gamma$		
VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT	
6.5 ± 0.9 ± 1.5	1250	DEL-AMO-SA..11M	BABR	$\gamma\gamma \rightarrow K^+K^-\pi^+\pi^-\pi^0$	

NODE=M057G02
NODE=M057G02

$\Gamma(K^*(892)^0 \bar{K}^*(892)^0) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$			$\Gamma_{17} \Gamma_{63} / \Gamma$		
VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT	
1.26 ± 0.24 OUR FIT					
0.8 ± 0.17 ± 0.27	151 ± 30	UEHARA	08 BELL	$\gamma\gamma \rightarrow \chi_{c2} \rightarrow K^+K^-\pi^+\pi^-$	

NODE=M057G10
NODE=M057G10

$\Gamma(\phi\phi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$				$\Gamma_{19}\Gamma_{63}/\Gamma$	
VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT	
0.59±0.05 OUR FIT					
[0.58 ± 0.06 eV OUR 2012 FIT]					
0.62±0.09 OUR AVERAGE				[0.58 ± 0.24 eV OUR 2012 AVERAGE]	

NODE=M057G12
NODE=M057G12
NEW

NEW

• • • 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 $\gamma\gamma \rightarrow \chi_{c2} \rightarrow 2(K^+K^-)$

¹⁷ Supersedes UEHARA 08. Using $B(\phi \rightarrow K^+K^-) = (48.9 \pm 0.5)\%$.

NODE=M057G12;LINKAGE=LI

$\Gamma(\omega\omega) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$				$\Gamma_{20}\Gamma_{63}/\Gamma$	
<u>VALUE (eV)</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.64	90	¹⁸ LIU	12B BELL	$\gamma\gamma \rightarrow 2(\pi^+\pi^-\pi^0)$	
¹⁸ Using $B(\omega \rightarrow \pi^+\pi^-\pi^0) = (89.2 \pm 0.7)\%$.					

NODE=M057G03
NODE=M057G03

NODE=M057G03;LINKAGE=LI

$\Gamma(\omega\phi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$					$\Gamma_{21}\Gamma_{63}/\Gamma$	
VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT		
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●						
<0.04	90	¹⁹ LIU	12B BELL	$\gamma\gamma \rightarrow K^+K^-\pi^+\pi^-\pi^0$		
¹⁹ Using $B(\phi \rightarrow K^+K^-) = (48.9 \pm 0.5)\%$ and $B(\omega \rightarrow \pi^+\pi^-\pi^0) = (89.2 \pm 0.7)\%$.						

NODE=M057G04
NODE=M057G04

NODE=M057G04;LINKAGE=LI

$$\Gamma(\pi\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{22}\Gamma_{63}/\Gamma$$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT

1.24±0.08 OUR FIT**1.18±0.25 OUR AVERAGE**

1.44±0.54±0.47	34 ± 13	²⁰ UEHARA	09 BELL	10.6 e ⁺ e ⁻ → e ⁺ e ⁻ π ⁰ π ⁰
1.14±0.21±0.17	54 ± 10	²¹ NAKAZAWA	05 BELL	10.6 e ⁺ e ⁻ → e ⁺ e ⁻ π ⁺ π ⁻

²⁰We multiplied the measurement by 3 to convert from π⁰π⁰ to ππ. Interference with the continuum included.

²¹We have multiplied π⁺π⁻ measurement by 3/2 to obtain ππ.

NODE=M057G4
NODE=M057G4

NODE=M057G4;LINKAGE=UE

NODE=M057G;LINKAGE=NA

$$\Gamma(\rho^0\pi^+\pi^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{23}\Gamma_{63}/\Gamma$$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT

2.0±0.9 OUR FIT

3.2±1.9±0.5	986 ± 578	UEHARA	08 BELL	γγ → χ _{c2} → 2(π ⁺ π ⁻)

NODE=M057G07
NODE=M057G07

$$\Gamma(\eta\eta) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{26}\Gamma_{63}/\Gamma$$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT

0.53±0.22±0.09	8	²² UEHARA	10A BELL	10.6 e ⁺ e ⁻ → e ⁺ e ⁻ ηη

²²Interference with the continuum not included.

NODE=M057G13
NODE=M057G13

NODE=M057G13;LINKAGE=UE

$$\Gamma(K^+K^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{27}\Gamma_{63}/\Gamma$$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT

0.56±0.04 OUR FIT

[0.56 ± 0.05 eV OUR 2012 FIT]

0.44±0.11±0.07	33 ± 8	NAKAZAWA	05 BELL	10.6 e ⁺ e ⁻ → e ⁺ e ⁻ K ⁺ K ⁻

NODE=M057G5
NODE=M057G5
NEW

$$\Gamma(K_S^0 K_S^0) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{28}\Gamma_{63}/\Gamma$$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT

0.297±0.025 OUR FIT

[0.297 ± 0.026 eV OUR 2012 FIT]

0.31 ± 0.05 ± 0.03	38 ± 7	CHEN	07B BELL	e ⁺ e ⁻ → e ⁺ e ⁻ χ _{c2}

NODE=M057G6
NODE=M057G6
NEW

$$\Gamma(\bar{K}^0 K^+ \pi^- + \text{c.c.}) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{29}\Gamma_{63}/\Gamma$$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT

0.71±0.11 OUR FIT

[0.72 ± 0.11 eV OUR 2012 FIT]

1.20±0.33±0.13	126	²³ DEL-AMO-SA..11M	BABR	γγ → K _S ⁰ K [±] π [∓]

²³We have multiplied $\bar{K} K \pi$ by 2/3 to obtain $\bar{K}^0 K^+ \pi^- + \text{c.c.}$

NODE=M057G01
NODE=M057G01
NEW

NODE=M057G01;LINKAGE=DE

$$\Gamma(K^+ K^- K^+ K^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{36}\Gamma_{63}/\Gamma$$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT

0.91±0.12 OUR FIT

1.10±0.21±0.15	126 ± 24	UEHARA	08 BELL	γγ → χ _{c2} → 2(K ⁺ K ⁻)

NODE=M057G11
NODE=M057G11

$$\Gamma(\eta_c(1S)\pi^+\pi^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{58}\Gamma_{63}/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT

<15.7	90	LEES	12AE BABR	e ⁺ e ⁻ → e ⁺ e ⁻ π ⁺ π ⁻ η _c

NODE=M057G05
NODE=M057G05

χ_{c2}(1P) BRANCHING RATIOS

NODE=M057225

HADRONIC DECAYS

NODE=M057305

$$\Gamma(2(\pi^+\pi^-))/\Gamma_{\text{total}} \quad \Gamma_1/\Gamma$$

VALUE	DOCUMENT ID

0.0110±0.0011 OUR FIT

NODE=M057R2
NODE=M057R2

$$\Gamma(\rho^0\pi^+\pi^-)/\Gamma(2(\pi^+\pi^-)) \quad \Gamma_{23}/\Gamma_1$$

VALUE	DOCUMENT ID	TECN	COMMENT

0.36±0.15 OUR FIT

0.31±0.17	TANENBAUM	78 MRK1	ψ(2S) → γχ _{c2}

NODE=M057R38
NODE=M057R38

$\Gamma(\pi^+\pi^-\pi^0\pi^0)/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
1.99±0.26 OUR AVERAGE		[(2.00 ± 0.26)% OUR 2012 AVERAGE]		
1.99±0.25±0.08	903.5	²⁴ HE	08B CLEO	$e^+e^- \rightarrow \gamma h^+ h^- h^0 h^0$

²⁴ 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 $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.76 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R46

NODE=M057R46

NEW

NODE=M057R46;LINKAGE=HE

 $\Gamma(\rho^+\pi^-\pi^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
2.4±0.4±0.1	1031.9	^{25,26} HE	08B CLEO	$e^+e^- \rightarrow \gamma h^+ h^- h^0 h^0$

²⁵ 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 $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.76 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

²⁶ Calculated by us. We have added the values from HE 08B for $\rho^+\pi^-\pi^0$ and $\rho^-\pi^+\pi^0$ decays assuming uncorrelated statistical and fully correlated systematic uncertainties.

NODE=M057R47

NODE=M057R47

NODE=M057R47;LINKAGE=HE

NODE=M057R47;LINKAGE=OC

 $\Gamma(4\pi^0)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.21±0.16±0.05	1164	²⁷ ABLIKIM	11A BES3	$e^+e^- \rightarrow \psi(2S) \rightarrow \gamma\chi_{c2}$

²⁷ 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 $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.76 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R58

NODE=M057R58

NODE=M057R58;LINKAGE=AB

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

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.22±0.04 OUR AVERAGE		[(0.22 ± 0.05)% OUR 2012 AVERAGE]		
0.22±0.04±0.01	76.9	²⁸ HE	08B CLEO	$e^+e^- \rightarrow \gamma h^+ h^- h^0 h^0$

²⁸ 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 $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.76 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R48

NODE=M057R48

NEW

NODE=M057R48;LINKAGE=HE

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

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
1.50±0.22 OUR AVERAGE		[(1.51 ± 0.22)% OUR 2012 AVERAGE]		
1.50±0.21±0.06	211.6	²⁹ HE	08B CLEO	$e^+e^- \rightarrow \gamma h^+ h^- h^0 h^0$

²⁹ HE 08B reports $1.41 \pm 0.11 \pm 0.16 \pm 0.10$ % from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K^+\pi^-K^0\pi^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ 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 $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.76 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R50

NODE=M057R50

NEW

NODE=M057R50;LINKAGE=HE

 $\Gamma(\rho^+K^-K^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.45±0.13±0.02	62.9	³⁰ HE	08B CLEO	$e^+e^- \rightarrow \gamma h^+ h^- h^0 h^0$

³⁰ HE 08B reports $0.42 \pm 0.11 \pm 0.06 \pm 0.03$ % from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \rho^+K^-K^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ 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 $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.76 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R51

NODE=M057R51

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
0.32±0.09±0.01	38.7	³¹ HE	08B CLEO	$e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$

NODE=M057R57
NODE=M057R57

³¹ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (8.76 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R57;LINKAGE=HE

$$\Gamma(K^*(892)^0 K^0 \pi^0 \rightarrow K^+ \pi^- K^0 \pi^0 + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_{10}/\Gamma$$

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.42±0.09±0.02	63.0	³² HE	08B CLEO	$e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$

NODE=M057R52
NODE=M057R52

³² HE 08B reports $0.39 \pm 0.07 \pm 0.05 \pm 0.03$ % from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K^*(892)^0 K^0 \pi^0 \rightarrow K^+ \pi^- K^0 \pi^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (8.76 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R52;LINKAGE=HE

$$\Gamma(K^*(892)^- K^+ \pi^0 \rightarrow K^+ \pi^- K^0 \pi^0 + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_{11}/\Gamma$$

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.40±0.09 OUR AVERAGE		[(0.41 ± 0.09)% OUR 2012 AVERAGE]		
0.40±0.09±0.02	51.1	³³ HE	08B CLEO	$e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$

NODE=M057R53
NODE=M057R53
NEW

³³ HE 08B reports $0.38 \pm 0.07 \pm 0.04 \pm 0.03$ % from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K^*(892)^- K^+ \pi^0 \rightarrow K^+ \pi^- K^0 \pi^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (8.76 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R53;LINKAGE=HE

$$\Gamma(K^*(892)^+ K^0 \pi^- \rightarrow K^+ \pi^- K^0 \pi^0 + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_{12}/\Gamma$$

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.32±0.09±0.01	39.3	³⁴ HE	08B CLEO	$e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$

NODE=M057R54
NODE=M057R54

³⁴ HE 08B reports $0.30 \pm 0.07 \pm 0.04 \pm 0.02$ % from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K^*(892)^+ K^0 \pi^- \rightarrow K^+ \pi^- K^0 \pi^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (8.76 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R54;LINKAGE=HE

$$\Gamma(K^+ K^- \eta \pi^0)/\Gamma_{\text{total}} \quad \Gamma_{13}/\Gamma$$

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.14±0.05±0.01	22.9	³⁵ HE	08B CLEO	$e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$

NODE=M057R55
NODE=M057R55

³⁵ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (8.76 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R55;LINKAGE=HE

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

VALUE (units 10^{-3})	DOCUMENT ID
9.1±1.1 OUR FIT	

NODE=M057R3
NODE=M057R3

$$\Gamma(K^+ \bar{K}^*(892)^0 \pi^- + \text{c.c.})/\Gamma(K^+ K^- \pi^+ \pi^-) \quad \Gamma_{16}/\Gamma_{14}$$

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

$$\Gamma(K^+ \bar{K}^*(892)^0 \pi^- + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_{16}/\Gamma$$

VALUE (units 10^{-4})	DOCUMENT ID
23±12 OUR FIT	

NODE=M057R9
NODE=M057R9

$$\Gamma(K^*(892)^0 \bar{K}^*(892)^0)/\Gamma_{\text{total}} \quad \Gamma_{17}/\Gamma$$

VALUE (units 10^{-3})	DOCUMENT ID
2.5±0.5 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

36 BAI

99B BES

 $\psi(2S) \rightarrow \gamma\chi_{c2}$

8.7±5.9±0.4

36 TANENBAUM 78

MRK1

 $\psi(2S) \rightarrow \gamma\chi_{c2}$

36 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_{18}/Γ

NODE=M057R4

NODE=M057R4

→ UNCHECKED ←

NODE=M057R;LINKAGE=X3

 $\Gamma(\phi\phi)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

DOCUMENT ID

1.16±0.10 OUR FIT[(1.14 ± 0.12) × 10^{-3} OUR 2012 FIT] Γ_{19}/Γ

NODE=M057R20

NODE=M057R20

NEW

 $\Gamma(\omega\omega)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

EVTS

DOCUMENT ID

TECN

COMMENT

0.92±0.11 OUR AVERAGE

0.89±0.11±0.03

762

37

ABLIKIM

11K BES3

 $\psi(2S) \rightarrow \gamma$ hadrons

1.9 ± 0.6 ± 0.1

27.7 ± 7.4

38

ABLIKIM

05N BES2

 $\psi(2S) \rightarrow \gamma\chi_{c2} \rightarrow \gamma 6\pi$

37 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 $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.76 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

38 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 $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.76 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

 Γ_{20}/Γ

NODE=M057R28

NODE=M057R28

NODE=M057R28;LINKAGE=AL

NODE=M057R28;LINKAGE=AB

 $\Gamma(\omega\phi)/\Gamma_{\text{total}}$ VALUE (units 10^{-5})

CL%

DOCUMENT ID

TECN

COMMENT

<2.0

90

39

ABLIKIM

11K BES3

 $\psi(2S) \rightarrow \gamma$ hadrons

39 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 $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = 8.76 \times 10^{-2}$.

 Γ_{21}/Γ

NODE=M057R63

NODE=M057R63

NODE=M057R63;LINKAGE=AL

 $\Gamma(\pi\pi)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

DOCUMENT ID

2.42±0.13 OUR FIT[(2.43 ± 0.13) × 10^{-3} OUR 2012 FIT] Γ_{22}/Γ

NODE=M057R27

NODE=M057R27

NEW

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

DOCUMENT ID

40±17 OUR FIT Γ_{23}/Γ

NODE=M057R8

NODE=M057R8

 $\Gamma(\pi^+\pi^-\eta)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

CL%

DOCUMENT ID

TECN

COMMENT

0.52±0.14±0.02

40

ATHAR

07

CLEO

 $\psi(2S) \rightarrow \gamma h^+ h^- h^0$

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

<1.6

90

41

ABLIKIM

06R

BES2

 $\psi(2S) \rightarrow \gamma\chi_{c2}$

40 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 $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.76 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

41 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 $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = 8.76 \times 10^{-2}$.

 Γ_{24}/Γ

NODE=M057R08

NODE=M057R08

NODE=M057R08;LINKAGE=AT

NODE=M057R08;LINKAGE=AB

$\Gamma(\pi^+ \pi^- \eta')/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

DOCUMENT ID

TECN

COMMENT

 Γ_{25}/Γ NODE=M057R35
NODE=M057R35**0.54±0.20 OUR AVERAGE** $[(0.55 \pm 0.20) \times 10^{-3}]$ OUR 2012 AVERAGE]

NEW

0.54±0.20±0.02⁴² ATHAR

07

CLEO

 $\psi(2S) \rightarrow \gamma h^+ h^- h^0$

NODE=M057R35;LINKAGE=AT

⁴² 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 $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (8.76 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

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

DOCUMENT ID

 Γ_{26}/Γ NODE=M057R16
NODE=M057R16**5.9±0.5 OUR FIT** $\Gamma(K^+ K^-)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

DOCUMENT ID

 Γ_{27}/Γ NODE=M057R11
NODE=M057R11**1.09±0.08 OUR FIT** $\Gamma(K_S^0 K_S^0)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

DOCUMENT ID

 Γ_{28}/Γ NODE=M057R19
NODE=M057R19**0.58±0.05 OUR FIT** $\Gamma(K_S^0 K_S^0)/\Gamma(\pi\pi)$

VALUE

DOCUMENT ID

TECN

COMMENT

 Γ_{28}/Γ_{22} NODE=M057R36
NODE=M057R36**0.239±0.019 OUR FIT**

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

0.27 ±0.07 ±0.04

^{43,44} CHEN

07B

BELL

 $e^+ e^- \rightarrow e^+ e^- \chi_{c2}$

NODE=M057R36;LINKAGE=CH

⁴³ 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 $\pi\pi$.

⁴⁴ Not independent from other measurements.

NODE=M057R36;LINKAGE=NI

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

VALUE

DOCUMENT ID

TECN

COMMENT

 Γ_{28}/Γ_{27} NODE=M057R37
NODE=M057R37**0.53±0.05 OUR FIT**

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

0.70±0.21±0.12

^{45,46} CHEN

07B

BELL

 $e^+ e^- \rightarrow e^+ e^- \chi_{c2}$

⁴⁵ Using $\Gamma(K^+ K^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ from NAKAZAWA 05.

⁴⁶ Not independent from other measurements.

NODE=M057R37;LINKAGE=CH
NODE=M057R37;LINKAGE=NI $\Gamma(K^+ K^- \pi^0)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

DOCUMENT ID

TECN

COMMENT

 Γ_{30}/Γ NODE=M057R05
NODE=M057R05**0.33±0.08±0.01**⁴⁷ ATHAR

07

CLEO

 $\psi(2S) \rightarrow \gamma h^+ h^- h^0$

NODE=M057R05;LINKAGE=AT

⁴⁷ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (8.76 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

 $\Gamma(K^+ K^- \eta)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

CL%

DOCUMENT ID

TECN

COMMENT

 Γ_{31}/Γ NODE=M057R09
NODE=M057R09**<0.35**

90

⁴⁸ ATHAR

07

CLEO

 $\psi(2S) \rightarrow \gamma h^+ h^- h^0$

NODE=M057R09;LINKAGE=AT

⁴⁸ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 8.76 \times 10^{-2}$.

 $\Gamma(\eta\eta')/\Gamma_{\text{total}}$ VALUE (units 10^{-4})

CL%

EVTS

DOCUMENT ID

TECN

COMMENT

 Γ_{32}/Γ NODE=M057R03
NODE=M057R03**<0.6**

90

3.3 ± 8.0

⁴⁹ ASNER

09

CLEO

 $\psi(2S) \rightarrow \gamma \eta \eta'$

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

<2.5

90

⁵⁰ ADAMS

07

CLEO

 $\psi(2S) \rightarrow \gamma \chi_{c2}$

- ⁴⁹ 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 $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = 8.76 \times 10^{-2}$.
- ⁵⁰ 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 $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = 8.76 \times 10^{-2}$.

NODE=M057R03;LINKAGE=AS

NODE=M057R03;LINKAGE=AD

 $\Gamma(\eta'\eta')/\Gamma_{\text{total}}$ Γ_{33}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<1.1	90	12 $\pm$ 7	⁵¹ ASNER	09 CLEO	$\psi(2S) \rightarrow \gamma\eta'\eta'$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<3.3	90		⁵² ADAMS	07 CLEO	$\psi(2S) \rightarrow \gamma\chi_{c2}$

NODE=M057R04
NODE=M057R04

- ⁵¹ 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 $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = 8.76 \times 10^{-2}$.

NODE=M057R04;LINKAGE=AS

- ⁵² 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 $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = 8.76 \times 10^{-2}$.

NODE=M057R04;LINKAGE=AD

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

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
2.4$\pm$0.6$\pm$0.1		57 $\pm$ 11	⁵³ ABLIKIM	050 BES2	$\psi(2S) \rightarrow \gamma\chi_{c2}$

NODE=M057R31
NODE=M057R31

- ⁵³ 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 $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.76 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R31;LINKAGE=AB

 $\Gamma(K^+K^-K_S^0K_S^0)/\Gamma_{\text{total}}$ Γ_{35}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<4	90	2.3 $\pm$ 2.2	⁵⁴ ABLIKIM	050 BES2	$e^+e^- \rightarrow \chi_{c2}\gamma$

NODE=M057R32
NODE=M057R32

- ⁵⁴ ABLIKIM 050 reports $[\Gamma(\chi_{c2}(1P) \rightarrow K^+K^-K_S^0K_S^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ < 3.5×10^{-5} which we divide by our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = 8.76 \times 10^{-2}$.

NODE=M057R32;LINKAGE=AB

 $\Gamma(K^+K^-K^+K^-)/\Gamma_{\text{total}}$ Γ_{36}/Γ

VALUE (units 10^{-3})	DOCUMENT ID
1.78$\pm$0.22 OUR FIT	

NODE=M057R18
NODE=M057R18 $\Gamma(K^+K^-\phi)/\Gamma_{\text{total}}$ Γ_{37}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.54$\pm$0.32 OUR AVERAGE		[(1.55 $\pm$ 0.33) $\times 10^{-3}$ OUR 2012 AVERAGE]		

NODE=M057R01
NODE=M057R01

- 1.54 $\pm$ 0.32 $\pm$ 0.06** 52 ⁵⁵ ABLIKIM 06T BES2 $\psi(2S) \rightarrow \gamma 2K^+ 2K^-$
- ⁵⁵ 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 $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.76 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NEW

NODE=M057R01;LINKAGE=AB

 $\Gamma(p\bar{p})/\Gamma_{\text{total}}$ Γ_{38}/Γ

VALUE (units 10^{-4})	DOCUMENT ID
0.71$\pm$0.04 OUR FIT	
[(0.72 $\pm$ 0.04) $\times 10^{-4}$ OUR 2012 FIT]	

NODE=M057R12
NODE=M057R12

NEW

 $\Gamma(p\bar{p}\pi^0)/\Gamma_{\text{total}}$ Γ_{39}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
0.51$\pm$0.05 OUR AVERAGE			
0.51 $\pm$ 0.04 $\pm$ 0.02	⁵⁶ ONYISI	10 CLE3	$\psi(2S) \rightarrow \gamma p\bar{p}X$
0.47 $\pm$ 0.10 $\pm$ 0.02	⁵⁷ ATHAR	07 CLEO	$\psi(2S) \rightarrow \gamma h^+ h^- h^0$

NODE=M057R06
NODE=M057R06

- ⁵⁶ 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 $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.76 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.
- ⁵⁷ 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 $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.76 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R06;LINKAGE=ON

NODE=M057R06;LINKAGE=AT

 $\Gamma(p\bar{p}\eta)/\Gamma_{\text{total}}$ **Γ_{40}/Γ** VALUE (units 10^{-3})

DOCUMENT ID

TECN

COMMENT

0.189±0.028 OUR AVERAGE[(0.190 ± 0.028) × 10⁻³ OUR 2012 AVERAGE]

0.188±0.028±0.007

⁵⁸ ONYISI

10

CLE3

 $\psi(2S) \rightarrow \gamma p\bar{p}X$

0.20 ± 0.08 ± 0.01

⁵⁹ ATHAR

07

CLEO

 $\psi(2S) \rightarrow \gamma h^+ h^- h^0$

- ⁵⁸ 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 $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.76 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R34;LINKAGE=ON

- ⁵⁹ 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 $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.76 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R34;LINKAGE=AT

 $\Gamma(p\bar{p}\omega)/\Gamma_{\text{total}}$ **Γ_{41}/Γ** VALUE (units 10^{-3})

DOCUMENT ID

TECN

COMMENT

0.39±0.05±0.02⁶⁰ ONYISI

10

CLE3

 $\psi(2S) \rightarrow \gamma p\bar{p}X$

- ⁶⁰ 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 $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.76 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R56
NODE=M057R56

NODE=M057R56;LINKAGE=ON

 $\Gamma(p\bar{p}\phi)/\Gamma_{\text{total}}$ **Γ_{42}/Γ** VALUE (units 10^{-5})

EVTS

DOCUMENT ID

TECN

COMMENT

3.0±0.9±0.1

24 ± 7

⁶¹ ABLIKIM

11F

BES3

 $\psi(2S) \rightarrow \gamma p\bar{p}K^+K^-$

- ⁶¹ 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 $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.76 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R62
NODE=M057R62

NODE=M057R62;LINKAGE=AB

 $\Gamma(p\bar{p}\pi^+\pi^-)/\Gamma_{\text{total}}$ **Γ_{43}/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

⁶² BAI

99B

BES

 $\psi(2S) \rightarrow \gamma\chi_{c2}$

2.64±1.03±0.14

⁶² TANENBAUM

78

MRK1

 $\psi(2S) \rightarrow \gamma\chi_{c2}$

- ⁶² 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_{44}/Γ**

VALUE (%)

EVTS

DOCUMENT ID

TECN

COMMENT

0.085±0.026 OUR AVERAGE

[(0.086 ± 0.026)% OUR 2012 AVERAGE]

0.085±0.025±0.003

29.2

⁶³ HE

08B

CLEO

 $e^+e^- \rightarrow \gamma h^+ h^- h^0 h^0$

- ⁶³ 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 $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.76 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R49
NODE=M057R49

NEW

NODE=M057R49;LINKAGE=HE

$\Gamma(p\bar{p}K^+K^- \text{ (non-resonant)})/\Gamma_{\text{total}}$ Γ_{45}/Γ

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

2.08±0.35 OUR AVERAGE $[(2.1 \pm 0.4) \times 10^{-4} \text{ OUR 2012 AVERAGE}]$ **2.08±0.34±0.08** 131 ± 12 ⁶⁴ ABLIKIM 11F BES3 $\psi(2S) \rightarrow \gamma p\bar{p}K^+K^-$

⁶⁴ 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 $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.76 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R59
NODE=M057R59

NEW

NODE=M057R59;LINKAGE=AB

 $\Gamma(p\bar{p}K_S^0K_S^0)/\Gamma_{\text{total}}$ Γ_{46}/Γ

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

<7.9 90 ⁶⁵ ABLIKIM 06D BES2 $\psi(2S) \rightarrow \chi_{c2}\gamma$ ⁶⁵ 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_{47}/Γ

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

11.1±3.7±0.4 ⁶⁶ ABLIKIM 06I BES2 $\psi(2S) \rightarrow \gamma p\pi^-X$

⁶⁶ 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 $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.76 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R33
NODE=M057R33

NODE=M057R33;LINKAGE=AB

 $\Gamma(\Lambda\bar{\Lambda})/\Gamma_{\text{total}}$ Γ_{48}/Γ

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

1.86±0.27 OUR FITNODE=M057R25
NODE=M057R25 $\Gamma(\Lambda\bar{\Lambda}\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{49}/Γ

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

<3.5 90 ⁶⁷ ABLIKIM 06D BES2 $\psi(2S) \rightarrow \chi_{c2}\gamma$ ⁶⁷ Using $B(\psi(2S) \rightarrow \chi_{c2}\gamma) = (9.3 \pm 0.6)\%$.NODE=M057R29
NODE=M057R29

NODE=M057R29;LINKAGE=AB

 $\Gamma(K^+\bar{p}\Lambda + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{50}/Γ

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

8.4±0.6 OUR AVERAGE $[(0.91 \pm 0.18) \times 10^{-3} \text{ OUR 2012 AVERAGE}]$ 8.4±0.6±0.3 5k ^{68,69} ABLIKIM 13D BES3 $\psi(2S) \rightarrow \gamma\Lambda\bar{p}K^+$ 9.1±1.7±0.4 ⁷⁰ ATHAR 07 CLEO $\psi(2S) \rightarrow \gamma h^+h^-h^0$

⁶⁸ 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 $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.76 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

⁶⁹ Using $B(\Lambda \rightarrow p\pi^-) = 63.9\%$.

⁷⁰ 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 $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.76 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R07
NODE=M057R07

NEW

NODE=M057R07;LINKAGE=AB

NODE=M057R07;LINKAGE=LB
NODE=M057R07;LINKAGE=AT $\Gamma(K^+p\Lambda(1520) + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{51}/Γ

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

3.1±0.7±0.1 79 ± 13 ⁷¹ ABLIKIM 11F BES3 $\psi(2S) \rightarrow \gamma p\bar{p}K^+K^-$

⁷¹ ABLIKIM 11F reports $(3.06 \pm 0.50 \pm 0.54) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K^+p\Lambda(1520) + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.74 \pm 0.35) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.76 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R60
NODE=M057R60

NODE=M057R60;LINKAGE=AB

$\Gamma(\Lambda(1520)\bar{\Lambda}(1520))/\Gamma_{\text{total}}$ Γ_{52}/Γ

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

5.0±1.6 OUR AVERAGE $[(5.1 \pm 1.6) \times 10^{-4}]$ OUR 2012 AVERAGE]**5.0±1.6±0.2** 29 ± 7 ⁷² ABLIKIM 11F BES3 $\psi(2S) \rightarrow \gamma p \bar{p} K^+ K^-$

⁷² 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 $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (8.76 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R61
NODE=M057R61

NEW

NODE=M057R61;LINKAGE=AB

 $\Gamma(\Sigma^0 \bar{\Sigma}^0)/\Gamma_{\text{total}}$ Γ_{53}/Γ

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

<0.8 90 7.5 ± 3.4 ⁷³ NAIK 08 CLEO $\psi(2S) \rightarrow \gamma \Sigma^0 \bar{\Sigma}^0$

⁷³ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 8.76 \times 10^{-2}$.

NODE=M057R43
NODE=M057R43

NODE=M057R43;LINKAGE=NA

 $\Gamma(\Sigma^+ \bar{\Sigma}^-)/\Gamma_{\text{total}}$ Γ_{54}/Γ

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

<0.7 90 4.0 ± 3.5 ⁷⁴ NAIK 08 CLEO $\psi(2S) \rightarrow \gamma \Sigma^+ \bar{\Sigma}^-$

⁷⁴ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 8.76 \times 10^{-2}$.

NODE=M057R44
NODE=M057R44

NODE=M057R44;LINKAGE=NA

 $\Gamma(\Xi^0 \bar{\Xi}^0)/\Gamma_{\text{total}}$ Γ_{55}/Γ

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

<1.1 90 2.9 ± 1.7 ⁷⁵ NAIK 08 CLEO $\psi(2S) \rightarrow \gamma \Xi^0 \bar{\Xi}^0$

⁷⁵ NAIK 08 reports $< 1.06 \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \Xi^0 \bar{\Xi}^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 8.76 \times 10^{-2}$.

NODE=M057R45
NODE=M057R45

NODE=M057R45;LINKAGE=NA

 $\Gamma(\Xi^- \bar{\Xi}^+)/\Gamma_{\text{total}}$ Γ_{56}/Γ

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

1.55±0.34±0.06 29 ± 5 ⁷⁶ NAIK 08 CLEO $\psi(2S) \rightarrow \gamma \Xi^+ \bar{\Xi}^-$

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

< 3.7 90 ⁷⁷ ABLIKIM 06D BES2 $\psi(2S) \rightarrow \chi_{c2} \gamma$

⁷⁶ NAIK 08 reports $(1.45 \pm 0.30 \pm 0.15) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \Xi^- \bar{\Xi}^+)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (8.76 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

⁷⁷ 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_{57}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<0.015 90 BARATE 81 SPEC 190 GeV $\pi^- \text{Be} \rightarrow 2\pi 2\mu$ NODE=M057R13
NODE=M057R13 $\Gamma(\eta_c(1S)\pi^+\pi^-)/\Gamma(K^0 K^+ \pi^- + \text{c.c.})$ Γ_{58}/Γ_{29}

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<16.4 90 ⁷⁸ LEES 12AE BABR $e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^- \eta_c$

⁷⁸ 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_{59}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT

0.198±0.008 OUR FIT

[0.195 ± 0.008 OUR 2012 FIT]

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

0.199±0.005±0.012 ⁷⁹ ADAM 05A CLEO $e^+ e^- \rightarrow \psi(2S) \rightarrow \gamma \chi_{c2}$

⁷⁹ 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=M057R7
NODE=M057R7
NEW

NODE=M057R7;LINKAGE=AD

$\Gamma(\gamma\rho^0)/\Gamma_{\text{total}}$ Γ_{60}/Γ

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

<21	90	13 $\pm$ 11	80 ABLIKIM	11E BES3	$\psi(2S) \rightarrow \gamma\gamma\rho^0$

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

<50	90	17.2 $\pm$ 6.8	81 BENNETT	08A CLEO	$\psi(2S) \rightarrow \gamma\gamma\rho^0$

80 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 $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = 8.76 \times 10^{-2}$.

81 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 $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = 8.76 \times 10^{-2}$.

NODE=M057R40
NODE=M057R40

NODE=M057R40;LINKAGE=AB

NODE=M057R40;LINKAGE=BE

 $\Gamma(\gamma\omega)/\Gamma_{\text{total}}$ Γ_{61}/Γ

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

<6	90	1 $\pm$ 6	82 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 $\pm$ 1.8	83 BENNETT	08A CLEO	$\psi(2S) \rightarrow \gamma\gamma\omega$

82 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 $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = 8.76 \times 10^{-2}$.

83 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 $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = 8.76 \times 10^{-2}$.

NODE=M057R41
NODE=M057R41

NODE=M057R41;LINKAGE=AB

NODE=M057R41;LINKAGE=BE

 $\Gamma(\gamma\phi)/\Gamma_{\text{total}}$ Γ_{62}/Γ

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

< 8	90	5 $\pm$ 5	84 ABLIKIM	11E BES3	$\psi(2S) \rightarrow \gamma\gamma\phi$

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

<12	90	1.3 $\pm$ 2.5	85 BENNETT	08A CLEO	$\psi(2S) \rightarrow \gamma\gamma\phi$

84 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 $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = 8.76 \times 10^{-2}$.

85 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 $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = 8.76 \times 10^{-2}$.

NODE=M057R42
NODE=M057R42

NODE=M057R42;LINKAGE=AB

NODE=M057R42;LINKAGE=BE

 $\Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ Γ_{63}/Γ

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

2.61 $\pm$ 0.16 OUR FIT

[(2.59 $\pm$ 0.16) $\times 10^{-4}$ OUR 2012 FIT]

NODE=M057R1
NODE=M057R1
NEW

 $\Gamma(\gamma\gamma)/\Gamma(\gamma J/\psi(1S))$ Γ_{63}/Γ_{59}

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

1.31 $\pm$ 0.09 OUR FIT

[(1.33 $\pm$ 0.09) $\times 10^{-3}$ OUR 2012 FIT]

0.99 $\pm$ 0.18

86 AMBROGIANI 00B E835 $\bar{p}p \rightarrow \chi_{c2} \rightarrow \gamma\gamma, \gamma J/\psi$

86 Calculated by us using $B(J/\psi(1S) \rightarrow e^+e^-) = 0.0593 \pm 0.0010$.

NODE=M057R23
NODE=M057R23

NEW

NODE=M057R;LINKAGE=7A

 $\Gamma(\gamma\gamma)/\Gamma_{\text{total}} \times \Gamma(\rho\bar{\rho})/\Gamma_{\text{total}}$ $\Gamma_{63}/\Gamma \times \Gamma_{38}/\Gamma$

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

1.85 $\pm$ 0.18 OUR FIT

[(1.86 $\pm$ 0.18) $\times 10^{-8}$ OUR 2012 FIT]

1.7 $\pm$ 0.4 OUR AVERAGE

1.60 $\pm$ 0.42

ARMSTRONG 93 E760 $\bar{p}p \rightarrow \gamma\gamma X$

9.9 $\pm$ 4.5

BAGLIN 87B SPEC $\bar{p}p \rightarrow \gamma\gamma X$

NODE=M057R24
NODE=M057R24

NEW

$\chi_{c2}(1P)$ CROSS-PARTICLE BRANCHING RATIOS

NODE=M057230

$$\Gamma(\chi_{c2}(1P) \rightarrow K^+ K^- \pi^+ \pi^-) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) / \Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)$$

$$\Gamma_{14} / \Gamma \times \Gamma_{120}^{\psi(2S)} / \Gamma_{11}^{\psi(2S)}$$

VALUE (units 10^{-3})

DOCUMENT ID

TECN

COMMENT

2.35±0.26 OUR FIT[(2.36 ± 0.27) × 10^{-3} OUR 2012 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

87 TANENBAUM

78

MRK1

 $\psi(2S) \rightarrow \gamma \chi_{c2}$

⁸⁷ The reported value is derived using $B(\psi(2S) \rightarrow \pi^+ \pi^- J/\psi) \times B(J/\psi \rightarrow \ell^+ \ell^-) = (4.6 \pm 0.7)\%$. Calculated by us using $B(J/\psi \rightarrow \ell^+ \ell^-) = 0.1181 \pm 0.0020$.

NODE=M057B18

NODE=M057B18

NEW

NODE=M057B18;LINKAGE=TA

$$\Gamma(\chi_{c2}(1P) \rightarrow K^*(892)^0 \bar{K}^*(892)^0) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) / \Gamma_{\text{total}}$$

$$\Gamma_{17} / \Gamma \times \Gamma_{120}^{\psi(2S)} / \Gamma^{\psi(2S)}$$

VALUE (units 10^{-4})

DOCUMENT ID

TECN

COMMENT

2.2 ±0.4 OUR FIT**3.11±0.36±0.48**

ABLIKIM

04H

BES2

 $\psi(2S) \rightarrow \gamma \chi_{c2}$

NODE=M057B19

NODE=M057B19

$$\Gamma(\chi_{c2}(1P) \rightarrow p \bar{p}) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) / \Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)$$

$$\Gamma_{38} / \Gamma \times \Gamma_{120}^{\psi(2S)} / \Gamma_{11}^{\psi(2S)}$$

VALUE (units 10^{-5})

DOCUMENT ID

TECN

COMMENT

1.83±0.13 OUR FIT[(1.86 ± 0.14) × 10^{-5} OUR 2012 FIT]**1.4 ±1.1**⁸⁸ BAI

98I

BES

 $\psi(2S) \rightarrow \gamma \chi_{c2} \rightarrow \gamma \bar{p} p$

⁸⁸ 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

NEW

NODE=M057B;LINKAGE=J8

$$\Gamma(\chi_{c2}(1P) \rightarrow p \bar{p}) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) / \Gamma_{\text{total}}$$

$$\Gamma_{38} / \Gamma \times \Gamma_{120}^{\psi(2S)} / \Gamma^{\psi(2S)}$$

VALUE (units 10^{-6})

EVTS

DOCUMENT ID

TECN

COMMENT

6.2±0.5 OUR FIT[(6.3 ± 0.5) × 10^{-6} OUR 2012 FIT]**6.7±1.1 OUR AVERAGE** Error includes scale factor of 1.5.

7.2±0.7±0.4

121 ± 12

⁸⁹ NAIK

08

CLEO

 $\psi(2S) \rightarrow \gamma p \bar{p}$ 4.4^{+1.6}_{-1.4}±0.614.3^{+5.2}_{-4.7}

BAI

04F

BES

 $\psi(2S) \rightarrow \gamma \chi_{c2}(1P) \rightarrow \gamma \bar{p} p$

⁸⁹ 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

NEW

NODE=M057B6;LINKAGE=NA

$$\Gamma(\chi_{c2}(1P) \rightarrow \Lambda \bar{\Lambda}) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) / \Gamma_{\text{total}}$$

$$\Gamma_{48} / \Gamma \times \Gamma_{120}^{\psi(2S)} / \Gamma^{\psi(2S)}$$

VALUE (units 10^{-6})

EVTS

DOCUMENT ID

TECN

COMMENT

16.3±2.3 OUR FIT**15.9±2.1±1.0**

71 ± 9

⁹⁰ NAIK

08

CLEO

 $\psi(2S) \rightarrow \gamma \Lambda \bar{\Lambda}$

⁹⁰ 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=NA

$$\Gamma(\chi_{c2}(1P) \rightarrow \Lambda \bar{\Lambda}) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) / \Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)$$

$$\Gamma_{48} / \Gamma \times \Gamma_{120}^{\psi(2S)} / \Gamma_{11}^{\psi(2S)}$$

VALUE (units 10^{-5})

EVTS

DOCUMENT ID

TECN

COMMENT

4.8±0.7 OUR FIT**7.1^{+3.1}_{-2.9}±1.3**8.3^{+3.7}_{-3.4}⁹¹ BAI

03E

BES

 $\psi(2S) \rightarrow \gamma \Lambda \bar{\Lambda}$

⁹¹ 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

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow \pi\pi)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))/\Gamma_{\text{total}}}{\Gamma_{22}/\Gamma \times \Gamma_{120}^{\psi(2S)}/\Gamma\psi(2S)}$$

VALUE (units 10 ⁻⁴)	EVTS	DOCUMENT ID	TECN	COMMENT

2.12±0.08 OUR FIT[(2.11 ± 0.08) × 10⁻⁴ OUR 2012 FIT]**2.17±0.09 OUR AVERAGE**

2.19±0.05±0.15	4.5k	92 ABLIKIM	10A BES3	e ⁺ e ⁻ → ψ(2S) → γχ _{c2}

2.23±0.06±0.10	2.5k	93 ASNER	09 CLEO	ψ(2S) → γπ ⁺ π ⁻

1.90±0.08±0.20	0.8k	94 ASNER	09 CLEO	ψ(2S) → γπ ⁰ π ⁰

⁹² Calculated by us. ABLIKIM 10A reports B(χ_{c2} → π⁰π⁰) = (0.88 ± 0.02 ± 0.06 ± 0.04) × 10⁻³ using B(ψ(2S) → γχ_{c2}) = (8.3 ± 0.4)%. We have multiplied the π⁰π⁰ measurement by 3 to obtain ππ.

⁹³ Calculated by us. ASNER 09 reports B(χ_{c2} → π⁺π⁻) = (1.59 ± 0.04 ± 0.07 ± 0.10) × 10⁻³ using B(ψ(2S) → γχ_{c2}) = (9.33 ± 0.14 ± 0.61)%. We have multiplied the π⁺π⁻ measurement by 3/2 to obtain ππ.

⁹⁴ Calculated by us. ASNER 09 reports B(χ_{c2} → π⁰π⁰) = (0.68 ± 0.03 ± 0.07 ± 0.04) × 10⁻³ using B(ψ(2S) → γχ_{c2}) = (9.33 ± 0.14 ± 0.61)%. We have multiplied the π⁰π⁰ measurement by 3 to obtain ππ.

NODE=M057B02

NODE=M057B02

NEW

OCCUR=2

NODE=M057B02;LINKAGE=AB

NODE=M057B02;LINKAGE=AS

NODE=M057B02;LINKAGE=AN

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow \pi\pi)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)}{\Gamma_{22}/\Gamma \times \Gamma_{120}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10 ⁻³)	EVTS	DOCUMENT ID	TECN	COMMENT

0.622±0.024 OUR FIT[(0.629 ± 0.024) × 10⁻³ OUR 2012 FIT]**0.54 ± 0.06 OUR AVERAGE**

0.66 ± 0.18 ± 0.37	21 ± 6	95 BAI	03C BES	ψ(2S) → γπ ⁰ π ⁰

0.54 ± 0.05 ± 0.04	185 ± 16	96 BAI	98i BES	ψ(2S) → γπ ⁺ π ⁻

⁹⁵ We have multiplied π⁰π⁰ measurement by 3 to obtain ππ.

⁹⁶ Calculated by us. The value for B(χ_{c2} → π⁺π⁻) reported by BAI 98i is derived using B(ψ(2S) → γχ_{c2}) = (7.8 ± 0.8)% and B(ψ(2S) → J/ψπ⁺π⁻) = (32.4 ± 2.6)% [BAI 98d]. We have multiplied π⁺π⁻ measurement by 3/2 to obtain ππ.

NODE=M057B9

NODE=M057B9

NEW

NODE=M057B;LINKAGE=BM

NODE=M057B;LINKAGE=BA

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow \eta\eta)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))/\Gamma_{\text{total}}}{\Gamma_{26}/\Gamma \times \Gamma_{120}^{\psi(2S)}/\Gamma\psi(2S)}$$

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	97 ABLIKIM	10A BES3	e ⁺ e ⁻ → ψ(2S) → γχ _{c2}

0.47±0.05±0.05	156 ± 14		ASNER	09 CLEO	ψ(2S) → γηη

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

< 0.44	90	98 ADAMS	07 CLEO	ψ(2S) → γχ _{c2}

< 3	90	BAI	03C BES	ψ(2S) → γηη → 5γ

0.62±0.31±0.19			LEE	85 CBAL	ψ(2S) → photons

⁹⁷ Calculated by us. ABLIKIM 10A reports B(χ_{c2} → ηη) = (0.65 ± 0.04 ± 0.05 ± 0.03) × 10⁻³ using B(ψ(2S) → γχ_{c2}) = (8.3 ± 0.4)%.

⁹⁸ Superseded by ASNER 09.

NODE=M057B04

NODE=M057B04

NODE=M057B04;LINKAGE=AB

NODE=M057B04;LINKAGE=AD

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow K^+K^-)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))/\Gamma_{\text{total}}}{\Gamma_{27}/\Gamma \times \Gamma_{120}^{\psi(2S)}/\Gamma\psi(2S)}$$

VALUE (units 10 ⁻⁵)	EVTS	DOCUMENT ID	TECN	COMMENT

9.5±0.6 OUR FIT**10.5±0.3±0.6**

1.6k	99 ASNER	09 CLEO	ψ(2S) → γK ⁺ K ⁻

⁹⁹ Calculated by us. ASNER 09 reports B(χ_{c2} → K⁺K⁻) = (1.13 ± 0.03 ± 0.06 ± 0.07) × 10⁻³ using B(ψ(2S) → γχ_{c2}) = (9.33 ± 0.14 ± 0.61)%.

NODE=M057B03

NODE=M057B03

NODE=M057B03;LINKAGE=AS

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow K^+K^-)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)}{\Gamma_{27}/\Gamma \times \Gamma_{120}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10 ⁻³)	EVTS	DOCUMENT ID	TECN	COMMENT

0.280±0.017 OUR FIT[(0.283 ± 0.017) × 10⁻³ OUR 2012 FIT]

115 ± 13	100 BAI	98i BES	ψ(2S) → γK ⁺ K ⁻

¹⁰⁰ Calculated by us. The value for B(χ_{c2} → K⁺K⁻) reported by BAI 98i is derived using B(ψ(2S) → γχ_{c2}) = (7.8 ± 0.8)% and B(ψ(2S) → J/ψπ⁺π⁻) = (32.4 ± 2.6)% [BAI 98d].

NODE=M057B8

NODE=M057B8

NEW

NODE=M057B;LINKAGE=BI

$$\Gamma(\chi_{c2}(1P) \rightarrow K_S^0 K_S^0) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) / \Gamma_{\text{total}}$$

$$\Gamma_{28} / \Gamma \times \Gamma_{120}^{\psi(2S)} / \Gamma^{\psi(2S)}$$

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

5.1 ± 0.4 OUR FIT

5.0 ± 0.4 OUR AVERAGE

4.9 ± 0.3 ± 0.3 373 ± 20 101 ASNER 09 CLEO $\psi(2S) \rightarrow \gamma K_S^0 K_S^0$
 5.72 ± 0.76 ± 0.63 65 ABLIKIM 05o BES2 $\psi(2S) \rightarrow \gamma K_S^0 K_S^0$

101 Calculated by us. ASNER 09 reports $B(\chi_{c2} \rightarrow K_S^0 K_S^0) = (0.53 \pm 0.03 \pm 0.03 \pm 0.03) \times 10^{-3}$ using $B(\psi(2S) \rightarrow \gamma \chi_{c2}) = (9.33 \pm 0.14 \pm 0.61)\%$.

NODE=M057B12
 NODE=M057B12

NODE=M057B12;LINKAGE=AS

$$\Gamma(\chi_{c2}(1P) \rightarrow K_S^0 K_S^0) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) / \Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)$$

$$\Gamma_{28} / \Gamma \times \Gamma_{120}^{\psi(2S)} / \Gamma_{11}^{\psi(2S)}$$

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

14.9 ± 1.1 OUR FIT

[(15.0 ± 1.1) × 10^{-5} OUR 2012 FIT]

14.7 ± 4.1 ± 3.3 102 BAI 99B BES $\psi(2S) \rightarrow \gamma K_S^0 K_S^0$

102 Calculated by us. The value of $B(\chi_{c2} \rightarrow K_S^0 K_S^0)$ reported by BAI 99B was derived using $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (7.8 \pm 0.8)\%$ and $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = (32.4 \pm 2.6)\%$ [BAI 98d].

NODE=M057B13
 NODE=M057B13

NEW

NODE=M057B13;LINKAGE=BA

$$\Gamma(\chi_{c2}(1P) \rightarrow \bar{K}^0 K^+ \pi^- + \text{c.c.}) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) / \Gamma_{\text{total}}$$

$$\Gamma_{29} / \Gamma \times \Gamma_{120}^{\psi(2S)} / \Gamma^{\psi(2S)}$$

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 37 103 ATHAR 07 CLEO $\psi(2S) \rightarrow \gamma K_S^0 K^\pm \pi^\mp$
 0.97 ± 0.32 ± 0.13 28 104 ABLIKIM 06R BES2 $\psi(2S) \rightarrow \gamma K_S^0 K^\pm \pi^\mp$

103 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 $B(\psi(2S) \rightarrow \gamma \chi_{c2}) = (9.33 \pm 0.14 \pm 0.61)\%$.

104 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

$$\Gamma(\chi_{c2}(1P) \rightarrow 2(\pi^+ \pi^-)) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) / \Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)$$

$$\Gamma_1 / \Gamma \times \Gamma_{120}^{\psi(2S)} / \Gamma_{11}^{\psi(2S)}$$

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

2.84 ± 0.27 OUR FIT

[(2.86 ± 0.27) × 10^{-3} OUR 2012 FIT]

3.1 ± 1.0 OUR AVERAGE Error includes scale factor of 2.5.

2.3 ± 0.1 ± 0.5 105 BAI 99B BES $\psi(2S) \rightarrow \gamma \chi_{c2}$
 4.3 ± 0.6 106 TANENBAUM 78 MRK1 $\psi(2S) \rightarrow \gamma \chi_{c2}$

105 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].

106 The value for $B(\psi(2S) \rightarrow \gamma \chi_{c2}) \times B(\chi_{c2} \rightarrow 2\pi^+ \pi^-)$ reported in TANENBAUM 78 is derived using $B(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-) \times B(J/\psi(1S) \ell^+ \ell^-) = (4.6 \pm 0.7)\%$. Calculated by us using $B(J/\psi(1S) \rightarrow \ell^+ \ell^-) = 0.1181 \pm 0.0020$.

NODE=M057B5
 NODE=M057B5

NEW

NODE=M057B;LINKAGE=K1

NODE=M057B;LINKAGE=K2

$$\Gamma(\chi_{c2}(1P) \rightarrow K^+ K^- K^+ K^-) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) / \Gamma_{\text{total}}$$

$$\Gamma_{36} / \Gamma \times \Gamma_{120}^{\psi(2S)} / \Gamma^{\psi(2S)}$$

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

1.56 ± 0.19 OUR FIT

[(1.55 ± 0.19) × 10^{-4} OUR 2012 FIT]

1.76 ± 0.16 ± 0.24 160 107 ABLIKIM 06T BES2 $\psi(2S) \rightarrow \gamma 2K^+ 2K^-$

107 Calculated by us. The value of $B(\chi_{c2} \rightarrow 2K^+ 2K^-)$ reported by ABLIKIM 06T was derived using $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (8.1 \pm 0.4)\%$.

NODE=M057B14
 NODE=M057B14

NEW

NODE=M057B14;LINKAGE=AB

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow K^+ K^- K^+ K^-) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) / \Gamma_{\text{total}}}{\Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)} \times \frac{\Gamma_{36} / \Gamma \times \Gamma_{120}^{\psi(2S)} / \Gamma_{11}^{\psi(2S)}}{\Gamma_{120}^{\psi(2S)} / \Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10^{-4})

DOCUMENT ID

TECN

COMMENT

4.6 ± 0.5 OUR FIT[(4.6 ± 0.6) × 10⁻⁴ OUR 2012 FIT]**3.6 ± 0.6 ± 0.6**

108 BAI

99B BES

 $\psi(2S) \rightarrow \gamma 2K^+ 2K^-$

108 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

NEW

NODE=M057B15;LINKAGE=BA

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow \phi \phi) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) / \Gamma_{\text{total}}}{\Gamma_{19} / \Gamma \times \Gamma_{120}^{\psi(2S)} / \Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10^{-4})

EVTS

DOCUMENT ID

TECN

COMMENT

1.01 ± 0.08 OUR FIT[(1.00 ± 0.10) × 10⁻⁴ OUR 2012 FIT]**0.98 ± 0.13 OUR AVERAGE** Error includes scale factor of 1.3.0.94 ± 0.03 ± 0.10 849 109 ABLIKIM 11K BES3 $\psi(2S) \rightarrow \gamma$ hadrons1.38 ± 0.24 ± 0.23 41 110 ABLIKIM 06T BES2 $\psi(2S) \rightarrow \gamma 2K^+ 2K^-$

109 Calculated by us. The value of $B(\chi_{c2} \rightarrow \phi \phi)$ reported by ABLIKIM 11K was derived using $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (8.74 \pm 0.35)\%$.

110 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

NEW

NODE=M057B16;LINKAGE=AL

NODE=M057B16;LINKAGE=AB

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow \phi \phi) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) / \Gamma_{\text{total}}}{\Gamma_{19} / \Gamma \times \Gamma_{120}^{\psi(2S)} / \Gamma_{11}^{\psi(2S)}}$$

2.98 ± 0.25 OUR FIT[(2.96 ± 0.29) × 10⁻⁴ OUR 2012 FIT]**4.8 ± 1.3 ± 1.3**

111 BAI

99B BES

 $\psi(2S) \rightarrow \gamma 2K^+ 2K^-$

111 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

NEW

NODE=M057B17;LINKAGE=BA

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow \gamma J/\psi(1S)) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) / \Gamma_{\text{total}}}{\Gamma_{59} / \Gamma \times \Gamma_{120}^{\psi(2S)} / \Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10^{-2})

EVTS

DOCUMENT ID

TECN

COMMENT

1.74 ± 0.04 OUR FIT[(1.70 ± 0.04) × 10⁻² OUR 2012 FIT]**1.52 ± 0.15 OUR AVERAGE** Error includes scale factor of 2.6. See the ideogram below.[(1.34 ± 0.14) × 10⁻² OUR 2012 AVERAGE Scale factor = 1.9]1.874 ± 0.007 ± 0.102 76k ABLIKIM 120 BES3 $\psi(2S) \rightarrow \gamma \chi_{c2}$ 1.62 ± 0.04 ± 0.12 5.8k BAI 04I BES2 $\psi(2S) \rightarrow J/\psi \gamma \gamma$ 0.99 ± 0.10 ± 0.08 GAISER 86 CBAL $\psi(2S) \rightarrow \gamma X$ 1.47 ± 0.17 112 OREGLIA 82 CBAL $\psi(2S) \rightarrow \gamma \chi_{c2}$ 1.8 ± 0.5 113 BRANDELIK 79B DASP $\psi(2S) \rightarrow \gamma \chi_{c2}$ 1.2 ± 0.2 113 BARTEL 78B CNTR $\psi(2S) \rightarrow \gamma \chi_{c2}$ 2.2 ± 1.2 114 BIDDICK 77 CNTR $e^+ e^- \rightarrow \gamma X$ 1.2 ± 0.7 112 WHITAKER 76 MRK1 $e^+ e^-$

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

1.95 ± 0.02 ± 0.07 12.4k 115 MENDEZ 08 CLEO $\psi(2S) \rightarrow \gamma \chi_{c2}$

1.85 ± 0.04 ± 0.07 1.9k 116 ADAM 05A CLEO Repl. by MENDEZ 08

112 Recalculated by us using $B(J/\psi(1S) \rightarrow \ell^+ \ell^-) = 0.1181 \pm 0.0020$.113 Recalculated by us using $B(J/\psi(1S) \rightarrow \mu^+ \mu^-) = 0.0588 \pm 0.0010$.

114 Assumes isotropic gamma distribution.

115 Not independent from other measurements of MENDEZ 08.

116 Not independent from other values reported by ADAM 05A.

NODE=M057B2

NODE=M057B2

NEW

NEW

NODE=M057B;LINKAGE=3Q

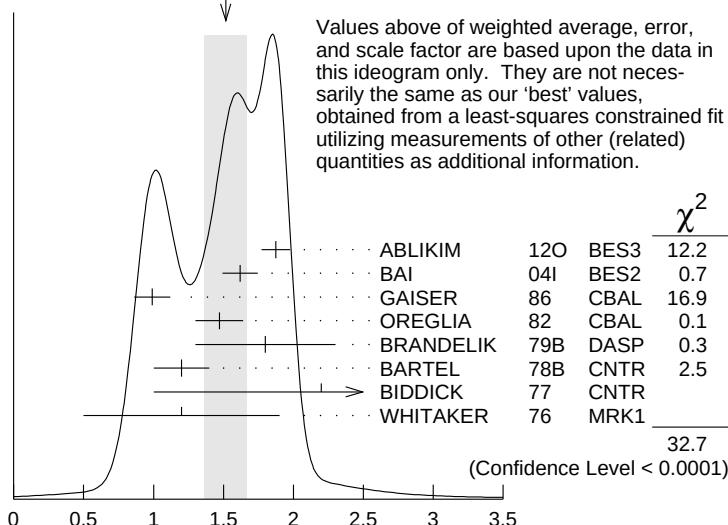
NODE=M057B;LINKAGE=2Q

NODE=M057B;LINKAGE=EA

NODE=M057B2;LINKAGE=ME

NODE=M057B;LINKAGE=AD

WEIGHTED AVERAGE
1.52±0.15 (Error scaled by 2.6)



$$\Gamma(\chi_{c2}(1P) \rightarrow \gamma J/\psi(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))/\Gamma_{\text{total}} \text{ (units } 10^{-2})$$

$$\Gamma(\chi_{c2}(1P) \rightarrow \gamma J/\psi(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S) \text{ anything})$$

$$\Gamma_{59}/\Gamma \times \Gamma_{120}^{\psi(2S)}/\Gamma_9^{\psi(2S)}$$

$$\Gamma_{59}/\Gamma \times \Gamma_{120}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)} + \Gamma_{12}^{\psi(2S)}/\Gamma_{13}^{\psi(2S)} + 0.348\Gamma_{119}^{\psi(2S)} + 0.198\Gamma_{120}^{\psi(2S)}$$

NODE=M057B7

NODE=M057B7

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

2.88±0.07 OUR FIT

[(2.86 ± 0.07) × 10^{-2} OUR 2012 FIT]

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

3.12±0.03±0.09 12.4k 117 MENDEZ 08 CLEO $\psi(2S) \rightarrow \gamma \chi_{c2}$
3.11±0.07±0.07 1.9k ADAM 05A CLEO Repl. by MENDEZ 08

117 Not independent from other measurements of MENDEZ 08.

NODE=M057B7

NEW

NODE=M057B7;LINKAGE=ME

$$\Gamma(\chi_{c2}(1P) \rightarrow \gamma J/\psi(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)$$

$$\Gamma_{59}/\Gamma \times \Gamma_{120}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}$$

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

5.10±0.12 OUR FIT

[(5.07 ± 0.13) × 10^{-2} OUR 2012 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 118 ABLIKIM 04B BES $\psi(2S) \rightarrow J/\psi X$
3.9 ± 1.2 119 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 120 ADAM 05A CLEO Repl. by MENDEZ 08

118 From a fit to the J/ψ recoil mass spectra.

119 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 $B(J/\psi(1S) \rightarrow \ell^+ \ell^-) = (0.1181 \pm 0.0020)$.

120 Not independent from other values reported by ADAM 05A.

NODE=M057B3

NODE=M057B3

NEW

NODE=M057B;LINKAGE=AB

NODE=M057B;LINKAGE=H8

NODE=M057B3;LINKAGE=AD

$$\Gamma(\chi_{c2}(1P) \rightarrow \gamma \gamma)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))/\Gamma_{\text{total}}$$

$$\Gamma_{63}/\Gamma \times \Gamma_{120}^{\psi(2S)}/\Gamma^{\psi(2S)}$$

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

2.28±0.16 OUR FIT

[(2.26 ± 0.16) × 10^{-5} OUR 2012 FIT]

2.73±0.32 OUR AVERAGE

2.68±0.28±0.15 333 ± 35 ECKLUND 08A CLEO $\psi(2S) \rightarrow \gamma \chi_{c2} \rightarrow 3\gamma$
7.0 ± 2.1 ± 2.0 LEE 85 CBAL $\psi(2S) \rightarrow \gamma \chi_{c2}$

NODE=M057B4

NODE=M057B4

NEW

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

NODE=M057A1
NODE=M057A1

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
-10.0±1.5 OUR AVERAGE				
-9.3±1.6±0.3	19.8k	¹²¹ ARTUSO	09 CLEO	$\psi(2S) \rightarrow \gamma\gamma\ell^+\ell^-$
-9.3 ^{+3.9} _{-4.1} ±0.6	5.9k	¹²² AMBROGIANI	02 E835	$p\bar{p} \rightarrow \chi_{c2} \rightarrow J/\psi\gamma$
-14 ± 6	1.9k	¹²² ARMSTRONG	93E E760	$p\bar{p} \rightarrow \chi_{c2} \rightarrow J/\psi\gamma$
-33.3 ^{+11.6} _{-29.2}	441	¹²² 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 ¹²³ ARTUSO 09 CLEO $\psi(2S) \rightarrow \gamma\gamma\ell^+\ell^-$

OCCUR=2

¹²¹ From a fit with floating M_2 amplitudes a_2 and b_2 , and fixed E_3 amplitudes $a_3=b_3=0$.

NODE=M057A1;LINKAGE=AR

¹²² Assuming $a_3=0$.

NODE=M057A1;LINKAGE=A

¹²³ From a fit with floating M_2 and E_3 amplitudes a_2 , b_2 , and a_3 , and b_3 .

NODE=M057A1;LINKAGE=AT

$a_3 = E_3/\sqrt{E_1^2 + M_2^2 + E_3^2}$ Electric octupole fractional transition amplitude

NODE=M057A2
NODE=M057A2

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
1.6±1.3 OUR AVERAGE				
1.7±1.4±0.3	19.8k	¹²⁴ ARTUSO	09 CLEO	$\psi(2S) \rightarrow \gamma\gamma\ell^+\ell^-$
2.0 ^{+5.5} _{-4.4} ±0.9	5908	AMBROGIANI	02 E835	$p\bar{p} \rightarrow \chi_{c2} \rightarrow J/\psi\gamma$
0 ⁺⁶ ₋₅	1904	ARMSTRONG	93E E760	$p\bar{p} \rightarrow \chi_{c2} \rightarrow J/\psi\gamma$

¹²⁴ From a fit with floating M_2 and E_3 amplitudes a_2 , b_2 , and a_3 , and b_3 .

NODE=M057A2;LINKAGE=AR

MULTIPOLE AMPLITUDES IN $\psi(2S) \rightarrow \gamma\chi_{c2}(1P)$ RADIATIVE DECAY

NODE=M057250

$b_2 = M_2/\sqrt{E_1^2 + M_2^2 + E_3^2}$ Magnetic quadrupole fractional transition amplitude

NODE=M057QB2
NODE=M057QB2

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
2.2±1.8 OUR AVERAGE Error includes scale factor of 1.7. See the ideogram below.				
4.6±1.0±1.3	13.8k	¹²⁵ ABLIKIM	11I BES3	$\psi(2S) \rightarrow \gamma\pi^+\pi^-, \gamma K^+ K^-$
0.2±1.5±0.4	19.8k	¹²⁶ ARTUSO	09 CLEO	$\psi(2S) \rightarrow \gamma\gamma\ell^+\ell^-$
-5.1 ^{+5.4} _{-3.6}	721	¹²⁵ ABLIKIM	04I BES2	$\psi(2S) \rightarrow \gamma\pi^+\pi^-, \gamma K^+ K^-$
13.2 ^{+9.8} _{-7.5}	441	¹²⁷ OREGLIA	82 CBAL	$\psi(2S) \rightarrow \gamma\gamma\ell^+\ell^-$

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

1.0±1.3±0.3 19.8k ¹²⁷ ARTUSO 09 CLEO $\psi(2S) \rightarrow \gamma\gamma\ell^+\ell^-$

OCCUR=2

¹²⁵ From a fit with floating M_2 and E_3 amplitudes b_2 and b_3 .

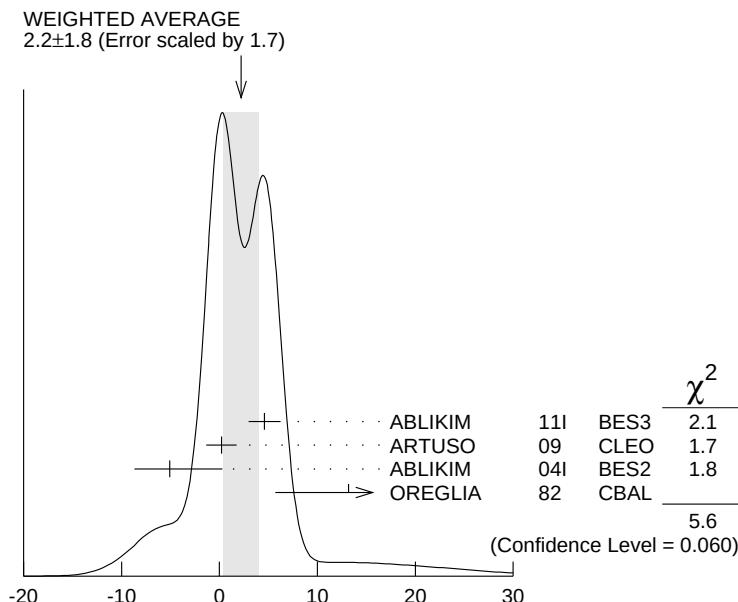
NODE=M057QB2;LINKAGE=AB

¹²⁶ From a fit with floating M_2 and E_3 amplitudes a_2 , b_2 , and a_3 , and b_3 .

NODE=M057QB2;LINKAGE=AT

¹²⁷ From a fit with floating M_2 amplitudes a_2 and b_2 , and fixed E_3 amplitudes $a_3=b_3=0$.

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
-0.3±1.0 OUR AVERAGE				
1.5±0.8±1.8	13.8k	128 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	128 ABLIKIM	04I BES2	$\psi(2S) \rightarrow \gamma\pi^+\pi^-, \gamma K^+K^-$

¹²⁸ From a fit with floating M_2 and E_3 amplitudes b_2 and b_3 .

NODE=M057QB3
NODE=M057QB3

NODE=M057QB3;LINKAGE=AB

MULTIPOLE AMPLITUDE RATIOS IN RADIATIVE DECAYS $\psi(2S) \rightarrow \gamma\chi_{c2}(1P)$ and $\chi_{c2} \rightarrow \gamma J/\psi(1S)$

NODE=M057260

b_2/a_2 Magnetic quadrupole transition amplitude ratio

NODE=M057QAR
NODE=M057QAR

VALUE (units 10^{-2})	EVTs	DOCUMENT ID	TECN	COMMENT
-11⁺¹⁴₋₁₅	19.8k	129 ARTUSO	09 CLEO	$\psi(2S) \rightarrow \gamma\gamma\ell^+\ell^-$

¹²⁹ 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;LINKAGE=AR

$\chi_{c2}(1P)$ REFERENCES

NODE=M057

ABLIKIM	13D	PR D87 012007	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=54879
ABLIKIM	120	PRL 109 172002	M. Ablikim <i>et al.</i>	(BES III 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>	(BES III Collab.)	REFID=53647
ABLIKIM	11E	PR D83 112005	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=16717
ABLIKIM	11F	PR D83 112009	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=16719
ABLIKIM	11I	PR D84 092006	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=53930
ABLIKIM	11K	PRL 107 092001	M. Ablikim <i>et al.</i>	(BES III 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>	(BES III 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

$$\eta_c(2S)$$

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

Quantum numbers are quark model predictions.

NODE=M059

NODE=M059

NODE=M059M

NODE=M059M

NEW

$\eta_c(2S)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
3639.4$\pm$1.3 OUR AVERAGE		Error includes scale factor of 1.2. [3638.9 $\pm$ 1.3 MeV OUR 2012 AVERAGE]		
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	¹ ABLIKIM	12G BES3	$\psi(2S) \rightarrow \gamma K^0 K \pi, K K \pi^0$
3638.5 $\pm$ 1.5 $\pm$ 0.8	624	² DEL-AMO-SA..11M BABR		$\gamma \gamma \rightarrow K_S^0 K^\pm \pi^\mp$
3640.5 $\pm$ 3.2 $\pm$ 2.5	1201	² 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	³ VINOKUROVA 11	BELL	$B^\pm \rightarrow K^\pm (K_S^0 K^\pm \pi^\mp)$
3626 $\pm$ 5 $\pm$ 6	311	⁴ 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 $\pm$ 7	98 $\pm$ 52	⁵ AUBERT	06E BABR	$B^\pm \rightarrow K^\pm X_{c \bar{c}}$
3630.8 $\pm$ 3.4 $\pm$ 1.0	112 $\pm$ 24	⁶ AUBERT	04D BABR	$\gamma \gamma \rightarrow \eta_c(2S) \rightarrow K \bar{K} \pi$
3654 $\pm$ 6 $\pm$ 8	39 $\pm$ 11	⁷ CHOI	02 BELL	$B \rightarrow K K_S K^- \pi^+$
3594 $\pm$ 5		⁸ EDWARDS	82C CBAL	$e^+ e^- \rightarrow \gamma X$

¹ From a simultaneous fit to $K_S^0 K^\pm \pi^\mp$ and $K^+ K^- \pi^0$ decay modes.

² Ignoring possible interference with continuum.

³ Accounts for interference with non-resonant continuum.

⁴ From a fit of the J/ψ recoil mass spectrum. Supersedes ABE, K 02 and ABE 04G.

⁵ From the fit of the kaon momentum spectrum. Systematic errors not evaluated.

⁶ Superseded by DEL-AMO-SANCHEZ 11M.

⁷ Superseded by VINOKUROVA 11.

⁸ Assuming mass of $\psi(2S) = 3686$ MeV.

OCCUR=2

NODE=M059M;LINKAGE=AB
 NODE=M059M;LINKAGE=DE
 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					
[10 $\pm$ 4 MeV OUR 2012 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	⁹ ABLIKIM	12G BES3	$\psi(2S) \rightarrow \gamma K^0 K \pi, K K \pi^0$
13.4 $\pm$ 4.6 $\pm$ 3.2		624	¹⁰ 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	¹¹ 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	¹² 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	¹³ AUBERT	04D BABR	$\gamma \gamma \rightarrow \eta_c(2S) \rightarrow K \bar{K} \pi$
<55	90	39 $\pm$ 11	¹⁴ CHOI	02 BELL	$B \rightarrow K K_S K^- \pi^+$
<8.0	95		¹⁵ EDWARDS	82C CBAL	$e^+ e^- \rightarrow \gamma X$

⁹ From a simultaneous fit to $K_S^0 K^\pm \pi^\mp$ and $K^+ K^- \pi^0$ decay modes.

¹⁰ Ignoring possible interference with continuum.

¹¹ Accounts for interference with non-resonant continuum.

¹² From the fit of the kaon momentum spectrum. Systematic errors not evaluated.

¹³ Superseded by DEL-AMO-SANCHEZ 11M.

¹⁴ For a mass value of 3654 $\pm$ 6 MeV. Superseded by VINOKUROVA 11.

¹⁵ For a mass value of 3594 $\pm$ 5 MeV

NODE=M059W

NODE=M059W

NEW

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 $2\pi^+ 2\pi^-$	not seen	
Γ_4 $\rho^0 \rho^0$	not seen	
Γ_5 $3\pi^+ 3\pi^-$	not seen	
Γ_6 $K^+ K^- \pi^+ \pi^-$	not seen	
Γ_7 $K^{*0} \bar{K}^{*0}$	not seen	
Γ_8 $K^+ K^- \pi^+ \pi^- \pi^0$	(1.4 ± 1.0) %	
Γ_9 $K^+ K^- 2\pi^+ 2\pi^-$	not seen	
Γ_{10} $K_S^0 K^- 2\pi^+ \pi^- + \text{c.c.}$	seen	
Γ_{11} $2K^+ 2K^-$	not seen	
Γ_{12} $\phi\phi$	not seen	
Γ_{13} $p\bar{p}$	$< 2.9 \times 10^{-4}$	90%
Γ_{14} $\gamma\gamma$	(1.9 ± 1.3) $\times 10^{-4}$	
Γ_{15} $\pi^+ \pi^- \eta$	not seen	
Γ_{16} $\pi^+ \pi^- \eta'$	not seen	
Γ_{17} $K^+ K^- \eta$	not seen	
Γ_{18} $\pi^+ \pi^- \eta_c(1S)$	< 25 %	90%

DESIG=1

DESIG=4

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=2

DESIG=12;OUR EVAL;→ UNCHECKED ←

DESIG=13;OUR EVAL;→ UNCHECKED ←

DESIG=14;OUR EVAL;→ UNCHECKED ←

DESIG=15

 $\eta_c(2S)$ PARTIAL WIDTHS

NODE=M059216

 $\Gamma(\gamma\gamma)$ Γ_{14}

VALUE (keV)	DOCUMENT ID	TECN	COMMENT

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

1.3 ± 0.6	16 ASNER	04	CLEO	$\gamma\gamma \rightarrow \eta_c \rightarrow K_S^0 K^\pm \pi^\mp$

¹⁶ 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 $K_S^0 K\pi$ are equal and using $\Gamma(\eta_c(1S) \rightarrow \gamma\gamma) = 7.4 \pm 0.4 \pm 2.3$ keV.

NODE=M059W1
NODE=M059W1

NODE=M059W1;LINKAGE=AS

 $\eta_c(2S)$ $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

NODE=M059218

 $\Gamma(2\pi^+ 2\pi^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_3\Gamma_{14}/\Gamma$

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 $\Gamma(K\bar{K}\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_2\Gamma_{14}/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
41 ± 4 ± 6	624	17 DEL-AMO-SA..11M	BABR	$\gamma\gamma \rightarrow K_S^0 K^\pm \pi^\mp$

NODE=M059G04
NODE=M059G04¹⁷ Not independent from other measurements reported in DEL-AMO-SANCHEZ 11M.

NODE=M059G04;LINKAGE=DE

 $\Gamma(K^+ K^- \pi^+ \pi^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_6\Gamma_{14}/\Gamma$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<5.0	90	UEHARA	08	BELL $\gamma\gamma \rightarrow \eta_c(2S) \rightarrow K^+ K^- \pi^+ \pi^-$

NODE=M059G02
NODE=M059G02 $\Gamma(K^+ K^- \pi^+ \pi^- \pi^0) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_8\Gamma_{14}/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
30 ± 6 ± 5	1201	18 DEL-AMO-SA..11M	BABR	$\gamma\gamma \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$

NODE=M059G05
NODE=M059G05¹⁸ Not independent from other measurements reported in DEL-AMO-SANCHEZ 11M.

NODE=M059G05;LINKAGE=DE

 $\Gamma(2K^+ 2K^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_{11}\Gamma_{14}/\Gamma$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<2.9	90	UEHARA	08	BELL $\gamma\gamma \rightarrow \eta_c(2S) \rightarrow 2(K^+ K^-)$

NODE=M059G03
NODE=M059G03 $\Gamma(\pi^+ \pi^- \eta_c(1S)) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_{18}\Gamma_{14}/\Gamma$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<133	90	LEES	12AE BABR	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^- \eta_c$

NODE=M059G06
NODE=M059G06

$\eta_c(2S) \Gamma(i) \Gamma(\gamma\gamma) / \Gamma^2(\text{total})$

NODE=M059217

 $\Gamma(p\bar{p}) / \Gamma_{\text{total}} \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$ $\Gamma_{13} / \Gamma \times \Gamma_{14} / \Gamma$

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

< 5.6	90 ^{19,20,21}	AMBROGIANI 01	E835	$\bar{p}p \rightarrow \gamma\gamma$

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

< 8.0	90 ^{19,20,22}	AMBROGIANI 01	E835	$\bar{p}p \rightarrow \gamma\gamma$

< 12.0	90 ^{20,22}	AMBROGIANI 01	E835	$\bar{p}p \rightarrow \gamma\gamma$

¹⁹ Including the measurements of of ARMSTRONG 95F in the AMBROGIANI 01 analysis.²⁰ For a total width $\Gamma=5$ MeV.²¹ For the resonance mass region 3589–3599 MeV/ c^2 .²² For the resonance mass region 3575–3660 MeV/ c^2 .NODE=M059G1
NODE=M059G1

OCCUR=2

OCCUR=3

NODE=M059G1;LINKAGE=A

NODE=M059G1;LINKAGE=B

NODE=M059G1;LINKAGE=C1

NODE=M059G1;LINKAGE=C2

 $\eta_c(2S)$ BRANCHING RATIOS

NODE=M059220

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

VALUE	DOCUMENT ID	TECN	COMMENT

not seen	ABREU 98O	DLPH	$e^+e^- \rightarrow e^+e^- + \text{hadrons}$

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

seen	²³ EDWARDS 82C	CBAL	$e^+e^- \rightarrow \gamma X$

²³ For a mass value of 3594 ± 5 MeVNODE=M059R1
NODE=M059R1

NODE=M059R;LINKAGE=W

 $\Gamma(K\bar{K}\pi) / \Gamma_{\text{total}}$ Γ_2 / Γ

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

$1.9 \pm 0.4 \pm 1.1$	59 ± 12	²⁴ AUBERT 08AB	BABR	$B \rightarrow \eta_c(2S) K \rightarrow K\bar{K}\pi K$

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

seen	127 ± 18	ABLIKIM 13K	BES3	$\psi(2S) \rightarrow \gamma K\bar{K}\pi$

seen	39 ± 11	²⁵ CHOI 02	BELL	$B \rightarrow K K_S K^- \pi^+$

²⁴ 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 $[B(B^+ \rightarrow \eta_c K^+) \times B(\eta_c \rightarrow K\bar{K}\pi)] = (6.88 \pm 0.77^{+0.55}_{-0.66}) \times 10^{-5}$.

²⁵ For a mass value of 3654 ± 6 MeVNODE=M059R3
NODE=M059R3

NODE=M059R3;LINKAGE=AU

NODE=M059R;LINKAGE=W2

 $\Gamma(2\pi^+ 2\pi^-) / \Gamma_{\text{total}}$ Γ_3 / Γ

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_4 / 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_6 / 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_8 / Γ_2

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

$0.73 \pm 0.17 \pm 0.17$	1201	²⁶ DEL-AMO-SA..11M	BABR	$\gamma\gamma \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$

²⁶ We have multiplied the value of $\Gamma(K^+ K^- \pi^+ \pi^- \pi^0) / \Gamma(K_S^0 K^\pm \pi^\mp)$ reported in DEL-AMO-SANCHEZ 11M by a factor 1/3 to obtain $\Gamma(K^+ K^- \pi^+ \pi^- \pi^0) / \Gamma(K\bar{K}\pi)$. Not independent from other measurements reported in DEL-AMO-SANCHEZ 11M.

NODE=M059R21
NODE=M059R21

NODE=M059R21;LINKAGE=DE

 $\Gamma(K^{*0} \bar{K}^{*0}) / \Gamma_{\text{total}}$ Γ_7 / 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_{10} / 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_{11} / 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_{12}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	ABLIKIM	11H BES3	$\psi(2S) \rightarrow \gamma K^+ K^- K^+ K^-$

NODE=M059R17
 NODE=M059R17

 $\Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ Γ_{14}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

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

<5 $\times 10^{-4}$	90	27 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	$\psi' \rightarrow \text{photons}$
27 WICHT 08 reports $[\Gamma(\eta_c(2S) \rightarrow \gamma\gamma)/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \eta_c(2S) K^+)] < 0.18 \times 10^{-6}$ which we divide by our best value $B(B^+ \rightarrow \eta_c(2S) K^+) = 3.4 \times 10^{-4}$.				

NODE=M059R2
 NODE=M059R2

NODE=M059R2;LINKAGE=WI

 $\Gamma(\pi^+ \pi^- \eta_c(1S))/\Gamma(K\bar{K}\pi)$ Γ_{18}/Γ_2

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<3.33	90	28 LEES	12AE BABR	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^- \eta_c$

28 We divided the reported limit by 3 to take into account isospin relations.

NODE=M059R23
 NODE=M059R23

NODE=M059R23;LINKAGE=LE

$\eta_c(2S)$ CROSS-PARTICLE BRANCHING RATIOS

NODE=M059230

$$\Gamma(\eta_c(2S) \rightarrow 2\pi^+ 2\pi^-)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\eta_c(2S))/\Gamma_{\text{total}}$$

$$\Gamma_3/\Gamma \times \Gamma_{122}^{\psi(2S)}/\Gamma\psi(2S)$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<14.6 $\times 10^{-6}$	90	29 CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma 2\pi^+ 2\pi^-$

29 Assuming $\Gamma(\eta_c(2S)) = 14$ MeV. CRONIN-HENNESSY 10 gives the analytic dependence of limits on width.

NODE=M059R05
 NODE=M059R05

NODE=M059R05;LINKAGE=CR

$$\Gamma(\eta_c(2S) \rightarrow \rho^0 \rho^0)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\eta_c(2S))/\Gamma_{\text{total}}$$

$$\Gamma_4/\Gamma \times \Gamma_{122}^{\psi(2S)}/\Gamma\psi(2S)$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<12.7 $\times 10^{-7}$	90	ABLIKIM	11H BES3	$\psi(2S) \rightarrow \gamma 2\pi^+ 2\pi^-$

NODE=M059R18
 NODE=M059R18

$$\Gamma(\eta_c(2S) \rightarrow 3\pi^+ 3\pi^-)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\eta_c(2S))/\Gamma_{\text{total}}$$

$$\Gamma_5/\Gamma \times \Gamma_{122}^{\psi(2S)}/\Gamma\psi(2S)$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<13.2 $\times 10^{-6}$	90	30 CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma 3\pi^+ 3\pi^-$

30 Assuming $\Gamma(\eta_c(2S)) = 14$ MeV. CRONIN-HENNESSY 10 gives the analytic dependence of limits on width.

NODE=M059R06
 NODE=M059R06

NODE=M059R06;LINKAGE=CR

$$\Gamma(\eta_c(2S) \rightarrow K^+ K^- \pi^+ \pi^-)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\eta_c(2S))/\Gamma_{\text{total}}$$

$$\Gamma_6/\Gamma \times \Gamma_{122}^{\psi(2S)}/\Gamma\psi(2S)$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<9.6 $\times 10^{-6}$	90	31 CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma K^+ K^- \pi^+ \pi^-$

31 Assuming $\Gamma(\eta_c(2S)) = 14$ MeV. CRONIN-HENNESSY 10 gives the analytic dependence of limits on width.

NODE=M059R07
 NODE=M059R07

NODE=M059R07;LINKAGE=CR

$$\Gamma(\eta_c(2S) \rightarrow K^{*0} \bar{K}^{*0})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\eta_c(2S))/\Gamma_{\text{total}}$$

$$\Gamma_7/\Gamma \times \Gamma_{122}^{\psi(2S)}/\Gamma\psi(2S)$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<19.6 $\times 10^{-7}$	90	ABLIKIM	11H BES3	$\psi(2S) \rightarrow \gamma K^+ K^- \pi^+ \pi^-$

NODE=M059R19
 NODE=M059R19

$$\Gamma(\eta_c(2S) \rightarrow K^+ K^- \pi^+ \pi^- \pi^0)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\eta_c(2S))/\Gamma_{\text{total}}$$

$$\Gamma_8/\Gamma \times \Gamma_{122}^{\psi(2S)}/\Gamma\psi(2S)$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<43.0 $\times 10^{-6}$	90	32 CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma K^+ K^- \pi^+ \pi^- \pi^0$

32 Assuming $\Gamma(\eta_c(2S)) = 14$ MeV. CRONIN-HENNESSY 10 gives the analytic dependence of limits on width.

NODE=M059R08
 NODE=M059R08

NODE=M059R08;LINKAGE=CR

$$\Gamma(\eta_c(2S) \rightarrow K^+ K^- 2\pi^+ 2\pi^-) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S)) / \Gamma_{\text{total}}$$

$$\Gamma_9 / \Gamma \times \Gamma_{122}^{\psi(2S)} / \Gamma_{\psi(2S)}$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<9.7 \times 10^{-6}$	90	33 CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma K^+ K^- 2\pi^+ 2\pi^-$
33 Assuming $\Gamma(\eta_c(2S)) = 14$ MeV. CRONIN-HENNESSY 10 gives the analytic dependence of limits on width.				

NODE=M059R09
NODE=M059R09

NODE=M059R09;LINKAGE=CR

$$\Gamma(\eta_c(2S) \rightarrow K_S^0 K^- 2\pi^+ \pi^- + \text{c.c.}) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S)) / \Gamma_{\text{total}}$$

$$\Gamma_{10} / \Gamma \times \Gamma_{122}^{\psi(2S)} / \Gamma_{\psi(2S)}$$

VALUE (units 10^{-6})	CL% EVTS	DOCUMENT ID	TECN	COMMENT
$7.03 \pm 2.10 \pm 0.7$	60	ABLIKIM	13K BES3	$\psi(2S) \rightarrow \gamma K_S^0 K^- 2\pi^+ \pi^- + \text{c.c.}$

NODE=M059R10
NODE=M059R10

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

< 15.2	90	34 CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma K_S^0 K^- 2\pi^+ \pi^- + \text{c.c.}$

34 Assuming $\Gamma(\eta_c(2S)) = 14$ MeV. CRONIN-HENNESSY 10 gives the analytic dependence of limits on width.

NODE=M059R10;LINKAGE=CR

$$\Gamma(\eta_c(2S) \rightarrow \phi \phi) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S)) / \Gamma_{\text{total}}$$

$$\Gamma_{12} / \Gamma \times \Gamma_{122}^{\psi(2S)} / \Gamma_{\psi(2S)}$$

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

$$\Gamma(\eta_c(2S) \rightarrow \pi^+ \pi^- \eta) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S)) / \Gamma_{\text{total}}$$

$$\Gamma_{15} / \Gamma \times \Gamma_{122}^{\psi(2S)} / \Gamma_{\psi(2S)}$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<4.3 \times 10^{-6}$	90	35 CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- \eta$

35 Assuming $\Gamma(\eta_c(2S)) = 14$ MeV. CRONIN-HENNESSY 10 gives the analytic dependence of limits on width.

NODE=M059R11
NODE=M059R11

NODE=M059R11;LINKAGE=CR

$$\Gamma(\eta_c(2S) \rightarrow \pi^+ \pi^- \eta') / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S)) / \Gamma_{\text{total}}$$

$$\Gamma_{16} / \Gamma \times \Gamma_{122}^{\psi(2S)} / \Gamma_{\psi(2S)}$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<14.2 \times 10^{-6}$	90	36 CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- \eta'$

36 Assuming $\Gamma(\eta_c(2S)) = 14$ MeV. CRONIN-HENNESSY 10 gives the analytic dependence of limits on width.

NODE=M059R12
NODE=M059R12

NODE=M059R12;LINKAGE=CR

$$\Gamma(\eta_c(2S) \rightarrow K^+ K^- \eta) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S)) / \Gamma_{\text{total}}$$

$$\Gamma_{17} / \Gamma \times \Gamma_{122}^{\psi(2S)} / \Gamma_{\psi(2S)}$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<5.9 \times 10^{-6}$	90	37 CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma K^+ K^- \eta$

37 Assuming $\Gamma(\eta_c(2S)) = 14$ MeV. CRONIN-HENNESSY 10 gives the analytic dependence of limits on width.

NODE=M059R13
NODE=M059R13

NODE=M059R13;LINKAGE=CR

$$\Gamma(\eta_c(2S) \rightarrow \pi^+ \pi^- \eta_c(1S)) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S)) / \Gamma_{\text{total}}$$

$$\Gamma_{18} / \Gamma \times \Gamma_{122}^{\psi(2S)} / \Gamma_{\psi(2S)}$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<1.7 \times 10^{-4}$	90	38 CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- \eta_c(1S)$

38 Assuming $\Gamma(\eta_c(2S)) = 14$ MeV. CRONIN-HENNESSY 10 gives the analytic dependence of limits on width.

NODE=M059R14
NODE=M059R14

NODE=M059R14;LINKAGE=CR

$\eta_c(2S)$ REFERENCES

ABLIKIM	13K	PR D87 052005	M. Ablikim <i>et al.</i>	(BES III Collab.)
ABLIKIM	12G	PRL 109 042003	M. Ablikim <i>et al.</i>	(BES III 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>	(BES III 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.)

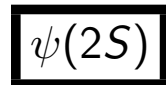
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REFID=52204
REFID=51627
REFID=51059

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+)

REFID=50773
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NODE=M071



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

See the Review on " $\psi(2S)$ and χ_c branching ratios" before the $\chi_{c0}(1P)$ Listings.

NODE=M071

$\psi(2S)$ MASS

NODE=M071M

OUR FIT includes measurements of $m_{\psi(2S)}$, $m_{\psi(3770)}$, and $m_{\psi(3770)} - m_{\psi(2S)}$.

NODE=M071M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

NODE=M071M

3686.109^{+0.012}_{-0.014} OUR FIT

3686.108^{+0.011}_{-0.014} OUR AVERAGE

3686.12 ± 0.06 ± 0.10	4k	AAIJ	12H	LHCB	$pp \rightarrow J/\psi \pi^+ \pi^- X$
3686.114 ± 0.007 ^{+0.011} _{-0.016}		¹ ANASHIN	12	KEDR	$e^+ e^- \rightarrow \text{hadrons}$
3686.111 ± 0.025 ± 0.009		AULCHENKO	03	KEDR	$e^+ e^- \rightarrow \text{hadrons}$
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. • • •					
3686.00 ± 0.10	413	⁴ ZHOLENTZ	80	OLYA	$e^+ e^-$

¹ From the scans in 2004 and 2006. ANASHIN 12 reports the value $3686.114 \pm 0.007 \pm 0.011^{+0.002}_{-0.012}$ MeV, where the third uncertainty is due to assumptions on the interference between the resonance and hadronic continuum. We combined the two systematic uncertainties.

² Reanalysis of ZHOLENTZ 80 using new electron mass (COHEN 87) and radiative corrections (KURAEV 85).

³ Mass central value and systematic error recalculated by us according to Eq.(16) in ARMSTRONG 93B, using the value for the $J/\psi(1S)$ mass from AULCHENKO 03.

⁴ Superseded by ARTAMONOV 00.

NODE=M071M;LINKAGE=AN

NODE=M071M;LINKAGE=AR

NODE=M071M;LINKAGE=NW

NODE=M071M;LINKAGE=RZ

$m_{\psi(2S)} - m_{J/\psi(1S)}$

NODE=M071DM

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

NODE=M071DM

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	$185 \pi^- \text{Be} \rightarrow \gamma \mu^+ \mu^- \text{A}$
589.07 ± 0.13	¹ ZHOLENTZ	80	OLYA	$e^+ e^-$
588.7 ± 0.8	LUTH	75	MRK1	

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

588 ± 1	² BAI	98E	BES	$e^+ e^-$

¹ Redundant with data in mass above.

² Systematic errors not evaluated.

NODE=M071DM;LINKAGE=R

NODE=M071DM;LINKAGE=BD

$\psi(2S)$ WIDTH

NODE=M071W

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT

NODE=M071W

303 ± 9 OUR FIT

[304 ± 9 keV OUR 2012 FIT]

286 ± 16 OUR AVERAGE

NEW

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	$\bar{p} p \rightarrow e^+ e^-$

¹ From a simultaneous fit to the hadronic and $\mu^+\mu^-$ cross section, assuming $\Gamma = \Gamma_h + \Gamma_e + \Gamma_\mu + \Gamma_\tau$ and lepton universality. Does not include vacuum polarization correction.

² The initial-state radiation correction reevaluated by ANDREOTTI 07 in its Ref. [4].

NODE=M071W;LINKAGE=BC

NODE=M071W;LINKAGE=AN

NODE=M071220;NODE=M071

$\psi(2S)$ DECAY MODES

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 $e^+ e^-$	(7.82 $\pm$ 0.17) $\times 10^{-3}$	
Γ_7 $\mu^+ \mu^-$	(7.8 $\pm$ 0.9) $\times 10^{-3}$	
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	(60.3 $\pm$ 0.7) %
Γ_{10} $J/\psi(1S)$ neutrals	(24.9 $\pm$ 0.4) %
Γ_{11} $J/\psi(1S) \pi^+ \pi^-$	(34.0 $\pm$ 0.4) %
Γ_{12} $J/\psi(1S) \pi^0 \pi^0$	(17.93 $\pm$ 0.33) %
Γ_{13} $J/\psi(1S) \eta$	(3.33 $\pm$ 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=4.6
Γ_{18} $\rho a_2(1320)$	(2.6 $\pm$ 0.9) $\times 10^{-4}$	
Γ_{19} $\rho \bar{\rho}$	(2.75 $\pm$ 0.12) $\times 10^{-4}$	
Γ_{20} $\Delta^{++} \bar{\Delta}^{--}$	(1.28 $\pm$ 0.35) $\times 10^{-4}$	
Γ_{21} $\Lambda \bar{\Lambda} \pi^0$	< 2.9 $\times 10^{-6}$	CL=90%
Γ_{22} $\Lambda \bar{\Lambda} \eta$	(2.5 $\pm$ 0.4) $\times 10^{-5}$	
Γ_{23} $\Lambda \bar{p} K^+$	(1.00 $\pm$ 0.14) $\times 10^{-4}$	
Γ_{24} $\Lambda \bar{p} K^+ \pi^+ \pi^-$	(1.8 $\pm$ 0.4) $\times 10^{-4}$	
Γ_{25} $\Lambda \bar{\Lambda} \pi^+ \pi^-$	(2.8 $\pm$ 0.6) $\times 10^{-4}$	
Γ_{26} $\Lambda \bar{\Lambda}$	(2.8 $\pm$ 0.5) $\times 10^{-4}$	S=2.6
Γ_{27} $\Sigma^0 \bar{p} K^+ + \text{c.c.}$	(1.67 $\pm$ 0.18) $\times 10^{-5}$	
Γ_{28} $\Sigma^+ \bar{\Sigma}^-$	(2.6 $\pm$ 0.8) $\times 10^{-4}$	
Γ_{29} $\Sigma^0 \bar{\Sigma}^0$	(2.2 $\pm$ 0.4) $\times 10^{-4}$	S=1.5
Γ_{30} $\Sigma(1385)^+ \bar{\Sigma}(1385)^-$	(1.1 $\pm$ 0.4) $\times 10^{-4}$	
Γ_{31} $\Xi^- \bar{\Xi}^+$	(1.8 $\pm$ 0.6) $\times 10^{-4}$	S=2.8
Γ_{32} $\Xi^0 \bar{\Xi}^0$	(2.8 $\pm$ 0.9) $\times 10^{-4}$	
Γ_{33} $\Xi(1530)^0 \bar{\Xi}(1530)^0$	< 8.1 $\times 10^{-5}$	CL=90%
Γ_{34} $\Omega^- \bar{\Omega}^+$	< 7.3 $\times 10^{-5}$	CL=90%
Γ_{35} $\pi^0 \rho \bar{\rho}$	(1.53 $\pm$ 0.07) $\times 10^{-4}$	
Γ_{36} $N(940) \bar{p} + \text{c.c.} \rightarrow \pi^0 \rho \bar{\rho}$	(6.4 $\begin{smallmatrix} +1.8 \\ -1.3 \end{smallmatrix}$) $\times 10^{-5}$	
Γ_{37} $N(1440) \bar{p} + \text{c.c.} \rightarrow \pi^0 \rho \bar{\rho}$	(7.3 $\begin{smallmatrix} +1.7 \\ -1.5 \end{smallmatrix}$) $\times 10^{-5}$	S=2.5
Γ_{38} $N(1520) \bar{p} + \text{c.c.} \rightarrow \pi^0 \rho \bar{\rho}$	(6.4 $\begin{smallmatrix} +2.3 \\ -1.8 \end{smallmatrix}$) $\times 10^{-6}$	
Γ_{39} $N(1535) \bar{p} + \text{c.c.} \rightarrow \pi^0 \rho \bar{\rho}$	(2.5 $\pm$ 1.0) $\times 10^{-5}$	
Γ_{40} $N(1650) \bar{p} + \text{c.c.} \rightarrow \pi^0 \rho \bar{\rho}$	(3.8 $\begin{smallmatrix} +1.4 \\ -1.7 \end{smallmatrix}$) $\times 10^{-5}$	
Γ_{41} $N(1720) \bar{p} + \text{c.c.} \rightarrow \pi^0 \rho \bar{\rho}$	(1.79 $\begin{smallmatrix} +0.26 \\ -0.70 \end{smallmatrix}$) $\times 10^{-5}$	
Γ_{42} $N(2300) \bar{p} + \text{c.c.} \rightarrow \pi^0 \rho \bar{\rho}$	(2.6 $\begin{smallmatrix} +1.2 \\ -0.7 \end{smallmatrix}$) $\times 10^{-5}$	
Γ_{43} $N(2570) \bar{p} + \text{c.c.} \rightarrow \pi^0 \rho \bar{\rho}$	(2.13 $\begin{smallmatrix} +0.40 \\ -0.31 \end{smallmatrix}$) $\times 10^{-5}$	
Γ_{44} $\pi^0 f_0(2100) \rightarrow \pi^0 \rho \bar{\rho}$	(1.1 $\pm$ 0.4) $\times 10^{-5}$	
Γ_{45} $\eta \rho \bar{\rho}$	(5.7 $\pm$ 0.6) $\times 10^{-5}$	
Γ_{46} $\eta f_0(2100) \rightarrow \eta \rho \bar{\rho}$	(1.2 $\pm$ 0.4) $\times 10^{-5}$	
Γ_{47} $N(1535) \bar{p} \rightarrow \eta \rho \bar{\rho}$	(4.4 $\pm$ 0.7) $\times 10^{-5}$	

NODE=M071;CLUMP=B

DESIG=254

DESIG=37

DESIG=25

DESIG=65

DESIG=27

DESIG=70

DESIG=238

DESIG=239

DESIG=214

DESIG=215

DESIG=213

DESIG=28

DESIG=274

DESIG=223

DESIG=71

DESIG=72

DESIG=29

DESIG=224

DESIG=73

DESIG=74

DESIG=35

DESIG=267

DESIG=261

DESIG=268

DESIG=269

DESIG=270

DESIG=271

DESIG=272

DESIG=273

DESIG=262

DESIG=200

DESIG=263

DESIG=264

Г48	$\omega p \bar{p}$	$(6.9 \pm 2.1) \times 10^{-5}$		DESIG=77
Г49	$\phi p \bar{p}$	$< 2.4 \times 10^{-5}$	CL=90%	DESIG=80
Г50	$\pi^+ \pi^- p \bar{p}$	$(6.0 \pm 0.4) \times 10^{-4}$		DESIG=31
Г51	$p \bar{n} \pi^-$ or c.c.	$(2.48 \pm 0.17) \times 10^{-4}$		DESIG=227
Г52	$p \bar{n} \pi^- \pi^0$	$(3.2 \pm 0.7) \times 10^{-4}$		DESIG=228
Г53	$2(\pi^+ \pi^- \pi^0)$	$(4.7 \pm 1.5) \times 10^{-3}$		DESIG=221
Г54	$\eta \pi^+ \pi^-$	$< 1.6 \times 10^{-4}$	CL=90%	DESIG=202
Г55	$\eta \pi^+ \pi^- \pi^0$	$(9.5 \pm 1.7) \times 10^{-4}$		DESIG=203
Г56	$2(\pi^+ \pi^-) \eta$	$(1.2 \pm 0.6) \times 10^{-3}$		DESIG=251
Г57	$\eta' \pi^+ \pi^- \pi^0$	$(4.5 \pm 2.1) \times 10^{-4}$		DESIG=204
Г58	$\omega \pi^+ \pi^-$	$(7.3 \pm 1.2) \times 10^{-4}$	S=2.1	DESIG=75
Г59	$b_1^\pm \pi^\mp$	$(4.0 \pm 0.6) \times 10^{-4}$	S=1.1	DESIG=40
Г60	$b_1^0 \pi^0$	$(2.4 \pm 0.6) \times 10^{-4}$		DESIG=193
Г61	$\omega f_2(1270)$	$(2.2 \pm 0.4) \times 10^{-4}$		DESIG=64
Г62	$\pi^+ \pi^- K^+ K^-$	$(7.5 \pm 0.9) \times 10^{-4}$	S=1.9	DESIG=26
Г63	$\rho^0 K^+ K^-$	$(2.2 \pm 0.4) \times 10^{-4}$		DESIG=205
Г64	$K^*(892)^0 \bar{K}_2^*(1430)^0$	$(1.9 \pm 0.5) \times 10^{-4}$		DESIG=66
Г65	$K^+ K^- \pi^+ \pi^- \eta$	$(1.3 \pm 0.7) \times 10^{-3}$		DESIG=252
Г66	$K^+ K^- 2(\pi^+ \pi^-) \pi^0$	$(1.00 \pm 0.31) \times 10^{-3}$		DESIG=240
Г67	$K^+ K^- 2(\pi^+ \pi^-)$	$(1.9 \pm 0.9) \times 10^{-3}$		DESIG=222
Г68	$K_1(1270)^\pm K^\mp$	$(1.00 \pm 0.28) \times 10^{-3}$		DESIG=41
Г69	$K_S^0 K_S^0 \pi^+ \pi^-$	$(2.2 \pm 0.4) \times 10^{-4}$		DESIG=225
Г70	$\rho^0 p \bar{p}$	$(5.0 \pm 2.2) \times 10^{-5}$		DESIG=210
Г71	$K^+ \bar{K}^*(892)^0 \pi^- + \text{c.c.}$	$(6.7 \pm 2.5) \times 10^{-4}$		DESIG=34
Г72	$2(\pi^+ \pi^-)$	$(2.4 \pm 0.6) \times 10^{-4}$	S=2.2	DESIG=24
Г73	$\rho^0 \pi^+ \pi^-$	$(2.2 \pm 0.6) \times 10^{-4}$	S=1.4	DESIG=33
Г74	$K^+ K^- \pi^+ \pi^- \pi^0$	$(1.26 \pm 0.09) \times 10^{-3}$		DESIG=206
Г75	$\omega f_0(1710) \rightarrow \omega K^+ K^-$	$(5.9 \pm 2.2) \times 10^{-5}$		DESIG=216
Г76	$K^*(892)^0 K^- \pi^+ \pi^0 + \text{c.c.}$	$(8.6 \pm 2.2) \times 10^{-4}$		DESIG=217
Г77	$K^*(892)^+ K^- \pi^+ \pi^- + \text{c.c.}$	$(9.6 \pm 2.8) \times 10^{-4}$		DESIG=218
Г78	$K^*(892)^+ K^- \rho^0 + \text{c.c.}$	$(7.3 \pm 2.6) \times 10^{-4}$		DESIG=219
Г79	$K^*(892)^0 K^- \rho^+ + \text{c.c.}$	$(6.1 \pm 1.8) \times 10^{-4}$		DESIG=220
Г80	$\eta K^+ K^-$, no $\eta \phi$	$(3.1 \pm 0.4) \times 10^{-5}$		DESIG=207
Г81	$\omega K^+ K^-$	$(1.85 \pm 0.25) \times 10^{-4}$	S=1.1	DESIG=76
Г82	$3(\pi^+ \pi^-)$	$(3.5 \pm 2.0) \times 10^{-4}$	S=2.8	DESIG=32
Г83	$p \bar{p} \pi^+ \pi^- \pi^0$	$(7.3 \pm 0.7) \times 10^{-4}$		DESIG=211
Г84	$K^+ K^-$	$(7.1 \pm 0.5) \times 10^{-5}$	S=1.5	DESIG=23
Г85	$K_S^0 K_L^0$	$(5.34 \pm 0.33) \times 10^{-5}$		DESIG=85
Г86	$\pi^+ \pi^- \pi^0$	$(2.01 \pm 0.17) \times 10^{-4}$	S=1.7	DESIG=36
Г87	$\rho(2150) \pi \rightarrow \pi^+ \pi^- \pi^0$	$(1.9 \pm 1.2 \pm 0.4) \times 10^{-4}$		DESIG=201
Г88	$\rho(770) \pi \rightarrow \pi^+ \pi^- \pi^0$	$(3.2 \pm 1.2) \times 10^{-5}$	S=1.8	DESIG=22
Г89	$\pi^+ \pi^-$	$(7.8 \pm 2.6) \times 10^{-6}$		DESIG=21
Г90	$K_1(1400)^\pm K^\mp$	$< 3.1 \times 10^{-4}$	CL=90%	DESIG=42
Г91	$K_2^*(1430)^\pm K^\mp$	$(7.1 \pm 1.3 \pm 0.9) \times 10^{-5}$		DESIG=265
Г92	$K^+ K^- \pi^0$	$(4.07 \pm 0.31) \times 10^{-5}$		DESIG=38
Г93	$K^+ K^*(892)^- + \text{c.c.}$	$(2.9 \pm 0.4) \times 10^{-5}$	S=1.2	DESIG=39
Г94	$K^*(892)^0 \bar{K}^0 + \text{c.c.}$	$(1.09 \pm 0.20) \times 10^{-4}$		DESIG=194
Г95	$\phi \pi^+ \pi^-$	$(1.17 \pm 0.29) \times 10^{-4}$	S=1.7	DESIG=78
Г96	$\phi f_0(980) \rightarrow \pi^+ \pi^-$	$(6.8 \pm 2.4) \times 10^{-5}$	S=1.1	DESIG=81
Г97	$2(K^+ K^-)$	$(6.0 \pm 1.4) \times 10^{-5}$		DESIG=208
Г98	$\phi K^+ K^-$	$(7.0 \pm 1.6) \times 10^{-5}$		DESIG=79
Г99	$2(K^+ K^-) \pi^0$	$(1.10 \pm 0.28) \times 10^{-4}$		DESIG=209
Г100	$\phi \eta$	$(3.10 \pm 0.31) \times 10^{-5}$		DESIG=89
Г101	$\phi \eta'$	$(3.1 \pm 1.6) \times 10^{-5}$		DESIG=90
Г102	$\omega \eta'$	$(3.2 \pm 2.5 \pm 2.1) \times 10^{-5}$		DESIG=91
Г103	$\omega \pi^0$	$(2.1 \pm 0.6) \times 10^{-5}$		DESIG=92
Г104	$\rho \eta'$	$(1.9 \pm 1.7 \pm 1.2) \times 10^{-5}$		DESIG=93

Г ₁₀₅	$\rho\eta$	$(2.2 \pm 0.6) \times 10^{-5}$	S=1.1	DESIG=94
Г ₁₀₆	$\omega\eta$	$< 1.1 \times 10^{-5}$	CL=90%	DESIG=95
Г ₁₀₇	$\phi\pi^0$	$< 4 \times 10^{-7}$	CL=90%	DESIG=96
Г ₁₀₈	$\eta_c\pi^+\pi^-\pi^0$	$< 1.0 \times 10^{-3}$	CL=90%	DESIG=229
Г ₁₀₉	$p\bar{p}K^+K^-$	$(2.7 \pm 0.7) \times 10^{-5}$		DESIG=212
Г ₁₁₀	$\bar{\Lambda}nK_S^0 + \text{c.c.}$	$(8.1 \pm 1.8) \times 10^{-5}$		DESIG=237
Г ₁₁₁	$\phi f_2'(1525)$	$(4.4 \pm 1.6) \times 10^{-5}$		DESIG=67
Г ₁₁₂	$\Theta(1540)\bar{\Theta}(1540) \rightarrow K_S^0 p K^- \bar{n} + \text{c.c.}$	$< 8.8 \times 10^{-6}$	CL=90%	DESIG=195
Г ₁₁₃	$\Theta(1540)K^-\bar{n} \rightarrow K_S^0 p K^- \bar{n}$	$< 1.0 \times 10^{-5}$	CL=90%	DESIG=196
Г ₁₁₄	$\Theta(1540)K_S^0\bar{p} \rightarrow K_S^0\bar{p}K^+n$	$< 7.0 \times 10^{-6}$	CL=90%	DESIG=197
Г ₁₁₅	$\bar{\Theta}(1540)K^+n \rightarrow K_S^0\bar{p}K^+n$	$< 2.6 \times 10^{-5}$	CL=90%	DESIG=198
Г ₁₁₆	$\bar{\Theta}(1540)K_S^0p \rightarrow K_S^0pK^-\bar{n}$	$< 6.0 \times 10^{-6}$	CL=90%	DESIG=199
Г ₁₁₇	$K_S^0 K_S^0$	$< 4.6 \times 10^{-6}$		DESIG=86

Radiative decays

NODE=M071;CLUMP=C

Г ₁₁₈	$\gamma\chi_{c0}(1P)$	$(9.84 \pm 0.31) \%$		DESIG=56
Г ₁₁₉	$\gamma\chi_{c1}(1P)$	$(9.3 \pm 0.4) \%$		DESIG=58
Г ₁₂₀	$\gamma\chi_{c2}(1P)$	$(8.76 \pm 0.34) \%$		DESIG=59
Г ₁₂₁	$\gamma\eta_c(1S)$	$(3.4 \pm 0.5) \times 10^{-3}$	S=1.3	DESIG=61
Г ₁₂₂	$\gamma\eta_c(2S)$	$(7 \pm 5) \times 10^{-4}$		DESIG=63
Г ₁₂₃	$\gamma\pi^0$	$(1.6 \pm 0.4) \times 10^{-6}$		DESIG=52
Г ₁₂₄	$\gamma\eta'(958)$	$(1.23 \pm 0.06) \times 10^{-4}$		DESIG=54
Г ₁₂₅	$\gamma f_2(1270)$	$(2.1 \pm 0.4) \times 10^{-4}$		DESIG=82
Г ₁₂₆	$\gamma f_0(1710)$			DESIG=236
Г ₁₂₇	$\gamma f_0(1710) \rightarrow \gamma\pi\pi$	$(3.0 \pm 1.3) \times 10^{-5}$		DESIG=83
Г ₁₂₈	$\gamma f_0(1710) \rightarrow \gamma K\bar{K}$	$(6.0 \pm 1.6) \times 10^{-5}$		DESIG=84
Г ₁₂₉	$\gamma\gamma$	$< 1.4 \times 10^{-4}$	CL=90%	DESIG=51
Г ₁₃₀	$\gamma\eta$	$(1.4 \pm 0.5) \times 10^{-6}$		DESIG=53
Г ₁₃₁	$\gamma\eta\pi^+\pi^-$	$(8.7 \pm 2.1) \times 10^{-4}$		DESIG=230
Г ₁₃₂	$\gamma\eta(1405)$			DESIG=231
Г ₁₃₃	$\gamma\eta(1405) \rightarrow \gamma K\bar{K}\pi$	$< 9 \times 10^{-5}$	CL=90%	DESIG=62
Г ₁₃₄	$\gamma\eta(1405) \rightarrow \eta\pi^+\pi^-$	$(3.6 \pm 2.5) \times 10^{-5}$		DESIG=232
Г ₁₃₅	$\gamma\eta(1475)$			DESIG=233
Г ₁₃₆	$\gamma\eta(1475) \rightarrow K\bar{K}\pi$	$< 1.4 \times 10^{-4}$	CL=90%	DESIG=234
Г ₁₃₇	$\gamma\eta(1475) \rightarrow \eta\pi^+\pi^-$	$< 8.8 \times 10^{-5}$	CL=90%	DESIG=235
Г ₁₃₈	$\gamma 2(\pi^+\pi^-)$	$(4.0 \pm 0.6) \times 10^{-4}$		DESIG=241
Г ₁₃₉	$\gamma K^{*0}K^+\pi^- + \text{c.c.}$	$(3.7 \pm 0.9) \times 10^{-4}$		DESIG=242
Г ₁₄₀	$\gamma K^{*0}\bar{K}^{*0}$	$(2.4 \pm 0.7) \times 10^{-4}$		DESIG=243
Г ₁₄₁	$\gamma K_S^0K^+\pi^- + \text{c.c.}$	$(2.6 \pm 0.5) \times 10^{-4}$		DESIG=244
Г ₁₄₂	$\gamma K^+K^-\pi^+\pi^-$	$(1.9 \pm 0.5) \times 10^{-4}$		DESIG=245
Г ₁₄₃	$\gamma p\bar{p}$	$(3.9 \pm 0.5) \times 10^{-5}$	S=2.0	DESIG=246
Г ₁₄₄	$\gamma f_2(1950) \rightarrow \gamma p\bar{p}$	$(1.20 \pm 0.22) \times 10^{-5}$		DESIG=257
Г ₁₄₅	$\gamma f_2(2150) \rightarrow \gamma p\bar{p}$	$(7.2 \pm 1.8) \times 10^{-6}$		DESIG=258
Г ₁₄₆	$\gamma X(1835) \rightarrow \gamma p\bar{p}$	$(4.6 \pm 1.8 - 4.0) \times 10^{-6}$		DESIG=259
Г ₁₄₇	$\gamma X \rightarrow \gamma p\bar{p}$	[a] $< 2 \times 10^{-6}$	CL=90%	DESIG=260
Г ₁₄₈	$\gamma\pi^+\pi^-p\bar{p}$	$(2.8 \pm 1.4) \times 10^{-5}$		DESIG=247
Г ₁₄₉	$\gamma 2(\pi^+\pi^-)K^+K^-$	$< 2.2 \times 10^{-4}$	CL=90%	DESIG=248
Г ₁₅₀	$\gamma 3(\pi^+\pi^-)$	$< 1.7 \times 10^{-4}$	CL=90%	DESIG=249
Г ₁₅₁	$\gamma K^+K^-K^+K^-$	$< 4 \times 10^{-5}$	CL=90%	DESIG=250
Г ₁₅₂	$\gamma\gamma J/\psi$	$(3.1 \pm 1.0 - 1.2) \times 10^{-4}$		DESIG=266

[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 227 measurements to determine 49 parameters. The overall fit has a $\chi^2 = 325.4$ for 178 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	4									
x_8	1	0								
x_{11}	39	11	3							
x_{12}	36	7	2	61						
x_{13}	21	5	1	47	27					
x_{19}	2	1	0	7	5	3				
x_{118}	1	0	0	3	2	1	0			
x_{119}	2	0	0	4	2	2	0	0		
x_{120}	2	1	0	5	3	2	0	0	0	
Γ	-80	-6	-1	-51	-44	-26	-9	-2	-2	-3
	x_6	x_7	x_8	x_{11}	x_{12}	x_{13}	x_{19}	x_{118}	x_{119}	x_{120}

$\psi(2S)$ 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
2.37 ± 0.04 OUR FIT			
[2.35 ± 0.04 keV OUR 2012 FIT]			
2.33 ± 0.07 OUR AVERAGE			
$2.338 \pm 0.037 \pm 0.096$	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	¹ 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. • • •			
2.0 ± 0.3	BRANDELIK	79C	DASP e^+e^-
2.1 ± 0.3	² LUTH	75	MRK1 e^+e^-

NODE=M071W1
NODE=M071W1
NEW

¹ 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

² 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_{129}

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
$2.233 \pm 0.015 \pm 0.042$	¹ ANASHIN	12	KEDR $e^+e^- \rightarrow \text{hadrons}$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
2.2 ± 0.4	ABRAMS	75	MRK1 e^+e^-

NODE=M071G3
NODE=M071G3

¹ ANASHIN 12 reports the value $2.233 \pm 0.015 \pm 0.037 \pm 0.020$ keV, where the third uncertainty is due to assumptions on the interference between the resonance and hadronic continuum. We combined the two systematic uncertainties.

$$\Gamma(\tau^+\tau^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_8\Gamma_6/\Gamma$$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT

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

9.0 ± 2.6	79	¹ ANASHIN	07	KEDR $e^+e^- \rightarrow \psi(2S) \rightarrow \tau^+\tau^-$

¹ Using $\psi(2S)$ total width of 337 ± 13 keV. Systematic errors not evaluated.

$$\Gamma(J/\psi(1S)\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{11}\Gamma_6/\Gamma$$

VALUE (keV)	EVTs	DOCUMENT ID	TECN	COMMENT

0.807 ± 0.014 OUR FIT

[0.789 ± 0.015 keV OUR 2012 FIT]

0.839 ± 0.025 OUR AVERAGE Error includes scale factor of 1.3. See the ideogram below.
[0.82 ± 0.04 keV OUR 2012 AVERAGE Scale factor = 1.6]

0.842 ± 0.028 ± 0.009		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 $e^+e^- \rightarrow J/\psi\pi^+\pi^-\gamma$

0.76 ± 0.05 ± 0.01	544	⁴ AUBERT	05D	BABR 10.6 $e^+e^- \rightarrow \pi^+\pi^-\mu^+\mu^-\gamma$

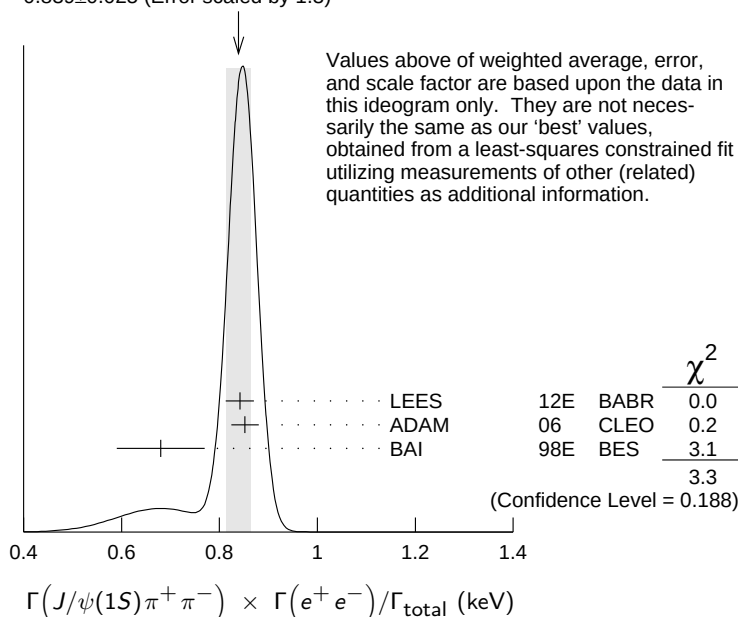
¹ LEES 12E reports $[\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) \times \Gamma(\psi(2S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \mu^+\mu^-)] = (49.9 \pm 1.3 \pm 1.0) \times 10^{-3}$ keV which we divide by our best value $B(J/\psi(1S) \rightarrow \mu^+\mu^-) = (5.93 \pm 0.06) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² The 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 $B(J/\psi(1S) \rightarrow \ell^+\ell^-) = 0.1181 \pm 0.0020$.

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 $B(J/\psi(1S) \rightarrow \pi^+\pi^-\pi^0) = (2.11 \pm 0.07) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

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 $B(J/\psi(1S) \rightarrow \mu^+\mu^-) = (5.93 \pm 0.06) \times 10^{-2}$. 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.

WEIGHTED AVERAGE
0.839 ± 0.025 (Error scaled by 1.3)



NODE=M071G3;LINKAGE=AN

NODE=M071G9
NODE=M071G9

NODE=M071G9;LINKAGE=AN

NODE=M071G1
NODE=M071G1
NEW

NEW

NODE=M071G1;LINKAGE=LE

NODE=M071G1;LINKAGE=A

NODE=M071G1;LINKAGE=UB

NODE=M071G1;LINKAGE=AU

$$\Gamma(J/\psi(1S)\pi^0\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{12}\Gamma_6/\Gamma$$

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
0.425±0.009 OUR FIT				
[0.417 ± 0.010 keV OUR 2012 FIT]				
0.411±0.008±0.018	3.6k±96	ADAM	06	CLEO 3.773 e ⁺ e ⁻ → γψ(2S)

NODE=M071G6
NODE=M071G6
NEW

$$\Gamma(J/\psi(1S)\eta) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{13}\Gamma_6/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
79.0± 1.7 OUR FIT				
[77.0 ± 1.9 eV OUR 2012 FIT]				
87 ± 9 OUR AVERAGE				

NODE=M071G7
NODE=M071G7
NEW

83 ±25 ±5	14	¹ AUBERT	07AU	BABR 10.6 e ⁺ e ⁻ → J/ψ π ⁺ π ⁻ π ⁰ γ
88 ± 6 ±7	291 ± 24	ADAM	06	CLEO 3.773 e ⁺ e ⁻ → γψ(2S)
¹ AUBERT 07AU quotes Γ _{ee} ^{ψ(2S)} · B(ψ(2S) → J/ψ η) · B(J/ψ → μ ⁺ μ ⁻) · B(η → π ⁺ π ⁻ π ⁰) = 1.11 ± 0.33 ± 0.07 eV.				

NODE=M071G7;LINKAGE=UB

$$\Gamma(J/\psi(1S)\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{14}\Gamma_6/\Gamma$$

VALUE (eV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<8	90	<37	ADAM	06	CLEO 3.773 e ⁺ e ⁻ → γψ(2S)

NODE=M071G8
NODE=M071G8

$$\Gamma(p\bar{p}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{19}\Gamma_6/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
0.653±0.028 OUR FIT				
[0.647 ± 0.028 eV OUR 2012 FIT]				
0.59 ±0.05 OUR AVERAGE				
0.579±0.038±0.036	2.7k	ANDREOTTI	07	E835 p $\bar{p}$ → e ⁺ e ⁻ , J/ψ X
0.70 ±0.17 ±0.03	22	AUBERT	06B	e ⁺ e ⁻ → p $\bar{p}$ γ

NODE=M071G2
NODE=M071G2
NEW

$$\Gamma(\Lambda\bar{\Lambda}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{26}\Gamma_6/\Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
1.5±0.4±0.1	AUBERT	07BD	BABR 10.6 e ⁺ e ⁻ → Λ $\bar{\Lambda}$ γ

NODE=M071G11
NODE=M071G11

$$\Gamma(2(\pi^+\pi^-\pi^0)) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{53}\Gamma_6/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
11.2±3.3±1.3	43	AUBERT	06D	BABR 10.6 e ⁺ e ⁻ → 2(π ⁺ π ⁻ π ⁰) γ

NODE=M071G4
NODE=M071G4

$$\Gamma(K^+K^-2(\pi^+\pi^-)) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{67}\Gamma_6/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
4.4±2.1±0.3	26	AUBERT	06D	BABR 10.6 e ⁺ e ⁻ → K ⁺ K ⁻ 2(π ⁺ π ⁻) γ

NODE=M071G5
NODE=M071G5

$$\Gamma(\pi^+\pi^-K^+K^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{62}\Gamma_6/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
2.56±0.42±0.16	85	AUBERT	07AK	BABR 10.6 e ⁺ e ⁻ → π ⁺ π ⁻ K ⁺ K ⁻ γ

NODE=M071G12
NODE=M071G12

$$\Gamma(\phi f_0(980) \rightarrow \pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{96}\Gamma_6/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
0.347±0.169±0.003	6 ± 3	¹ AUBERT	07AK	BABR 10.6 e ⁺ e ⁻ → π ⁺ π ⁻ K ⁺ K ⁻ γ

NODE=M071G13
NODE=M071G13

¹ AUBERT 07AK reports [Γ(ψ(2S) → φ f₀(980) → π⁺ π⁻) × Γ(ψ(2S) → e⁺ e⁻)/Γ_{total}] × [B(φ(1020) → K⁺ K⁻)] = 0.17 ± 0.08 ± 0.02 eV which we divide by our best value B(φ(1020) → K⁺ K⁻) = (48.9 ± 0.5) × 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

$$\Gamma(\phi\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{95}\Gamma_6/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
0.57±0.23±0.01	10	¹ AUBERT,BE	06D	BABR 10.6 e ⁺ e ⁻ → K ⁺ K ⁻ π ⁺ π ⁻ γ

NODE=M071G10
NODE=M071G10

¹ AUBERT,BE 06D reports [Γ(ψ(2S) → φ π⁺ π⁻) × Γ(ψ(2S) → e⁺ e⁻)/Γ_{total}] × [B(φ(1020) → K⁺ K⁻)] = 0.28 ± 0.11 ± 0.02 eV which we divide by our best value B(φ(1020) → K⁺ K⁻) = (48.9 ± 0.5) × 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

$$\Gamma(2(\pi^+\pi^-)\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{17}\Gamma_6/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
29.7±2.2±1.8	410	AUBERT	07AU	BABR 10.6 e ⁺ e ⁻ → 2(π ⁺ π ⁻) π ⁰ γ

NODE=M071G01
NODE=M071G01

$$\Gamma(\omega\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{58}\Gamma_6/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
3.01±0.84±0.02	37	¹ AUBERT	07AU BABR	10.6 e ⁺ e ⁻ → ωπ ⁺ π ⁻ γ

¹ AUBERT 07AU reports $[\Gamma(\psi(2S) \rightarrow \omega\pi^+\pi^-) \times \Gamma(\psi(2S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\omega(782) \rightarrow \pi^+\pi^-\pi^0)] = 2.69 \pm 0.73 \pm 0.16$ eV which we divide by our best value $B(\omega(782) \rightarrow \pi^+\pi^-\pi^0) = (89.2 \pm 0.7) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M071G02
NODE=M071G02

NODE=M071G02;LINKAGE=UB

$$\Gamma(2(\pi^+\pi^-)\eta) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{56}\Gamma_6/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
2.87±1.41±0.01	16	¹ AUBERT	07AU BABR	10.6 e ⁺ e ⁻ → 2(π ⁺ π ⁻)ηγ

¹ AUBERT 07AU reports $[\Gamma(\psi(2S) \rightarrow 2(\pi^+\pi^-)\eta) \times \Gamma(\psi(2S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\eta \rightarrow 2\gamma)] = 1.13 \pm 0.55 \pm 0.08$ 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
NODE=M071G03

NODE=M071G03;LINKAGE=UB

$$\Gamma(K^+K^-\pi^+\pi^-\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{74}\Gamma_6/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
4.4±1.3±0.3	32	AUBERT	07AU BABR	10.6 e ⁺ e ⁻ → K ⁺ K ⁻ π ⁺ π ⁻ π ⁰ γ

NODE=M071G04
NODE=M071G04

$$\Gamma(K^+K^-\pi^+\pi^-\eta) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{65}\Gamma_6/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
3.0 ±1.8 OUR AVERAGE				[3.1 ± 1.8 eV OUR 2012 AVERAGE]

3.04±1.79±0.02 7 ¹ AUBERT 07AU BABR 10.6 e⁺e⁻ → K⁺K⁻π⁺π⁻ηγ

¹ AUBERT 07AU reports $[\Gamma(\psi(2S) \rightarrow K^+K^-\pi^+\pi^-\eta) \times \Gamma(\psi(2S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\eta \rightarrow 2\gamma)] = 1.2 \pm 0.7 \pm 0.1$ eV which we divide by our best value $B(\eta \rightarrow 2\gamma) = (39.41 \pm 0.20) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M071G05
NODE=M071G05

NEW

NODE=M071G05;LINKAGE=UB

ψ(2S) BRANCHING RATIOS

NODE=M071235

$$\Gamma(\text{hadrons})/\Gamma_{\text{total}} \quad \Gamma_1/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
0.9785±0.0013 OUR AVERAGE			
0.9779±0.0015	¹ BAI	02B	BES2 e ⁺ e ⁻
0.981 ±0.003	¹ LUTH	75	MRK1 e ⁺ e ⁻

¹ Includes cascade decay into J/ψ(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 ψ(2S) → hadrons

¹ Calculated using $\Gamma(\gamma gg)/\Gamma(ggg) = 0.097 \pm 0.026 \pm 0.016$ from LIBBY 09, $B(\psi(2S) \rightarrow XJ/\psi)$ 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 ψ(2S) → γ + 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

$\Gamma(\gamma g g)/\Gamma(g g g)$ Γ_4/Γ_3

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
9.7$\pm$2.6$\pm$1.6	2.9 M	LIBBY	09	CLEO $\psi(2S) \rightarrow (\gamma +) \text{ hadrons}$

NODE=M071S45
 NODE=M071S45

 $\Gamma(\text{light hadrons})/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
0.154$\pm$0.015	¹ MENDEZ	08	CLEO $e^+e^- \rightarrow \psi(2S)$

NODE=M071S27
 NODE=M071S27

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

0.169 $\pm$ 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, $B(\chi_{c,J}\gamma)$, $B(\eta_c\gamma)$ from ATHAR 04 and $B(\ell^+\ell^-)$ from PDG 04. Superseded by MENDEZ 08.

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

78.2 $\pm$ 1.7 OUR FIT

[(77.3 $\pm$ 1.7) $\times 10^{-4}$ OUR 2012 FIT]

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

88 $\pm$ 13	¹ FELDMAN	77	RVUE e^+e^-

¹ From an overall fit assuming equal partial widths for e^+e^- and $\mu^+\mu^-$. For a measurement of the ratio see the entry $\Gamma(\mu^+\mu^-)/\Gamma(e^+e^-)$ below. Includes LUTH 75, HILGER 75, BURMESTER 77.

NODE=M071R1
 NODE=M071R1
 NEW

NODE=M071R;LINKAGE=L

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

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

78 $\pm$ 9 OUR FIT

[(77 $\pm$ 8) $\times 10^{-4}$ OUR 2012 FIT]

NODE=M071R2
 NODE=M071R2
 NEW

 $\Gamma(\mu^+\mu^-)/\Gamma(e^+e^-)$ Γ_7/Γ_6

VALUE	DOCUMENT ID	TECN	COMMENT

1.00 $\pm$ 0.11 OUR FIT

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

0.89 $\pm$ 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 $\pm$ 4 OUR FIT

[(30 $\pm$ 4) $\times 10^{-4}$ OUR 2012 FIT]

30.8$\pm$2.1$\pm$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
 NEW

NODE=M071R75;LINKAGE=AB

———— DECAYS INTO $J/\psi(1S)$ AND ANYTHING ————

 $\Gamma(J/\psi(1S)\text{anything})/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

0.603 $\pm$ 0.007 OUR FIT

[0.595 $\pm$ 0.008 OUR 2012 FIT]

0.55 $\pm$ 0.07 OUR AVERAGE

0.51 $\pm$ 0.12	BRANDELIK	79C	DASP $e^+e^- \rightarrow \mu^+\mu^- X$

0.57 $\pm$ 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 $\pm$ 0.0016 $\pm$ 0.0155	1.1M	¹ MENDEZ	08	CLEO $\psi(2S) \rightarrow \ell^+\ell^- X$

0.5950 $\pm$ 0.0015 $\pm$ 0.0190	151k	ADAM	05A	CLEO Repl. by MENDEZ 08

¹ Not independent from other measurements of MENDEZ 08.

NODE=M071R10
 NODE=M071R10
 NEW

NODE=M071R10;LINKAGE=ME

 $\Gamma(e^+e^-)/\Gamma(J/\psi(1S)\text{anything})$

$$\Gamma_6/\Gamma_9 = \Gamma_6/(\Gamma_{11} + \Gamma_{12} + \Gamma_{13} + 0.348\Gamma_{119} + 0.198\Gamma_{120})$$

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

1.298 $\pm$ 0.026 OUR FIT

[(1.299 $\pm$ 0.026) $\times 10^{-2}$ OUR 2012 FIT]

1.28 $\pm$ 0.04 OUR AVERAGE Error includes scale factor of 1.6. See the ideogram below.

1.22 $\pm$ 0.02 $\pm$ 0.05	5097 $\pm$ 73	¹ ANDREOTTI	05	E835 $p\bar{p} \rightarrow \psi(2S) \rightarrow$

e^+e^-

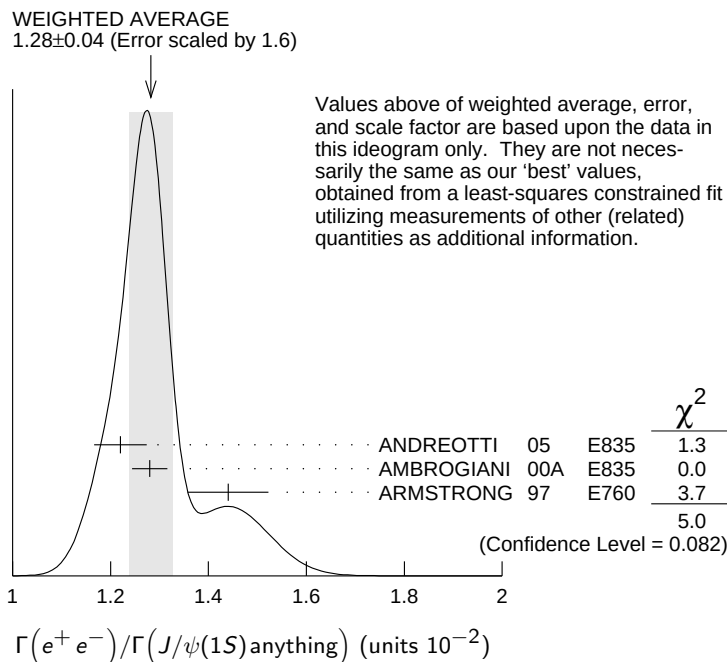
1.28 $\pm$ 0.03 $\pm$ 0.02		¹ AMBROGIANI	00A	E835 $p\bar{p} \rightarrow \psi(2S)$

1.44 $\pm$ 0.08 $\pm$ 0.02		¹ ARMSTRONG	97	E760 $\bar{p}p \rightarrow \psi(2S)$

NODE=M071R72
 NODE=M071R72
 NEW

¹ Using $B(J/\psi(1S) \rightarrow e^+ e^-) = 0.0593 \pm 0.0010$.

NODE=M071R;LINKAGE=7A



$\Gamma(\mu^+ \mu^-)/\Gamma(J/\psi(1S)\text{anything})$

$$\Gamma_7/\Gamma_9 = \Gamma_7/(\Gamma_{11} + \Gamma_{12} + \Gamma_{13} + 0.348\Gamma_{119} + 0.198\Gamma_{120})$$

VALUE	DOCUMENT ID	TECN	COMMENT
0.0130±0.0014 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
0.249±0.004 OUR FIT	
[0.246 ± 0.004 OUR 2012 FIT]	

Γ_{10}/Γ

NODE=M071R18
NODE=M071R18
NEW

$\Gamma(J/\psi(1S)\pi^+ \pi^-)/\Gamma_{\text{total}}$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.340 ±0.004 OUR FIT				
[0.336 ± 0.004 OUR 2012 FIT]				
0.343 ±0.011 OUR AVERAGE				Error includes scale factor of 1.7.

Γ_{11}/Γ

NODE=M071R12
NODE=M071R12
NEW

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

$\Gamma(e^+ e^-)/\Gamma(J/\psi(1S)\pi^+ \pi^-)$

VALUE	DOCUMENT ID	TECN	COMMENT
0.0230±0.0005 OUR FIT			
0.0252±0.0028±0.0011	¹ AUBERT	02B	BABR $e^+ e^-$

Γ_6/Γ_{11}

NODE=M071R73
NODE=M071R73

¹ Using $B(J/\psi(1S) \rightarrow e^+ e^-) = 0.0593 \pm 0.0010$.

NODE=M071R73;LINKAGE=7A

$\Gamma(\mu^+ \mu^-)/\Gamma(J/\psi(1S)\pi^+ \pi^-)$

VALUE	DOCUMENT ID	TECN	COMMENT
0.0229±0.0025 OUR FIT			
0.0224±0.0029 OUR AVERAGE			

Γ_7/Γ_{11}

NODE=M071R63
NODE=M071R63

0.0216±0.0026±0.0014	¹ AUBERT	02B	BABR $e^+ e^-$
0.0327±0.0077±0.0072	¹ GRIBUSHIN	96	FMPS 515 $\pi^- \text{Be} \rightarrow 2\mu X$

¹ Using $B(J/\psi(1S) \rightarrow \mu^+ \mu^-) = 0.0588 \pm 0.0010$.

NODE=M071R;LINKAGE=Q2

$\Gamma(\tau^+ \tau^-)/\Gamma(J/\psi(1S)\pi^+ \pi^-)$

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
9.0 ±1.1 OUR FIT			
8.73±1.39±1.57	BAI	02	BES $e^+ e^-$

Γ_8/Γ_{11}

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

0.5648±0.0026 OUR FIT

[0.5646 ± 0.0026 OUR 2012 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 $B(\psi(2S) \rightarrow J/\psi X) / B(\psi(2S) \rightarrow J/\psi\pi^+\pi^-)$.

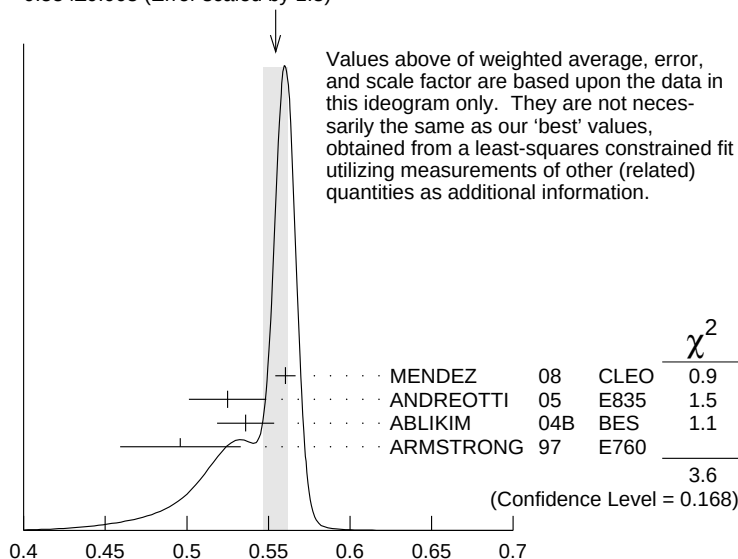
NODE=M071R70

NODE=M071R70

NEW

NODE=M071R;LINKAGE=AB

NODE=M071R;LINKAGE=AL

WEIGHTED AVERAGE
0.554±0.008 (Error scaled by 1.3)
 $\Gamma(J/\psi(1S)\pi^+\pi^-)/\Gamma(J/\psi(1S)\text{anything})$
 Γ_{11}/Γ_9
 $\Gamma(J/\psi(1S)\text{neutrals})/\Gamma(J/\psi(1S)\pi^+\pi^-)$
 $\Gamma_{10}/\Gamma_{11} = (0.9761\Gamma_{12} + 0.719\Gamma_{13} + 0.348\Gamma_{119} + 0.198\Gamma_{120})/\Gamma_{11}$

VALUE	DOCUMENT ID	TECN	COMMENT

0.730±0.008 OUR FIT

[0.731 ± 0.008 OUR 2012 FIT]

0.73 ±0.09 TANENBAUM 76 MRK1 e^+e^-

NODE=M071R11

NODE=M071R11

NEW

 $\Gamma(J/\psi(1S)\pi^0\pi^0)/\Gamma_{\text{total}}$
 Γ_{12}/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

0.1793±0.0033 OUR FIT

[0.1775 ± 0.0034 OUR 2012 FIT]

• • • 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 08¹ Not independent from other measurements of MENDEZ 08.² Not independent from other values reported by ADAM 05A.

NODE=M071R17

NODE=M071R17

NEW

NODE=M071R17;LINKAGE=ME

NODE=M071R17;LINKAGE=AD

 $\Gamma(J/\psi(1S)\pi^0\pi^0)/\Gamma(J/\psi(1S)\text{anything})$
 Γ_{12}/Γ_9

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

0.2975±0.0031 OUR FIT

[0.2982 ± 0.0032 OUR 2012 FIT]

0.320 ±0.012 OUR AVERAGE0.300 ±0.008 ±0.022 1655 ± 44 ANDREOTTI 05 E835 $\psi(2S) \rightarrow J/\psi X$ 0.328 ±0.013 ±0.008 AMBROGIANI 00A E835 $\rho\bar{\rho} \rightarrow \psi(2S)$ 0.323 ±0.033 ARMSTRONG 97 E760 $\bar{p}p \rightarrow \psi(2S)$

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

0.2829±0.0012±0.0056 61k MENDEZ 08 CLEO $\psi(2S) \rightarrow \ell^+\ell^-2\pi^0$

0.2776±0.0025±0.0043 13.4k ADAM 05A CLEO Repl. by MENDEZ 08

NODE=M071R69

NODE=M071R69

NEW

$\Gamma(J/\psi(1S)\pi^0\pi^0)/\Gamma(J/\psi(1S)\pi^+\pi^-)$
 Γ_{12}/Γ_{11}

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
0.527 ± 0.008 OUR FIT				
[0.528 ± 0.008 OUR 2012 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 $\psi(2S) \rightarrow J/\psi X$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
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
NEW

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
33.3 ± 0.5 OUR FIT				
[0.0328 ± 0.0007 OUR 2012 FIT]				
32.9 ± 1.7 OUR AVERAGE				Error includes scale factor of 2.1. See the ideogram below.
[0.0296 ± 0.0031 OUR 2012 AVERAGE Scale factor = 1.8]				
33.75 ± 0.17 ± 0.86	68.2k	ABLIKIM	12M	BES3 $e^+ e^- \rightarrow \ell^+ \ell^- 2\gamma$
29.8 ± 0.9 ± 2.3	5.7k	BAI	04I	BES2 $\psi(2S) \rightarrow J/\psi\gamma\gamma$
25.5 ± 2.9	386	¹ OREGLIA	80	CBAL $e^+ e^- \rightarrow J/\psi 2\gamma$
45 ± 12	17	² BRANDELIK	79B	DASP $e^+ e^- \rightarrow J/\psi 2\gamma$
42 ± 6	164	² BARTEL	78B	CNTR $e^+ e^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
34.3 ± 0.4 ± 0.9	18.4k	³ MENDEZ	08	CLEO $\psi(2S) \rightarrow \ell^+ \ell^- \eta$
32.5 ± 0.6 ± 1.1	2.8k	⁴ ADAM	05A	CLEO Repl. by MENDEZ 08
43 ± 8	44	TANENBAUM	76	MRK1 $e^+ e^-$

¹ Recalculated by us using $B(J/\psi(1S) \rightarrow \ell^+ \ell^-) = 0.1181 \pm 0.0020$.

² Recalculated by us using $B(J/\psi(1S) \rightarrow \mu^+ \mu^-) = 0.0588 \pm 0.0010$.

³ Not independent from other measurements of MENDEZ 08.

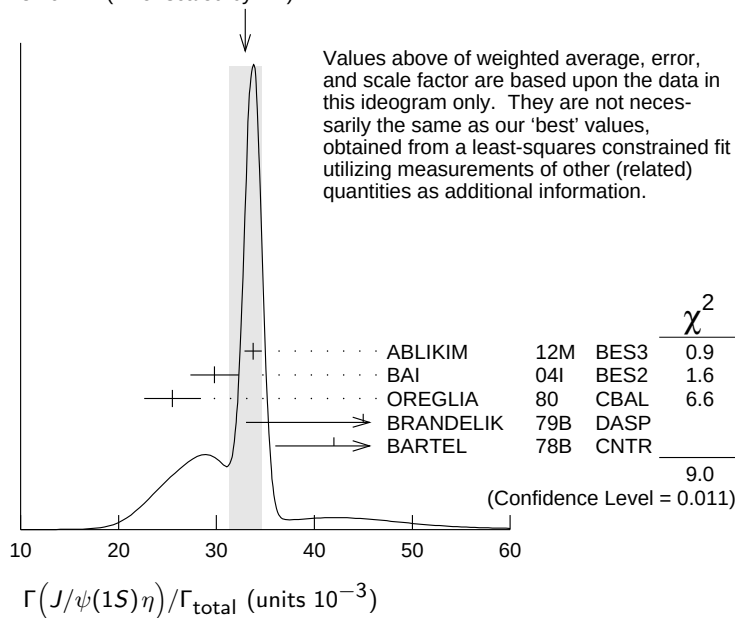
⁴ Not independent from other values reported by ADAM 05A.

NODE=M071R15
NODE=M071R15
NEW

NEW

NODE=M071R;LINKAGE=3Q
NODE=M071R;LINKAGE=2Q
NODE=M071R15;LINKAGE=ME
NODE=M071R15;LINKAGE=AD

WEIGHTED AVERAGE
32.9 ± 1.7 (Error scaled by 2.1)



$\Gamma(J/\psi(1S)\eta)/\Gamma(J/\psi(1S)\text{anything})$ Γ_{13}/Γ_9

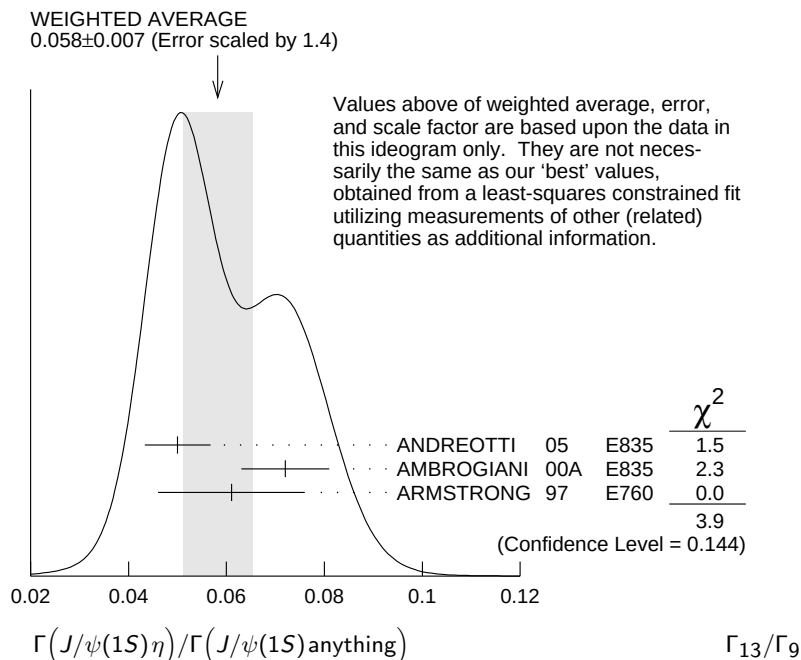
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.0553$\pm$0.0008 OUR FIT				
[0.0551 $\pm$ 0.0009 OUR 2012 FIT]				
0.058 $\pm$ 0.007 OUR AVERAGE				Error includes scale factor of 1.4. See the ideogram below.
0.050 $\pm$ 0.006 $\pm$ 0.003	298 $\pm$ 20	ANDREOTTI 05	E835	$\psi(2S) \rightarrow J/\psi X$
0.072 $\pm$ 0.009		AMBROGIANI 00A	E835	$p\bar{p} \rightarrow \psi(2S)$
0.061 $\pm$ 0.015		ARMSTRONG 97	E760	$p\bar{p} \rightarrow \psi(2S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.0549 $\pm$ 0.0006 $\pm$ 0.0009	18.4k	¹ MENDEZ	08 CLEO	$\psi(2S) \rightarrow \ell^+ \ell^- \eta$
0.0546 $\pm$ 0.0010 $\pm$ 0.0007	2.8k	ADAM	05A CLEO	Repl. by MENDEZ 08

¹ Not independent from other measurements of MENDEZ 08.

NODE=M071R68
 NODE=M071R68
 NEW

OCCUR=2

NODE=M071R68;LINKAGE=ME

 $\Gamma(J/\psi(1S)\eta)/\Gamma(J/\psi(1S)\pi^+\pi^-)$ Γ_{13}/Γ_{11}

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.0979$\pm$0.0014 OUR FIT				
[0.0976 $\pm$ 0.0016 OUR 2012 FIT]				
0.0979$\pm$0.0018 OUR AVERAGE				
0.0979 $\pm$ 0.0010 $\pm$ 0.0015	18.4k	MENDEZ	08 CLEO	$\psi(2S) \rightarrow \ell^+ \ell^- \eta$
0.098 $\pm$ 0.005 $\pm$ 0.010	2k	¹ ABLIKIM	04B BES	$\psi(2S) \rightarrow J/\psi X$
0.091 $\pm$ 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 $\pm$ 0.0019 $\pm$ 0.0013	2.8k	³ ADAM	05A CLEO	Repl. by MENDEZ 08
0.095 $\pm$ 0.007 $\pm$ 0.007		⁴ ANDREOTTI 05	E835	$\psi(2S) \rightarrow J/\psi X$

¹ From a fit to the J/ψ recoil mass spectra.² The value for $B(\psi(2S) \rightarrow J/\psi(1S)\eta)$ reported in HIMEL 80 is derived using $B(\psi(2S)) \rightarrow J/\psi(1S)\pi^+\pi^- = (33 \pm 3)\%$ and $B(J/\psi(1S) \rightarrow \ell^+ \ell^-) = 0.138 \pm 0.018$. Calculated by us using $B(J/\psi(1S) \rightarrow \ell^+ \ell^-) = (0.1181 \pm 0.0020)$.³ Not independent from other values reported by ADAM 05A.⁴ Not independent from other values reported by ANDREOTTI 05.

NODE=M071R71
 NODE=M071R71
 NEW

NODE=M071R71;LINKAGE=AB
 NODE=M071R;LINKAGE=8H

NODE=M071R71;LINKAGE=AD
 NODE=M071R71;LINKAGE=AN

 $\Gamma(J/\psi(1S)\pi^0)/\Gamma_{\text{total}}$ Γ_{14}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
12.68$\pm$0.32 OUR AVERAGE				
[(13.0 $\pm$ 1.0) $\times 10^{-4}$ OUR 2012 AVERAGE Scale factor = 1.4]				
12.6 $\pm$ 0.2 $\pm$ 0.3	4.1k	ABLIKIM	12M BES3	$e^+ e^- \rightarrow \ell^+ \ell^- 2\gamma$
13.3 $\pm$ 0.8 $\pm$ 0.3	530	MENDEZ	08 CLEO	$\psi(2S) \rightarrow \ell^+ \ell^- 2\gamma$
14.3 $\pm$ 1.4 $\pm$ 1.2	280	BAI	04I BES2	$\psi(2S) \rightarrow J/\psi \gamma \gamma$
14 $\pm$ 6	7	HIMEL	80 MRK2	$e^+ e^-$
9 $\pm$ 2 $\pm$ 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 $\pm$ 1 $\pm$ 1	88	ADAM	05A CLEO	Repl. by MENDEZ 08

¹ Recalculated by us using $B(J/\psi(1S) \rightarrow \ell^+ \ell^-) = 0.1181 \pm 0.0020$.

NODE=M071R16
 NODE=M071R16
 NEW

NODE=M071R16;LINKAGE=3Q

$\Gamma(J/\psi(1S)\pi^0)/\Gamma(J/\psi(1S)\text{anything})$

$$\Gamma_{14}/\Gamma_9 = \Gamma_{14}/(\Gamma_{11}+\Gamma_{12}+\Gamma_{13}+0.348\Gamma_{119}+0.198\Gamma_{120})$$

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

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

$0.213 \pm 0.012 \pm 0.003$	527	¹ MENDEZ	08	CLEO $e^+e^- \rightarrow J/\psi\gamma\gamma$
$0.22 \pm 0.02 \pm 0.01$		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=M071S25
NODE=M071S25

NODE=M071S25;LINKAGE=ME
NODE=M071S25;LINKAGE=AD

 $\Gamma(J/\psi(1S)\pi^0)/\Gamma(J/\psi(1S)\pi^+\pi^-)$

$$\Gamma_{14}/\Gamma_{11}$$

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

HADRONIC DECAYS

 $\Gamma(\pi^0 h_c(1P))/\Gamma_{\text{total}}$

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

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 $\Upsilon(2S) \rightarrow \pi^0 \text{ anything}$
$8.4 \pm 1.3 \pm 1.0$	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=M071S10

NODE=M071S42;LINKAGE=GE

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

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

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

35 ± 16	6	FRANKLIN	83	MRK2 $e^+e^- \rightarrow \text{hadrons}$

NODE=M071R37
NODE=M071R37

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

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

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

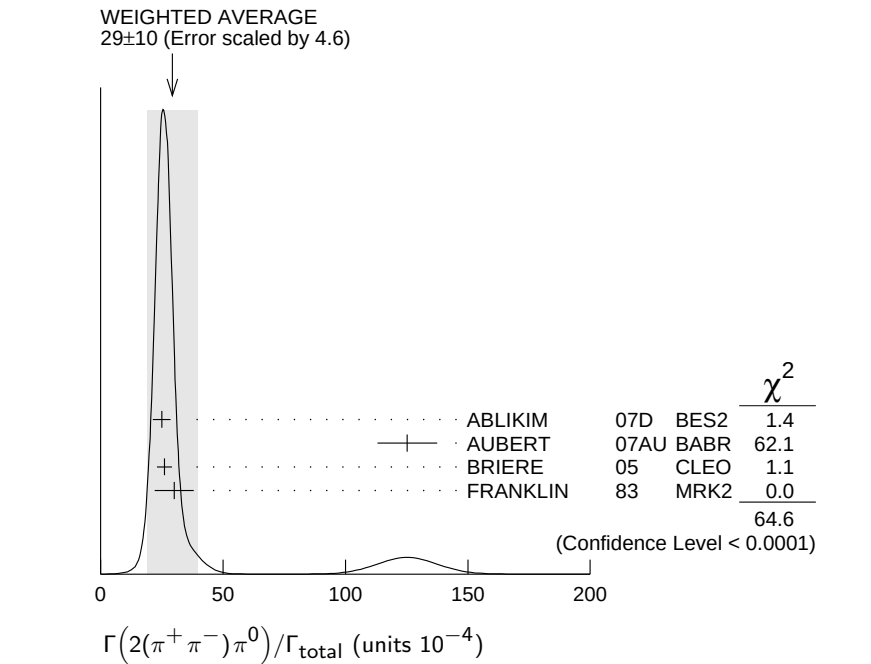
29 ± 10 OUR AVERAGE Error includes scale factor of 4.6. See the ideogram below.

$24.9 \pm 0.7 \pm 3.6$	2173	ABLIKIM	07D	BES2 $e^+e^- \rightarrow \psi(2S)$
$125 \pm 12 \pm 2$	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 $\Gamma(\psi(2S) \rightarrow e^+e^-) = 2.37 \pm 0.04 \text{ keV}$. 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

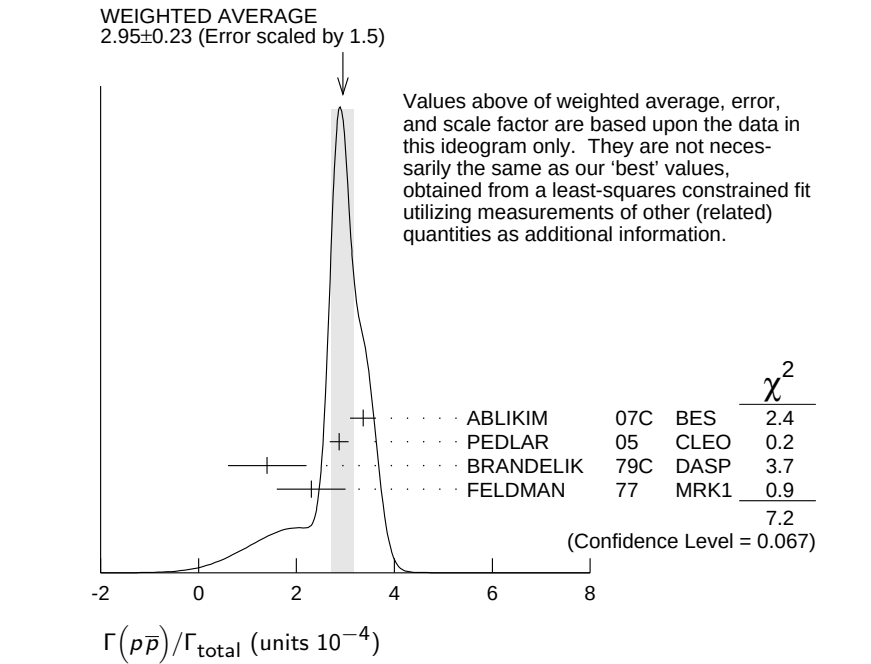


$\Gamma(\rho_2(1320))/\Gamma_{\text{total}}$					Γ_{18}/Γ
VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$2.55 \pm 0.73 \pm 0.47$		112 ± 31	BAI	04C BES2	$\psi(2S) \rightarrow 2(\pi^+\pi^-\pi^0)$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<2.3	90		BAI	98J BES	e^+e^-

NODE=M071R65
NODE=M071R65

$\Gamma(\rho\bar{\rho})/\Gamma_{\text{total}}$					Γ_{19}/Γ
VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT	
2.75 ± 0.12 OUR FIT					
[(2.76 ± 0.12) $\times 10^{-4}$ OUR 2012 FIT]					
2.95 ± 0.23 OUR AVERAGE		Error includes scale factor of 1.5. See the ideogram below.			
$3.36 \pm 0.09 \pm 0.25$	1618	ABLIKIM	07C BES	$e^+e^- \rightarrow \psi(2S) \rightarrow \rho\bar{\rho}$	
$2.87 \pm 0.12 \pm 0.15$	557	PEDLAR	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow \rho\bar{\rho}$	
1.4 ± 0.8	4	BRANDELIK	79C DASP	$e^+e^- \rightarrow \psi(2S) \rightarrow \rho\bar{\rho}$	
2.3 ± 0.7		FELDMAN	77 MRK1	$e^+e^- \rightarrow \psi(2S) \rightarrow \rho\bar{\rho}$	

NODE=M071R25
NODE=M071R25
NEW



$\Gamma(p\bar{p})/\Gamma(J/\psi(1S)\pi^+\pi^-)$ Γ_{19}/Γ_{11} VALUE (units 10^{-4})

DOCUMENT ID

TECN

COMMENT

8.09±0.35 OUR FIT[(8.2 ± 0.4) × 10⁻⁴ OUR 2012 FIT]**6.98±0.49±0.97**

BAI

01

BES

 $e^+e^- \rightarrow \psi(2S) \rightarrow p\bar{p}$

NODE=M071S40

NODE=M071S40

NEW

 $\Gamma(\Delta^{++}\bar{\Delta}^{--})/\Gamma_{\text{total}}$ Γ_{20}/Γ VALUE (units 10^{-5})

EVTS

DOCUMENT ID

TECN

COMMENT

12.8±1.0±3.4

157

¹BAI

01

BES

 $e^+e^- \rightarrow \psi(2S) \rightarrow$
hadrons

NODE=M071R50

NODE=M071R50

¹ Estimated using $B(\psi(2S) \rightarrow J/\psi\pi^+\pi^-) = 0.310 \pm 0.028$.

NODE=M071R50;LINKAGE=PP

 $\Gamma(\Lambda\bar{\Lambda}\pi^0)/\Gamma_{\text{total}}$ Γ_{21}/Γ VALUE (units 10^{-5})

CL%

DOCUMENT ID

TECN

COMMENT

< 0.29 (CL = 90%) [$< 1.2 \times 10^{-4}$ (CL = 90%) OUR 2012 BEST LIMIT]**< 0.29**

90

¹ABLIKIM

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

²ABLIKIM

07H

BES2

 $e^+e^- \rightarrow \psi(2S)$ ¹ Using $B(\Lambda \rightarrow \pi^- p) = 63.9\%$ and $B(\pi^0 \rightarrow \gamma\gamma) = 98.8\%$.² Using $B(\Lambda \rightarrow \pi^- p) = 63.9\%$ and $B(\eta \rightarrow \gamma\gamma) = 39.4\%$.

NODE=M071R6

NODE=M071R6

 $\Gamma(\Lambda\bar{\Lambda}\eta)/\Gamma_{\text{total}}$ Γ_{22}/Γ VALUE (units 10^{-5})

CL%

EVTS

DOCUMENT ID

TECN

COMMENT

2.48±0.34±0.19

60

¹ABLIKIM

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

²ABLIKIM

07H

BES2

 $e^+e^- \rightarrow \psi(2S)$ ¹ Using $B(\Lambda \rightarrow \pi^- p) = 63.9\%$ and $B(\eta \rightarrow \gamma\gamma) = 39.31\%$.² Using $B(\Lambda \rightarrow \pi^- p) = 63.9\%$.

NODE=M071R7

NODE=M071R7

 $\Gamma(\Lambda\bar{p}K^+)/\Gamma_{\text{total}}$ Γ_{23}/Γ VALUE (units 10^{-4})

EVTS

DOCUMENT ID

TECN

COMMENT

1.0±0.1±0.1

74.0

BRIERE

05

CLEO

 $e^+e^- \rightarrow \psi(2S) \rightarrow$
 $p\bar{p}K^+\pi^-$

NODE=M071S18

NODE=M071S18

 $\Gamma(\Lambda\bar{p}K^+\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{24}/Γ VALUE (units 10^{-4})

EVTS

DOCUMENT ID

TECN

COMMENT

1.8±0.3±0.3

45.8

BRIERE

05

CLEO

 $e^+e^- \rightarrow \psi(2S) \rightarrow$
 $p\bar{p}K^+\pi^+\pi^-\pi^-$

NODE=M071S19

NODE=M071S19

 $\Gamma(\Lambda\bar{\Lambda}\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{25}/Γ VALUE (units 10^{-4})

EVTS

DOCUMENT ID

TECN

COMMENT

2.8±0.4±0.5

73.4

BRIERE

05

CLEO

 $e^+e^- \rightarrow \psi(2S) \rightarrow$
 $p\bar{p}2(\pi^+\pi^-)$

NODE=M071S17

NODE=M071S17

 $\Gamma(\Lambda\bar{\Lambda})/\Gamma_{\text{total}}$ Γ_{26}/Γ VALUE (units 10^{-4})

CL% EVTS

DOCUMENT ID

TECN

COMMENT

2.8 ± 0.5 OUR AVERAGE

Error includes scale factor of 2.6. See the ideogram below.

3.39±0.20±0.32

337

ABLIKIM

07C

BES

 $e^+e^- \rightarrow \psi(2S) \rightarrow$ hadrons

6.3 ± 1.7 ± 0.1

¹

AUBERT

07BD

BABR

10.6 $e^+e^- \rightarrow \Lambda\bar{\Lambda}\gamma$

3.28±0.23±0.25

208

PEDLAR

05

CLEO

 $e^+e^- \rightarrow \psi(2S) \rightarrow$ hadrons

1.81±0.20±0.27

80

²

BAI

01

BES

 $e^+e^- \rightarrow \psi(2S) \rightarrow$ hadrons

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

< 4

90

FELDMAN

77

MRK1

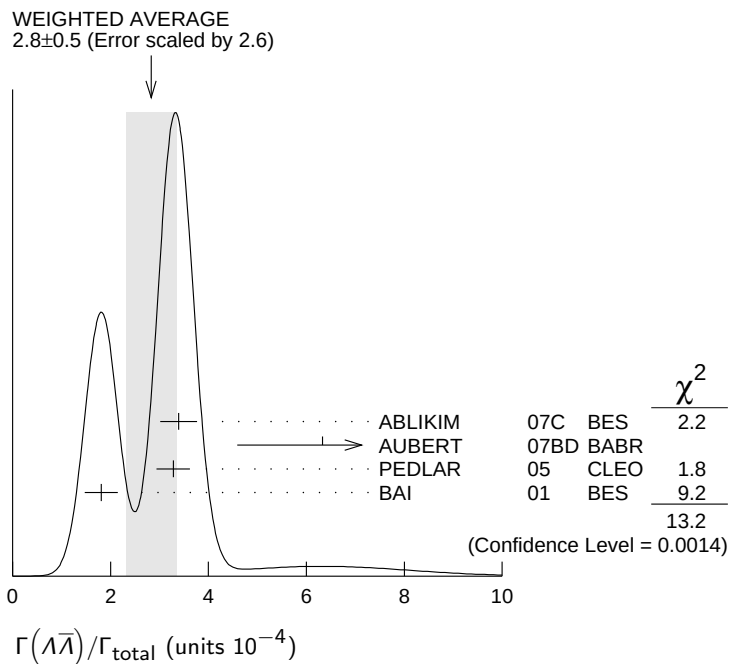
 $e^+e^- \rightarrow \psi(2S) \rightarrow$ hadrons¹ AUBERT 07BD reports $[\Gamma(\psi(2S) \rightarrow \Lambda\bar{\Lambda})/\Gamma_{\text{total}}] \times [\Gamma(\psi(2S) \rightarrow e^+e^-)] = (15 \pm 4 \pm 1) \times 10^{-4}$ keV which we divide by our best value $\Gamma(\psi(2S) \rightarrow e^+e^-) = 2.37 \pm 0.04$ keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.² Estimated using $B(\psi(2S) \rightarrow J/\psi\pi^+\pi^-) = 0.310 \pm 0.028$.

NODE=M071R28

NODE=M071R28

NODE=M071R28;LINKAGE=AU

NODE=M071R28;LINKAGE=PP



$\Gamma(\Sigma^0 \bar{p} K^+ + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{27}/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_{28}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
25.7±4.4±6.8	35	PEDLAR	05 CLEO	$e^+ e^- \rightarrow \psi(2S) \rightarrow$ hadrons

NODE=M071R47
NODE=M071R47

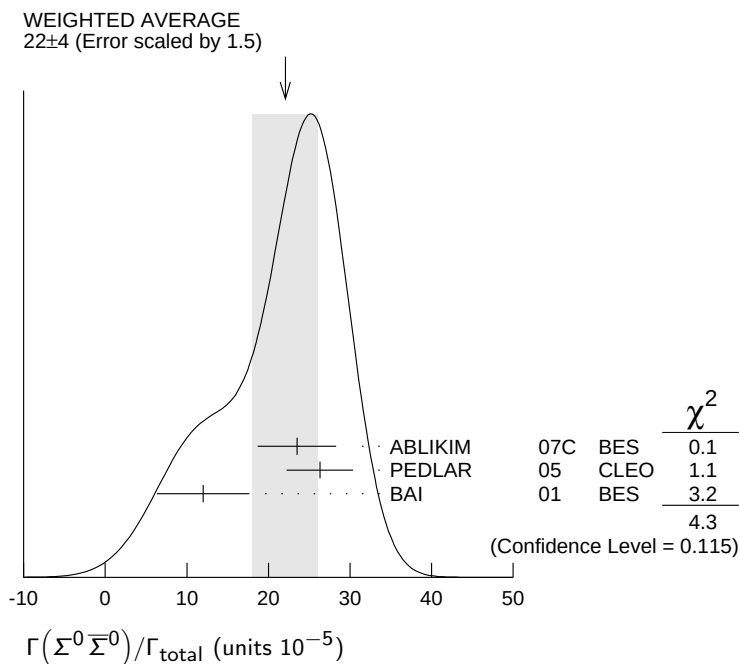
$\Gamma(\Sigma^0 \bar{\Sigma}^0)/\Gamma_{\text{total}}$ Γ_{29}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
22 ±4 OUR AVERAGE		Error includes scale factor of 1.5. See the ideogram below.		
23.5±3.6±3.2	59	ABLIKIM	07C BES	$e^+ e^- \rightarrow \psi(2S) \rightarrow$ hadrons
26.3±3.5±2.1	58	PEDLAR	05 CLEO	$e^+ e^- \rightarrow \psi(2S) \rightarrow$ hadrons
12 ±4 ±4	8	¹ BAI	01 BES	$e^+ e^- \rightarrow \psi(2S) \rightarrow$ hadrons

¹ Estimated using $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = 0.310 \pm 0.028$.

NODE=M071R51
NODE=M071R51

NODE=M071R51;LINKAGE=PP



$\Gamma(\Sigma(1385)^+ \bar{\Sigma}(1385)^-)/\Gamma_{\text{total}}$ Γ_{30}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
$11 \pm 3 \pm 3$	14	¹ BAI	01 BES	$e^+ e^- \rightarrow \psi(2S) \rightarrow$ hadrons

¹ Estimated using $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = 0.310 \pm 0.028$.

NODE=M071R52
NODE=M071R52

NODE=M071R52;LINKAGE=PP

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

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
18 ± 6 OUR AVERAGE			Error includes scale factor of 2.8. See the ideogram below.		
$30.3 \pm 4.0 \pm 3.2$	67		ABLIKIM	07C BES	$e^+ e^- \rightarrow \psi(2S) \rightarrow$ hadrons
$23.8 \pm 3.0 \pm 2.1$	63		PEDLAR	05 CLEO	$e^+ e^- \rightarrow \psi(2S) \rightarrow$ hadrons
$9.4 \pm 2.7 \pm 1.5$	12	¹ BAI	01 BES		$e^+ e^- \rightarrow \psi(2S) \rightarrow$ hadrons

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

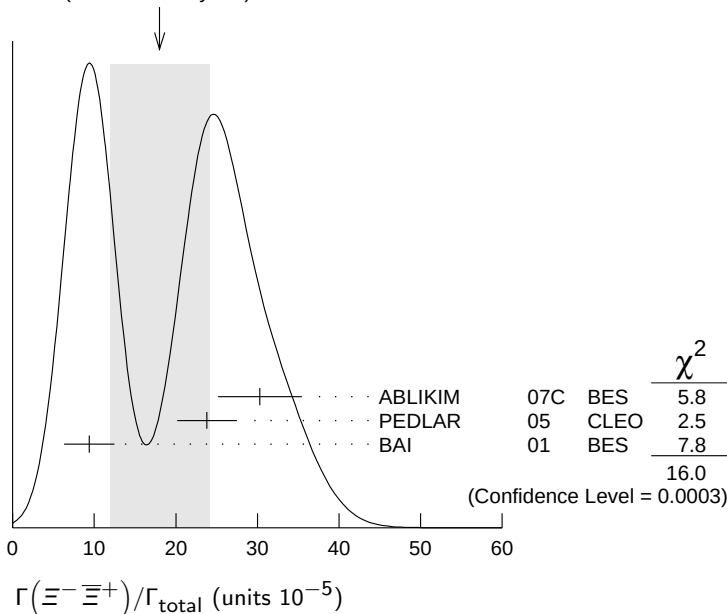
<20 90 FELDMAN 77 MRK1 $e^+ e^- \rightarrow \psi(2S) \rightarrow$ hadrons

¹ Estimated using $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = 0.310 \pm 0.028$.

NODE=M071R29
NODE=M071R29

NODE=M071R29;LINKAGE=PP

WEIGHTED AVERAGE
 18 ± 6 (Error scaled by 2.8)

 $\Gamma(\Xi^0 \bar{\Xi}^0)/\Gamma_{\text{total}}$ Γ_{32}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
$27.5 \pm 6.4 \pm 6.1$	19	PEDLAR	05 CLEO	$e^+ e^- \rightarrow \psi(2S) \rightarrow$ hadrons

NODE=M071R48
NODE=M071R48

 $\Gamma(\Xi(1530)^0 \bar{\Xi}(1530)^0)/\Gamma_{\text{total}}$ Γ_{33}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
< 8.1	90	¹ BAI	01 BES	$e^+ e^- \rightarrow \psi(2S) \rightarrow$ hadrons
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<32	90	PEDLAR	05 CLEO	$e^+ e^- \rightarrow \psi(2S) \rightarrow$ hadrons

¹ Estimated using $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = 0.310 \pm 0.028$.

NODE=M071R53
NODE=M071R53

NODE=M071R53;LINKAGE=PP

 $\Gamma(\Omega^- \bar{\Omega}^+)/\Gamma_{\text{total}}$ Γ_{34}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
< 7.3	90	¹ BAI	01 BES	$e^+ e^- \rightarrow \psi(2S) \rightarrow$ hadrons
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<16	90	PEDLAR	05 CLEO	$e^+ e^- \rightarrow \psi(2S) \rightarrow$ hadrons

¹ Estimated using $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = 0.310 \pm 0.028$.

NODE=M071R54
NODE=M071R54

NODE=M071R54;LINKAGE=PP

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

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

1.53±0.07 OUR AVERAGE[(1.50 ± 0.08) × 10⁻⁴ OUR 2012 AVERAGE Scale factor = 1.1]

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 ± 18	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 $B(\pi^0 \rightarrow \gamma \gamma) = (98.80 \pm 0.03)\%$. Γ_{35}/Γ

NODE=M071R35

NODE=M071R35

NEW

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

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. Γ_{36}/Γ

NODE=M071S56

NODE=M071S56

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

7.3 ^{+1.7}_{-1.5} OUR AVERAGE Error includes scale factor of 2.5. [(8.1 ± 0.8) × 10⁻⁵ OUR 2012 AVERAGE]

3.58±0.25 ^{+1.59} _{-0.84}	1.1k	¹ ABLIKIM	13A BES3	$\psi(2S) \rightarrow p \bar{p} \pi^0$
8.1 ± 0.7 ± 0.3	474	² ALEXANDER	10 CLEO	$\psi(2S) \rightarrow \pi^0 p \bar{p}$

¹ From a fit of $\pi^0 p \bar{p}$ data to eight distinct intermediate $N \bar{p}$ resonant states.² From a fit of the $p \bar{p}$ and $p \pi^0$ mass distributions to a combination of $N(1440) \bar{p}$, $\pi^0 f_0(2100)$, and two other broad, unestablished resonances. Γ_{37}/Γ

NODE=M071S50

NODE=M071S50

NEW

NODE=M071S50;LINKAGE=AB

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

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. Γ_{38}/Γ

NODE=M071S57

NODE=M071S57

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

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. Γ_{39}/Γ

NODE=M071S58

NODE=M071S58

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

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. Γ_{40}/Γ

NODE=M071S59

NODE=M071S59

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

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. Γ_{41}/Γ

NODE=M071S60

NODE=M071S60

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

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. Γ_{42}/Γ

NODE=M071S61

NODE=M071S61

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

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. Γ_{43}/Γ

NODE=M071S62

NODE=M071S62

NODE=M071S62;LINKAGE=AB

$\Gamma(\pi^0 f_0(2100) \rightarrow \pi^0 p \bar{p}) / \Gamma_{\text{total}}$
 Γ_{44} / Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
1.1 ± 0.4 ± 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_{45} / Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
5.7 ± 0.6 OUR AVERAGE				
5.6 ± 0.6 ± 0.3	154	ALEXANDER 10	CLEO	$\psi(2S) \rightarrow \eta p \bar{p}$
5.8 ± 1.1 ± 0.7	44.8 ± 8.5	¹ ABLIKIM 05E	BES2	$e^+ e^- \rightarrow \psi(2S) \rightarrow p \bar{p} \gamma \gamma$
8 ± 3 ± 3	9.8	BRIERE 05	CLEO	$e^+ e^- \rightarrow \psi(2S) \rightarrow p \bar{p} \pi^+ \pi^- \pi^0$

¹ Computed using $B(\eta \rightarrow \gamma \gamma) = (39.43 \pm 0.26)\%$.

NODE=M071R56
NODE=M071R56

NODE=M071R56;LINKAGE=AB

 $\Gamma(\eta f_0(2100) \rightarrow \eta p \bar{p}) / \Gamma_{\text{total}}$
 Γ_{46} / Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
1.2 ± 0.4 ± 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_{47} / Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
4.4 ± 0.6 ± 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_{48} / Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
0.69 ± 0.21 OUR AVERAGE				
0.6 ± 0.2 ± 0.2	21.2	BRIERE 05	CLEO	$e^+ e^- \rightarrow \psi(2S) \rightarrow p \bar{p} \pi^+ \pi^- \pi^0$
0.8 ± 0.3 ± 0.1	14.9 ± 0.1	¹ BAI 03B	BES	$\psi(2S) \rightarrow p \bar{p} \pi^+ \pi^- \pi^0$

¹ Normalized to $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = 0.305 \pm 0.016$.

NODE=M071R79
NODE=M071R79

NODE=M071R;LINKAGE=B3

 $\Gamma(\phi p \bar{p}) / \Gamma_{\text{total}}$
 Γ_{49} / Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<0.24	90	BRIERE 05	CLEO	$e^+ e^- \rightarrow \psi(2S) \rightarrow p \bar{p} K^+ K^-$

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

<0.26	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

 $\Gamma(\pi^+ \pi^- p \bar{p}) / \Gamma_{\text{total}}$
 Γ_{50} / Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
6.0 ± 0.4 OUR AVERAGE				
5.9 ± 0.2 ± 0.4	904.5	BRIERE 05	CLEO	$e^+ e^- \rightarrow \psi(2S) \rightarrow p \bar{p} \pi^+ \pi^-$
8 ± 2		¹ TANENBAUM 78	MRK1	$e^+ e^-$

¹ Assuming entirely strong decay.

NODE=M071R31
NODE=M071R31

NODE=M071R;LINKAGE=K

 $\Gamma(p \bar{n} \pi^- \text{ or c.c.}) / \Gamma_{\text{total}}$
 Γ_{51} / 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_{52} / 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_{54} / 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

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

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$9.5 \pm 0.7 \pm 1.5$		¹ BRIERE	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadr}$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$10.3 \pm 0.8 \pm 1.4$	201.7	² BRIERE	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow \eta 3\pi(\eta \rightarrow \gamma\gamma)$
$8.1 \pm 1.4 \pm 1.6$	50.0	² BRIERE	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow \eta 3\pi(\eta \rightarrow 3\pi)$

¹ Average of $\eta \rightarrow \gamma\gamma$ and $\eta \rightarrow 3\pi$.² Not independent from other values reported by BRIERE 05. Γ_{55}/Γ NODE=M071S07
NODE=M071S07

OCCUR=2

OCCUR=3

NODE=M071S07;LINKAGE=BR
NODE=M071S07;LINKAGE=BI $\Gamma(2(\pi^+\pi^-\eta))/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.2 \pm 0.6 \pm 0.1$	16	¹ AUBERT	07AU BABR	10.6 $e^+e^- \rightarrow 2(\pi^+\pi^-\eta)\gamma$
¹ AUBERT 07AU quotes $\Gamma_{ee}^{\psi(2S)} \cdot B(\psi(2S) \rightarrow 2(\pi^+\pi^-\eta)) \cdot B(\eta \rightarrow \gamma\gamma) = 1.2 \pm 0.7 \pm 0.1$ eV.				

 Γ_{56}/Γ NODE=M071S38
NODE=M071S38

NODE=M071S38;LINKAGE=UB

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

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$4.5 \pm 1.6 \pm 1.3$	12.8	BRIERE	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadr}$

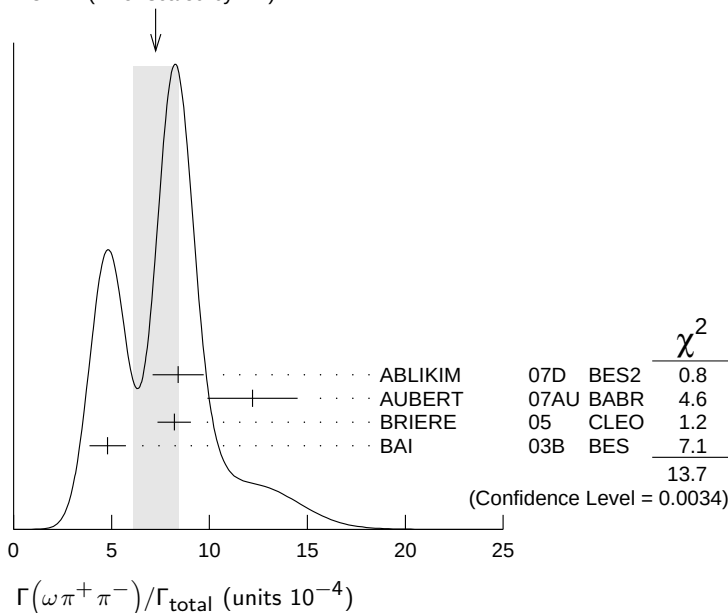
 Γ_{57}/Γ NODE=M071S08
NODE=M071S08 $\Gamma(\omega\pi^+\pi^-)/\Gamma_{\text{total}}$

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.		
$8.4 \pm 0.5 \pm 1.2$	386	ABLIKIM	07D BES2	$e^+e^- \rightarrow \psi(2S)$
$12.2 \pm 2.2 \pm 0.7$	37	¹ AUBERT	07AU BABR	10.6 $e^+e^- \rightarrow \omega\pi^+\pi^-\gamma$
$8.2 \pm 0.5 \pm 0.7$	391	BRIERE	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow 2(\pi^+\pi^-)\pi^0$
$4.8 \pm 0.6 \pm 0.7$	100 ± 22	² BAI	03B BES	$\psi(2S) \rightarrow 2(\pi^+\pi^-)\pi^0$
¹ AUBERT 07AU quotes $\Gamma_{ee}^{\psi(2S)} \cdot B(\psi(2S) \rightarrow \omega\pi^+\pi^-) \cdot B(\omega \rightarrow 3\pi) = 2.69 \pm 0.73 \pm 0.16$ eV.				
² Normalized to $B(\psi(2S) \rightarrow J/\psi\pi^+\pi^-) = 0.305 \pm 0.016$.				

 Γ_{58}/Γ 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

 Γ_{59}/Γ NODE=M071R40
NODE=M071R40

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=M071R;LINKAGE=M1

NODE=M071R40;LINKAGE=B3

$\Gamma(b_1^0\pi^0)/\Gamma_{\text{total}}$					Γ_{60}/Γ
VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$2.35^{+0.47}_{-0.42} \pm 0.40$		45	ADAM	05	CLEO $e^+e^- \rightarrow \psi(2S)$

NODE=M071R21
NODE=M071R21

$\Gamma(\omega f_2(1270))/\Gamma_{\text{total}}$					Γ_{61}/Γ
VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
2.2 $\pm$ 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 $\pm$ 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

NODE=M071R64
NODE=M071R64

¹ Normalized to $B(\psi(2S) \rightarrow J/\psi\pi^+\pi^-) = 0.305 \pm 0.016$.

NODE=M071R64;LINKAGE=B3

$\Gamma(\pi^+\pi^-K^+K^-)/\Gamma_{\text{total}}$					Γ_{62}/Γ
VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
7.5 $\pm$ 0.9 OUR AVERAGE					
Error includes scale factor of 1.9. $[(7.5 \pm 0.9) \times 10^{-4} \text{ OUR 2012 AVERAGE Scale factor} = 1.9]$					
10.8 $\pm$ 1.9 $\pm$ 0.2		85	¹ AUBERT	07AK 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 $\pm$ 4			² TANENBAUM	78 MRK1	e^+e^-

NODE=M071R24
NODE=M071R24

NEW

¹ AUBERT 07AK reports $[\Gamma(\psi(2S) \rightarrow \pi^+\pi^-K^+K^-)/\Gamma_{\text{total}}] \times [\Gamma(\psi(2S) \rightarrow e^+e^-)] = (2.56 \pm 0.42 \pm 0.16) \times 10^{-3} \text{ keV}$ which we divide by our best value $\Gamma(\psi(2S) \rightarrow e^+e^-) = 2.37 \pm 0.04 \text{ keV}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M071R24;LINKAGE=BE

² Assuming entirely strong decay.

NODE=M071R24;LINKAGE=K

$\Gamma(\rho^0K^+K^-)/\Gamma_{\text{total}}$					Γ_{63}/Γ
VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
2.2 $\pm$ 0.2 $\pm$ 0.4		223.8	BRIERE	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow K^+K^-\pi^+\pi^-$

NODE=M071S09
NODE=M071S09

$\Gamma(K^*(892)^0\bar{K}_2^*(1430)^0)/\Gamma_{\text{total}}$					Γ_{64}/Γ
VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
1.86 $\pm$ 0.32 $\pm$ 0.43		93 $\pm$ 16	BAI	04C	$\psi(2S) \rightarrow K^+K^-\pi^+\pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<1.2	90		BAI	98J BES	e^+e^-

NODE=M071R66
NODE=M071R66

$\Gamma(K^+K^-\pi^+\pi^-\eta)/\Gamma_{\text{total}}$					Γ_{65}/Γ
VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
1.3 $\pm$ 0.7 $\pm$ 0.1		7	¹ AUBERT	07AU BABR	10.6 $e^+e^- \rightarrow K^+K^-\pi^+\pi^-\eta\gamma$
¹ AUBERT 07AU quotes $\Gamma_{ee}^{\psi(2S)} \cdot B(\psi(2S) \rightarrow 2(\pi^+\pi^-\eta)) \cdot B(\eta \rightarrow \gamma\gamma) = 1.2 \pm 0.7 \pm 0.1 \text{ eV}$.					

NODE=M071S39
NODE=M071S39

NODE=M071S39;LINKAGE=UB

$\Gamma(K^+K^-2(\pi^+\pi^-)\pi^0)/\Gamma_{\text{total}}$					Γ_{66}/Γ
VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
10.0 $\pm$ 2.5 $\pm$ 1.8		65	ABLIKIM	07D BES2	$e^+e^- \rightarrow \psi(2S)$

NODE=M071R09
NODE=M071R09

$\Gamma(K_1(1270)^\pm K^\mp)/\Gamma_{\text{total}}$					Γ_{68}/Γ
VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
10.0 $\pm$ 1.8 $\pm$ 2.1			¹ BAI	99C BES	e^+e^-

NODE=M071R41
NODE=M071R41

¹ Assuming $B(K_1(1270) \rightarrow K\rho)=0.42 \pm 0.06$

NODE=M071R;LINKAGE=M2

$\Gamma(K_S^0 K_S^0 \pi^+\pi^-)/\Gamma_{\text{total}}$					Γ_{69}/Γ
VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
2.20 $\pm$ 0.25 $\pm$ 0.37		83 $\pm$ 9	ABLIKIM	05O BES2	$e^+e^- \rightarrow \psi(2S)$

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	$e^+ e^- \rightarrow \psi(2S) \rightarrow \rho \bar{p} \pi^+ \pi^-$

 Γ_{70}/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_{71}/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_{72}/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_{73}/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				
18.6±5.6±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_{74}/Γ

NODE=M071S10
 NODE=M071S10

¹ AUBERT 07AU reports $[\Gamma(\psi(2S) \rightarrow K^+ K^- \pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}] \times [\Gamma(\psi(2S) \rightarrow e^+ e^-)] = (44 \pm 13 \pm 3) \times 10^{-4}$ keV which we divide by our best value $\Gamma(\psi(2S) \rightarrow e^+ e^-) = 2.37 \pm 0.04$ keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M071S10;LINKAGE=UB

 $\Gamma(\omega f_0(1710) \rightarrow \omega K^+ K^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
5.9±2.0±0.9	19	ABLIKIM	06G BES2	$\psi(2S) \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$

 Γ_{75}/Γ

NODE=M071S20
 NODE=M071S20

 $\Gamma(K^*(892)^0 K^- \pi^+ \pi^0 + \text{c.c.})/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
8.6±1.3±1.8	238	ABLIKIM	06G BES2	$\psi(2S) \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$

 Γ_{76}/Γ

NODE=M071S21
 NODE=M071S21

 $\Gamma(K^*(892)^+ K^- \pi^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
9.6±2.2±1.7	133	ABLIKIM	06G BES2	$\psi(2S) \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$

 Γ_{77}/Γ

NODE=M071S22
 NODE=M071S22

 $\Gamma(K^*(892)^+ K^- \rho^0 + \text{c.c.})/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
7.3±2.2±1.4	78	ABLIKIM	06G BES2	$\psi(2S) \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$

 Γ_{78}/Γ

NODE=M071S23
 NODE=M071S23

 $\Gamma(K^*(892)^0 K^- \rho^+ + \text{c.c.})/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
6.1±1.3±1.2	125	ABLIKIM	06G BES2	$\psi(2S) \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$

 Γ_{79}/Γ

NODE=M071S24
 NODE=M071S24

$\Gamma(\eta K^+ K^-, \text{no } \eta\phi)/\Gamma_{\text{total}}$ Γ_{80}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$3.08 \pm 0.29 \pm 0.25$		0.3k	¹ ABLIKIM	12L BES3	$\psi(2S) \rightarrow K^+ K^- \gamma\gamma$

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

<13	90	BRIERE	05	CLEO	$e^+ e^- \rightarrow \psi(2S) \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$

¹ Excluding $\eta\phi$.

NODE=M071S11
NODE=M071S11

NODE=M071S11;LINKAGE=AB

$\Gamma(\omega K^+ K^-)/\Gamma_{\text{total}}$ Γ_{81}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.85 ± 0.25 OUR AVERAGE				Error includes scale factor of 1.1.

$2.38 \pm 0.37 \pm 0.29$	78	ABLIKIM	06G BES2	$\psi(2S) \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$
$1.9 \pm 0.3 \pm 0.3$	76.8	BRIERE	05	CLEO $e^+ e^- \rightarrow \psi(2S) \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$
$1.5 \pm 0.3 \pm 0.2$	23.0 ± 5.2	¹ BAI	03B BES	$\psi(2S) \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$

¹ Normalized to $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = 0.305 \pm 0.016$.

NODE=M071R78
NODE=M071R78

NODE=M071R78;LINKAGE=B3

$\Gamma(3(\pi^+ \pi^-))/\Gamma_{\text{total}}$ Γ_{82}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
3.5 ± 2.0 OUR AVERAGE				Error includes scale factor of 2.8.

$5.45 \pm 0.42 \pm 0.87$	671	ABLIKIM	05H BES2	$e^+ e^- \rightarrow \psi(2S) \rightarrow 3(\pi^+ \pi^-)$
1.5 ± 1.0		¹ TANENBAUM	78	MRK1 $e^+ e^-$

¹ Assuming entirely strong decay.

NODE=M071R32
NODE=M071R32

NODE=M071R32;LINKAGE=K

$\Gamma(\rho \bar{\rho} \pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}$ Γ_{83}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$7.3 \pm 0.4 \pm 0.6$	434.9	BRIERE	05	CLEO $e^+ e^- \rightarrow \psi(2S) \rightarrow \rho \bar{\rho} \pi^+ \pi^- \pi^0$

NODE=M071S15
NODE=M071S15

$\Gamma(K^+ K^-)/\Gamma_{\text{total}}$ Γ_{84}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
7.1 ± 0.5 OUR AVERAGE					Error includes scale factor of 1.5. $[(6.3 \pm 0.7) \times 10^{-5}]$

OUR 2012 AVERAGE]					
$7.48 \pm 0.23 \pm 0.39$	1.3k	¹ METREVELI	12		$\psi(2S) \rightarrow K^+ K^-$
$6.3 \pm 0.6 \pm 0.3$		DOBBS	06A	CLEO	$e^+ e^-$
10 ± 7		BRANDELIK	79C	DASP	$e^+ e^-$

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

< 5	90	FELDMAN	77	MRK1	$e^+ e^-$

¹ Obtained by analyzing CLEO-c data but not authored by the CLEO Collaboration.

NODE=M071R23
NODE=M071R23

NEW

NODE=M071R23;LINKAGE=ME

$\Gamma(K_S^0 K_L^0)/\Gamma_{\text{total}}$ Γ_{85}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
5.34 ± 0.33 OUR AVERAGE				$[(5.4 \pm 0.5) \times 10^{-5}]$ OUR 2012 AVERAGE]

$5.28 \pm 0.25 \pm 0.34$	478 ± 23	¹ METREVELI	12		$\psi(2S) \rightarrow K_S^0 K_L^0$
$5.8 \pm 0.8 \pm 0.4$		DOBBS	06A	CLEO	$e^+ e^-$
$5.24 \pm 0.47 \pm 0.48$	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

NEW

NODE=M071R87;LINKAGE=ME

NODE=M071R;LINKAGE=KZ

$\Gamma(\pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}$ Γ_{86}/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. $[(1.68 \pm 0.26) \times 10^{-4}]$ OUR 2012 AVERAGE Scale factor = 1.4]

$2.14 \pm 0.03^{+0.12}_{-0.11}$	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 $e^+ e^- \rightarrow \text{hadrons}$

NODE=M071R36
NODE=M071R36

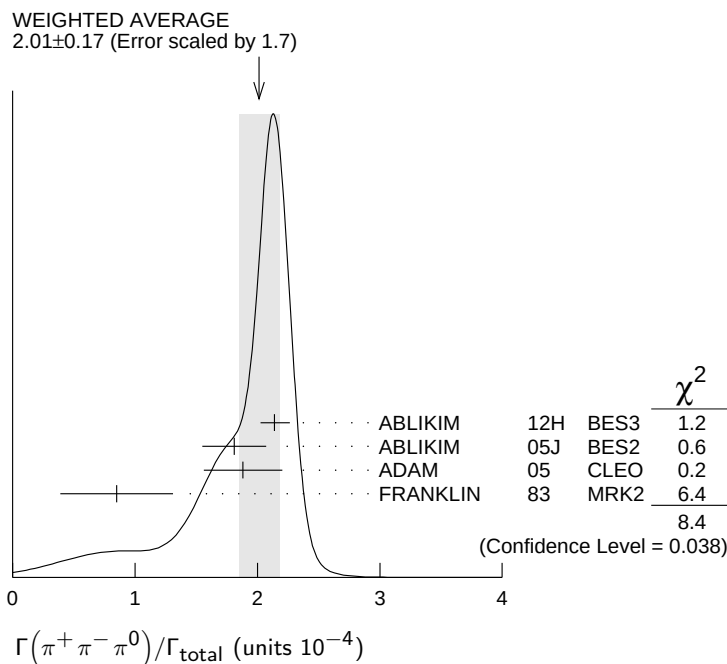
NEW

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;LINKAGE=AB

NODE=M071R;LINKAGE=AK



$\Gamma(\rho(2150)\pi \rightarrow \pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}$

Γ_{87}/Γ

VALUE (units 10 ⁻⁴)	DOCUMENT ID	TECN	COMMENT
1.94±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_{88}/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±0.07±0.11			¹ ABLIKIM	05J BES2	$\psi(2S) \rightarrow \rho(770)\pi \rightarrow \pi^+ \pi^- \pi^0$

0.24^{+0.08}_{-0.07}±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_{89}/Γ

VALUE (units 10 ⁻⁵)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
0.78±0.26 OUR AVERAGE					
[(8 ± 5) × 10 ⁻⁵ OUR 2012 AVERAGE]					

0.76±0.25±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

NEW

NODE=M071R20;LINKAGE=ME

$\Gamma(K_1(1400)^\pm K^\mp)/\Gamma_{\text{total}}$

Γ_{90}/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_{91}/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_{92}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$4.07 \pm 0.16 \pm 0.26$	0.9k		ABLIKIM	12L BES3	$e^+ e^- \rightarrow \psi(2S)$

NODE=M071R38
NODE=M071R38

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

<8.9	90	1	FRANKLIN	83 MRK2	$e^+ e^- \rightarrow \text{hadrons}$

 $\Gamma(K^+ K^*(892)^- + \text{c.c.})/\Gamma_{\text{total}}$
 Γ_{93}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
2.9 ± 0.4 OUR AVERAGE					Error includes scale factor of 1.2. $[(1.7^{+0.8}_{-0.7}) \times 10^{-5}]$

NODE=M071R39
NODE=M071R39

OUR 2012 AVERAGE]

$3.18 \pm 0.30^{+0.26}_{-0.31}$	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	$e^+ e^- \rightarrow \text{hadrons}$

 $\Gamma(K^*(892)^0 \bar{K}^0 + \text{c.c.})/\Gamma_{\text{total}}$
 Γ_{94}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
10.9 ± 2.0 OUR AVERAGE				

NODE=M071R30
NODE=M071R30

$13.3^{+2.4}_{-2.8} \pm 1.7$	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	$e^+ e^- \rightarrow \psi(2S)$

 $\Gamma(K^+ K^*(892)^- + \text{c.c.})/\Gamma(K^*(892)^0 \bar{K}^0 + \text{c.c.})$
 Γ_{93}/Γ_{94}

VALUE	DOCUMENT ID	TECN	COMMENT
0.16 ± 0.06 OUR AVERAGE			

NODE=M071R46
NODE=M071R46

$0.22^{+0.10}_{-0.14}$		ABLIKIM	05I BES2	$e^+ e^- \rightarrow \psi(2S)$
$0.14^{+0.08}_{-0.06}$		ADAM	05 CLEO	$e^+ e^- \rightarrow \psi(2S)$

 $\Gamma(\phi \pi^+ \pi^-)/\Gamma_{\text{total}}$
 Γ_{95}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.17 ± 0.29 OUR AVERAGE				Error includes scale factor of 1.7.

NODE=M071R80
NODE=M071R80

$2.40 \pm 0.94 \pm 0.04$	10 ± 4	^{1,2} AUBERT	07AK 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	³ BAI	03B BES	$\psi(2S) \rightarrow K^+ K^- \pi^+ \pi^-$

¹ 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 $\Gamma(\psi(2S) \rightarrow e^+ e^-) = 2.37 \pm 0.04$ keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² Using $B(\phi \rightarrow K^+ K^-) = (49.3 \pm 0.6)\%$.

³ Normalized to $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = 0.305 \pm 0.016$.

NODE=M071R80;LINKAGE=BE

NODE=M071R80;LINKAGE=UB
NODE=M071R80;LINKAGE=B3

 $\Gamma(\phi f_0(980) \rightarrow \pi^+ \pi^-)/\Gamma_{\text{total}}$
 Γ_{96}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
0.68 ± 0.24 OUR AVERAGE				Error includes scale factor of 1.1. $[(0.68 \pm 0.25) \times 10^{-4}]$

NODE=M071R83
NODE=M071R83

OUR 2012 AVERAGE Scale factor = 1.1]

$1.43 \pm 0.70 \pm 0.02$	6 ± 3	^{1,2} AUBERT	07AK BABR	$10.6 e^+ e^- \rightarrow \pi^+ \pi^- K^+ K^- \gamma$
$0.6 \pm 0.2 \pm 0.1$	18.4 ± 6.4	³ BAI	03B BES	$\psi(2S) \rightarrow K^+ K^- \pi^+ \pi^-$

¹ 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 $\Gamma(\psi(2S) \rightarrow e^+ e^-) = 2.37 \pm 0.04$ keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² Using $B(\phi \rightarrow K^+ K^-) = (49.3 \pm 0.6)\%$.

³ Normalized to $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = 0.305 \pm 0.016$.

NODE=M071R83;LINKAGE=BE

NODE=M071R83;LINKAGE=UB
NODE=M071R83;LINKAGE=B3

$\Gamma(2(K^+ K^-))/\Gamma_{\text{total}}$ Γ_{97}/Γ NODE=M071S12
NODE=M071S12

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$0.6 \pm 0.1 \pm 0.1$	59.2	BRIERE	05	CLEO $e^+ e^- \rightarrow \psi(2S) \rightarrow 2(K^+ K^-)$

 $\Gamma(\phi K^+ K^-)/\Gamma_{\text{total}}$ Γ_{98}/Γ NODE=M071R81
NODE=M071R81

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
0.70 ± 0.16 OUR AVERAGE				
$0.8 \pm 0.2 \pm 0.1$	36.8	BRIERE	05	CLEO $e^+ e^- \rightarrow \psi(2S) \rightarrow 2(K^+ K^-)$
$0.6 \pm 0.2 \pm 0.1$	16.1 ± 5.0	¹ BAI	03B	BES $\psi(2S) \rightarrow 2(K^+ K^-)$
¹ Normalized to $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = 0.305 \pm 0.016$.				

NODE=M071R81;LINKAGE=B3

 $\Gamma(2(K^+ K^-)\pi^0)/\Gamma_{\text{total}}$ Γ_{99}/Γ NODE=M071S13
NODE=M071S13

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.1 \pm 0.2 \pm 0.2$	44.7	BRIERE	05	CLEO $e^+ e^- \rightarrow \psi(2S) \rightarrow 2(K^+ K^-)\pi^0$

 $\Gamma(\phi\eta)/\Gamma_{\text{total}}$ Γ_{100}/Γ NODE=M071R89
NODE=M071R89
NEW

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
3.10 ± 0.31 OUR AVERAGE				
$[(2.8^{+1.0}_{-0.8}) \times 10^{-5}]$ OUR 2012 AVERAGE]				
$3.14 \pm 0.23 \pm 0.23$	0.2k	ABLIKIM	12L	BES3 $e^+ e^- \rightarrow \psi(2S)$
$2.0^{+1.5}_{-1.1} \pm 0.4$	6	ADAM	05	CLEO $e^+ e^- \rightarrow \psi(2S)$
$3.3 \pm 1.1 \pm 0.5$	17	ABLIKIM	04K	BES $e^+ e^- \rightarrow \psi(2S)$

 $\Gamma(\phi\eta')/\Gamma_{\text{total}}$ Γ_{101}/Γ NODE=M071R90
NODE=M071R90

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
$3.1 \pm 1.4 \pm 0.7$	8	¹ ABLIKIM	04K	BES $e^+ e^- \rightarrow \psi(2S)$
¹ Calculated combining $\eta' \rightarrow \gamma\rho$ and $\eta\pi^+\pi^-$ channels.				

NODE=M071R;LINKAGE=AI

 $\Gamma(\omega\eta')/\Gamma_{\text{total}}$ Γ_{102}/Γ NODE=M071R91
NODE=M071R91

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
$3.2^{+2.4}_{-2.0} \pm 0.7$	4	¹ ABLIKIM	04K	BES $e^+ e^- \rightarrow \psi(2S)$
¹ Calculated combining $\eta' \rightarrow \gamma\rho$ and $\eta\pi^+\pi^-$ channels.				

NODE=M071R91;LINKAGE=AI

 $\Gamma(\omega\pi^0)/\Gamma_{\text{total}}$ Γ_{103}/Γ NODE=M071R92
NODE=M071R92

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
2.1 ± 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 $e^+ e^- \rightarrow \psi(2S)$

 $\Gamma(\rho\eta')/\Gamma_{\text{total}}$ Γ_{104}/Γ NODE=M071R93
NODE=M071R93

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.87^{+1.64}_{-1.11} \pm 0.33$	2	ABLIKIM	04L	BES $e^+ e^- \rightarrow \psi(2S)$

 $\Gamma(\rho\eta)/\Gamma_{\text{total}}$ Γ_{105}/Γ NODE=M071R94
NODE=M071R94

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
2.2 ± 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 $e^+ e^- \rightarrow \psi(2S)$

 $\Gamma(\omega\eta)/\Gamma_{\text{total}}$ Γ_{106}/Γ NODE=M071R95
NODE=M071R95

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 $e^+ e^- \rightarrow \psi(2S)$

$\Gamma(\phi\pi^0)/\Gamma_{\text{total}}$ Γ_{107}/Γ

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

<0.04 (CL = 90%) [$<0.4 \times 10^{-5}$ (CL = 90%) OUR 2012 BEST LIMIT]

<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 $e^+e^- \rightarrow \psi(2S)$

 $\Gamma(\eta_c\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{108}/Γ

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

<1.0	90	PEDLAR	07	CLEO $e^+e^- \rightarrow \psi(2S)$

 $\Gamma(p\bar{p}K^+K^-)/\Gamma_{\text{total}}$ Γ_{109}/Γ

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

$2.7 \pm 0.6 \pm 0.4$	30.1	BRIERE	05	CLEO $e^+e^- \rightarrow \psi(2S) \rightarrow p\bar{p}K^+K^-$

 $\Gamma(\bar{\Lambda}nK_S^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{110}/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 $B(K_S^0 \rightarrow \pi^+\pi^-) = 69.2\%$. $\Gamma(\phi f_2'(1525))/\Gamma_{\text{total}}$ Γ_{111}/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 $e^+e^- \rightarrow 2(K^+K^-)$

 $\Gamma(\Theta(1540)\bar{\Theta}(1540) \rightarrow K_S^0 p K^- \bar{n} + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{112}/Γ

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

<0.88	90	BAI	04G	BES2 e^+e^-

 $\Gamma(\Theta(1540)K^-\bar{n} \rightarrow K_S^0 p K^- \bar{n})/\Gamma_{\text{total}}$ Γ_{113}/Γ

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

<1.0	90	BAI	04G	BES2 e^+e^-

 $\Gamma(\Theta(1540)K_S^0\bar{p} \rightarrow K_S^0\bar{p}K^+n)/\Gamma_{\text{total}}$ Γ_{114}/Γ

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

<0.70	90	BAI	04G	BES2 e^+e^-

 $\Gamma(\bar{\Theta}(1540)K^+n \rightarrow K_S^0\bar{p}K^+n)/\Gamma_{\text{total}}$ Γ_{115}/Γ

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

<2.6	90	BAI	04G	BES2 e^+e^-

 $\Gamma(\bar{\Theta}(1540)K_S^0p \rightarrow K_S^0pK^-\bar{n})/\Gamma_{\text{total}}$ Γ_{116}/Γ

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

<0.60	90	BAI	04G	BES2 e^+e^-

 $\Gamma(K_S^0 K_S^0)/\Gamma_{\text{total}}$ Γ_{117}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT

<0.046	¹ BAI	04D	BES e^+e^-

¹ Forbidden by CP.

————— RADIATIVE DECAYS —————

 $\Gamma(\gamma\chi_{c0}(1P))/\Gamma_{\text{total}}$ Γ_{118}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT

 9.84 ± 0.31 OUR FIT[$(9.68 \pm 0.31) \times 10^{-2}$ OUR 2012 FIT] **9.2 ± 0.4 OUR AVERAGE**

$9.22 \pm 0.11 \pm 0.46$	72600	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=M071R96
NODE=M071R96NODE=M071R03
NODE=M071R03NODE=M071S16
NODE=M071S16NODE=M071R08
NODE=M071R08

NODE=M071R08;LINKAGE=AB

NODE=M071R67
NODE=M071R67NODE=M071S01
NODE=M071S01NODE=M071S02
NODE=M071S02NODE=M071S03
NODE=M071S03NODE=M071S04
NODE=M071S04NODE=M071S05
NODE=M071S05NODE=M071R88
NODE=M071R88

NODE=M071R;LINKAGE=BA

NODE=M071315

NODE=M071R55
NODE=M071R55

NEW

NODE=M071R;LINKAGE=A

$\Gamma(\gamma\chi_{c1}(1P))/\Gamma_{\text{total}}$ Γ_{119}/Γ VALUE (units 10^{-2})

EVTS

DOCUMENT ID

TECN

COMMENT

9.3 ± 0.4 OUR FIT[(9.2 ± 0.4) × 10⁻² OUR 2012 FIT]**8.9 ± 0.5 OUR AVERAGE**

9.07 ± 0.11 ± 0.54 76700

ATHAR

04

CLEO

 $e^+e^- \rightarrow \gamma X$

9.0 ± 0.5 ± 0.7

¹ GAISER

86

CBAL

 $e^+e^- \rightarrow \gamma X$

7.1 ± 1.9

² BIDDICK

77

CNTR

 $e^+e^- \rightarrow \gamma X$ ¹ Angular distribution (1 - 0.189 cos²θ) assumed.² Valid for isotropic distribution of the photon.

NODE=M071R58

NODE=M071R58

NEW

NODE=M071R;LINKAGE=G

NODE=M071R;LINKAGE=B

 $\Gamma(\gamma\chi_{c2}(1P))/\Gamma_{\text{total}}$ Γ_{120}/Γ VALUE (units 10^{-2})

EVTS

DOCUMENT ID

TECN

COMMENT

8.76 ± 0.34 OUR FIT[(8.72 ± 0.34) × 10⁻² OUR 2012 FIT]**8.8 ± 0.5 OUR AVERAGE** Error includes scale factor of 1.1.

9.33 ± 0.14 ± 0.61 79300

ATHAR

04

CLEO

 $e^+e^- \rightarrow \gamma X$

8.0 ± 0.5 ± 0.7

¹ GAISER

86

CBAL

 $e^+e^- \rightarrow \gamma X$

7.0 ± 2.0

² BIDDICK

77

CNTR

 $e^+e^- \rightarrow \gamma X$ ¹ Angular distribution (1 - 0.052 cos²θ) assumed.² Valid for isotropic distribution of the photon.

NODE=M071R59

NODE=M071R59

NEW

NODE=M071R;LINKAGE=F

NODE=M071R59;LINKAGE=B

 $[\Gamma(\gamma\chi_{c0}(1P)) + \Gamma(\gamma\chi_{c1}(1P)) + \Gamma(\gamma\chi_{c2}(1P))]/\Gamma_{\text{total}}$ ($\Gamma_{118} + \Gamma_{119} + \Gamma_{120})/\Gamma$

VALUE

DOCUMENT ID

TECN

COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

27.6 ± 0.3 ± 2.0

¹ ATHAR

04

CLEO

 $e^+e^- \rightarrow \gamma X$ ¹ Not independent from ATHAR 04 measurements of B($\gamma\chi_{cJ}$).

NODE=M071R19

NODE=M071R19

NODE=M071R;LINKAGE=AH

 $\Gamma(\gamma\chi_{c0}(1P))/\Gamma(\gamma\chi_{c1}(1P))$ $\Gamma_{118}/\Gamma_{119}$

VALUE

DOCUMENT ID

TECN

COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.02 ± 0.01 ± 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

 $\Gamma(\gamma\chi_{c2}(1P))/\Gamma(\gamma\chi_{c1}(1P))$ $\Gamma_{120}/\Gamma_{119}$

VALUE

DOCUMENT ID

TECN

COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.03 ± 0.02 ± 0.03

¹ ATHAR

04

CLEO

 $e^+e^- \rightarrow \gamma X$ ¹ Not independent from ATHAR 04 measurements of B($\gamma\chi_{cJ}$).

NODE=M071R98

NODE=M071R98

NODE=M071R98;LINKAGE=AH

 $\Gamma(\gamma\chi_{c0}(1P))/\Gamma(\gamma\chi_{c2}(1P))$ $\Gamma_{118}/\Gamma_{120}$

VALUE

DOCUMENT ID

TECN

COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.99 ± 0.02 ± 0.08

¹ ATHAR

04

CLEO

 $e^+e^- \rightarrow \gamma X$ 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_{121}/Γ VALUE (units 10^{-2})

EVTS

DOCUMENT ID

TECN

COMMENT

0.34 ± 0.05 OUR AVERAGE Error includes scale factor of 1.3. See the ideogram below.

0.432 ± 0.016 ± 0.060

MITCHELL

09

CLEO

 $e^+e^- \rightarrow \gamma X$

0.32 ± 0.04 ± 0.06 2560

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.

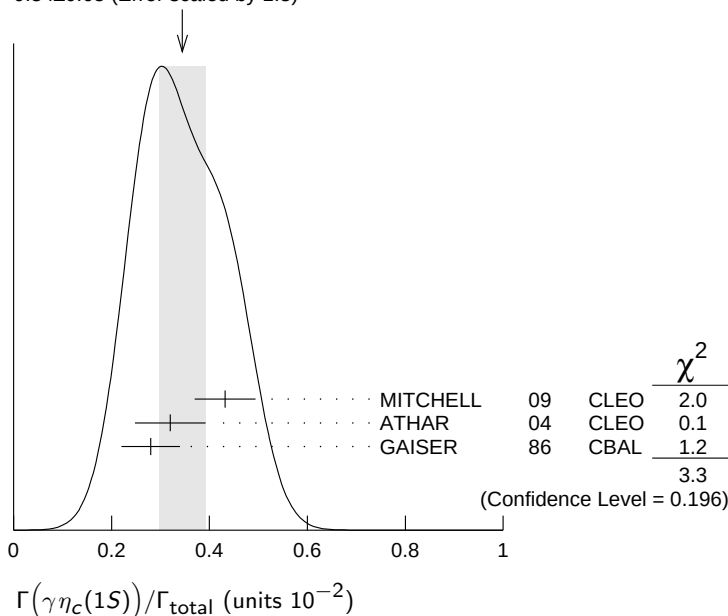
NODE=M071R60

NODE=M071R60

NODE=M071R60;LINKAGE=AT

NODE=M071R60;LINKAGE=GA

WEIGHTED AVERAGE
0.34±0.05 (Error scaled by 1.3)



$\Gamma(\gamma \eta_c(2S))/\Gamma_{\text{total}}$

Γ_{122}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
7±2±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_{123}/Γ

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
1.58±0.40±0.13		37	ABLIKIM	10F BES3	$\psi(2S) \rightarrow \gamma \pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 5	90		PEDLAR	09 CLE3	$\psi(2S) \rightarrow \gamma X$
< 5400	95		¹ LIBERMAN	75 SPEC	$e^+ e^-$
< 1×10^4	90		WIJK	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

$\Gamma(\gamma \eta'(958))/\Gamma_{\text{total}}$

Γ_{124}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
1.23±0.06 OUR AVERAGE					
1.26±0.03±0.08		2226	¹ ABLIKIM	10F BES3	$\psi(2S) \rightarrow 3\gamma \pi^+ \pi^-, 2\gamma \pi^+ \pi^-$
1.19±0.08±0.03			PEDLAR	09 CLE3	$\psi(2S) \rightarrow \gamma X$
1.24±0.27±0.15		23	ABLIKIM	06R BES2	$e^+ e^- \rightarrow \psi(2S)$
1.54±0.31±0.20		~ 43	BAI	98F BES	$\psi(2S) \rightarrow \pi^+ \pi^- 2\gamma, \pi^+ \pi^- 3\gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 60	90	² BRAUNSCH...	77 DASP	$e^+ e^-$
< 11	90	³ BARTEL	76 CNTR	$e^+ e^-$

¹ Combining the results from $\eta' \rightarrow \pi^+ \pi^- \eta$ and $\eta' \rightarrow \pi^+ \pi^- \gamma$ decay modes.

² Restated by us using total decay width 228 keV.

³ The value is normalized to the branching ratio for $\Gamma(J/\psi(1S)\eta)/\Gamma_{\text{total}}$.

NODE=M071R44
NODE=M071R44

NODE=M071R44;LINKAGE=AB
NODE=M071R;LINKAGE=R
NODE=M071R;LINKAGE=C

$\Gamma(\gamma f_2(1270))/\Gamma_{\text{total}}$ Γ_{125}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$2.12 \pm 0.19 \pm 0.32$		^{1,2} 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 ± 18.8	¹ BAI	03C BES	$\psi(2S) \rightarrow \gamma \pi^+ \pi^-$
$2.90 \pm 1.08 \pm 1.07$	29.9 ± 11.1	¹ BAI	03C BES	$\psi(2S) \rightarrow \gamma \pi^0 \pi^0$

¹ Normalized to $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = 0.305 \pm 0.016$.² Combining the results from $\pi^+ \pi^-$ and $\pi^0 \pi^0$ decay modes.NODE=M071R84
NODE=M071R84

OCCUR=2

OCCUR=3

NODE=M071R;LINKAGE=3B
NODE=M071R;LINKAGE=B9 $\Gamma(\gamma f_0(1710) \rightarrow \gamma \pi \pi)/\Gamma_{\text{total}}$ Γ_{127}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$0.301 \pm 0.041 \pm 0.124$	35.6 ± 4.8	¹ BAI	03C BES	$\psi(2S) \rightarrow \gamma \pi^+ \pi^-$

¹ Normalized to $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = 0.305 \pm 0.016$.NODE=M071R85
NODE=M071R85

NODE=M071R85;LINKAGE=3B

 $\Gamma(\gamma f_0(1710) \rightarrow \gamma K \bar{K})/\Gamma_{\text{total}}$ Γ_{128}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$0.604 \pm 0.090 \pm 0.132$	39.6 ± 5.9	^{1,2} BAI	03C BES		$\psi(2S) \rightarrow \gamma K^+ K^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 1.56	90	6.8 ± 3.1	^{1,2} BAI	03C BES	$\psi(2S) \rightarrow \gamma K_S^0 K_S^0$

¹ 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.² Normalized to $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = 0.305 \pm 0.016$.NODE=M071R86
NODE=M071R86

OCCUR=2

NODE=M071R;LINKAGE=CK

NODE=M071R86;LINKAGE=3B

 $\Gamma(\gamma \eta)/\Gamma_{\text{total}}$ Γ_{130}/Γ

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$1.38 \pm 0.48 \pm 0.09$	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_{131}/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_{133}/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_{134}/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 $\Gamma(\gamma \eta(1475) \rightarrow K \bar{K} \pi)/\Gamma_{\text{total}}$ Γ_{136}/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_{137}/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

$$\Gamma(\gamma 2(\pi^+ \pi^-))/\Gamma_{\text{total}}$$

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT
39.6±2.8±5.0	583	ABLIKIM	07D BES2	$e^+ e^- \rightarrow \psi(2S)$

$$\Gamma_{138}/\Gamma$$

NODE=M071S28
NODE=M071S28

$$\Gamma(\gamma K^{*0} K^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}}$$

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT
37.0±6.1±7.2	237	ABLIKIM	07D BES2	$e^+ e^- \rightarrow \psi(2S)$

$$\Gamma_{139}/\Gamma$$

NODE=M071S29
NODE=M071S29

$$\Gamma(\gamma K^{*0} \bar{K}^{*0})/\Gamma_{\text{total}}$$

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT
24.0±4.5±5.0	41	ABLIKIM	07D BES2	$e^+ e^- \rightarrow \psi(2S)$

$$\Gamma_{140}/\Gamma$$

NODE=M071S30
NODE=M071S30

$$\Gamma(\gamma K_S^0 K^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}}$$

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT
25.6±3.6±3.6	115	ABLIKIM	07D BES2	$e^+ e^- \rightarrow \psi(2S)$

$$\Gamma_{141}/\Gamma$$

NODE=M071S31
NODE=M071S31

$$\Gamma(\gamma K^+ K^- \pi^+ \pi^-)/\Gamma_{\text{total}}$$

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT
19.1±2.7±4.3	132	ABLIKIM	07D BES2	$e^+ e^- \rightarrow \psi(2S)$

$$\Gamma_{142}/\Gamma$$

NODE=M071S32
NODE=M071S32

$$\Gamma(\gamma p \bar{p})/\Gamma_{\text{total}}$$

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT
3.9 ±0.5 OUR AVERAGE		Error includes scale factor of 2.0.		
4.18±0.26±0.18	348	¹ ALEXANDER	10 CLEO	$\psi(2S) \rightarrow \gamma p \bar{p}$
2.9 ±0.4 ±0.4	142	ABLIKIM	07D BES2	$e^+ e^- \rightarrow \psi(2S)$

$$\Gamma_{143}/\Gamma$$

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

$$\Gamma(\gamma f_2(1950) \rightarrow \gamma p \bar{p})/\Gamma_{\text{total}}$$

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT
1.2±0.2±0.1	111	¹ ALEXANDER	10 CLEO	$\psi(2S) \rightarrow \gamma p \bar{p}$

$$\Gamma_{144}/\Gamma$$

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

$$\Gamma(\gamma f_2(2150) \rightarrow \gamma p \bar{p})/\Gamma_{\text{total}}$$

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT
0.72±0.18±0.03	73	¹ ALEXANDER	10 CLEO	$\psi(2S) \rightarrow \gamma p \bar{p}$

$$\Gamma_{145}/\Gamma$$

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

$$\Gamma(\gamma X(1835) \rightarrow \gamma p \bar{p})/\Gamma_{\text{total}}$$

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
4.57±0.36^{+1.77}_{-4.26}		ABLIKIM	12D BES3	$J/\psi \rightarrow \gamma p \bar{p}$

$$\Gamma_{146}/\Gamma$$

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	$\psi(2S) \rightarrow \gamma p \bar{p}$

$$\Gamma(\gamma X \rightarrow \gamma p \bar{p})/\Gamma_{\text{total}}$$

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<2	90	ALEXANDER	10 CLEO	$\psi(2S) \rightarrow \gamma p \bar{p}$

$$\Gamma_{147}/\Gamma$$

NODE=M071S49
NODE=M071S49
NODE=M071S49

For a narrow resonance in the range $2.2 < M(X) < 2.8$ GeV.

$$\Gamma(\gamma \pi^+ \pi^- p \bar{p})/\Gamma_{\text{total}}$$

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT
2.8±1.2±0.7	17	ABLIKIM	07D BES2	$e^+ e^- \rightarrow \psi(2S)$

$$\Gamma_{148}/\Gamma$$

NODE=M071S34
NODE=M071S34

$$\Gamma(\gamma 2(\pi^+ \pi^-) K^+ K^-)/\Gamma_{\text{total}}$$

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<22	90	ABLIKIM	07D BES2	$e^+ e^- \rightarrow \psi(2S)$

$$\Gamma_{149}/\Gamma$$

NODE=M071S35
NODE=M071S35

$\Gamma(\gamma 3(\pi^+ \pi^-))/\Gamma_{\text{total}}$ Γ_{150}/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_{151}/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_{152}/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

 $\psi(2S)$ 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

NODE=M071QAR
 NODE=M071QAR

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
67^{+19}_{-13}	59k	¹ ARTUSO	09 CLEO	$\psi(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$

¹ 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=AR

 $b_2(\chi_{c2})/b_2(\chi_{c1})$ Magnetic quadrupole transition amplitude ratio

NODE=M071QBR
 NODE=M071QBR

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
37^{+53}_{-47}	59k	¹ ARTUSO	09 CLEO	$\psi(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$

¹ 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;LINKAGE=AR

 $\psi(2S)$ REFERENCES

NODE=M071

ABLIKIM	13A	PRL 110 022001	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=54834
ABLIKIM	13D	PR D87 012007	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=54879
ABLIKIM	13F	arXiv:1211.4682 (PR D)	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=54920
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>	(BES III Collab.)	REFID=54269
ABLIKIM	12G	PRL 109 042003	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=54272
ABLIKIM	12H	PL B710 594	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=54273
ABLIKIM	12L	PR D86 072011	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=54739
ABLIKIM	12M	PR D86 092008	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=54740
ABLIKIM	12O	PRL 109 172002	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=54742
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
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>	(BES III Collab.)	REFID=53348
ABLIKIM	10F	PRL 105 261801	M. Ablikim <i>et al.</i>	(BES III 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=1
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>		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 Collab., 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
3773.15±0.33 OUR FIT				
3778.1 ±1.2 OUR AVERAGE				
3779.2 $\begin{smallmatrix} +1.8 \\ -1.7 \end{smallmatrix}$ $\begin{smallmatrix} +0.6 \\ -0.8 \end{smallmatrix}$		¹ ANASHIN	12A KEDR	$e^+e^- \rightarrow D\bar{D}$
3775.5 $\pm 2.4 \pm 0.5$	57	AUBERT	08B BABR	$B \rightarrow D\bar{D}K$
3776 $\pm 5 \pm 4$	68	BRODZICKA	08 BELL	$B^+ \rightarrow D^0\bar{D}^0K^+$
3778.8 $\pm 1.9 \pm 0.9$		AUBERT	07BE BABR	$e^+e^- \rightarrow D\bar{D}\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
3772.0 ± 1.9		^{2,3} ABLIKIM	08D BES2	$e^+e^- \rightarrow \text{hadrons}$
3778.4 $\pm 3.0 \pm 1.3$	34	CHISTOV	04 BELL	Sup. by BRODZICKA 08

NODE=M053M

¹ Taking into account interference between the resonant and non-resonant $D\bar{D}$ production.

² Reanalysis of data presented in BAI 02C. From a global fit over the center-of-mass energy region 3.7–5.0 GeV covering the $\psi(3770)$, $\psi(4040)$, $\psi(4160)$, and $\psi(4415)$ resonances. Phase angle fixed in the fit to $\delta = 0^\circ$.

³ Interference between the resonant and non-resonant $D\bar{D}$ production not taken into account.

NODE=M053M;LINKAGE=AN

NODE=M053M;LINKAGE=AB

NODE=M053M;LINKAGE=NI

 $m_{\psi(3770)} - m_{\psi(2S)}$

NODE=M053DM

OUR FIT includes measurements of $m_{\psi(2S)}$, $m_{\psi(3770)}$, and $m_{\psi(3770)} - m_{\psi(2S)}$.

NODE=M053DM

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
87.04±0.33 OUR FIT			
86.6 ±0.7 OUR AVERAGE Error includes scale factor of 2.0. See the ideogram below.			
86.9 ± 0.4	⁴ 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	⁵ BACINO	78 DLCO	e^+e^-
88 ± 3	RAPIDIS	77 LGW	e^+e^-

NODE=M053DM

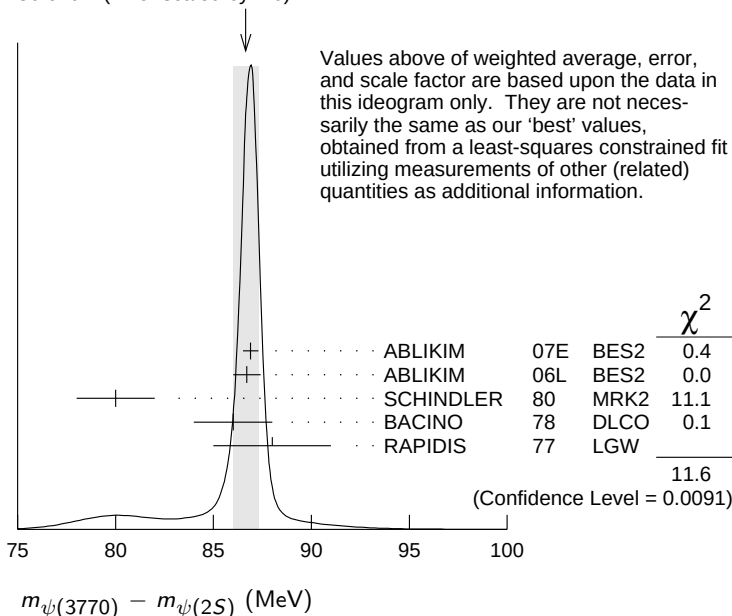
⁴ BES-II $\psi(2S)$ mass subtracted (see ABLIKIM 06L).

⁵ 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$\pm$ 1.0 OUR FIT				
27.5$\pm$ 0.9 OUR AVERAGE				
24.9 $^{+4.6+0.5}_{-4.0-1.1}$		⁶ ANASHIN	12A KEDR	$e^+e^- \rightarrow D\bar{D}$
30.4 $\pm$ 8.5		^{7,8} ABLIKIM	08D BES2	$e^+e^- \rightarrow \text{hadrons}$
27 $\pm$ 10 $\pm$ 5	68	BRODZICKA	08 BELL	$B^+ \rightarrow D^0\bar{D}^0 K^+$
28.5 $\pm$ 1.2 $\pm$ 0.2		⁸ ABLIKIM	07E BES2	$e^+e^- \rightarrow \text{hadrons}$
23.5 $\pm$ 3.7 $\pm$ 0.9		AUBERT	07BE BABR	$e^+e^- \rightarrow D\bar{D}\gamma$
26.9 $\pm$ 2.4 $\pm$ 0.3		⁸ ABLIKIM	06L BES2	$e^+e^- \rightarrow \text{hadrons}$
24 $\pm$ 5		⁸ SCHINDLER	80 MRK2	e^+e^-
24 $\pm$ 5		⁸ BACINO	78 DLCO	e^+e^-
28 $\pm$ 5		⁸ RAPIDIS	77 LGW	e^+e^-

⁶ Taking into account interference between the resonant and non-resonant $D\bar{D}$ production.⁷ 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 $\delta = 0^\circ$.⁸ Interference between the resonant and non-resonant $D\bar{D}$ production not taken into account.

NODE=M053W

NODE=M053W;LINKAGE=AN
NODE=M053W;LINKAGE=AB

NODE=M053W;LINKAGE=NI

 $\psi(3770)$ 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
Γ_2 $D^0\bar{D}^0$	(52 $\pm$ 5) %	S=2.0
Γ_3 D^+D^-	(41 $\pm$ 4) %	S=2.0
Γ_4 $J/\psi\pi^+\pi^-$	(1.93 $\pm$ 0.28) $\times 10^{-3}$	
Γ_5 $J/\psi\pi^0\pi^0$	(8.0 $\pm$ 3.0) $\times 10^{-4}$	
Γ_6 $J/\psi\eta$	(9 $\pm$ 4) $\times 10^{-4}$	
Γ_7 $J/\psi\pi^0$	< 2.8 $\times 10^{-4}$	CL=90%
Γ_8 e^+e^-	(9.6 $\pm$ 0.7) $\times 10^{-6}$	S=1.3

DESIG=2

DESIG=5

DESIG=6

DESIG=4

DESIG=46

DESIG=47

DESIG=48

DESIG=1

Decays to light hadrons

NODE=M053;CLUMP=H

Γ_9 $b_1(1235)\pi$	< 1.4	$\times 10^{-5}$	CL=90%
Γ_{10} $\phi\eta'$	< 7	$\times 10^{-4}$	CL=90%
Γ_{11} $\omega\eta'$	< 4	$\times 10^{-4}$	CL=90%
Γ_{12} $\rho^0\eta'$	< 6	$\times 10^{-4}$	CL=90%
Γ_{13} $\phi\eta$	(3.1 $\pm$ 0.7) $\times 10^{-4}$		
Γ_{14} $\omega\eta$	< 1.4	$\times 10^{-5}$	CL=90%
Γ_{15} $\rho^0\eta$	< 5	$\times 10^{-4}$	CL=90%
Γ_{16} $\phi\pi^0$	< 3	$\times 10^{-5}$	CL=90%
Γ_{17} $\omega\pi^0$	< 6	$\times 10^{-4}$	CL=90%
Γ_{18} $\pi^+\pi^-\pi^0$	< 5	$\times 10^{-6}$	CL=90%
Γ_{19} $\rho\pi$	< 5	$\times 10^{-6}$	CL=90%
Γ_{20} $K^*(892)^+K^- + \text{c.c.}$	< 1.4	$\times 10^{-5}$	CL=90%
Γ_{21} $K^*(892)^0\bar{K}^0 + \text{c.c.}$	< 1.2	$\times 10^{-3}$	CL=90%
Γ_{22} $K_S^0 K_L^0$	< 1.2	$\times 10^{-5}$	CL=90%
Γ_{23} $2(\pi^+\pi^-)$	< 1.12	$\times 10^{-3}$	CL=90%
Γ_{24} $2(\pi^+\pi^-)\pi^0$	< 1.06	$\times 10^{-3}$	CL=90%
Γ_{25} $2(\pi^+\pi^-\pi^0)$	< 5.85	%	CL=90%
Γ_{26} $\omega\pi^+\pi^-$	< 6.0	$\times 10^{-4}$	CL=90%
Γ_{27} $3(\pi^+\pi^-)$	< 9.1	$\times 10^{-3}$	
Γ_{28} $3(\pi^+\pi^-)\pi^0$	< 1.37	%	
Γ_{29} $3(\pi^+\pi^-)2\pi^0$	< 11.74	%	CL=90%
Γ_{30} $\eta\pi^+\pi^-$	< 1.24	$\times 10^{-3}$	CL=90%
Γ_{31} $\pi^+\pi^-2\pi^0$	< 8.9	$\times 10^{-3}$	CL=90%

DESIG=20

DESIG=17

DESIG=16

DESIG=15

DESIG=8

DESIG=14

DESIG=13

DESIG=12

DESIG=11

DESIG=9

DESIG=10

DESIG=19

DESIG=18

DESIG=3

DESIG=21

DESIG=22

DESIG=208

DESIG=24

DESIG=52

DESIG=55

DESIG=210

DESIG=23

DESIG=206

Г32	$\rho^0 \pi^+ \pi^-$	< 6.9	$\times 10^{-3}$	CL=90%	DESIG=64
Г33	$\eta 3\pi$	< 1.34	$\times 10^{-3}$	CL=90%	DESIG=25
Г34	$\eta 2(\pi^+ \pi^-)$	< 2.43	%		DESIG=53
Г35	$\eta \rho^0 \pi^+ \pi^-$	< 1.45	%	CL=90%	DESIG=221
Г36	$\eta' 3\pi$	< 2.44	$\times 10^{-3}$	CL=90%	DESIG=26
Г37	$K^+ K^- \pi^+ \pi^-$	< 9.0	$\times 10^{-4}$	CL=90%	DESIG=27
Г38	$\phi \pi^+ \pi^-$	< 4.1	$\times 10^{-4}$	CL=90%	DESIG=28
Г39	$K^+ K^- 2\pi^0$	< 4.2	$\times 10^{-3}$	CL=90%	DESIG=207
Г40	$4(\pi^+ \pi^-)$	< 1.67	%	CL=90%	DESIG=62
Г41	$4(\pi^+ \pi^-) \pi^0$	< 3.06	%	CL=90%	DESIG=63
Г42	$\phi f_0(980)$	< 4.5	$\times 10^{-4}$	CL=90%	DESIG=29
Г43	$K^+ K^- \pi^+ \pi^- \pi^0$	< 2.36	$\times 10^{-3}$	CL=90%	DESIG=30
Г44	$K^+ K^- \rho^0 \pi^0$	< 8	$\times 10^{-4}$	CL=90%	DESIG=67
Г45	$K^+ K^- \rho^+ \pi^-$	< 1.46	%	CL=90%	DESIG=68
Г46	$\omega K^+ K^-$	< 3.4	$\times 10^{-4}$	CL=90%	DESIG=32
Г47	$\phi \pi^+ \pi^- \pi^0$	< 3.8	$\times 10^{-3}$	CL=90%	DESIG=69
Г48	$K^{*0} K^- \pi^+ \pi^0 + \text{c.c.}$	< 1.62	%	CL=90%	DESIG=70
Г49	$K^{*+} K^- \pi^+ \pi^- + \text{c.c.}$	< 3.23	%	CL=90%	DESIG=71
Г50	$K^+ K^- \pi^+ \pi^- 2\pi^0$	< 2.67	%	CL=90%	DESIG=209
Г51	$K^+ K^- 2(\pi^+ \pi^-)$	< 1.03	%	CL=90%	DESIG=57
Г52	$K^+ K^- 2(\pi^+ \pi^-) \pi^0$	< 3.60	%	CL=90%	DESIG=58
Г53	$\eta K^+ K^-$	< 4.1	$\times 10^{-4}$	CL=90%	DESIG=31
Г54	$\eta K^+ K^- \pi^+ \pi^-$	< 1.24	%	CL=90%	DESIG=222
Г55	$\rho^0 K^+ K^-$	< 5.0	$\times 10^{-3}$	CL=90%	DESIG=65
Г56	$2(K^+ K^-)$	< 6.0	$\times 10^{-4}$	CL=90%	DESIG=33
Г57	$\phi K^+ K^-$	< 7.5	$\times 10^{-4}$	CL=90%	DESIG=34
Г58	$2(K^+ K^-) \pi^0$	< 2.9	$\times 10^{-4}$	CL=90%	DESIG=35
Г59	$2(K^+ K^-) \pi^+ \pi^-$	< 3.2	$\times 10^{-3}$	CL=90%	DESIG=59
Г60	$K_S^0 K^- \pi^+$	< 3.2	$\times 10^{-3}$	CL=90%	DESIG=200
Г61	$K_S^0 K^- \pi^+ \pi^0$	< 1.33	%	CL=90%	DESIG=201
Г62	$K_S^0 K^- \rho^+$	< 6.6	$\times 10^{-3}$	CL=90%	DESIG=214
Г63	$K_S^0 K^- 2\pi^+ \pi^-$	< 8.7	$\times 10^{-3}$	CL=90%	DESIG=202
Г64	$K_S^0 K^- \pi^+ \rho^0$	< 1.6	%	CL=90%	DESIG=215
Г65	$K_S^0 K^- \pi^+ \eta$	< 1.3	%	CL=90%	DESIG=216
Г66	$K_S^0 K^- 2\pi^+ \pi^- \pi^0$	< 4.18	%	CL=90%	DESIG=203
Г67	$K_S^0 K^- 2\pi^+ \pi^- \eta$	< 4.8	%	CL=90%	DESIG=217
Г68	$K_S^0 K^- \pi^+ 2(\pi^+ \pi^-)$	< 1.22	%	CL=90%	DESIG=204
Г69	$K_S^0 K^- \pi^+ 2\pi^0$	< 2.65	%	CL=90%	DESIG=205
Г70	$K_S^0 K^- K^+ K^- \pi^+$	< 4.9	$\times 10^{-3}$	CL=90%	DESIG=218
Г71	$K_S^0 K^- K^+ K^- \pi^+ \pi^0$	< 3.0	%	CL=90%	DESIG=219
Г72	$K_S^0 K^- K^+ K^- \pi^+ \eta$	< 2.2	%	CL=90%	DESIG=220
Г73	$K^{*0} K^- \pi^+ + \text{c.c.}$	< 9.7	$\times 10^{-3}$	CL=90%	DESIG=60
Г74	$p \bar{p} \pi^0$	< 1.2	$\times 10^{-3}$		DESIG=54
Г75	$p \bar{p} \pi^+ \pi^-$	< 5.8	$\times 10^{-4}$	CL=90%	DESIG=36
Г76	$\Lambda \bar{\Lambda}$	< 1.2	$\times 10^{-4}$	CL=90%	DESIG=42
Г77	$p \bar{p} \pi^+ \pi^- \pi^0$	< 1.85	$\times 10^{-3}$	CL=90%	DESIG=37
Г78	$\omega p \bar{p}$	< 2.9	$\times 10^{-4}$	CL=90%	DESIG=39
Г79	$\Lambda \bar{\Lambda} \pi^0$	< 1.2	$\times 10^{-3}$	CL=90%	DESIG=72
Г80	$p \bar{p} 2(\pi^+ \pi^-)$	< 2.6	$\times 10^{-3}$	CL=90%	DESIG=61
Г81	$\eta p \bar{p}$	< 5.4	$\times 10^{-4}$	CL=90%	DESIG=38
Г82	$\eta p \bar{p} \pi^+ \pi^-$	< 3.3	$\times 10^{-3}$	CL=90%	DESIG=223
Г83	$\rho^0 p \bar{p}$	< 1.7	$\times 10^{-3}$	CL=90%	DESIG=66
Г84	$p \bar{p} K^+ K^-$	< 3.2	$\times 10^{-4}$	CL=90%	DESIG=40
Г85	$\eta p \bar{p} K^+ K^-$	< 6.9	$\times 10^{-3}$	CL=90%	DESIG=224
Г86	$\pi^0 p \bar{p} K^+ K^-$	< 1.2	$\times 10^{-3}$	CL=90%	DESIG=225
Г87	$\phi p \bar{p}$	< 1.3	$\times 10^{-4}$	CL=90%	DESIG=41
Г88	$\Lambda \bar{\Lambda} \pi^+ \pi^-$	< 2.5	$\times 10^{-4}$	CL=90%	DESIG=43
Г89	$\Lambda \bar{p} K^+$	< 2.8	$\times 10^{-4}$	CL=90%	DESIG=44
Г90	$\Lambda \bar{p} K^+ \pi^+ \pi^-$	< 6.3	$\times 10^{-4}$	CL=90%	DESIG=45

Radiative decays

Γ_{91}	$\gamma\chi_{c2}$	< 9	$\times 10^{-4}$	CL=90%
Γ_{92}	$\gamma\chi_{c1}$	(2.9 ± 0.6)	$\times 10^{-3}$	
Γ_{93}	$\gamma\chi_{c0}$	(7.3 ± 0.9)	$\times 10^{-3}$	
Γ_{94}	$\gamma\eta'$	< 1.8	$\times 10^{-4}$	CL=90%
Γ_{95}	$\gamma\eta$	< 1.5	$\times 10^{-4}$	CL=90%
Γ_{96}	$\gamma\pi^0$	< 2	$\times 10^{-4}$	CL=90%

NODE=M053;CLUMP=R

DESIG=51

DESIG=50

DESIG=49

DESIG=213

DESIG=212

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 $\chi^2 = 20.0$ 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	98		
x_8	0	0	
Γ	0	0	-44
	x_2	x_3	x_8

	Mode	Rate (MeV)	Scale factor
Γ_2	$D^0 \bar{D}^0$	14.1 ± 1.4	1.7
Γ_3	$D^+ D^-$	11.2 ± 1.1	1.7
Γ_8	$e^+ e^-$	$(2.62 \pm 0.18) \times 10^{-4}$	1.4

DESIG=5

DESIG=6

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.

$0.154^{+0.079+0.021}_{-0.058-0.027}$	9,10	ANASHIN	12A	KEDR	$e^+ e^- \rightarrow D \bar{D}$
0.22 ± 0.05	11,12	ABLIKIM	08D	BES2	$e^+ e^- \rightarrow \text{hadrons}$
$0.277 \pm 0.011 \pm 0.013$	12	ABLIKIM	07E	BES2	$e^+ e^- \rightarrow \text{hadrons}$
$0.203 \pm 0.003^{+0.041}_{-0.027}$	1.4M 12,13	BESSION	06	CLEO	$e^+ e^- \rightarrow \text{hadrons}$
0.276 ± 0.050	12	SCHINDLER	80	MRK2	$e^+ e^-$
0.18 ± 0.06	12	BACINO	78	DLCO	$e^+ e^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

$0.414^{+0.072+0.093}_{-0.080-0.028}$	10,14	ANASHIN	12A	KEDR	$e^+ e^- \rightarrow D \bar{D}$
0.37 ± 0.09	15	RAPIDIS	77	LGW	$e^+ e^-$

OCCUR=2

⁹ Solution I of the two solutions.¹⁰ Taking into account interference between the resonant and non-resonant $D \bar{D}$ production.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 $\delta = 0^\circ$.¹² Interference between the resonant and non-resonant $D \bar{D}$ production not taken into account.¹³ 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 $\Gamma_{e^+ e^-}$ from the Born-level cross section calculated using $\psi(3770)$ mass and width from our 2004 edition, PDG 04.¹⁴ Solution II of the two solutions.¹⁵ See also $\Gamma(e^+ e^-) / \Gamma_{\text{total}}$ below.
 NODE=M053W1;LINKAGE=A1
 NODE=M053W1;LINKAGE=AN
 NODE=M053W1;LINKAGE=AB

NODE=M053W1;LINKAGE=NI

NODE=M053W1;LINKAGE=BE

 NODE=M053W1;LINKAGE=A2
 NODE=M053W1;LINKAGE=R

$\psi(3770)$ 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

NODE=M053R1
NODE=M053R1

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 $\pm 0.056 \pm 0.018$ ¹⁶ ABLIKIM 08B BES2 $e^+e^- \rightarrow \text{non-}D\bar{D}$

1.033 ± 0.014 $^{+0.048}_{-0.066}$ 1.427M ¹⁷ BESSON 06 CLEO $e^+e^- \rightarrow \text{hadrons}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.866 $\pm 0.050 \pm 0.036$ ^{18,19} ABLIKIM 07K BES2 $e^+e^- \rightarrow \text{non-}D\bar{D}$

0.836 $\pm 0.073 \pm 0.042$ ¹⁹ ABLIKIM 06L BES2 $e^+e^- \rightarrow D\bar{D}$

0.855 $\pm 0.017 \pm 0.058$ ^{19,20} ABLIKIM 06N BES2 $e^+e^- \rightarrow D\bar{D}$

 $\Gamma(D^0\bar{D}^0)/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE	DOCUMENT ID	TECN	COMMENT

NODE=M053R46
NODE=M053R46

0.52 ± 0.05 OUR FIT Error includes scale factor of 2.0.

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.467 $\pm 0.047 \pm 0.023$ ABLIKIM 06L BES2 $e^+e^- \rightarrow D^0\bar{D}^0$

0.499 $\pm 0.013 \pm 0.038$ ²⁰ ABLIKIM 06N BES2 $e^+e^- \rightarrow D^0\bar{D}^0$

 $\Gamma(D^+D^-)/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE	DOCUMENT ID	TECN	COMMENT

NODE=M053R47
NODE=M053R47

0.41 ± 0.04 OUR FIT Error includes scale factor of 2.0.

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.369 $\pm 0.037 \pm 0.028$ ABLIKIM 06L BES2 $e^+e^- \rightarrow D^+D^-$

0.357 $\pm 0.011 \pm 0.034$ ²⁰ ABLIKIM 06N BES2 $e^+e^- \rightarrow D^+D^-$

 $\Gamma(D^0\bar{D}^0)/\Gamma(D^+D^-)$ Γ_2/Γ_3

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

NODE=M053R5
NODE=M053R5

1.260 ± 0.021 OUR FIT

1.260 ± 0.021 OUR AVERAGE

1.39 $\pm 0.31 \pm 0.12$ PAKHLOVA 08 BELL 10.6 $e^+e^- \rightarrow D\bar{D}\gamma$

1.78 $\pm 0.33 \pm 0.24$ AUBERT 07BE BABR $e^+e^- \rightarrow D\bar{D}\gamma$

1.258 $\pm 0.016 \pm 0.014$ DOBBS 07 CLEO $e^+e^- \rightarrow D\bar{D}$

1.27 $\pm 0.12 \pm 0.08$ ABLIKIM 06L BES2 $e^+e^- \rightarrow D\bar{D}$

2.43 $\pm 1.50 \pm 0.43$ ³⁴ ²¹ CHISTOV 04 BELL $B^+ \rightarrow \psi(3770)K^+$

 $\Gamma(J/\psi\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT

NODE=M053R4
NODE=M053R4

1.93 ± 0.28 OUR AVERAGE

1.89 $\pm 0.20 \pm 0.20$ 231 ± 33 ADAM 06 CLEO $e^+e^- \rightarrow \psi(3770)$

3.4 $\pm 1.4 \pm 0.9$ 17.8 ± 4.8 BAI 05 BES2 $e^+e^- \rightarrow \psi(3770)$

 $\Gamma(J/\psi\pi^0\pi^0)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT

NODE=M053R7
NODE=M053R7

0.080 $\pm 0.025 \pm 0.016$ 39 ± 14 ADAM 06 CLEO $e^+e^- \rightarrow \psi(3770)$

 $\Gamma(J/\psi\eta)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT

NODE=M053R8
NODE=M053R8

87 $\pm 33 \pm 22$ 22 ± 10 ADAM 06 CLEO $e^+e^- \rightarrow \psi(3770)$

 $\Gamma(J/\psi\pi^0)/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT

NODE=M053R9
NODE=M053R9

<28 90 <10 ADAM 06 CLEO $e^+e^- \rightarrow \psi(3770)$

 $\Gamma(e^+e^-)/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT

NODE=M053R2
NODE=M053R2

0.96 ± 0.07 OUR FIT Error includes scale factor of 1.3.

1.3 ± 0.2 RAPIDIS 77 LGW e^+e^-

¹⁶ Neglecting interference.

¹⁷ Obtained by comparing a measurement of the total cross section (corrected in BESSON 10) with that of $D\bar{D}$ reported by CLEO in DOBBS 07.

¹⁸ Using $\sigma^{obs} = 7.07 \pm 0.58$ nb and neglecting interference.

¹⁹ Not independent of ABLIKIM 08B.

²⁰ 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.

²¹ See ADLER 88C for older measurements of this quantity.

NODE=M053R1;LINKAGE=AI

NODE=M053R1;LINKAGE=BE

NODE=M053R1;LINKAGE=AL

NODE=M053R1;LINKAGE=SU

NODE=M053R;LINKAGE=AB

NODE=M053R5;LINKAGE=CH

NODE=M053250

———— DECAYS TO LIGHT HADRONS ————

$\Gamma(b_1(1235)\pi)/\Gamma_{total}$ Γ_9/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<1.4	90	²² ADAMS	06	CLEO $e^+e^- \rightarrow \psi(3770)$

NODE=M053R82
NODE=M053R82

$\Gamma(\phi\eta')/\Gamma_{total}$ Γ_{10}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<7	90	²² ADAMS	06	CLEO $e^+e^- \rightarrow \psi(3770)$

NODE=M053R83
NODE=M053R83

$\Gamma(\omega\eta')/\Gamma_{total}$ Γ_{11}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<4	90	²² ADAMS	06	CLEO $e^+e^- \rightarrow \psi(3770)$

NODE=M053R84
NODE=M053R84

$\Gamma(\rho^0\eta')/\Gamma_{total}$ Γ_{12}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<6	90	²² ADAMS	06	CLEO $e^+e^- \rightarrow \psi(3770)$

NODE=M053R85
NODE=M053R85

$\Gamma(\phi\eta)/\Gamma_{total}$ Γ_{13}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
$3.1 \pm 0.6 \pm 0.3$		²² ADAMS	06	CLEO $3.773 e^+e^- \rightarrow \phi\eta$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<19		²³ ABLIKIM	07B	BES2 $e^+e^- \rightarrow \psi(3770)$

NODE=M053R6
NODE=M053R6

$\Gamma(\omega\eta)/\Gamma_{total}$ Γ_{14}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<1.4	90	²² ADAMS	06	CLEO $e^+e^- \rightarrow \psi(3770)$

NODE=M053R86
NODE=M053R86

$\Gamma(\rho^0\eta)/\Gamma_{total}$ Γ_{15}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<5	90	²² ADAMS	06	CLEO $e^+e^- \rightarrow \psi(3770)$

NODE=M053R87
NODE=M053R87

$\Gamma(\phi\pi^0)/\Gamma_{total}$ Γ_{16}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
< 3	90	²² ADAMS	06	CLEO $e^+e^- \rightarrow \psi(3770)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<50		²³ ABLIKIM	07B	BES2 $e^+e^- \rightarrow \psi(3770)$

NODE=M053R11
NODE=M053R11

$\Gamma(\omega\pi^0)/\Gamma_{total}$ Γ_{17}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<6	90	²² ADAMS	06	CLEO $e^+e^- \rightarrow \psi(3770)$

NODE=M053R88
NODE=M053R88

$\Gamma(\pi^+\pi^-\pi^0)/\Gamma_{total}$ Γ_{18}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<5	90	^{22,24} ADAMS	06	CLEO $e^+e^- \rightarrow \psi(3770)$

NODE=M053R89
NODE=M053R89

$\Gamma(\rho\pi)/\Gamma_{total}$ Γ_{19}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<5	90	^{22,24} ADAMS	06	CLEO $e^+e^- \rightarrow \psi(3770)$

NODE=M053R90
NODE=M053R90

$\Gamma(K^*(892)^+K^- + c.c.)/\Gamma_{total}$ Γ_{20}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<1.4	90	²² ADAMS	06	CLEO $e^+e^- \rightarrow \psi(3770)$

NODE=M053R91
NODE=M053R91

$\Gamma(K^*(892)^0 \bar{K}^0 + \text{c.c.})/\Gamma_{\text{total}}$
 Γ_{21}/Γ
 NODE=M053R92
 NODE=M053R92

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<1.2	90	22 ADAMS 06	CLEO	$e^+ e^- \rightarrow \psi(3770)$

 $\Gamma(K_S^0 K_L^0)/\Gamma_{\text{total}}$
 Γ_{22}/Γ
 NODE=M053R3
 NODE=M053R3

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
< 1.2	90	25 CRONIN-HEN..06	CLEO	$e^+ e^- \rightarrow \psi(3770)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<21	90	26 ABLIKIM 04F	BES	$e^+ e^- \rightarrow \psi(3770)$

 $\Gamma(2(\pi^+ \pi^-))/\Gamma_{\text{total}}$
 Γ_{23}/Γ
 NODE=M053R21
 NODE=M053R21

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<11.2	90	27 HUANG 06A	CLEO	$e^+ e^- \rightarrow \psi(3770)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<48		23 ABLIKIM 07B	BES2	$e^+ e^- \rightarrow \psi(3770)$

 $\Gamma(2(\pi^+ \pi^-) \pi^0)/\Gamma_{\text{total}}$
 Γ_{24}/Γ
 NODE=M053R22
 NODE=M053R22

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<10.6	90	27 HUANG 06A	CLEO	$e^+ e^- \rightarrow \psi(3770)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<62		23 ABLIKIM 07B	BES2	$e^+ e^- \rightarrow \psi(3770)$

 $\Gamma(2(\pi^+ \pi^- \pi^0))/\Gamma_{\text{total}}$
 Γ_{25}/Γ
 NODE=M053R72
 NODE=M053R72

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<58.5	90	305	ABLIKIM 08N	BES2	$e^+ e^- \rightarrow \psi(3770)$

 $\Gamma(\omega \pi^+ \pi^-)/\Gamma_{\text{total}}$
 Γ_{26}/Γ
 NODE=M053R24
 NODE=M053R24

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 6.0	90	27 HUANG 06A	CLEO	$e^+ e^- \rightarrow \psi(3770)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<55	90	23 ABLIKIM 07I	BES2	$3.77 e^+ e^-$

 $\Gamma(3(\pi^+ \pi^-))/\Gamma_{\text{total}}$
 Γ_{27}/Γ
 NODE=M053R07
 NODE=M053R07

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
<91	23 ABLIKIM 07B	BES2	$e^+ e^- \rightarrow \psi(3770)$

 $\Gamma(3(\pi^+ \pi^-) \pi^0)/\Gamma_{\text{total}}$
 Γ_{28}/Γ
 NODE=M053R10
 NODE=M053R10

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
<137	23 ABLIKIM 07B	BES2	$e^+ e^- \rightarrow \psi(3770)$

 $\Gamma(3(\pi^+ \pi^-) 2\pi^0)/\Gamma_{\text{total}}$
 Γ_{29}/Γ
 NODE=M053R74
 NODE=M053R74

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<117.4	90	59	ABLIKIM 08N	BES2	$e^+ e^- \rightarrow \psi(3770)$

 $\Gamma(\eta \pi^+ \pi^-)/\Gamma_{\text{total}}$
 Γ_{30}/Γ
 NODE=M053R23
 NODE=M053R23

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<1.24	90	27 HUANG 06A	CLEO	$e^+ e^- \rightarrow \psi(3770)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<2.3	90	23 ABLIKIM 10D	BES2	$e^+ e^- \rightarrow \psi(3770)$

 $\Gamma(\pi^+ \pi^- 2\pi^0)/\Gamma_{\text{total}}$
 Γ_{31}/Γ
 NODE=M053R70
 NODE=M053R70

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<8.9	90	218	ABLIKIM 08N	BES2	$e^+ e^- \rightarrow \psi(3770)$

 $\Gamma(\rho^0 \pi^+ \pi^-)/\Gamma_{\text{total}}$
 Γ_{32}/Γ
 NODE=M053R53
 NODE=M053R53

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<6.9	90	23 ABLIKIM 07F	BES2	$e^+ e^- \rightarrow \psi(3770)$

 $\Gamma(\eta 3\pi)/\Gamma_{\text{total}}$
 Γ_{33}/Γ
 NODE=M053R25
 NODE=M053R25

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<13.4	90	27 HUANG 06A	CLEO	$e^+ e^- \rightarrow \psi(3770)$

$$\Gamma(\eta 2(\pi^+ \pi^-))/\Gamma_{\text{total}}$$

VALUE (units 10^{-4})

<243

DOCUMENT ID

23 ABLIKIM

TECN

07B

COMMENT

BES2 $e^+ e^- \rightarrow \psi(3770)$

Γ_{34}/Γ

NODE=M053R08
NODE=M053R08

$$\Gamma(\eta \rho^0 \pi^+ \pi^-)/\Gamma_{\text{total}}$$

VALUE (units 10^{-2})

<1.45

CL%

90

DOCUMENT ID

23 ABLIKIM

TECN

10D

COMMENT

BES2 $e^+ e^- \rightarrow \psi(3770)$

Γ_{35}/Γ

NODE=M053R77
NODE=M053R77

$$\Gamma(\eta' 3\pi)/\Gamma_{\text{total}}$$

VALUE (units 10^{-4})

<24.4

CL%

90

DOCUMENT ID

27 HUANG

TECN

06A

COMMENT

CLEO $e^+ e^- \rightarrow \psi(3770)$

Γ_{36}/Γ

NODE=M053R26
NODE=M053R26

$$\Gamma(K^+ K^- \pi^+ \pi^-)/\Gamma_{\text{total}}$$

VALUE (units 10^{-4})

< 9.0

CL%

90

DOCUMENT ID

27 HUANG

TECN

06A

COMMENT

CLEO $e^+ e^- \rightarrow \psi(3770)$

Γ_{37}/Γ

NODE=M053R27
NODE=M053R27

• • • We do not use the following data for averages, fits, limits, etc. • • •

<48

23 ABLIKIM

07B

BES2

$e^+ e^- \rightarrow \psi(3770)$

$$\Gamma(\phi \pi^+ \pi^-)/\Gamma_{\text{total}}$$

VALUE (units 10^{-4})

< 4.1

CL%

90

DOCUMENT ID

27 HUANG

TECN

06A

COMMENT

CLEO $e^+ e^- \rightarrow \psi(3770)$

Γ_{38}/Γ

NODE=M053R28
NODE=M053R28

• • • We do not use the following data for averages, fits, limits, etc. • • •

<16

23 ABLIKIM

07B

BES2

$e^+ e^- \rightarrow \psi(3770)$

$$\Gamma(K^+ K^- 2\pi^0)/\Gamma_{\text{total}}$$

VALUE (units 10^{-3})

<4.2

CL%

90

EVTS

14

DOCUMENT ID

ABLIKIM

TECN

08N

COMMENT

BES2 $e^+ e^- \rightarrow \psi(3770)$

Γ_{39}/Γ

NODE=M053R71
NODE=M053R71

$$\Gamma(4(\pi^+ \pi^-))/\Gamma_{\text{total}}$$

VALUE (units 10^{-3})

<16.7

CL%

90

DOCUMENT ID

23 ABLIKIM

TECN

07F

COMMENT

BES2 $e^+ e^- \rightarrow \psi(3770)$

Γ_{40}/Γ

NODE=M053R50
NODE=M053R50

$$\Gamma(4(\pi^+ \pi^-) \pi^0)/\Gamma_{\text{total}}$$

VALUE (units 10^{-3})

<30.6

CL%

90

DOCUMENT ID

23 ABLIKIM

TECN

07F

COMMENT

BES2 $e^+ e^- \rightarrow \psi(3770)$

Γ_{41}/Γ

NODE=M053R52
NODE=M053R52

$$\Gamma(\phi f_0(980))/\Gamma_{\text{total}}$$

VALUE (units 10^{-4})

<4.5

CL%

90

DOCUMENT ID

27 HUANG

TECN

06A

COMMENT

CLEO $e^+ e^- \rightarrow \psi(3770)$

Γ_{42}/Γ

NODE=M053R29
NODE=M053R29

$$\Gamma(K^+ K^- \pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}$$

VALUE (units 10^{-4})

< 23.6

CL%

90

DOCUMENT ID

27 HUANG

TECN

06A

COMMENT

CLEO $e^+ e^- \rightarrow \psi(3770)$

Γ_{43}/Γ

NODE=M053R30
NODE=M053R30

• • • We do not use the following data for averages, fits, limits, etc. • • •

<111

23 ABLIKIM

07B

BES2

$e^+ e^- \rightarrow \psi(3770)$

$$\Gamma(K^+ K^- \rho^0 \pi^0)/\Gamma_{\text{total}}$$

VALUE (units 10^{-4})

<8

CL%

90

DOCUMENT ID

23 ABLIKIM

TECN

07I

COMMENT

BES2 $3.77 e^+ e^-$

Γ_{44}/Γ

NODE=M053R58
NODE=M053R58

$$\Gamma(K^+ K^- \rho^+ \pi^-)/\Gamma_{\text{total}}$$

VALUE (units 10^{-4})

<146

CL%

90

DOCUMENT ID

23 ABLIKIM

TECN

07I

COMMENT

BES2 $3.77 e^+ e^-$

Γ_{45}/Γ

NODE=M053R59
NODE=M053R59

$$\Gamma(\omega K^+ K^-)/\Gamma_{\text{total}}$$

VALUE (units 10^{-4})

< 3.4

CL%

90

DOCUMENT ID

27 HUANG

TECN

06A

COMMENT

CLEO $e^+ e^- \rightarrow \psi(3770)$

Γ_{46}/Γ

NODE=M053R32
NODE=M053R32

• • • We do not use the following data for averages, fits, limits, etc. • • •

<66

90

23 ABLIKIM

07I

BES2 $3.77 e^+ e^-$

$$\Gamma(\phi\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$$

$$\Gamma_{47}/\Gamma$$

NODE=M053R60
NODE=M053R60

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<38	90	23 ABLIKIM	07I BES2	$3.77 e^+ e^-$

$$\Gamma(K^{*0}K^-\pi^+\pi^0 + \text{c.c.})/\Gamma_{\text{total}}$$

$$\Gamma_{48}/\Gamma$$

NODE=M053R61
NODE=M053R61

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<162	90	23 ABLIKIM	07I BES2	$3.77 e^+ e^-$

$$\Gamma(K^{*+}K^-\pi^+\pi^- + \text{c.c.})/\Gamma_{\text{total}}$$

$$\Gamma_{49}/\Gamma$$

NODE=M053R62
NODE=M053R62

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<323	90	23 ABLIKIM	07I BES2	$3.77 e^+ e^-$

$$\Gamma(K^+K^-\pi^+\pi^-2\pi^0)/\Gamma_{\text{total}}$$

$$\Gamma_{50}/\Gamma$$

NODE=M053R73
NODE=M053R73

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<26.7	90	24	ABLIKIM	08N BES2	$e^+ e^- \rightarrow \psi(3770)$

$$\Gamma(K^+K^-2(\pi^+\pi^-))/\Gamma_{\text{total}}$$

$$\Gamma_{51}/\Gamma$$

NODE=M053R57
NODE=M053R57

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<10.3	90	23 ABLIKIM	07F BES2	$e^+ e^- \rightarrow \psi(3770)$

$$\Gamma(K^+K^-2(\pi^+\pi^-)\pi^0)/\Gamma_{\text{total}}$$

$$\Gamma_{52}/\Gamma$$

NODE=M053R51
NODE=M053R51

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<36.0	90	23 ABLIKIM	07F BES2	$e^+ e^- \rightarrow \psi(3770)$

$$\Gamma(\eta K^+K^-)/\Gamma_{\text{total}}$$

$$\Gamma_{53}/\Gamma$$

NODE=M053R31
NODE=M053R31

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 4.1	90	27 HUANG	06A CLEO	$e^+ e^- \rightarrow \psi(3770)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<31	90	23 ABLIKIM	10D BES2	$e^+ e^- \rightarrow \psi(3770)$

$$\Gamma(\eta K^+K^-\pi^+\pi^-)/\Gamma_{\text{total}}$$

$$\Gamma_{54}/\Gamma$$

NODE=M053R78
NODE=M053R78

VALUE (units 10^{-2})	CL%	DOCUMENT ID	TECN	COMMENT
<1.24	90	23 ABLIKIM	10D BES2	$e^+ e^- \rightarrow \psi(3770)$

$$\Gamma(\rho^0 K^+K^-)/\Gamma_{\text{total}}$$

$$\Gamma_{55}/\Gamma$$

NODE=M053R54
NODE=M053R54

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<5.0	90	23 ABLIKIM	07F BES2	$e^+ e^- \rightarrow \psi(3770)$

$$\Gamma(2(K^+K^-))/\Gamma_{\text{total}}$$

$$\Gamma_{56}/\Gamma$$

NODE=M053R33
NODE=M053R33

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 6.0	90	27 HUANG	06A CLEO	$e^+ e^- \rightarrow \psi(3770)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<17		23 ABLIKIM	07B BES2	$e^+ e^- \rightarrow \psi(3770)$

$$\Gamma(\phi K^+K^-)/\Gamma_{\text{total}}$$

$$\Gamma_{57}/\Gamma$$

NODE=M053R34
NODE=M053R34

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 7.5	90	27 HUANG	06A CLEO	$e^+ e^- \rightarrow \psi(3770)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<24		23 ABLIKIM	07B BES2	$e^+ e^- \rightarrow \psi(3770)$

$$\Gamma(2(K^+K^-)\pi^0)/\Gamma_{\text{total}}$$

$$\Gamma_{58}/\Gamma$$

NODE=M053R35
NODE=M053R35

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 2.9	90	27 HUANG	06A CLEO	$e^+ e^- \rightarrow \psi(3770)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<46		23 ABLIKIM	07B BES2	$e^+ e^- \rightarrow \psi(3770)$

$$\Gamma(2(K^+K^-)\pi^+\pi^-)/\Gamma_{\text{total}}$$

$$\Gamma_{59}/\Gamma$$

NODE=M053R48
NODE=M053R48

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<3.2	90	23 ABLIKIM	07F BES2	$e^+ e^- \rightarrow \psi(3770)$

$$\Gamma(K_S^0 K^- \pi^+)/\Gamma_{\text{total}}$$

VALUE (units 10^{-3})	CL%	EVTs
<3.2	90	18

DOCUMENT ID	TECN	COMMENT
ABLIKIM 08M BES2		$e^+ e^- \rightarrow \psi(3770)$

$$\Gamma_{60}/\Gamma$$

NODE=M053R64
NODE=M053R64

$$\Gamma(K_S^0 K^- \pi^+ \pi^0)/\Gamma_{\text{total}}$$

VALUE (units 10^{-3})	CL%	EVTs
<13.3	90	40

DOCUMENT ID	TECN	COMMENT
ABLIKIM 08M BES2		$e^+ e^- \rightarrow \psi(3770)$

$$\Gamma_{61}/\Gamma$$

NODE=M053R65
NODE=M053R65

$$\Gamma(K_S^0 K^- \rho^+)/\Gamma_{\text{total}}$$

VALUE (units 10^{-3})	CL%
<6.6	90

DOCUMENT ID	TECN	COMMENT
ABLIKIM 09C BES2		$e^+ e^- \rightarrow \psi(3770)$

$$\Gamma_{62}/\Gamma$$

NODE=M053R15
NODE=M053R15

$$\Gamma(K_S^0 K^- 2\pi^+ \pi^-)/\Gamma_{\text{total}}$$

VALUE (units 10^{-3})	CL%	EVTs
<8.7	90	39

DOCUMENT ID	TECN	COMMENT
ABLIKIM 08M BES2		$e^+ e^- \rightarrow \psi(3770)$

$$\Gamma_{63}/\Gamma$$

NODE=M053R66
NODE=M053R66

$$\Gamma(K_S^0 K^- \pi^+ \rho^0)/\Gamma_{\text{total}}$$

VALUE (units 10^{-2})	CL%
<1.6	90

DOCUMENT ID	TECN	COMMENT
ABLIKIM 09C BES2		$e^+ e^- \rightarrow \psi(3770)$

$$\Gamma_{64}/\Gamma$$

NODE=M053R16
NODE=M053R16

$$\Gamma(K_S^0 K^- \pi^+ \eta)/\Gamma_{\text{total}}$$

VALUE (units 10^{-2})	CL%
<1.3	90

DOCUMENT ID	TECN	COMMENT
ABLIKIM 09C BES2		$e^+ e^- \rightarrow \psi(3770)$

$$\Gamma_{65}/\Gamma$$

NODE=M053R17
NODE=M053R17

$$\Gamma(K_S^0 K^- 2\pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}$$

VALUE (units 10^{-3})	CL%	EVTs
<41.8	90	23

DOCUMENT ID	TECN	COMMENT
ABLIKIM 08M BES2		$e^+ e^- \rightarrow \psi(3770)$

$$\Gamma_{66}/\Gamma$$

NODE=M053R67
NODE=M053R67

$$\Gamma(K_S^0 K^- 2\pi^+ \pi^- \eta)/\Gamma_{\text{total}}$$

VALUE (units 10^{-2})	CL%
<4.8	90

DOCUMENT ID	TECN	COMMENT
ABLIKIM 09C BES2		$e^+ e^- \rightarrow \psi(3770)$

$$\Gamma_{67}/\Gamma$$

NODE=M053R18
NODE=M053R18

$$\Gamma(K_S^0 K^- \pi^+ 2(\pi^+ \pi^-))/\Gamma_{\text{total}}$$

VALUE (units 10^{-3})	CL%	EVTs
<12.2	90	4

DOCUMENT ID	TECN	COMMENT
ABLIKIM 08M BES2		$e^+ e^- \rightarrow \psi(3770)$

$$\Gamma_{68}/\Gamma$$

NODE=M053R68
NODE=M053R68

$$\Gamma(K_S^0 K^- \pi^+ 2\pi^0)/\Gamma_{\text{total}}$$

VALUE (units 10^{-3})	CL%	EVTs
<26.5	90	17

DOCUMENT ID	TECN	COMMENT
ABLIKIM 08M BES2		$e^+ e^- \rightarrow \psi(3770)$

$$\Gamma_{69}/\Gamma$$

NODE=M053R69
NODE=M053R69

$$\Gamma(K_S^0 K^- K^+ K^- \pi^+)/\Gamma_{\text{total}}$$

VALUE (units 10^{-3})	CL%
<4.9	90

DOCUMENT ID	TECN	COMMENT
ABLIKIM 09C BES2		$e^+ e^- \rightarrow \psi(3770)$

$$\Gamma_{70}/\Gamma$$

NODE=M053R19
NODE=M053R19

$$\Gamma(K_S^0 K^- K^+ K^- \pi^+ \pi^0)/\Gamma_{\text{total}}$$

VALUE (units 10^{-2})	CL%
<3.0	90

DOCUMENT ID	TECN	COMMENT
ABLIKIM 09C BES2		$e^+ e^- \rightarrow \psi(3770)$

$$\Gamma_{71}/\Gamma$$

NODE=M053R75
NODE=M053R75

$$\Gamma(K_S^0 K^- K^+ K^- \pi^+ \eta)/\Gamma_{\text{total}}$$

VALUE (units 10^{-2})	CL%
<2.2	90

DOCUMENT ID	TECN	COMMENT
ABLIKIM 09C BES2		$e^+ e^- \rightarrow \psi(3770)$

$$\Gamma_{72}/\Gamma$$

NODE=M053R76
NODE=M053R76

$$\Gamma(K^{*0} K^- \pi^+ + \text{c.c.})/\Gamma_{\text{total}}$$

VALUE (units 10^{-3})	CL%
<9.7	90

DOCUMENT ID	TECN	COMMENT
²³ ABLIKIM 07F BES2		$e^+ e^- \rightarrow \psi(3770)$

$$\Gamma_{73}/\Gamma$$

NODE=M053R55
NODE=M053R55

$$\Gamma(p\bar{p}\pi^0)/\Gamma_{\text{total}}$$

VALUE (units 10^{-4})
<12

DOCUMENT ID	TECN	COMMENT
²³ ABLIKIM 07B BES2		$e^+ e^- \rightarrow \psi(3770)$

$$\Gamma_{74}/\Gamma$$

NODE=M053R09
NODE=M053R09

$\Gamma(p\bar{p}\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{75}/Γ NODE=M053R36
NODE=M053R36

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 5.8	90	27 HUANG	06A CLEO	$e^+e^- \rightarrow \psi(3770)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<16		23 ABLIKIM	07B BES2	$e^+e^- \rightarrow \psi(3770)$

 $\Gamma(\Lambda\bar{\Lambda})/\Gamma_{\text{total}}$ Γ_{76}/Γ NODE=M053R42
NODE=M053R42

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.2	90	27 HUANG	06A CLEO	$e^+e^- \rightarrow \psi(3770)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<4	90	23 ABLIKIM	07F BES2	$e^+e^- \rightarrow \psi(3770)$

 $\Gamma(p\bar{p}\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{77}/Γ NODE=M053R37
NODE=M053R37

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<18.5	90	27 HUANG	06A CLEO	$e^+e^- \rightarrow \psi(3770)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<73		23 ABLIKIM	07B BES2	$e^+e^- \rightarrow \psi(3770)$

 $\Gamma(\omega p\bar{p})/\Gamma_{\text{total}}$ Γ_{78}/Γ NODE=M053R39
NODE=M053R39

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 2.9	90	27 HUANG	06A CLEO	$e^+e^- \rightarrow \psi(3770)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<30	90	28 ABLIKIM	07I BES2	$3.77 e^+e^-$

 $\Gamma(\Lambda\bar{\Lambda}\pi^0)/\Gamma_{\text{total}}$ Γ_{79}/Γ NODE=M053R63
NODE=M053R63

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<12	90	23 ABLIKIM	07I BES2	$3.77 e^+e^-$

 $\Gamma(p\bar{p}2(\pi^+\pi^-))/\Gamma_{\text{total}}$ Γ_{80}/Γ NODE=M053R49
NODE=M053R49

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<2.6	90	23 ABLIKIM	07F BES2	$e^+e^- \rightarrow \psi(3770)$

 $\Gamma(\eta p\bar{p})/\Gamma_{\text{total}}$ Γ_{81}/Γ NODE=M053R38
NODE=M053R38

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 5.4	90	27 HUANG	06A CLEO	$e^+e^- \rightarrow \psi(3770)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<11	90	23 ABLIKIM	10D BES2	$e^+e^- \rightarrow \psi(3770)$

 $\Gamma(\eta p\bar{p}\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{82}/Γ NODE=M053R79
NODE=M053R79

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<3.3	90	23 ABLIKIM	10D BES2	$e^+e^- \rightarrow \psi(3770)$

 $\Gamma(\rho^0 p\bar{p})/\Gamma_{\text{total}}$ Γ_{83}/Γ NODE=M053R56
NODE=M053R56

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<1.7	90	23 ABLIKIM	07F BES2	$e^+e^- \rightarrow \psi(3770)$

 $\Gamma(p\bar{p}K^+K^-)/\Gamma_{\text{total}}$ Γ_{84}/Γ NODE=M053R40
NODE=M053R40

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 3.2	90	27 HUANG	06A CLEO	$e^+e^- \rightarrow \psi(3770)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<11		23 ABLIKIM	07B BES2	$e^+e^- \rightarrow \psi(3770)$

 $\Gamma(\eta p\bar{p}K^+K^-)/\Gamma_{\text{total}}$ Γ_{85}/Γ NODE=M053R80
NODE=M053R80

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<6.9	90	23 ABLIKIM	10D BES2	$e^+e^- \rightarrow \psi(3770)$

 $\Gamma(\pi^0 p\bar{p}K^+K^-)/\Gamma_{\text{total}}$ Γ_{86}/Γ NODE=M053R81
NODE=M053R81

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<1.2	90	23 ABLIKIM	10D BES2	$e^+e^- \rightarrow \psi(3770)$

$\Gamma(\phi\rho\bar{\rho})/\Gamma_{\text{total}}$ Γ_{87}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.3	90	27 HUANG	06A CLEO	$e^+e^- \rightarrow \psi(3770)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<9		23 ABLIKIM	07B BES2	$e^+e^- \rightarrow \psi(3770)$

NODE=M053R41
 NODE=M053R41

 $\Gamma(\Lambda\bar{\Lambda}\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{88}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 2.5	90	27 HUANG	06A CLEO	$e^+e^- \rightarrow \psi(3770)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<39	90	23 ABLIKIM	07F BES2	$e^+e^- \rightarrow \psi(3770)$

NODE=M053R43
 NODE=M053R43

 $\Gamma(\Lambda\bar{\rho}K^+)/\Gamma_{\text{total}}$ Γ_{89}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<2.8	90	27 HUANG	06A CLEO	$e^+e^- \rightarrow \psi(3770)$

NODE=M053R44
 NODE=M053R44

 $\Gamma(\Lambda\bar{\rho}K^+\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{90}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<6.3	90	27 HUANG	06A CLEO	$e^+e^- \rightarrow \psi(3770)$

NODE=M053R45
 NODE=M053R45

- 22 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.
- 23 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.
- 24 Data suggest possible destructive interference with continuum.
- 25 Using $\sigma(e^+e^- \rightarrow \psi(3770) \rightarrow \text{hadrons}) = (6.38 \pm 0.08^{+0.41}_{-0.30})$ nb from BESSON 06 and $B(K_S^0 \rightarrow \pi^+\pi^-) = 0.6895 \pm 0.0014$.
- 26 Using $B(K_S^0 \rightarrow \pi^+\pi^-) = 0.6860 \pm 0.0027$.
- 27 Using $\sigma_{tot}(e^+e^- \rightarrow \psi(3770)) = 7.9 \pm 0.6$ nb at the resonance.
- 28 Using $\sigma^{obs} = 7.15 \pm 0.27 \pm 0.27$ nb and neglecting interference.

NODE=M053R6;LINKAGE=AD

NODE=M053R10;LINKAGE=AK

NODE=M053R89;LINKAGE=AD

NODE=M053R3;LINKAGE=CR

NODE=M053R3;LINKAGE=AB

NODE=M053R;LINKAGE=HU

NODE=M053R24;LINKAGE=AB

NODE=M053240

RADIATIVE DECAYS

 $\Gamma(\gamma\chi_{c2})/\Gamma_{\text{total}}$ Γ_{91}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<0.9	90	29 COAN	06A CLEO	$e^+e^- \rightarrow \psi(3770) \rightarrow \gamma\gamma J/\psi$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<2.0	90	30 BRIERE	06 CLEO	$e^+e^- \rightarrow \psi(3770) \rightarrow \gamma + \text{hadrons}$

NODE=M053R03
 NODE=M053R03

 $\Gamma(\gamma\chi_{c1})/\Gamma_{\text{total}}$ Γ_{92}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
2.9±0.5±0.4		31 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 ± 17	32 BRIERE	06 CLEO	$e^+e^- \rightarrow \psi(3770) \rightarrow \gamma + \text{hadrons}$
2.8±0.5±0.4	53 ± 10	29 COAN	06A CLEO	$e^+e^- \rightarrow \psi(3770) \rightarrow \gamma\gamma J/\psi$

NODE=M053R02
 NODE=M053R02

OCCUR=2

 $\Gamma(\gamma\chi_{c1})/\Gamma(J/\psi\pi^+\pi^-)$ Γ_{92}/Γ_4

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
1.49±0.31±0.26	53 ± 10	33 COAN	06A CLEO	$e^+e^- \rightarrow \psi(3770) \rightarrow \gamma\gamma J/\psi$

NODE=M053R04
 NODE=M053R04

 $\Gamma(\gamma\chi_{c0})/\Gamma_{\text{total}}$ Γ_{93}/Γ

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
7.3±0.7±0.6	274 ± 27		34 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		29 COAN	06A CLEO	$e^+e^- \rightarrow \psi(3770) \rightarrow \gamma\gamma J/\psi$

NODE=M053R01
 NODE=M053R01

$\Gamma(\gamma\chi_{c0})/\Gamma(\gamma\chi_{c2})$ Γ_{93}/Γ_{91}

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

>8	90	35 BRIERE	06	CLEO $e^+e^- \rightarrow \psi(3770)$

NODE=M053R06
 NODE=M053R06

 $\Gamma(\gamma\chi_{c0})/\Gamma(\gamma\chi_{c1})$ Γ_{93}/Γ_{92}

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

2.5 ± 0.6		35 BRIERE	06	CLEO $e^+e^- \rightarrow \psi(3770)$

NODE=M053R05
 NODE=M053R05

 $\Gamma(\gamma\eta')/\Gamma_{\text{total}}$ Γ_{94}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT

<1.8	90	36 PEDLAR	09	CLE3 $\psi(2S) \rightarrow \gamma X$

NODE=M053R14
 NODE=M053R14

 $\Gamma(\gamma\eta)/\Gamma_{\text{total}}$ Γ_{95}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT

<1.5	90	36 PEDLAR	09	CLE3 $\psi(2S) \rightarrow \gamma X$

NODE=M053R13
 NODE=M053R13

 $\Gamma(\gamma\pi^0)/\Gamma_{\text{total}}$ Γ_{96}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT

<2	90	PEDLAR	09	CLE3 $\psi(2S) \rightarrow \gamma X$

NODE=M053R12
 NODE=M053R12

²⁹ 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=M053R0;LINKAGE=CO

³⁰ 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.

NODE=M053R03;LINKAGE=BR

³¹ Averages the two measurements from COAN 06A and BRIERE 06.

NODE=M053R02;LINKAGE=BI

³² 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.

NODE=M053R02;LINKAGE=BR

³³ 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;LINKAGE=CO

³⁴ Uses $B(\psi(2S) \rightarrow \gamma\chi_{c0}) = 9.33 \pm 0.14 \pm 0.61\%$ 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.

NODE=M053R01;LINKAGE=BR

³⁵ Not independent of other results in BRIERE 06.

NODE=M053R05;LINKAGE=BR

³⁶ Assuming maximal destructive interference between $\psi(3770)$ and continuum sources.

NODE=M053R13;LINKAGE=PE

 $\psi(3770)$ REFERENCES

NODE=M053

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 159901E	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 B670 184	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52570
AUBERT	08B	PR D77 011102	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52120
BRODZICKA	08	PRL 100 092001	J. Brodzicka <i>et al.</i>	(BELLE Collab.)	REFID=52144
PAKHLOVA	08	PR D77 011103	G. Pakhlova <i>et al.</i>	(BELLE Collab.)	REFID=52132
ABLIKIM	07B	PL B650 111	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51704
ABLIKIM	07E	PL B652 238	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51882
ABLIKIM	07F	PL B656 30	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51940
ABLIKIM	07I	EPJ C52 805	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52045
ABLIKIM	07K	PR D76 122002	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52073
AUBERT	07BE	PR D76 111105	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52074
DOBBS	07	PR D76 112001	S. Dobbs <i>et al.</i>	(CLEO Collab.)	REFID=52075
ABLIKIM	06L	PRL 97 121801	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51129
ABLIKIM	06N	PL B641 145	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51131
ADAM	06	PRL 96 082004	N.E. Adam <i>et al.</i>	(CLEO Collab.)	REFID=50989
ADAMS	06	PR D73 012002	G.S. Adams <i>et al.</i>	(CLEO Collab.)	REFID=50990
BESSION	06	PRL 96 092002	D. Besson <i>et al.</i>	(CLEO Collab.)	REFID=51041
Also		PRL 104 159901E	D. Besson <i>et al.</i>	(CLEO Collab.)	REFID=53245
BRIERE	06	PR D74 031106	R.A. Briere <i>et al.</i>	(CLEO Collab.)	REFID=51149
COAN	06A	PRL 96 182002	T.E. Coan <i>et al.</i>	(CLEO Collab.)	REFID=51155
CRONIN-HEN...	06	PR D74 012005	D. Cronin-Hennessy <i>et al.</i>	(CLEO Collab.)	REFID=51156
HUANG	06A	PRL 96 032003	G.S. Huang <i>et al.</i>	(CLEO Collab.)	REFID=50999
BAI	05	PL B605 63	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=50332
HE	05	PRL 95 121801	Q. He <i>et al.</i>	(CLEO Collab.)	REFID=50924
Also		PRL 96 199903 (err.)	Q. He <i>et al.</i>	(CLEO Collab.)	REFID=51211
ABLIKIM	04F	PR D70 077101	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50185
ATHAR	04	PR D70 112002	S.B. Athar <i>et al.</i>	(CLEO Collab.)	REFID=50331
CHISTOV	04	PRL 93 051803	R. Chistov <i>et al.</i>	(BELLE Collab.)	REFID=50002
PDG	04	PL B592 1	S. Eidelman <i>et al.</i>	(PDG Collab.)	REFID=49653
BAI	02C	PRL 88 101802	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=50506
ADLER	88C	PRL 60 89	J. Adler <i>et al.</i>	(Mark III Collab.)	REFID=40361
SCHINDLER	80	PR D21 2716	R.H. Schindler <i>et al.</i>	(Mark II Collab.)	REFID=22222
BACINO	78	PRL 40 671	W.J. Bacino <i>et al.</i>	(SLAC, UCLA, UCI)	REFID=11437
RAPIDIS	77	PRL 39 526	P.A. Rapidis <i>et al.</i>	(LGW Collab.)	REFID=22220

X(3872)

$$J^{PC} = 0^{++}(1^{++})$$

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 $B^+ \rightarrow X(3872) K^+$ decays, where $X(3872) \rightarrow J/\psi \pi^+ \pi^-$ and $J/\psi \rightarrow \mu^+ \mu^-$, which unambiguously gives the $J^{PC} = 1^{++}$ assignment.

See our note on "Developments in Heavy Quarkonium Spectroscopy".

NODE=M176

NODE=M176

X(3872) MASS FROM $J/\psi X$ MODE

NODE=M176M

NODE=M176M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
3871.68 ± 0.17 OUR AVERAGE				
3871.95 ± 0.48 ± 0.12	0.6k	AAIJ	12H	LHCB $pp \rightarrow J/\psi \pi^+ \pi^- X$
3871.85 ± 0.27 ± 0.19	~ 170	¹ CHOI	11	BELL $B \rightarrow K \pi^+ \pi^- J/\psi$
3873 ± 1.8 ± 1.3	27 ± 8	² DEL-AMO-SA.10B	BABR	$B \rightarrow \omega J/\psi K$
3871.61 ± 0.16 ± 0.19	6k	^{2,3} AALTONEN	09AU	CDF2 $p\bar{p} \rightarrow J/\psi \pi^+ \pi^- X$
3871.4 ± 0.6 ± 0.1	93.4	AUBERT	08Y	BABR $B^+ \rightarrow K^+ J/\psi \pi^+ \pi^-$
3868.7 ± 1.5 ± 0.4	9.4	AUBERT	08Y	BABR $B^0 \rightarrow K_S^0 J/\psi \pi^+ \pi^-$
3871.8 ± 3.1 ± 3.0	522	^{2,4} ABAZOV	04F	D0 $p\bar{p} \rightarrow J/\psi \pi^+ \pi^- X$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
3868.6 ± 1.2 ± 0.2	8	⁵ AUBERT	06	BABR $B^0 \rightarrow K_S^0 J/\psi \pi^+ \pi^-$
3871.3 ± 0.6 ± 0.1	61	⁵ AUBERT	06	BABR $B^- \rightarrow K^- J/\psi \pi^+ \pi^-$
3873.4 ± 1.4	25	⁶ AUBERT	05R	BABR $B^+ \rightarrow K^+ J/\psi \pi^+ \pi^-$
3871.3 ± 0.7 ± 0.4	730	^{2,7} ACOSTA	04	CDF2 $p\bar{p} \rightarrow J/\psi \pi^+ \pi^- X$
3872.0 ± 0.6 ± 0.5	36	⁸ CHOI	03	BELL $B \rightarrow K \pi^+ \pi^- J/\psi$
3836 ± 13	58	^{2,9} ANTONIAZZI	94	E705 $300 \pi^\pm Li \rightarrow J/\psi \pi^+ \pi^- X$

OCCUR=2

OCCUR=2

¹ The mass difference for the $X(3872)$ produced in B^+ and B^0 decays is $(-0.71 \pm 0.96 \pm 0.19)$ MeV.

² Width consistent with detector resolution.

³ A possible equal mixture of two states with a mass difference greater than 3.6 MeV/ c^2 is excluded at 95% CL.

⁴ Calculated from the corresponding $m_{X(3872)} - m_{J/\psi}$ using $m_{J/\psi} = 3096.916$ MeV.

⁵ Calculated from the corresponding $m_{X(3872)} - m_{\psi(2S)}$ using $m_{\psi(2S)} = 3686.093$ MeV. Superseded by AUBERT 08Y.

⁶ Calculated from the corresponding $m_{X(3872)} - m_{\psi(2S)}$ using $m_{\psi(2S)} = 3685.96$ MeV. Superseded by AUBERT 06.

⁷ Superseded by AALTONEN 09AU.

⁸ Superseded by CHOI 11.

⁹ A lower mass value can be due to an incorrect momentum scale for soft pions.

NODE=M176M;LINKAGE=CO

NODE=M176M;LINKAGE=AC

NODE=M176M;LINKAGE=AA

NODE=M176M;LINKAGE=AB

NODE=M176M;LINKAGE=AE

NODE=M176M;LINKAGE=AU

NODE=M176M;LINKAGE=AT

NODE=M176M;LINKAGE=CH

NODE=M176M;LINKAGE=AN

X(3872) MASS FROM $\bar{D}^{*0} D^0$ MODE

NODE=M176MD0

NODE=M176MD0

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 ^{10,11}	AUSHEV	10	BELL $B \rightarrow \bar{D}^{*0} D^0 K$
3875.1 ^{+0.7} _{-0.5} ± 0.5	33 ± 6	¹¹ AUBERT	08B	BABR $B \rightarrow \bar{D}^{*0} D^0 K$
3875.2 ± 0.7 ^{+0.9} _{-1.8}	24 ± 6 ^{11,12}	GOKHROO	06	BELL $B \rightarrow D^0 \bar{D}^0 \pi^0 K$

¹⁰ Calculated from the measured $m_{X(3872)} - m_{\bar{D}^{*0}} - m_{D^0} = 1.1^{+0.6+0.1}_{-0.4-0.3}$ MeV.

¹¹ 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.

¹² Superseded by AUSHEV 10.

NODE=M176MD0;LINKAGE=AS

NODE=M176MD0;LINKAGE=AU

NODE=M176MD0;LINKAGE=GO

$m_{X(3872)} - m_{J/\psi}$

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$774.9 \pm 3.1 \pm 3.0$	522	ABAZOV	04F D0	$\rho \bar{p} \rightarrow J/\psi \pi^+ \pi^- X$

NODE=M176207

NODE=M176DM

 $m_{X(3872)} - m_{\psi(2S)}$

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

187.4 ± 1.4 25 ¹³ AUBERT 05R BABR $B^+ \rightarrow K^+ J/\psi \pi^+ \pi^-$

¹³ Superseded by AUBERT 06.

NODE=M176DM2

NODE=M176DM2

NODE=M176DM2;LINKAGE=AU

 $X(3872)$ WIDTH

VALUE (MeV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT

<1.2 90 CHOI 11 BELL $B \rightarrow K \pi^+ \pi^- J/\psi$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<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 ¹⁴CHOI 03 BELL $B \rightarrow K \pi^+ \pi^- J/\psi$

¹⁴ Superseded by CHOI 11.

NODE=M176W

NODE=M176W

NODE=M176W;LINKAGE=CH

 $X(3872)$ 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 ¹⁵ 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 $B \rightarrow \bar{D}^{*0} D^0 K$

¹⁵ With a measured value of $B(B \rightarrow X(3872) K) \times B(X(3872) \rightarrow D^{*0} \bar{D}^0) = (0.80 \pm 0.20 \pm 0.10) \times 10^{-4}$, assumed to be equal for both charged and neutral modes.

NODE=M176WD0

NODE=M176WD0

NODE=M176WD0;LINKAGE=AU

 $X(3872)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $e^+ e^-$	
Γ_2 $\pi^+ \pi^- J/\psi(1S)$	> 2.6 %
Γ_3 $\rho^0 J/\psi(1S)$	
Γ_4 $\omega J/\psi(1S)$	> 1.9 %
Γ_5 $D^0 \bar{D}^0 \pi^0$	> 32 %
Γ_6 $\bar{D}^{*0} D^0$	> 24 %
Γ_7 $\gamma \gamma$	
Γ_8 $D^0 \bar{D}^0$	
Γ_9 $D^+ D^-$	
Γ_{10} $\gamma \chi_{c1}$	
Γ_{11} $\eta J/\psi$	
Γ_{12} $\gamma J/\psi$	> 6×10^{-3}
Γ_{13} $\gamma \psi(2S)$	[a] > 3.0 %
Γ_{14} $\pi^+ \pi^- \eta_c(1S)$	not seen

DESIG=1

DESIG=2

DESIG=10

DESIG=13

DESIG=8

DESIG=12

DESIG=5

DESIG=6

DESIG=7

DESIG=3

DESIG=4

DESIG=9

DESIG=11

DESIG=14;OUR EVAL;→ UNCHECKED ←

[a] BHARDWAJ 11 does not observe this decay and presents a stronger 90% CL limit than this value. See measurements listings for details.

LINKAGE=BBL

 $X(3872)$ PARTIAL WIDTHS

$\Gamma(e^+ e^-)$	CL%	DOCUMENT ID	TECN	COMMENT	Γ_1
VALUE (keV)					

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.28 90 ¹⁶ YUAN 04 RVUE $e^+ e^- \rightarrow \pi^+ \pi^- J/\psi$

¹⁶ Using BAI 98E data on $e^+ e^- \rightarrow \pi^+ \pi^- \ell^+ \ell^-$. Assuming that $\Gamma(\pi^+ \pi^- J/\psi)$ of $X(3872)$ is the same as that of $\psi(2S)$ (85.4 keV).

NODE=M176220

NODE=M176W1

NODE=M176W1

NODE=M176W1;LINKAGE=A

$X(3872) \Gamma(i) \Gamma(e^+ e^-) / \Gamma(\text{total})$

NODE=M176230

$\Gamma(\pi^+ \pi^- J/\psi(1S)) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$		$\Gamma_2 \Gamma_1 / \Gamma$		
VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
< 6.2	90	17,18 AUBERT	05D BABR	$10.6 e^+ e^- \rightarrow K^+ K^- \pi^+ \pi^- \gamma$

NODE=M176G1
NODE=M176G1

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 8.3	90	18 DOBBS	05 CLE3	$e^+ e^- \rightarrow \pi^+ \pi^- J/\psi$
< 10	90	19 YUAN	04 RVUE	$e^+ e^- \rightarrow \pi^+ \pi^- J/\psi$

¹⁷ Using $B(X(3872) \rightarrow J/\psi \pi^+ \pi^-) \cdot B(J/\psi \rightarrow \mu^+ \mu^-) \cdot \Gamma(X(3872) \rightarrow e^+ e^-) < 0.37$ eV from AUBERT 05D and $B(J/\psi \rightarrow \mu^+ \mu^-) = 0.0588 \pm 0.0010$ from the PDG 04.

¹⁸ Assuming $X(3872)$ has $J^{PC} = 1^{--}$.

¹⁹ Using BAI 98E data on $e^+ e^- \rightarrow \pi^+ \pi^- \ell^+ \ell^-$. From theoretical calculation of the production cross section and using $B(J/\psi \rightarrow \mu^+ \mu^-) = (5.88 \pm 0.10)\%$.

NODE=M176G1;LINKAGE=AU

NODE=M176G1;LINKAGE=DO
NODE=M176G1;LINKAGE=A **$X(3872) \Gamma(i) \Gamma(\gamma\gamma) / \Gamma(\text{total})$**

NODE=M176232

$\Gamma(\pi^+ \pi^- J/\psi(1S)) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$		$\Gamma_2 \Gamma_7 / \Gamma$		
VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
< 12.9	90	20 DOBBS	05 CLE3	$e^+ e^- \rightarrow \pi^+ \pi^- J/\psi \gamma$

NODE=M176H1
NODE=M176H1

• • • We do not use the following data for averages, fits, limits, etc. • • •

²⁰ Assuming $X(3872)$ has positive C parity and spin 0.

NODE=M176H1;LINKAGE=DO

$\Gamma(\omega J/\psi(1S)) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$		$\Gamma_4 \Gamma_7 / \Gamma$		
VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
< 1.7	90	21 LEES	12AD BABR	$e^+ e^- \rightarrow e^+ e^- \omega J/\psi$

NODE=M176G01
NODE=M176G01

²¹ Assuming $X(3872)$ has spin 2.

NODE=M176G01;LINKAGE=LE

$\Gamma(\pi^+ \pi^- \eta_c(1S)) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$		$\Gamma_{14} \Gamma_7 / \Gamma$		
VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
< 11.1	90	LEES	12AE BABR	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^- \eta_c$

NODE=M176G02
NODE=M176G02 **$X(3872)$ BRANCHING RATIOS**

NODE=M176235

$\Gamma(\pi^+ \pi^- J/\psi(1S)) / \Gamma_{\text{total}}$		Γ_2 / Γ		
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
> 0.026	93 ± 17	22 AUBERT	08Y BABR	$B \rightarrow X(3872) K$

NODE=M176R6
NODE=M176R6

• • • We do not use the following data for averages, fits, limits, etc. • • •

> 0.04	30	23 AUBERT	05R BABR	$B^+ \rightarrow K^+ J/\psi \pi^+ \pi^-$
> 0.04	36 ± 7	24 CHOI	03 BABR	$B^+ \rightarrow K^+ J/\psi \pi^+ \pi^-$

²² AUBERT 08Y reports $[\Gamma(X(3872) \rightarrow \pi^+ \pi^- J/\psi(1S)) / \Gamma_{\text{total}}] \times [B(B^+ \rightarrow X(3872) K^+)] = (8.4 \pm 1.5 \pm 0.7) \times 10^{-6}$ which we divide by our best value $B(B^+ \rightarrow X(3872) K^+) < 3.2 \times 10^{-4}$.

NODE=M176R6;LINKAGE=AB

²³ Superseded by AUBERT 08Y. AUBERT 05R reports $[\Gamma(X(3872) \rightarrow \pi^+ \pi^- J/\psi(1S)) / \Gamma_{\text{total}}] \times [B(B^+ \rightarrow X(3872) K^+)] = (1.28 \pm 0.41) \times 10^{-5}$ which we divide by our best value $B(B^+ \rightarrow X(3872) K^+) < 3.2 \times 10^{-4}$.

NODE=M176R6;LINKAGE=AE

²⁴ CHOI 03 reports $[\Gamma(X(3872) \rightarrow \pi^+ \pi^- J/\psi(1S)) / \Gamma_{\text{total}}] \times [B(B^+ \rightarrow X(3872) K^+)] / [B(B^+ \rightarrow \psi(2S) K^+)] / [B(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)] = 0.063 \pm 0.012 \pm 0.007$ which we multiply or divide by our best values $B(B^+ \rightarrow X(3872) K^+) < 3.2 \times 10^{-4}$, $B(B^+ \rightarrow \psi(2S) K^+) = (6.27 \pm 0.24) \times 10^{-4}$, $B(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-) = (34.0 \pm 0.4) \times 10^{-2}$.

NODE=M176R6;LINKAGE=CH

$\Gamma(\omega J/\psi(1S)) / \Gamma_{\text{total}}$		Γ_4 / Γ		
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
> 0.019	21 ± 7	25 DEL-AMO-SA..10B	BABR	$B^+ \rightarrow \omega J/\psi K^+$

NODE=M176R14
NODE=M176R14

²⁵ DEL-AMO-SANCHEZ 10B reports $[\Gamma(X(3872) \rightarrow \omega J/\psi(1S)) / \Gamma_{\text{total}}] \times [B(B^+ \rightarrow X(3872) K^+)] = (6 \pm 2 \pm 1) \times 10^{-6}$ which we divide by our best value $B(B^+ \rightarrow X(3872) K^+) < 3.2 \times 10^{-4}$. DEL-AMO-SANCHEZ 10B also reports $B(B^0 \rightarrow X(3872) K^0) \times B(X(3872) \rightarrow J/\psi \omega) = (6 \pm 3 \pm 1) \times 10^{-6}$.

NODE=M176R14;LINKAGE=DE

$\Gamma(\omega J/\psi(1S))/\Gamma(\pi^+\pi^- J/\psi(1S))$ Γ_4/Γ_2

VALUE	DOCUMENT ID	TECN	COMMENT
0.8±0.3	²⁶ DEL-AMO-SA...10B	BABR	$B \rightarrow \omega J/\psi K$

NODE=M176R15
 NODE=M176R15

²⁶ Statistical and systematic errors added in quadrature. Uses the values of $B(B \rightarrow X(3872)K) \times B(X(3872) \rightarrow J/\psi \pi^+ \pi^-)$ reported in AUBERT 08Y, taking into account the common systematics.

NODE=M176R15;LINKAGE=DE

 $\Gamma(D^0 \bar{D}^0 \pi^0)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
>0.32	$>3.2 \times 10^{-3}$	OUR 2012 BEST LIMIT]		

NODE=M176R12
 NODE=M176R12

>0.32 17 ± 5 ²⁷ GOKHROO 06 BELL $B^+ \rightarrow D^0 \bar{D}^0 \pi^0 K^+$
²⁷ GOKHROO 06 reports $[\Gamma(X(3872) \rightarrow D^0 \bar{D}^0 \pi^0)/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow X(3872)K^+)] = (1.02 \pm 0.31^{+0.21}_{-0.29}) \times 10^{-4}$ which we divide by our best value $B(B^+ \rightarrow X(3872)K^+) < 3.2 \times 10^{-4}$.

NODE=M176R12;LINKAGE=GO

 $\Gamma(\bar{D}^{*0} D^0)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
>0.24	$>5 \times 10^{-3}$	OUR 2012 BEST LIMIT]		

NODE=M176R13
 NODE=M176R13

>0.24 41 $^{+9}_{-8}$ ²⁸ AUSHEV 10 BELL $B^+ \rightarrow D^{*0} \bar{D}^0 K^+$

• • • We do not use the following data for averages, fits, limits, etc. • • •

>0.5 27 ± 6 ²⁹ AUBERT 08B BABR $B^+ \rightarrow \bar{D}^{*0} D^0 K^+$

²⁸ AUSHEV 10 reports $[\Gamma(X(3872) \rightarrow \bar{D}^{*0} D^0)/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow X(3872)K^+)] = (0.77 \pm 0.16 \pm 0.10) \times 10^{-4}$ which we divide by our best value $B(B^+ \rightarrow X(3872)K^+) < 3.2 \times 10^{-4}$.

NODE=M176R13;LINKAGE=AS

²⁹ AUBERT 08B reports $[\Gamma(X(3872) \rightarrow \bar{D}^{*0} D^0)/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow X(3872)K^+)] = (1.67 \pm 0.36 \pm 0.47) \times 10^{-4}$ which we divide by our best value $B(B^+ \rightarrow X(3872)K^+) < 3.2 \times 10^{-4}$.

NODE=M176R13;LINKAGE=AU

 $\Gamma(D^0 \bar{D}^0 \pi^0)/\Gamma(\pi^+\pi^- J/\psi(1S))$ Γ_5/Γ_2

VALUE	DOCUMENT ID	TECN	COMMENT
seen	³⁰ GOKHROO 06	BELL	$B \rightarrow D^0 \bar{D}^0 \pi^0 K$

NODE=M176R5
 NODE=M176R5

• • • We do not use the following data for averages, fits, limits, etc. • • •

seen AUSHEV 10 BELL $B \rightarrow D^0 \bar{D}^0 \pi^0 K$

³⁰ May not necessarily be the same state as that observed in the $J/\psi \pi^+ \pi^-$ mode. Supersedes CHISTOV 04.

NODE=M176R5;LINKAGE=GO

 $\Gamma(D^0 \bar{D}^0)/\Gamma(\pi^+\pi^- J/\psi(1S))$ Γ_8/Γ_2

VALUE	DOCUMENT ID	TECN	COMMENT

NODE=M176R3
 NODE=M176R3

• • • We do not use the following data for averages, fits, limits, etc. • • •

not seen CHISTOV 04 BELL $B \rightarrow K D^0 \bar{D}^0$

 $\Gamma(D^+ D^-)/\Gamma(\pi^+\pi^- J/\psi(1S))$ Γ_9/Γ_2

VALUE	DOCUMENT ID	TECN	COMMENT

NODE=M176R4
 NODE=M176R4

• • • We do not use the following data for averages, fits, limits, etc. • • •

not seen CHISTOV 04 BELL $B \rightarrow K D^+ D^-$

 $\Gamma(\gamma \chi_{c1})/\Gamma(\pi^+\pi^- J/\psi(1S))$ Γ_{10}/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

 $\Gamma(\eta J/\psi)/\Gamma(\pi^+\pi^- J/\psi(1S))$ Γ_{11}/Γ_2

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

NODE=M176R2
 NODE=M176R2

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.6 90 AUBERT 04Y BABR $B \rightarrow K \eta J/\psi$

 $\Gamma(\gamma J/\psi)/\Gamma_{\text{total}}$ Γ_{12}/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
>6	$\times 10^{-3}$	³¹ BHARDWAJ 11	BELL	$B^\pm \rightarrow \gamma J/\psi K^\pm$

NODE=M176R7
 NODE=M176R7

• • • We do not use the following data for averages, fits, limits, etc. • • •

>9 $\times 10^{-3}$ 20 ³² AUBERT 09B BABR $B^+ \rightarrow \gamma J/\psi K^+$

>0.010 19 ³³ AUBERT,BE 06M BABR $B^+ \rightarrow \gamma J/\psi K^+$

- ³¹ BHARDWAJ 11 reports $[\Gamma(X(3872) \rightarrow \gamma J/\psi)/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow X(3872)K^+)] = (1.78^{+0.48}_{-0.44} \pm 0.12) \times 10^{-6}$ which we divide by our best value $B(B^+ \rightarrow X(3872)K^+) < 3.2 \times 10^{-4}$.
- ³² AUBERT 09B reports $[\Gamma(X(3872) \rightarrow \gamma J/\psi)/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow X(3872)K^+)] = (2.8 \pm 0.8 \pm 0.1) \times 10^{-6}$ which we divide by our best value $B(B^+ \rightarrow X(3872)K^+) < 3.2 \times 10^{-4}$.
- ³³ Superseded by AUBERT 09B. AUBERT, BE 06M reports $[\Gamma(X(3872) \rightarrow \gamma J/\psi)/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow X(3872)K^+)] = (3.3 \pm 1.0 \pm 0.3) \times 10^{-6}$ which we divide by our best value $B(B^+ \rightarrow X(3872)K^+) < 3.2 \times 10^{-4}$.

NODE=M176R7;LINKAGE=BA

NODE=M176R7;LINKAGE=AB

NODE=M176R7;LINKAGE=AU

 $\Gamma(\gamma\psi(2S))/\Gamma_{\text{total}}$ Γ_{13}/Γ

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
not seen		³⁴ BHARDWAJ 11	BELL	$B^+ \rightarrow \gamma\psi(2S)K^+$
>0.030	25 ± 7	³⁵ AUBERT 09B	BABR	$B^+ \rightarrow \gamma\psi(2S)K^+$
³⁴ BHARDWAJ 11 reports $B(B^+ \rightarrow K^+ X(3872)) \times B(X \rightarrow \gamma\psi(2S)) < 3.45 \times 10^{-6}$ at 90% CL.				
³⁵ AUBERT 09B reports $[\Gamma(X(3872) \rightarrow \gamma\psi(2S))/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow X(3872)K^+)] = (9.5 \pm 2.7 \pm 0.6) \times 10^{-6}$ which we divide by our best value $B(B^+ \rightarrow X(3872)K^+) < 3.2 \times 10^{-4}$.				

NODE=M176R10
NODE=M176R10

NODE=M176R10;LINKAGE=BH

NODE=M176R10;LINKAGE=AU

 $\Gamma(\gamma\psi(2S))/\Gamma(\gamma J/\psi)$ Γ_{13}/Γ_{12}

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<2.1	90	BHARDWAJ 11	BELL	$B^+ \rightarrow K^+ \psi(2S)\gamma$
3.4 ± 1.4		AUBERT 09B	BABR	$B^+ \rightarrow \gamma c\bar{c}K^+$

NODE=M176R11
NODE=M176R11**X(3872) REFERENCES**

NODE=M176

AAIJ	13Q	PRL 110 222001	R. Aaij <i>et al.</i>	(LHCb Collab.) JP
AAIJ	12H	EPJ C72 1972	R. Aaij <i>et al.</i>	(LHCb 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.)
BHARDWAJ	11	PRL 107 091803	V. Bhardwaj <i>et al.</i>	(BELLE Collab.)
CHOI	11	PR D84 052004	S.-K. Choi <i>et al.</i>	(BELLE 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.)
AALTONEN	09AU	PRL 103 152001	T. Aaltonen <i>et al.</i>	(CDF Collab.)
AUBERT	09B	PRL 102 132001	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT	08B	PR D77 011102	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT	08Y	PR D77 111101	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT	06	PR D73 011101	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT, BE	06M	PR D74 071101	B. Aubert <i>et al.</i>	(BABAR Collab.)
GOKHROO	06	PRL 97 162002	G. Gokhroo <i>et al.</i>	(BELLE Collab.)
AUBERT	05B	PR D71 031501	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT	05D	PR D71 052001	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT	05R	PR D71 071103	B. Aubert <i>et al.</i>	(BABAR Collab.)
DOBBS	05	PRL 94 032004	S. Dobbs <i>et al.</i>	(CLEO Collab.)
ABAZOV	04F	PRL 93 162002	V.M. Abazov <i>et al.</i>	(D0 Collab.)
ACOSTA	04	PRL 93 072001	D. Acosta <i>et al.</i>	(CDF Collab.)
AUBERT	04Y	PRL 93 041801	B. Aubert <i>et al.</i>	(BaBar Collab.)
CHISTOV	04	PRL 93 051803	R. Chistov <i>et al.</i>	(BELLE Collab.)
PDG	04	PL B592 1	S. Eidelman <i>et al.</i>	(PDG Collab.)
YUAN	04	PL B579 74	C.Z. Yuan <i>et al.</i>	
CHOI	03	PRL 91 262001	S.-K. Choi <i>et al.</i>	(BELLE Collab.)
BAI	98E	PR D57 3854	J.Z. Bai <i>et al.</i>	(BES Collab.)
ANTONIAZZI	94	PR D50 4258	L. Antoniazzi <i>et al.</i>	(E705 Collab.)

REFID=54985
REFID=54056
REFID=54751
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REFID=50002
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REFID=49628
REFID=46339
REFID=44074

$\chi_{c0}(2P)$
was $X(3915)$

$$I^G(J^{PC}) = 0^+(0^{++})$$

NODE=M159

$\chi_{c0}(2P)$ MASS

NODE=M159M

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
3918.4 ± 1.9 OUR AVERAGE				
[3917.5 ± 2.7 MeV OUR 2012 AVERAGE]				
3919.4 ± 2.2 ± 1.6	59 ± 10	LEES	12AD BABR	$e^+e^- \rightarrow e^+e^-\omega J/\psi$
3919.1 ⁺ ₋ 3.8 3.4 ± 2.0		DEL-AMO-SA..10B	BABR	$B \rightarrow \omega J/\psi K$
3915 ± 3 ± 2	49 ± 15	UEHARA	10 BELL	10.6 $e^+e^- \rightarrow e^+e^-\omega J/\psi$
3943 ± 11 ± 13	58 ± 11	¹ CHOI	05 BELL	$B \rightarrow \omega J/\psi K$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
3914.6 ⁺ ₋ 3.8 3.4 ± 2.0		¹ AUBERT	08W BABR	Superseded by DEL-AMO-SANCHEZ 10B
¹ $\omega J/\psi$ threshold enhancement fitted as an S-wave Breit-Wigner resonance.				

NODE=M159M

NEW

NODE=M159M;LINKAGE=CH

$\chi_{c0}(2P)$ WIDTH

NODE=M159W

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
20 ± 5 OUR AVERAGE				
Error includes scale factor of 1.1. [27 ± 10 MeV OUR 2012 AVERAGE Scale factor = 1.4]				
13 ± 6 ± 3	59 ± 10	LEES	12AD BABR	$e^+e^- \rightarrow e^+e^-\omega J/\psi$
31 ⁺ ₋ 10 8 ± 5		DEL-AMO-SA..10B	BABR	$B \rightarrow \omega J/\psi K$
17 ± 10 ± 3	49 ± 15	UEHARA	10 BELL	10.6 $e^+e^- \rightarrow e^+e^-\omega J/\psi$
87 ± 22 ± 26	58 ± 11	² CHOI	05 BELL	$B \rightarrow \omega J/\psi K$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
34 ⁺ ₋ 12 8 ± 5		² AUBERT	08W BABR	Superseded by DEL-AMO-SANCHEZ 10B
² $\omega J/\psi$ threshold enhancement fitted as an S-wave Breit-Wigner resonance.				

NODE=M159W

NEW

NODE=M159W;LINKAGE=CH

$\chi_{c0}(2P)$ 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 $\gamma\gamma$	seen

DESIG=1;OUR EST;→ UNCHECKED ←

DESIG=3

DESIG=4;OUR EVAL;→ UNCHECKED ←

DESIG=2

$\chi_{c0}(2P)$ $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

NODE=M159220

$\Gamma(\omega J/\psi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$					$\Gamma_1\Gamma_4/\Gamma$
VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT	
54± 9 OUR AVERAGE					
[18 ± 5 eV OUR 2012 AVERAGE]					
52±10±3	59 ± 10	³ LEES	12AD BABR	$e^+e^- \rightarrow e^+e^-\omega J/\psi$	
61±17±8	49 ± 15	³ 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	⁴ UEHARA	10 BELL	10.6 $e^+e^- \rightarrow e^+e^-\omega J/\psi$	
³ For $J^P = 0^+$.					
⁴ For $J^P = 2^+$, helicity-2.					

NODE=M159G01

NODE=M159G01

NEW

OCCUR=2

NODE=M159G01;LINKAGE=UH

NODE=M159G01;LINKAGE=UR

$\Gamma(\pi^+\pi^-\eta_c(1S)) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$					$\Gamma_3\Gamma_4/\Gamma$
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

$\chi_{c0}(2P)$ BRANCHING RATIOS

$\Gamma(\gamma\gamma)/\Gamma_{\text{total}}$					Γ_4/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 $e^+e^- \rightarrow e^+e^-\omega J/\psi$	

$\Gamma(\omega J/\psi)/\Gamma(\bar{D}^{*0}D^0)$					Γ_1/Γ_2
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
>0.71	90	⁵ AUSHEV	10 BELL	$B \rightarrow \bar{D}^{*0}D^0K$	

⁵ 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 $B(B \rightarrow X(3915)K) \times B(X(3915) \rightarrow \omega J/\psi) = (0.51 \pm 0.11) \times 10^{-4}$.

$\Gamma(\omega J/\psi)/\Gamma_{\text{total}}$					Γ_1/Γ
VALUE		DOCUMENT ID	TECN	COMMENT	
seen		⁶ DEL-AMO-SA...10B	BABR	$B \rightarrow \omega J/\psi K$	
seen		⁷ CHOI	05 BELL	$B \rightarrow \omega J/\psi K$	

⁶ 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 $B(B^0 \rightarrow X(3915)K^0) \times B(X(3915) \rightarrow J/\psi\omega) = (2.1 \pm 0.9 \pm 0.3) \times 10^{-5}$.

⁷ CHOI 05 reports $B(B \rightarrow X(3915)K) \times B(X(3915) \rightarrow J/\psi\omega) = (7.1 \pm 1.3 \pm 3.1) \times 10^{-5}$.

$\chi_{c0}(2P)$ REFERENCES

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.)

$\chi_{c2}(2P)$

$$I^G(J^{PC}) = 0^+(2^{++})$$

$\chi_{c2}(2P)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
3927.2±2.6 OUR AVERAGE				
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 $e^+e^- \rightarrow e^+e^-D\bar{D}$

$\chi_{c2}(2P)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
24 ± 6 OUR AVERAGE				
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 $e^+e^- \rightarrow e^+e^-D\bar{D}$

$\chi_{c2}(2P)$ 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

NODE=M159225

NODE=M159R01
NODE=M159R01

NODE=M159R02
NODE=M159R02

NODE=M159R02;LINKAGE=AU

NODE=M159R03
NODE=M159R03

NODE=M159R03;LINKAGE=DE

NODE=M159R03;LINKAGE=CH

NODE=M159

REFID=54751
REFID=54752
REFID=53225
REFID=53362
REFID=53232
REFID=52263
REFID=50737

NODE=M050

NODE=M050M

NODE=M050M

NODE=M050W

NODE=M050W

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 ←

$\chi_{c2}(2P)$ PARTIAL WIDTHS

NODE=M050220

 $\chi_{c2}(2P) \Gamma(i) \Gamma(\gamma\gamma) / \Gamma(\text{total})$

NODE=M050222

 $\Gamma(K\bar{K}\pi) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}} \quad \Gamma_2 \Gamma_1 / \Gamma$ NODE=M050G01
NODE=M050G01

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<2.1	90	DEL-AMO-SA...11M	BABR	$\gamma\gamma \rightarrow K_S^0 K^\pm \pi^\mp$

 $\Gamma(K^+ K^- \pi^+ \pi^- \pi^0) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}} \quad \Gamma_3 \Gamma_1 / \Gamma$ NODE=M050G02
NODE=M050G02

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<3.4	90	DEL-AMO-SA...11M	BABR	$\gamma\gamma \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$

 $\Gamma(D\bar{D}) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}} \quad \Gamma_4 \Gamma_1 / \Gamma$ NODE=M050G1
NODE=M050G1

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	¹ UEHARA	06	BELL	10.6 $e^+e^- \rightarrow e^+e^-D\bar{D}$

¹ Assuming $B(D^+ D^-) = 0.89 B(D^0 \bar{D}^0)$.

NODE=M050G1;LINKAGE=UE

 $\Gamma(\pi^+ \pi^- \eta_c(1S)) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}} \quad \Gamma_7 \Gamma_1 / \Gamma$ NODE=M050G03
NODE=M050G03

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<18	90	LEES	12AE BABR	$e^+e^- \rightarrow e^+e^-\pi^+\pi^-\eta_c$

 $\chi_{c2}(2P)$ BRANCHING RATIOS

NODE=M050225

 $\Gamma(D^+ D^-) / \Gamma(D^0 \bar{D}^0) \quad \Gamma_5 / \Gamma_6$ NODE=M050R01
NODE=M050R01

<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.74±0.43±0.16	64	UEHARA	06	BELL
10.6 $e^+ e^- \rightarrow e^+ e^- D \bar{D}$				

 $\chi_{c2}(2P)$ REFERENCES

NODE=M050

LEES	12AE	PR D86 092005	J.P. Lees <i>et al.</i>	(BABAR Collab.)
DEL-AMO-SA... 11M	PR D84 012004	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)	
AUBERT	10G	PR D81 092003	B. Aubert <i>et al.</i>	(BABAR Collab.)
UEHARA	06	PRL 96 082003	S. Uehara <i>et al.</i>	(BELLE Collab.)

REFID=54752
REFID=16751
REFID=53357
REFID=51039

NODE=M029

X(3940)

$$I^G(J^{PC}) = ?^?(??)$$

OMITTED FROM SUMMARY TABLE

Reported by ABE 07, observed in $e^+ e^- \rightarrow J/\psi X$.

NODE=M029

X(3940) MASS

NODE=M029M

<u>VALUE (MeV)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
3942⁺₆⁺7₆[±]6	52	PAKHLOV	08	BELL
				$e^+e^- \rightarrow J/\psi X$

NODE=M029M

• • • We do not use the following data for averages, fits, limits, etc. • • •

3943 ± 6 ± 6	25	¹ ABE	07	BELL	$e^+ e^- \rightarrow J/\psi X$
3936 ± 14	266	² ABE	07	BELL	$e^+ e^- \rightarrow J/\psi(c\bar{c})$

OCCUR=2

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.NODE=M029M;LINKAGE=EB
NODE=M029M;LINKAGE=EM**X(3940) WIDTH**

NODE=M029W

VALUE (MeV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
37⁺²⁶₋₁₅±8		52	PAKHLOV	08	BELL
					$e^+e^- \rightarrow J/\psi X$

NODE=M029W

• • • We do not use the following data for averages, fits, limits, etc. • • •

<52	90	25	ABE	07	BELL	$e^+ e^- \rightarrow J/\psi X$

X(3940) DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $D\bar{D}^* + \text{c.c.}$	seen
Γ_2 $D\bar{D}$	not seen
Γ_3 $J/\psi\omega$	not seen

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 ^{3,4} ABE 07 BELL $e^+e^- \rightarrow J/\psi X$

³ For X(3940) decaying to final states with more than two tracks.

⁴ 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 ^{5,6} ABE 07 BELL $e^+e^- \rightarrow J/\psi X$

⁵ For X(3940) decaying to final states with more than two tracks.

⁶ 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 ^{7,8} ABE 07 BELL $e^+e^- \rightarrow J/\psi X$

⁷ For X(3940) decaying to final states with more than two tracks.

⁸ 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=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

• • • We do not use the following data for averages, fits, limits, etc. • • •

4034 ± 6 ¹ ABLIKIM 08D BES2 $e^+e^- \rightarrow$ hadrons

4037 ± 2 ² MO 10 RVUE $e^+e^- \rightarrow$ hadrons

4040 ± 1 ³ SETH 05A RVUE $e^+e^- \rightarrow$ hadrons

4040 ± 10 ⁴ SETH 05A RVUE $e^+e^- \rightarrow$ hadrons

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 $e^+e^- \rightarrow$ hadrons

NODE=M072W

NODE=M072W
 → UNCHECKED ←

• • • We do not use the following data for averages, fits, limits, etc. • • •

87 ± 11	⁶ MO	10 RVUE	$e^+ e^- \rightarrow$ hadrons
85 ± 10	⁷ SETH	05A RVUE	$e^+ e^- \rightarrow$ hadrons
89 ± 6	⁸ SETH	05A RVUE	$e^+ e^- \rightarrow$ hadrons
52 ± 10	BRANDELIK	78C DASP	$e^+ e^-$

OCCUR=2

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 $\delta = (130 \pm 46)^\circ$.

NODE=M072W;LINKAGE=AB

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.

NODE=M072W;LINKAGE=MO

⁷ From a fit to Crystal Ball (OSTERHELD 86) data.

NODE=M072W;LINKAGE=ST

⁸ From a fit to BES (BAI 02C) data.

NODE=M072W;LINKAGE=SE

$\psi(4040)$ DECAY MODES

NODE=M072215;NODE=M072

NODE=M072

Due to the complexity of the $c\bar{c}$ threshold region, in this listing, “seen” (“not seen”) means that a cross section for the mode in question has been measured at effective $\sqrt{s}$ near this particle’s central mass value, more (less) than 2σ above zero, without regard to any peaking behavior in $\sqrt{s}$ or absence thereof. See mode listing(s) for details and references.

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 $e^+ e^-$	$(1.07 \pm 0.16) \times 10^{-5}$	
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} $D^0 D^- \pi^+ + \text{c.c.}$ (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} $J/\psi(1S)\text{hadrons}$		
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} $\chi_{c1}\gamma$	< 1.1 %	90%
Γ_{23} $\chi_{c2}\gamma$	< 1.7 %	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} $\mu^+\mu^-$		

DESIG=5

DESIG=17;OUR EST; $\rightarrow$ UNCHECKED $\leftarrow$

DESIG=1

DESIG=18

DESIG=19;OUR EST; $\rightarrow$ UNCHECKED $\leftarrow$

DESIG=2

DESIG=20

DESIG=21;OUR EST; $\rightarrow$ UNCHECKED $\leftarrow$

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=6

$\psi(4040)$ PARTIAL WIDTHS $\Gamma(e^+e^-)$ Γ_1

VALUE (keV)

DOCUMENT ID

TECN

COMMENT

0.86±0.07 OUR ESTIMATE**0.83±0.20**⁹ ABLIKIM 08D BES2 $e^+e^- \rightarrow$ hadrons

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.6 to 1.4

¹⁰ MO 10 RVUE $e^+e^- \rightarrow$ hadrons

0.88±0.11

¹¹ SETH 05A RVUE $e^+e^- \rightarrow$ hadrons

0.91±0.13

¹² SETH 05A RVUE $e^+e^- \rightarrow$ hadrons

0.75±0.15

BRANDELIK 78C DASP e^+e^-

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=M072220

NODE=M072W5

NODE=M072W5

→ UNCHECKED ←

OCCUR=2

NODE=M072W5;LINKAGE=AB

NODE=M072W5;LINKAGE=MO

NODE=M072W5;LINKAGE=ST

NODE=M072W5;LINKAGE=SE

 $\psi(4040)$ BRANCHING RATIOS $\Gamma(e^+e^-)/\Gamma_{\text{total}}$ Γ_1/Γ VALUE (units 10^{-5})

DOCUMENT ID

TECN

COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

~ 1.0

FELDMAN 77 MRK1 e^+e^- $\Gamma(D^0\bar{D}^0)/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE

DOCUMENT ID

TECN

COMMENT

seen

AUBERT 09M BABR $e^+e^- \rightarrow D^0\bar{D}^0\gamma$

seen

CRONIN-HEN..09 CLEO $e^+e^- \rightarrow D^0\bar{D}^0$

seen

PAKHLOVA 08 BELL $e^+e^- \rightarrow D^0\bar{D}^0\gamma$

NODE=M072R14

NODE=M072R14

 $\Gamma(D^+D^-)/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE

DOCUMENT ID

TECN

COMMENT

seen

AUBERT 09M BABR $e^+e^- \rightarrow D^+D^-\gamma$

seen

CRONIN-HEN..09 CLEO $e^+e^- \rightarrow D^+D^-$

seen

PAKHLOVA 08 BELL $e^+e^- \rightarrow D^+D^-\gamma$

NODE=M072R15

NODE=M072R15

 $\Gamma(D\bar{D})/\Gamma(D^*\bar{D}^0 + \text{c.c.})$ Γ_2/Γ_5

VALUE

DOCUMENT ID

TECN

COMMENT

0.24±0.05±0.12AUBERT 09M BABR $e^+e^- \rightarrow \gamma D^{(*)}\bar{D}$

NODE=M072R12

NODE=M072R12

 $\Gamma(D^0\bar{D}^0)/\Gamma(D^*(2007)^0\bar{D}^0 + \text{c.c.})$ Γ_3/Γ_6

VALUE

DOCUMENT ID

TECN

COMMENT

0.05±0.03¹³ GOLDHABER 77 MRK1 e^+e^-

NODE=M072R1

NODE=M072R1

¹³ Phase-space factor (p^3) explicitly removed.

NODE=M072R;LINKAGE=P

 $\Gamma(D^*(2007)^0\bar{D}^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE

DOCUMENT ID

TECN

COMMENT

seen

AUBERT 09M BABR $e^+e^- \rightarrow D^{*0}\bar{D}^0\gamma$

seen

CRONIN-HEN..09 CLEO $e^+e^- \rightarrow D^{*0}\bar{D}^0$

NODE=M072R16

NODE=M072R16

 $\Gamma(D^*(2010)^+D^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE

DOCUMENT ID

TECN

COMMENT

seen

AUBERT 09M BABR $e^+e^- \rightarrow D^{*+}D^-\gamma$

seen

CRONIN-HEN..09 CLEO $e^+e^- \rightarrow D^{*+}D^-$

seen

PAKHLOVA 07 BELL $e^+e^- \rightarrow D^{*+}D^-\gamma$

NODE=M072R17

NODE=M072R17

 $\Gamma(D^*(2010)^+D^- + \text{c.c.})/\Gamma(D^*(2007)^0\bar{D}^0 + \text{c.c.})$ Γ_7/Γ_6

VALUE

DOCUMENT ID

TECN

COMMENT

0.95±0.09±0.10AUBERT 09M BABR $e^+e^- \rightarrow \gamma D^*\bar{D}$

NODE=M072R11

NODE=M072R11

$$\Gamma(D^*\bar{D}^*)/\Gamma(D^*\bar{D} + \text{c.c.})$$

 Γ_8/Γ_5

VALUE	DOCUMENT ID	TECN	COMMENT
0.18±0.14±0.03	AUBERT	09M BABR	$e^+e^- \rightarrow \gamma D(^*)\bar{D}(^*)$

 NODE=M072R13
 NODE=M072R13

$$\Gamma(D^*(2007)^0\bar{D}^*(2007)^0)/\Gamma_{\text{total}}$$

 Γ_9/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	AUBERT	09M BABR	$e^+e^- \rightarrow D^{*0}\bar{D}^{*0}\gamma$
seen	CRONIN-HEN..09	CLEO	$e^+e^- \rightarrow D^{*0}\bar{D}^{*0}$

 NODE=M072R18
 NODE=M072R18

$$\Gamma(D^*(2007)^0\bar{D}^*(2007)^0)/\Gamma(D^*(2007)^0\bar{D}^0 + \text{c.c.})$$

 Γ_9/Γ_6

VALUE	DOCUMENT ID	TECN	COMMENT
32.0±12.0	14 GOLDHABER 77	MRK1	e^+e^-

 NODE=M072R2
 NODE=M072R2

¹⁴ Phase-space factor (p^3) explicitly removed.

NODE=M072R2;LINKAGE=P

$$\Gamma(D^*(2010)^+D^*(2010)^-)/\Gamma_{\text{total}}$$

 Γ_{10}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	AUBERT	09M BABR	$e^+e^- \rightarrow D^{*+}D^{*-}\gamma$
seen	CRONIN-HEN..09	CLEO	$e^+e^- \rightarrow D^{*+}D^{*-}$
seen	PAKHLOVA 07	BELL	$e^+e^- \rightarrow D^{*+}D^{*-}\gamma$

 NODE=M072R19
 NODE=M072R19

$$\Gamma(D^0D^-\pi^+ + \text{c.c. (excl. } D^*(2007)^0\bar{D}^0 + \text{c.c., } D^*(2010)^+D^- + \text{c.c.}))/$$

 Γ_{total}
 Γ_{12}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	PAKHLOVA 08A	BELL	$e^+e^- \rightarrow D^0D^-\pi^+\gamma$

 NODE=M072R20
 NODE=M072R20

$$\Gamma(D\bar{D}^*\pi(\text{excl. } D^*\bar{D}^*))/\Gamma_{\text{total}}$$

 Γ_{13}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	CRONIN-HEN..09	CLEO	$e^+e^- \rightarrow D\bar{D}^*\pi$

 NODE=M072R21
 NODE=M072R21

$$\Gamma(D^0\bar{D}^{*-}\pi^+ + \text{c.c. (excl. } D^*(2010)^+D^*(2010)^-))/\Gamma_{\text{total}}$$

 Γ_{14}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	PAKHLOVA 09	BELL	$e^+e^- \rightarrow D^0D^{*-}\pi^+\gamma$

 NODE=M072R22
 NODE=M072R22

$$\Gamma(D_s^+D_s^-)/\Gamma_{\text{total}}$$

 Γ_{15}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	PAKHLOVA 11	BELL	$e^+e^- \rightarrow D_s^+D_s^-\gamma$
seen	DEL-AMO-SA..10N	BABR	$e^+e^- \rightarrow D_s^+D_s^-\gamma$
seen	CRONIN-HEN..09	CLEO	$e^+e^- \rightarrow D_s^+D_s^-$

 NODE=M072R23
 NODE=M072R23

$$\Gamma(J/\psi\pi^+\pi^-)/\Gamma_{\text{total}}$$

 Γ_{17}/Γ

VALUE (units 10 ⁻³)	CL%	DOCUMENT ID	TECN	COMMENT
<4	90	COAN	06	CLEO 3.97–4.06 $e^+e^- \rightarrow$ hadrons

 NODE=M072R01
 NODE=M072R01

$$\Gamma(J/\psi\pi^0\pi^0)/\Gamma_{\text{total}}$$

 Γ_{18}/Γ

VALUE (units 10 ⁻³)	CL%	DOCUMENT ID	TECN	COMMENT
<2	90	COAN	06	CLEO 3.97–4.06 $e^+e^- \rightarrow$ hadrons

 NODE=M072R02
 NODE=M072R02

$$\Gamma(J/\psi\eta)/\Gamma_{\text{total}}$$

 Γ_{19}/Γ

VALUE (units 10 ⁻³)	CL%	DOCUMENT ID	TECN	COMMENT
5.2±0.5±0.5		15 ABLIKIM 12K	BES3	$e^+e^- \rightarrow \ell^+\ell^-2\gamma$

 NODE=M072R03
 NODE=M072R03

• • • We do not use the following data for averages, fits, limits, etc. • • •

<7	90	COAN	06	CLEO 3.97–4.06 $e^+e^- \rightarrow$ hadrons

¹⁵ABLIKIM 12K measure $\sigma(e^+e^- \rightarrow J/\psi\eta) = 32.1 \pm 2.8 \pm 1.3$ pb. They assume the $\eta J/\psi$ fully originates from $\psi(4040)$ decays.

NODE=M072R03;LINKAGE=AB

$$\Gamma(J/\psi\pi^0)/\Gamma_{\text{total}}$$

 Γ_{20}/Γ

VALUE (units 10 ⁻³)	CL%	DOCUMENT ID	TECN	COMMENT
<0.28 (CL = 90%)		[<2 × 10 ⁻³ (CL = 90%) OUR 2012 BEST LIMIT]		
<0.28	90	16 ABLIKIM 12K	BES3	$e^+e^- \rightarrow \ell^+\ell^-2\gamma$

 NODE=M072R04
 NODE=M072R04

• • • We do not use the following data for averages, fits, limits, etc. • • •

<2	90	COAN	06	CLEO 3.97–4.06 $e^+e^- \rightarrow$ hadrons

¹⁶ABLIKIM 12K measure $\sigma(e^+e^- \rightarrow J/\psi\pi^0) < 1.6$ pb. They assume the $\eta J/\psi$ fully originates from $\psi(4040)$ decays.

NODE=M072R04;LINKAGE=AB

$\Gamma(J/\psi\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{21}/Γ NODE=M072R05
NODE=M072R05

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<2	90	COAN 06	CLEO	3.97–4.06 $e^+e^- \rightarrow$ hadrons

 $\Gamma(\chi_{c1}\gamma)/\Gamma_{\text{total}}$ Γ_{22}/Γ NODE=M072R06
NODE=M072R06

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<11	90	COAN 06	CLEO	3.97–4.06 $e^+e^- \rightarrow$ hadrons

 $\Gamma(\chi_{c2}\gamma)/\Gamma_{\text{total}}$ Γ_{23}/Γ NODE=M072R07
NODE=M072R07

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<17	90	COAN 06	CLEO	3.97–4.06 $e^+e^- \rightarrow$ hadrons

 $\Gamma(\chi_{c1}\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{24}/Γ NODE=M072R08
NODE=M072R08

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<11	90	COAN 06	CLEO	3.97–4.06 $e^+e^- \rightarrow$ hadrons

 $\Gamma(\chi_{c2}\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{25}/Γ NODE=M072R09
NODE=M072R09

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<32	90	COAN 06	CLEO	3.97–4.06 $e^+e^- \rightarrow$ hadrons

 $\Gamma(h_c(1P)\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{26}/Γ NODE=M072R24
NODE=M072R24

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<3	90	17 PEDLAR 11	CLEO	$e^+e^- \rightarrow h_c(1P)\pi^+\pi^-$

¹⁷ From several values of $\sqrt{s}$ near the peak of the $\psi(4040)$, PEDLAR 11 measures $\sigma(e^+e^- \rightarrow h_c(1P)\pi^+\pi^-) = 1.0 \pm 8.0 \pm 5.4 \pm 0.2$ pb, where the errors are statistical, systematic, and due to uncertainty in $B(\psi(2S) \rightarrow \pi^0 h_c(1P))$, respectively.

NODE=M072R24;LINKAGE=PE

 $\Gamma(\phi\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{27}/Γ NODE=M072R10
NODE=M072R10

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<3	90	COAN 06	CLEO	3.97–4.06 $e^+e^- \rightarrow$ hadrons

 $\psi(4040)$ REFERENCES

NODE=M072

ABLIKIM 12K	PR D86 071101	M. Ablikim <i>et al.</i>	(BES III 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=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)[±]

$I(J^P) = ?(?^?)$

NODE=M191

OMITTED FROM SUMMARY TABLE

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

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 ₋₁₇ ⁺⁴⁷ ₋₂₂	² MIZUK	08	BELL $\bar{B}^0 \rightarrow K^-\pi^+\chi_{c1}(1P)$

NODE=M191W

² 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)
$\Gamma_1 \quad \pi^+\chi_{c1}(1P)$	seen

DESIG=1

X(4050)[±] BRANCHING RATIOS

NODE=M191225

$\Gamma(\pi^+\chi_{c1}(1P))/\Gamma_{\text{total}}$				Γ_1/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
seen	³ 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	⁴ LEES	12B	BABR $B \rightarrow K\pi\chi_{c1}(1P)$	
³ With a product branching fraction measurement of $B(\bar{B}^0 \rightarrow K^-\chi_{c1}(1P)) \times B(X(4050)^+ \rightarrow \pi^+\chi_{c1}(1P)) = (3.0^{+1.5+3.7}_{-0.8-1.6}) \times 10^{-5}$.				
⁴ 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
NODE=M191R01

NODE=M191R01;LINKAGE=MI

NODE=M191R01;LINKAGE=LE

X(4050)[±] REFERENCES

NODE=M191

LEES	12B	PR D85 052003	J.P. Lees <i>et al.</i>	(BABAR Collab.)
MIZUK	08	PR D78 072004	R. Mizuk <i>et al.</i>	(BELLE Collab.)

REFID=54042
REFID=52535

X(4140)

$$J^G(J^{PC}) = 0^+(\text{?}^?+)$$

OMITTED FROM SUMMARY TABLE

Needs confirmation.

Seen by AALTONEN 09AH in the $B^+ \rightarrow X K^+$, $X \rightarrow J/\psi \phi$.Not seen by SHEN 10 in $\gamma\gamma \rightarrow J/\psi \phi$ or AAIJ 12AA in $B^+ \rightarrow J/\psi \phi K^+$.

NODE=M193

NODE=M193

X(4140) MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
$4143.0 \pm 2.9 \pm 1.2$	14 ± 5	¹ AALTONEN	09AH CDF	$B^+ \rightarrow J/\psi \phi K^+$
¹ Statistical significance of 3.8 σ .				

NODE=M193M

NODE=M193M

NODE=M193M;LINKAGE=AA

X(4140) WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
$11.7^{+8.3}_{-5.0} \pm 3.7$	14 ± 5	² AALTONEN	09AH CDF	$B^+ \rightarrow J/\psi \phi K^+$
² Statistical significance of 3.8 σ .				

NODE=M193W

NODE=M193W

NODE=M193W;LINKAGE=AA

X(4140) DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $J/\psi \phi$	not seen
Γ_2 $\gamma\gamma$	not seen

DESIG=1

DESIG=2

NODE=M193215;NODE=M193

X(4140) $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

$\Gamma(\gamma\gamma) \times \Gamma(J/\psi \phi)/\Gamma_{\text{total}}$				$\Gamma_2\Gamma_1/\Gamma$	
VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT	
<41	90	³ 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	⁴ SHEN	10	BELL	$10.6 e^+ e^- \rightarrow e^+ e^- J/\psi \phi$
³ For $J^P = 0^+$.					
⁴ For $J^P = 2^+$.					

NODE=M193220

NODE=M193G01
NODE=M193G01

OCCUR=2

NODE=M193G01;LINKAGE=S0
NODE=M193G01;LINKAGE=S2**X(4140) BRANCHING RATIOS**

$\Gamma(J/\psi\phi)/\Gamma_{\text{total}}$					Γ_1/Γ
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
not seen [seen OUR 2012 BEST LIMIT]					
not seen		⁵ AAIJ	12AA LHCb	$pp \rightarrow B^+ X$ at 7 TeV	
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
seen	14 ± 5	⁶ AALTONEN	09AH CDF	$B^+ \rightarrow J/\psi\phi K^+$	
⁵ Reported $B(B^+ \rightarrow X(4140) K^+) \cdot B(X(4140) \rightarrow J/\psi\phi)/B(B^+ \rightarrow J/\psi\phi K^+) < 0.07$ at 90% CL.					
⁶ Statistical significance of 3.8 σ .					
$\Gamma(\gamma\gamma)/\Gamma_{\text{total}}$					Γ_2/Γ
VALUE	DOCUMENT ID	TECN	COMMENT		
not seen	SHEN	10	BELL	$10.6 e^+ e^- \rightarrow e^+ e^- J/\psi\phi$	

NODE=M193225

NODE=M193R01
NODE=M193R01

NODE=M193R01;LINKAGE=AI

NODE=M193R01;LINKAGE=AA

NODE=M193R02
NODE=M193R02**X(4140) REFERENCES**

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=54263
REFID=53235
REFID=52968

$\psi(4160)$

$$J^{PC} = 0^{-}(1^{-}-)$$

NODE=M025

 $\psi(4160)$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
4153 $\pm$ 3 OUR ESTIMATE			
4191.7 $\pm$ 6.5	¹ ABLIKIM	08D BES2	$e^+e^- \rightarrow$ hadrons
• • • We do not use the following data for averages, fits, limits, etc. • • •			
4193 $\pm$ 7	² MO	10 RVUE	$e^+e^- \rightarrow$ hadrons
4151 $\pm$ 4	³ SETH	05A RVUE	$e^+e^- \rightarrow$ hadrons
4155 $\pm$ 5	⁴ SETH	05A RVUE	$e^+e^- \rightarrow$ hadrons
4159 $\pm$ 20	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.			
³ From a fit to Crystal Ball (OSTERHELD 86) data.			
⁴ From a fit to BES (BAI 02C) data.			

NODE=M025M

NODE=M025M

→ UNCHECKED ←

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
103 $\pm$ 8 OUR ESTIMATE			
71.8 $\pm$ 12.3	⁵ ABLIKIM	08D BES2	$e^+e^- \rightarrow$ hadrons
• • • We do not use the following data for averages, fits, limits, etc. • • •			
79 $\pm$ 14	⁶ MO	10 RVUE	$e^+e^- \rightarrow$ hadrons
107 $\pm$ 10	⁷ SETH	05A RVUE	$e^+e^- \rightarrow$ hadrons
107 $\pm$ 16	⁸ SETH	05A RVUE	$e^+e^- \rightarrow$ hadrons
78 $\pm$ 20	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 $\delta = (293 \pm 57)^\circ$.			
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=M025W

NODE=M025W

→ UNCHECKED ←

OCCUR=2

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^-	$(8.1 \pm 0.9) \times 10^{-6}$	DESIG=1
Γ_2 $D\bar{D}$	seen	DESIG=15;OUR EVAL;→ UNCHECKED ←
Γ_3 $D^0\bar{D}^0$	seen	DESIG=16
Γ_4 D^+D^-	seen	DESIG=17
Γ_5 $D^*\bar{D} + \text{c.c.}$	seen	DESIG=18;OUR EVAL;→ UNCHECKED ←
Γ_6 $D^*(2007)^0\bar{D}^0 + \text{c.c.}$	seen	DESIG=19
Γ_7 $D^*(2010)^+D^- + \text{c.c.}$	seen	DESIG=20
Γ_8 $D^*\bar{D}^*$	seen	DESIG=21;OUR EVAL;→ UNCHECKED ←
Γ_9 $D^*(2007)^0\bar{D}^*(2007)^0$	seen	DESIG=22
Γ_{10} $D^*(2010)^+D^*(2010)^-$	seen	DESIG=23
Γ_{11} $D^0D^-\pi^+ + \text{c.c. (excl. } D^*(2007)^0\bar{D}^0 + \text{c.c., } D^*(2010)^+D^- + \text{c.c.)}$	not seen	DESIG=24
Γ_{12} $D\bar{D}^*\pi + \text{c.c. (excl. } D^*\bar{D}^*)$	seen	DESIG=25

Γ_{13}	$D^0 D^{*-} \pi^+ + \text{c.c. (excl. } D^*(2010)^+ D^*(2010)^-)$	not seen			DESIG=26
Γ_{14}	$D_s^+ D_s^-$	not seen			DESIG=27
Γ_{15}	$D_s^{*+} D_s^- + \text{c.c.}$	seen			DESIG=28
Γ_{16}	$J/\psi \pi^+ \pi^-$	< 3	$\times 10^{-3}$	90%	DESIG=2
Γ_{17}	$J/\psi \pi^0 \pi^0$	< 3	$\times 10^{-3}$	90%	DESIG=3
Γ_{18}	$J/\psi K^+ K^-$	< 2	$\times 10^{-3}$	90%	DESIG=4
Γ_{19}	$J/\psi \eta$	< 8	$\times 10^{-3}$	90%	DESIG=5
Γ_{20}	$J/\psi \pi^0$	< 1	$\times 10^{-3}$	90%	DESIG=6
Γ_{21}	$J/\psi \eta'$	< 5	$\times 10^{-3}$	90%	DESIG=7
Γ_{22}	$J/\psi \pi^+ \pi^- \pi^0$	< 1	$\times 10^{-3}$	90%	DESIG=8
Γ_{23}	$\psi(2S) \pi^+ \pi^-$	< 4	$\times 10^{-3}$	90%	DESIG=9
Γ_{24}	$\chi_{c1} \gamma$	< 7	$\times 10^{-3}$	90%	DESIG=10
Γ_{25}	$\chi_{c2} \gamma$	< 1.3	%	90%	DESIG=11
Γ_{26}	$\chi_{c1} \pi^+ \pi^- \pi^0$	< 2	$\times 10^{-3}$	90%	DESIG=12
Γ_{27}	$\chi_{c2} \pi^+ \pi^- \pi^0$	< 8	$\times 10^{-3}$	90%	DESIG=13
Γ_{28}	$h_c(1P) \pi^+ \pi^-$	< 5	$\times 10^{-3}$	90%	DESIG=29
Γ_{29}	$h_c(1P) \pi^0 \pi^0$	< 2	$\times 10^{-3}$	90%	DESIG=30
Γ_{30}	$h_c(1P) \eta$	< 2	$\times 10^{-3}$	90%	DESIG=31
Γ_{31}	$h_c(1P) \pi^0$	< 4	$\times 10^{-4}$	90%	DESIG=32
Γ_{32}	$\phi \pi^+ \pi^-$	< 2	$\times 10^{-3}$	90%	DESIG=14

 $\psi(4160)$ PARTIAL WIDTHS

NODE=M025220

 $\Gamma(e^+ e^-)$ **Γ_1**

VALUE (keV)

DOCUMENT ID

TECN

COMMENT

0.83±0.07 OUR ESTIMATE**0.48±0.22**⁹ 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

¹⁰ MO 10 RVUE $e^+ e^- \rightarrow \text{hadrons}$

0.83±0.08

¹¹ SETH 05A RVUE $e^+ e^- \rightarrow \text{hadrons}$

0.84±0.13

¹² SETH 05A RVUE $e^+ e^- \rightarrow \text{hadrons}$

0.77±0.23

BRANDELIK 78C DASP $e^+ e^-$

OCCUR=2

⁹ Reanalysis of data presented in BAI 02C. From a global fit over the center-of-mass energy region 3.7–5.0 GeV covering the $\psi(3770)$, $\psi(4040)$, $\psi(4160)$, and $\psi(4415)$ resonances. Phase angle fixed in the fit to $\delta = (293 \pm 57)^\circ$.

NODE=M025W1;LINKAGE=AB

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.

NODE=M025W1;LINKAGE=MO

¹¹ From a fit to Crystal Ball (OSTERHELD 86) data.

NODE=M025W1;LINKAGE=ST

¹² From a fit to BES (BAI 02C) data.

NODE=M025W1;LINKAGE=SE

 $\psi(4160)$ BRANCHING RATIOS

NODE=M025225

 $\Gamma(D\bar{D})/\Gamma(D^* \bar{D}^*)$ **Γ_2/Γ_8**

VALUE

DOCUMENT ID

TECN

COMMENT

0.02±0.03±0.02AUBERT 09M BABR $e^+ e^- \rightarrow \gamma D^{(*)} \bar{D}^{(*)}$ NODE=M025R14
NODE=M025R14 **$\Gamma(D^0 \bar{D}^0)/\Gamma_{\text{total}}$** **$\Gamma_3/\Gamma$**

VALUE

DOCUMENT ID

TECN

COMMENT

seen

CRONIN-HEN..09 CLEO $e^+ e^- \rightarrow D^0 \bar{D}^0$

seen

PAKHOVA 08 BELL $e^+ e^- \rightarrow D^0 \bar{D}^0 \gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

not seen

AUBERT 09M BABR $e^+ e^- \rightarrow D^0 \bar{D}^0 \gamma$ NODE=M025R16
NODE=M025R16 **$\Gamma(D^+ D^-)/\Gamma_{\text{total}}$** **$\Gamma_4/\Gamma$**

VALUE

DOCUMENT ID

TECN

COMMENT

seen

CRONIN-HEN..09 CLEO $e^+ e^- \rightarrow D^+ D^-$

seen

PAKHOVA 08 BELL $e^+ e^- \rightarrow D^+ D^- \gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

not seen

AUBERT 09M BABR $e^+ e^- \rightarrow D^+ D^- \gamma$ NODE=M025R17
NODE=M025R17

$$\Gamma(D^*(2007)^0 \bar{D}^0 + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_6/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
seen	AUBERT 09M	BABR	$e^+ e^- \rightarrow D^{*0} \bar{D}^0 \gamma$
seen	CRONIN-HEN..09	CLEO	$e^+ e^- \rightarrow D^{*0} \bar{D}^0$

NODE=M025R18
NODE=M025R18

$$\Gamma(D^*(2010)^+ D^- + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_7/\Gamma$$

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 07	BELL	$e^+ e^- \rightarrow D^{*+} D^- \gamma$

NODE=M025R19
NODE=M025R19

$$\Gamma(D^* \bar{D} + \text{c.c.})/\Gamma(D^* \bar{D}^*) \quad \Gamma_5/\Gamma_8$$

VALUE	DOCUMENT ID	TECN	COMMENT
$0.34 \pm 0.14 \pm 0.05$	AUBERT 09M	BABR	$e^+ e^- \rightarrow \gamma D^{(*)} \bar{D}^{(*)}$

NODE=M025R15
NODE=M025R15

$$\Gamma(D^*(2007)^0 \bar{D}^{*0}(2007)^0)/\Gamma_{\text{total}} \quad \Gamma_9/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
seen	AUBERT 09M	BABR	$e^+ e^- \rightarrow D^{*0} \bar{D}^{*0} \gamma$
seen	CRONIN-HEN..09	CLEO	$e^+ e^- \rightarrow D^{*0} \bar{D}^{*0}$

NODE=M025R20
NODE=M025R20

$$\Gamma(D^*(2010)^+ D^*(2010)^-)/\Gamma_{\text{total}} \quad \Gamma_{10}/\Gamma$$

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 07	BELL	$e^+ e^- \rightarrow D^{*+} D^{*-} \gamma$

NODE=M025R21
NODE=M025R21

$$\Gamma(D^0 D^- \pi^+ + \text{c.c. (excl. } D^*(2007)^0 \bar{D}^0 + \text{c.c., } D^*(2010)^+ D^- + \text{c.c.}))/\Gamma_{\text{total}} \quad \Gamma_{11}/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	PAKHLOVA 08A	BELL	$e^+ e^- \rightarrow D^0 D^- \pi^+ \gamma$

NODE=M025R22
NODE=M025R22

$$\Gamma(D \bar{D}^* \pi + \text{c.c. (excl. } D^* \bar{D}^*))/\Gamma_{\text{total}} \quad \Gamma_{12}/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
seen	CRONIN-HEN..09	CLEO	$e^+ e^- \rightarrow D \bar{D}^* \pi$

NODE=M025R23
NODE=M025R23

$$\Gamma(D^0 D^{*-} \pi^+ + \text{c.c. (excl. } D^*(2010)^+ D^*(2010)^-))/\Gamma_{\text{total}} \quad \Gamma_{13}/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	PAKHLOVA 09	BELL	$e^+ e^- \rightarrow D^0 D^{*-} \pi^+ \gamma$

NODE=M025R24
NODE=M025R24

$$\Gamma(D_s^+ D_s^-)/\Gamma_{\text{total}} \quad \Gamma_{14}/\Gamma$$

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	$e^+ e^- \rightarrow D_s^+ D_s^- \gamma$
not seen	CRONIN-HEN..09	CLEO	$e^+ e^- \rightarrow D_s^+ D_s^-$

NODE=M025R25
NODE=M025R25

$$\Gamma(D_s^{*+} D_s^- + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_{15}/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
seen	PAKHLOVA 11	BELL	$e^+ e^- \rightarrow D_s^{*+} D_s^- \gamma$
seen	DEL-AMO-SA..10N	BABR	$e^+ e^- \rightarrow D_s^{*+} D_s^- \gamma$
seen	CRONIN-HEN..09	CLEO	$e^+ e^- \rightarrow D_s^{*+} D_s^-$

NODE=M025R26
NODE=M025R26

$$\Gamma(J/\psi \pi^+ \pi^-)/\Gamma_{\text{total}} \quad \Gamma_{16}/\Gamma$$

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<3	90	COAN 06	CLEO	$4.12-4.2 e^+ e^- \rightarrow \text{hadrons}$

NODE=M025R01
NODE=M025R01

$$\Gamma(J/\psi \pi^0 \pi^0)/\Gamma_{\text{total}} \quad \Gamma_{17}/\Gamma$$

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<3	90	COAN 06	CLEO	$4.12-4.2 e^+ e^- \rightarrow \text{hadrons}$

NODE=M025R02
NODE=M025R02

$$\Gamma(J/\psi K^+ K^-)/\Gamma_{\text{total}} \quad \Gamma_{18}/\Gamma$$

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<2	90	COAN 06	CLEO	$4.12-4.2 e^+ e^- \rightarrow \text{hadrons}$

NODE=M025R03
NODE=M025R03

$\Gamma(J/\psi\eta)/\Gamma_{\text{total}}$ Γ_{19}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<8	90	COAN 06	CLEO	4.12–4.2 $e^+e^- \rightarrow$ hadrons

NODE=M025R04
NODE=M025R04

 $\Gamma(J/\psi\pi^0)/\Gamma_{\text{total}}$ Γ_{20}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<1	90	COAN 06	CLEO	4.12–4.2 $e^+e^- \rightarrow$ hadrons

NODE=M025R05
NODE=M025R05

 $\Gamma(J/\psi\eta')/\Gamma_{\text{total}}$ Γ_{21}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<5	90	COAN 06	CLEO	4.12–4.2 $e^+e^- \rightarrow$ hadrons

NODE=M025R06
NODE=M025R06

 $\Gamma(J/\psi\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{22}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<1	90	COAN 06	CLEO	4.12–4.2 $e^+e^- \rightarrow$ hadrons

NODE=M025R07
NODE=M025R07

 $\Gamma(\psi(2S)\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{23}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<4	90	COAN 06	CLEO	4.12–4.2 $e^+e^- \rightarrow$ hadrons

NODE=M025R08
NODE=M025R08

 $\Gamma(\chi_{c1}\gamma)/\Gamma_{\text{total}}$ Γ_{24}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<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_{25}/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_{26}/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_{27}/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_{28}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<5	90	13 PEDLAR 11	CLEO	$e^+e^- \rightarrow h_c(1P)\pi^+\pi^-$

NODE=M025R27
NODE=M025R27

¹³ At $\sqrt{s} = 4170$ MeV, PEDLAR 11 measures $\sigma(e^+e^- \rightarrow h_c(1P)\pi^+\pi^-) = 15.6 \pm 2.3 \pm 1.9 \pm 3.0$ pb, where the errors are statistical, systematic, and due to uncertainty in $B(\psi(2S) \rightarrow \pi^0 h_c(1P))$, respectively.

NODE=M025R27;LINKAGE=PE

 $\Gamma(h_c(1P)\pi^0\pi^0)/\Gamma_{\text{total}}$ Γ_{29}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<2	90	14 PEDLAR 11	CLEO	$e^+e^- \rightarrow h_c(1P)\pi^0\pi^0$

NODE=M025R28
NODE=M025R28

¹⁴ At $\sqrt{s} = 4170$ MeV, PEDLAR 11 measures $\sigma(e^+e^- \rightarrow h_c(1P)\pi^0\pi^0) = 3.0 \pm 3.3 \pm 1.1 \pm 0.6$ pb, where the errors are statistical, systematic, and due to uncertainty in $B(\psi(2S) \rightarrow \pi^0 h_c(1P))$, respectively.

NODE=M025R28;LINKAGE=PE

 $\Gamma(h_c(1P)\eta)/\Gamma_{\text{total}}$ Γ_{30}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<2	90	15 PEDLAR 11	CLEO	$e^+e^- \rightarrow h_c(1P)\eta$

NODE=M025R29
NODE=M025R29

¹⁵ 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.

NODE=M025R29;LINKAGE=PE

 $\Gamma(h_c(1P)\pi^0)/\Gamma_{\text{total}}$ Γ_{31}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<0.4	90	16 PEDLAR 11	CLEO	$e^+e^- \rightarrow h_c(1P)\pi^0$

NODE=M025R30
NODE=M025R30

¹⁶ 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;LINKAGE=PE

$\Gamma(\phi\pi^+\pi^-)/\Gamma_{\text{total}}$					Γ_{32}/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

$\psi(4160)$ REFERENCES

NODE=M025

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.)

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

$X(4160)$

$I^G(J^{PC}) = ?^?(?^{??})$

NODE=M190

OMITTED FROM SUMMARY TABLE
Seen by PAKHLOV 08 in $e^+e^- \rightarrow J/\psi X$, $X \rightarrow D^*\bar{D}^*$

NODE=M190

$X(4160)$ MASS

NODE=M190M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$4156^{+25}_{-20} \pm 15$	24	PAKHLOV	08	BELL $e^+e^- \rightarrow J/\psi X$

NODE=M190M

$X(4160)$ WIDTH

NODE=M190W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$139^{+111}_{-61} \pm 21$	24	PAKHLOV	08	BELL $e^+e^- \rightarrow J/\psi X$

NODE=M190W

$X(4160)$ DECAY MODES

NODE=M190215;NODE=M190

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

DESIG=1;OUR EVAL;→ UNCHECKED ←
DESIG=2;OUR EVAL;→ UNCHECKED ←
DESIG=3;OUR EVAL;→ UNCHECKED ←

$X(4160)$ BRANCHING RATIOS

NODE=M190225

$\Gamma(D\bar{D})/\Gamma(D^*\bar{D}^*)$					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 $e^+e^- \rightarrow J/\psi X$	

NODE=M190R01
NODE=M190R01

NODE=M190R02
NODE=M190R02

$X(4160)$ REFERENCES

NODE=M190

PAKHLOV	08	PRL 100 202001	P. Pakhlov <i>et al.</i>	(BELLE Collab.)

REFID=52302

NODE=M192

$X(4250)^\pm$

$I(J^P) = ?(?^?)$

OMITTED FROM SUMMARY TABLE

Observed by MIZUK 08 in the $\pi^+\chi_{c1}(1P)$ invariant mass distribution in $\bar{B}^0 \rightarrow K^-\pi^+\chi_{c1}(1P)$ decays. Not seen by LEES 12B in this same mode after accounting for $K\pi$ resonant mass and angular structure.

NODE=M192

$X(4250)^\pm$ MASS

NODE=M192M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$4248^{+44+180}_{-29-35}$	¹ MIZUK	08	BELL $\bar{B}^0 \rightarrow K^-\pi^+\chi_{c1}(1P)$

NODE=M192M

¹ From a Dalitz plot analysis with two Breit-Wigner amplitudes.

NODE=M192M;LINKAGE=MI

$X(4250)^\pm$ WIDTH

NODE=M192W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$177^{+54+316}_{-39-61}$	² MIZUK	08	BELL $\bar{B}^0 \rightarrow K^-\pi^+\chi_{c1}(1P)$

NODE=M192W

² From a Dalitz plot analysis with two Breit-Wigner amplitudes.

NODE=M192W;LINKAGE=MI

$X(4250)^\pm$ DECAY MODES

NODE=M192215;NODE=M192

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \pi^+\chi_{c1}(1P)$	seen

DESIG=1

$X(4250)^\pm$ BRANCHING RATIOS

NODE=M192225

$\Gamma(\pi^+\chi_{c1}(1P))/\Gamma_{\text{total}}$	Γ_1/Γ
VALUE	
seen	³ 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	⁴ LEES 12B BABR $B \rightarrow K\pi\chi_{c1}(1P)$
³ With a product branching fraction measurement of $B(\bar{B}^0 \rightarrow K^-\chi_{c1}(1P)) \times B(X(4250)^+ \rightarrow \pi^+\chi_{c1}(1P)) = (4.0^{+2.3+19.7}_{-0.9-0.5}) \times 10^{-5}$.	
⁴ 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=M192R01
NODE=M192R01

NODE=M192R01;LINKAGE=MI

NODE=M192R01;LINKAGE=LE

$X(4250)^\pm$ REFERENCES

NODE=M192

LEES	12B	PR D85 052003	J.P. Lees <i>et al.</i>	(BABAR Collab.)
MIZUK	08	PR D78 072004	R. Mizuk <i>et al.</i>	(BELLE Collab.)

REFID=54042
REFID=52535

X(4260)

$$I^G(J^{PC}) = ?^?(1^{--})$$

Seen in radiative return from e^+e^- collisions at $\sqrt{s} = 9.54\text{--}10.58$ GeV by AUBERT,B 05I, HE 06B, and YUAN 07, and in e^+e^- collisions at $\sqrt{s} \approx 4.26$ GeV by COAN 06. Possibly seen by AUBERT 06 in $B^- \rightarrow K^- \pi^+ \pi^- J/\psi$. See also the mini-review under the X(3872). (See the index for the page number.)

NODE=M074

NODE=M074

X(4260) MASS

NODE=M074M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
4250$\pm$9 OUR AVERAGE				Error includes scale factor of 1.6. See the ideogram below.
[4263 $\pm$ 8 MeV OUR 2012 AVERAGE Scale factor = 1.1]				

NODE=M074M

NEW

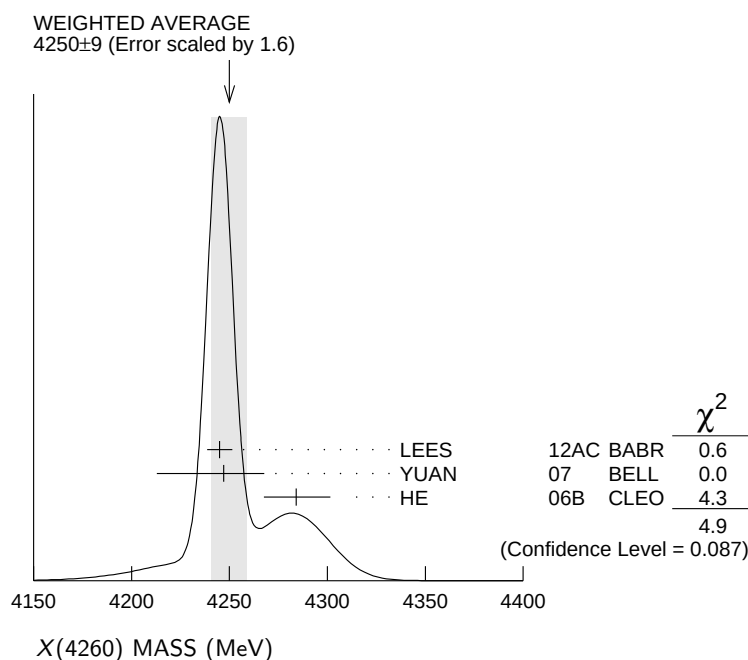
4245 $\pm$ 5 $\pm$ 4		¹ LEES	12AC BABR	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^- J/\psi$
4247 $\pm$ 12 $\pm$ 17 -32		² YUAN	07 BELL	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^- J/\psi$
4284 $\pm$ 17 $\pm$ 4	13.6	HE	06B CLEO	9.4–10.6 $e^+e^- \rightarrow \gamma\pi^+\pi^- J/\psi$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
4259 $\pm$ 8 $\pm$ 2 -6	125	³ 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 From a two-resonance fit.

³ From a single-resonance fit. Two interfering resonances are not excluded. Superseded by LEES 12AC.

NODE=M074M;LINKAGE=LE
 NODE=M074M;LINKAGE=YU
 NODE=M074M;LINKAGE=AU

**X(4260) WIDTH**

NODE=M074W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
108$\pm$12 OUR AVERAGE				
[95 $\pm$ 14 MeV OUR 2012 AVERAGE]				

NODE=M074W

NEW

114 $\pm$ 16 $\pm$ 7 -15		⁴ LEES	12AC BABR	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^- J/\psi$
108 $\pm$ 19 $\pm$ 10		⁵ YUAN	07 BELL	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^- J/\psi$
73 $\pm$ 39 $\pm$ 5 -25	13.6	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. • • •				
88 $\pm$ 23 $\pm$ 6 -4	125	⁶ AUBERT,B	05I BABR	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^- J/\psi$

⁴ From a single-resonance fit. Supersedes AUBERT,B 05I.

⁵ From a two-resonance fit.

⁶ From a single-resonance fit. Two interfering resonances are not excluded. Superseded by LEES 12AC.

NODE=M074W;LINKAGE=LE
 NODE=M074W;LINKAGE=YU
 NODE=M074W;LINKAGE=AU

X(4260) DECAY MODES

NODE=M074215;NODE=M074

Mode	Fraction (Γ_i/Γ)
Γ_1 $e^+ e^-$	
Γ_2 $J/\psi \pi^+ \pi^-$	seen
Γ_3 $J/\psi f_0(980), f_0(980) \rightarrow \pi^+ \pi^-$	seen
Γ_4 $J/\psi \pi^0 \pi^0$	seen
Γ_5 $J/\psi K^+ K^-$	seen
Γ_6 $J/\psi \eta$	not seen
Γ_7 $J/\psi \pi^0$	not seen
Γ_8 $J/\psi \eta'$	not seen
Γ_9 $J/\psi \pi^+ \pi^- \pi^0$	not seen
Γ_{10} $J/\psi \eta \eta$	not seen
Γ_{11} $\psi(2S) \pi^+ \pi^-$	not seen
Γ_{12} $\psi(2S) \eta$	not seen
Γ_{13} $\chi_{c0} \omega$	not seen
Γ_{14} $\chi_{c1} \gamma$	not seen
Γ_{15} $\chi_{c2} \gamma$	not seen
Γ_{16} $\chi_{c1} \pi^+ \pi^- \pi^0$	not seen
Γ_{17} $\chi_{c2} \pi^+ \pi^- \pi^0$	not seen
Γ_{18} $h_c(1P) \pi^+ \pi^-$	not seen
Γ_{19} $\phi \pi^+ \pi^-$	not seen
Γ_{20} $\phi f_0(980) \rightarrow \phi \pi^+ \pi^-$	not seen
Γ_{21} $D \bar{D}$	not seen
Γ_{22} $D^0 \bar{D}^0$	not seen
Γ_{23} $D^+ D^-$	not seen
Γ_{24} $D^* \bar{D} + \text{c.c.}$	not seen
Γ_{25} $D^*(2007)^0 \bar{D}^0 + \text{c.c.}$	not seen
Γ_{26} $D^*(2010)^+ D^- + \text{c.c.}$	not seen
Γ_{27} $D^* \bar{D}^*$	not seen
Γ_{28} $D^*(2007)^0 \bar{D}^*(2007)^0$	not seen
Γ_{29} $D^*(2010)^+ D^*(2010)^-$	not seen
Γ_{30} $D \bar{D} \pi + \text{c.c.}$	
Γ_{31} $D^0 D^- \pi^+ + \text{c.c. (excl. } D^*(2007)^0 \bar{D}^{*0} + \text{c.c., } D^*(2010)^+ D^- + \text{c.c.)}$	not seen
Γ_{32} $D \bar{D}^* \pi + \text{c.c. (excl. } D^* \bar{D}^*)$	not seen
Γ_{33} $D^0 D^{*-} \pi^+ + \text{c.c. (excl. } D^*(2010)^+ D^*(2010)^-)$	not seen
Γ_{34} $D^0 D^*(2010)^- \pi^+ + \text{c.c.}$	not seen
Γ_{35} $D^* \bar{D}^* \pi$	not seen
Γ_{36} $D_s^+ D_s^-$	not seen
Γ_{37} $D_s^{*+} D_s^{*-} + \text{c.c.}$	not seen
Γ_{38} $D_s^* D_s^{*-}$	not seen
Γ_{39} $p \bar{p}$	not seen
Γ_{40} $K_S^0 K^\pm \pi^\mp$	not seen
Γ_{41} $K^+ K^- \pi^0$	not seen

DESIG=1

DESIG=2;OUR EVAL; $\rightarrow$ UNCHECKED $\leftarrow$
DESIG=41;OUR EVAL; $\rightarrow$ UNCHECKED $\leftarrow$
DESIG=4;OUR EVAL; $\rightarrow$ UNCHECKED $\leftarrow$
DESIG=5;OUR EVAL; $\rightarrow$ UNCHECKED $\leftarrow$
DESIG=6;OUR EVAL; $\rightarrow$ UNCHECKED $\leftarrow$
DESIG=7;OUR EVAL; $\rightarrow$ UNCHECKED $\leftarrow$
DESIG=8;OUR EVAL; $\rightarrow$ UNCHECKED $\leftarrow$
DESIG=9;OUR EVAL; $\rightarrow$ UNCHECKED $\leftarrow$
DESIG=10;OUR EVAL; $\rightarrow$ UNCHECKED $\leftarrow$
DESIG=11;OUR EVAL; $\rightarrow$ UNCHECKED $\leftarrow$
DESIG=12;OUR EVAL; $\rightarrow$ UNCHECKED $\leftarrow$
DESIG=13;OUR EVAL; $\rightarrow$ UNCHECKED $\leftarrow$
DESIG=14;OUR EVAL; $\rightarrow$ UNCHECKED $\leftarrow$
DESIG=15;OUR EVAL; $\rightarrow$ UNCHECKED $\leftarrow$
DESIG=16;OUR EVAL; $\rightarrow$ UNCHECKED $\leftarrow$
DESIG=17;OUR EVAL; $\rightarrow$ UNCHECKED $\leftarrow$
DESIG=40;OUR EVAL; $\rightarrow$ UNCHECKED $\leftarrow$
DESIG=18;OUR EVAL; $\rightarrow$ UNCHECKED $\leftarrow$
DESIG=22;OUR EVAL; $\rightarrow$ UNCHECKED $\leftarrow$
DESIG=19;OUR EVAL; $\rightarrow$ UNCHECKED $\leftarrow$
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DESIG=34
DESIG=24;OUR EVAL; $\rightarrow$ UNCHECKED $\leftarrow$
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DESIG=37
DESIG=38

DESIG=25

DESIG=39

DESIG=30;OUR EVAL; $\rightarrow$ UNCHECKED $\leftarrow$
DESIG=26
DESIG=27
DESIG=28
DESIG=29

DESIG=3;OUR EVAL; $\rightarrow$ UNCHECKED $\leftarrow$
DESIG=20;OUR EVAL; $\rightarrow$ UNCHECKED $\leftarrow$
DESIG=21;OUR EVAL; $\rightarrow$ UNCHECKED $\leftarrow$

X(4260) $\Gamma(i)\Gamma(e^+ e^-)/\Gamma(\text{total})$

NODE=M074230

$\Gamma(J/\psi \pi^+ \pi^-) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}}$	$\Gamma_2 \Gamma_1 / \Gamma$
VALUE (eV)	EVTS

9.0 $^{+1.0}_{-0.8}$ OUR AVERAGE[5.9 $^{+1.2}_{-0.9}$ eV OUR 2012 AVERAGE]

9.2 $\pm 0.8 \pm 0.7$	7	LEES	12AC	BABR	10.58	$e^+ e^- \rightarrow \gamma \pi^+ \pi^- J/\psi$
6.0 $\pm 1.2^{+4.7}_{-0.5}$	8	YUAN	07	BELL	10.58	$e^+ e^- \rightarrow \gamma \pi^+ \pi^- J/\psi$
8.9 $^{+3.9}_{-3.1} \pm 1.8$	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. ● ● ●						
20.6 $\pm 2.3^{+9.1}_{-1.7}$	9	YUAN	07	BELL	10.58	$e^+ e^- \rightarrow \gamma \pi^+ \pi^- J/\psi$
5.5 $\pm 1.0^{+0.8}_{-0.7}$	125	10 AUBERT,B	05I	BABR	10.58	$e^+ e^- \rightarrow \gamma \pi^+ \pi^- J/\psi$

NEW

OCCUR=2

⁷ From a single-resonance fit. Supersedes AUBERT,B 05I.

⁸ Solution I of two equivalent solutions in a fit using two interfering resonances.

⁹ Solution II of two equivalent solutions in a fit using two interfering resonances.

¹⁰ From a single-resonance fit. Two interfering resonances are not excluded. Superseded by LEES 12AC.

$$\Gamma(J/\psi K^+ K^-) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_5 \Gamma_1 / \Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

<1.2	90	¹¹ YUAN	08	BELL $e^+ e^- \rightarrow \gamma K^+ K^- J/\psi$

¹¹ From a fit of the broad $K^+ K^- J/\psi$ enhancement including a coherent $X(4260)$ amplitude with mass and width from YUAN 07.

$$\Gamma(\psi(2S) \pi^+ \pi^-) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{11} \Gamma_1 / \Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

<4.3	90	¹² LIU	08H	RVUE $10.58 e^+ e^- \rightarrow \psi(2S) \pi^+ \pi^- \gamma$
$7.4^{+2.1}_{-1.7}$		¹³ LIU	08H	RVUE $10.58 e^+ e^- \rightarrow \psi(2S) \pi^+ \pi^- \gamma$

¹² For constructive interference with the $X(4360)$ in a combined fit of AUBERT 07S and WANG 07D data with three resonances.

¹³ For destructive interference with the $X(4360)$ in a combined fit of AUBERT 07S and WANG 07D data with three resonances.

$$\Gamma(\phi \pi^+ \pi^-) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{19} \Gamma_1 / \Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT

<0.4	90	AUBERT,BE	06D	BABR $10.6 e^+ e^- \rightarrow K^+ K^- \pi^+ \pi^- \gamma$

$$\Gamma(\phi f_0(980) \rightarrow \phi \pi^+ \pi^-) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{20} \Gamma_1 / \Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT

<0.29	90	¹⁴ AUBERT	07AK	BABR $10.6 e^+ e^- \rightarrow \pi^+ \pi^- K^+ K^- \gamma$

¹⁴ AUBERT 07AK reports $[\Gamma(X(4260) \rightarrow \phi f_0(980) \rightarrow \phi \pi^+ \pi^-) \times \Gamma(X(4260) \rightarrow e^+ e^-) / \Gamma_{\text{total}}] \times [B(\phi(1020) \rightarrow K^+ K^-)] < 0.14$ eV which we divide by our best value $B(\phi(1020) \rightarrow K^+ K^-) = 48.9 \times 10^{-2}$.

$$\Gamma(K_S^0 K^\pm \pi^\mp) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{40} \Gamma_1 / \Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.5	90	AUBERT	08S	BABR $10.6 e^+ e^- \rightarrow K_S^0 K^\pm \pi^\mp \gamma$

$$\Gamma(K^+ K^- \pi^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{41} \Gamma_1 / \Gamma$$

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 $10.6 e^+ e^- \rightarrow K^+ K^- \pi^0 \gamma$

X(4260) BRANCHING RATIOS

$$\Gamma(J/\psi f_0(980), f_0(980) \rightarrow \pi^+ \pi^-) / \Gamma(J/\psi \pi^+ \pi^-) \quad \Gamma_3 / \Gamma_2$$

VALUE	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.17 ± 0.13	¹⁵ LEES	12AC	BABR $10.58 e^+ e^- \rightarrow \gamma \pi^+ \pi^- J/\psi$

¹⁵ Systematic uncertainties not estimated.

$$\Gamma(h_c(1P) \pi^+ \pi^-) / \Gamma(J/\psi \pi^+ \pi^-) \quad \Gamma_{18} / \Gamma_2$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<1.0	90	¹⁶ PEDLAR	11	CLEO $e^+ e^- \rightarrow h_c(1P) \pi^+ \pi^-$

¹⁶ 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.

$$\Gamma(D\bar{D}) / \Gamma(J/\psi \pi^+ \pi^-) \quad \Gamma_{21} / \Gamma_2$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<1.0	90	¹⁷ 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	$e^+ e^-$

¹⁷ Using 4259 ± 10 MeV for the mass and 88 ± 24 MeV for the width of $X(4260)$.

NODE=M074G1;LINKAGE=LE

NODE=M074G1;LINKAGE=YU

NODE=M074G1;LINKAGE=YA

NODE=M074G1;LINKAGE=AU

NODE=M074G3

NODE=M074G3

NODE=M074G3;LINKAGE=YU

NODE=M074G7

NODE=M074G7

OCCUR=2

NODE=M074G7;LINKAGE=LI

NODE=M074G7;LINKAGE=LU

NODE=M074G2

NODE=M074G2

NODE=M074G6

NODE=M074G6

NODE=M074G6;LINKAGE=AU

NODE=M074G4

NODE=M074G4

NODE=M074G5

NODE=M074G5

NODE=M074240

NODE=M074R02

NODE=M074R02

NODE=M074R02;LINKAGE=LE

NODE=M074R25

NODE=M074R25

NODE=M074R25;LINKAGE=PE

NODE=M074R2

NODE=M074R2

NODE=M074R2;LINKAGE=AU

$\Gamma(D^0 \bar{D}^0)/\Gamma_{\text{total}}$ Γ_{22}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	CRONIN-HEN..09	CLEO	$e^+ e^- \rightarrow D^0 \bar{D}^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
not seen	AUBERT	09M BABR	$e^+ e^- \rightarrow D^0 \bar{D}^0 \gamma$
not seen	PAKHLOVA	08 BELL	$e^+ e^- \rightarrow D^0 \bar{D}^0 \gamma$

NODE=M074R12
 NODE=M074R12

 $\Gamma(D^+ D^-)/\Gamma_{\text{total}}$ Γ_{23}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	CRONIN-HEN..09	CLEO	$e^+ e^- \rightarrow D^+ D^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
not seen	AUBERT	09M BABR	$e^+ e^- \rightarrow D^+ D^- \gamma$
not seen	PAKHLOVA	08 BELL	$e^+ e^- \rightarrow D^+ D^- \gamma$

NODE=M074R13
 NODE=M074R13

 $\Gamma(D^* \bar{D} + \text{c.c.})/\Gamma(J/\psi \pi^+ \pi^-)$ Γ_{24}/Γ_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

 $\Gamma(D^*(2007)^0 \bar{D}^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{25}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	CRONIN-HEN..09	CLEO	$e^+ e^- \rightarrow D^{*0} \bar{D}^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
not seen	AUBERT	09M BABR	$e^+ e^- \rightarrow D^{*0} \bar{D}^0 \gamma$

NODE=M074R14
 NODE=M074R14

 $\Gamma(D^*(2010)^+ D^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{26}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	CRONIN-HEN..09	CLEO	$e^+ e^- \rightarrow D^{*+} D^-$
not seen	PAKHLOVA	07 BELL	$e^+ e^- \rightarrow D^{*+} D^- \gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
not seen	AUBERT	09M BABR	$e^+ e^- \rightarrow D^{*+} D^- \gamma$

NODE=M074R15
 NODE=M074R15

 $\Gamma(D^* \bar{D}^*)/\Gamma(J/\psi \pi^+ \pi^-)$ Γ_{27}/Γ_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

 $\Gamma(D^*(2007)^0 \bar{D}^*(2007)^0)/\Gamma_{\text{total}}$ Γ_{28}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	CRONIN-HEN..09	CLEO	$e^+ e^- \rightarrow D^{*0} \bar{D}^{*0}$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
not seen	AUBERT	09M BABR	$e^+ e^- \rightarrow D^{*0} \bar{D}^{*0} \gamma$

NODE=M074R17
 NODE=M074R17

 $\Gamma(D^*(2010)^+ D^*(2010)^-)/\Gamma_{\text{total}}$ Γ_{29}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	CRONIN-HEN..09	CLEO	$e^+ e^- \rightarrow D^{*+} D^{*-}$
not seen	PAKHLOVA	07 BELL	$e^+ e^- \rightarrow D^{*+} D^{*-} \gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
not seen	AUBERT	09M BABR	$e^+ e^- \rightarrow D^{*+} D^{*-} \gamma$

NODE=M074R18
 NODE=M074R18

 $\Gamma(D^0 D^- \pi^+ + \text{c.c. (excl. } D^*(2007)^0 \bar{D}^{*0} + \text{c.c., } D^*(2010)^+ D^- + \text{c.c.}))/\Gamma_{\text{total}}$ Γ_{31}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	PAKHLOVA	08A BELL	$10.6 e^+ e^- \rightarrow D^0 D^- \pi^+ \gamma$

NODE=M074R16
 NODE=M074R16

 $\Gamma(D \bar{D}^* \pi + \text{c.c. (excl. } D^* \bar{D}^*))/\Gamma_{\text{total}}$ Γ_{32}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	CRONIN-HEN..09	CLEO	$e^+ e^- \rightarrow D^* \bar{D} \pi$

NODE=M074R22
 NODE=M074R22

 $\Gamma(D \bar{D}^* \pi + \text{c.c. (excl. } D^* \bar{D}^*))/\Gamma(J/\psi \pi^+ \pi^-)$ Γ_{32}/Γ_2

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<15	90	CRONIN-HEN..09	CLEO	$e^+ e^-$

NODE=M074R05
 NODE=M074R05

$$\Gamma(D^0 D^{*-} \pi^+ + \text{c.c. (excl. } D^*(2010)^+ D^*(2010)^-))/\Gamma_{\text{total}} \quad \Gamma_{33}/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	PAKHLOVA 09	BELL	$e^+ e^- \rightarrow D^0 D^{*-} \pi^+ \gamma$

NODE=M074R23
NODE=M074R23

$$\Gamma(D^0 D^*(2010)^- \pi^+ + \text{c.c.})/\Gamma(J/\psi \pi^+ \pi^-) \quad \Gamma_{34}/\Gamma_2$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<9	90	PAKHLOVA 09	BELL	$e^+ e^- \rightarrow D^0 D^{*-} \pi^+$

NODE=M074R10
NODE=M074R10

$$\Gamma(D^0 D^*(2010)^- \pi^+ + \text{c.c.})/\Gamma_{\text{total}} \times \Gamma(e^+ e^-)/\Gamma_{\text{total}} \quad \Gamma_{34}/\Gamma \times \Gamma_1/\Gamma$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.42 × 10 ⁻⁶	90	¹⁸ PAKHLOVA 09	BELL	$e^+ e^- \rightarrow D^0 D^{*-} \pi^+$

NODE=M074R11
NODE=M074R11

¹⁸ Using 4263⁺⁸₋₉ MeV for the mass of X(4260).

NODE=M074R11;LINKAGE=PA

$$\Gamma(D^* \bar{D}^* \pi)/\Gamma_{\text{total}} \quad \Gamma_{35}/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	CRONIN-HEN..09	CLEO	$e^+ e^- \rightarrow D^* \bar{D}^* \pi$

NODE=M074R24
NODE=M074R24

$$\Gamma(D^* \bar{D}^* \pi)/\Gamma(J/\psi \pi^+ \pi^-) \quad \Gamma_{35}/\Gamma_2$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<8.2	90	CRONIN-HEN..09	CLEO	$e^+ e^-$

NODE=M074R06
NODE=M074R06

$$\Gamma(D_s^+ D_s^-)/\Gamma_{\text{total}} \quad \Gamma_{36}/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	DEL-AMO-SA..10N	BABR	$e^+ e^- \rightarrow D_s^+ D_s^- \gamma$

NODE=M074R19
NODE=M074R19

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	$e^+ e^- \rightarrow D_s^+ D_s^- \gamma$

$$\Gamma(D_s^+ D_s^-)/\Gamma(J/\psi \pi^+ \pi^-) \quad \Gamma_{36}/\Gamma_2$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.7	95	DEL-AMO-SA..10N	BABR	10.6 $e^+ e^-$

NODE=M074R07
NODE=M074R07

• • • We do not use the following data for averages, fits, limits, etc. • • •

<1.3	90	CRONIN-HEN..09	CLEO	$e^+ e^-$

$$\Gamma(D_s^{*+} D_s^- + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_{37}/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	DEL-AMO-SA..10N	BABR	$e^+ e^- \rightarrow D_s^{*+} D_s^- \gamma$

NODE=M074R20
NODE=M074R20

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	$e^+ e^- \rightarrow D_s^{*+} D_s^- \gamma$

$$\Gamma(D_s^{*+} D_s^- + \text{c.c.})/\Gamma(J/\psi \pi^+ \pi^-) \quad \Gamma_{37}/\Gamma_2$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
< 0.8	90	CRONIN-HEN..09	CLEO	$e^+ e^-$

NODE=M074R08
NODE=M074R08

• • • We do not use the following data for averages, fits, limits, etc. • • •

<44	95	DEL-AMO-SA..10N	BABR	10.6 $e^+ e^-$

$$\Gamma(D_s^{*+} D_s^{*-})/\Gamma_{\text{total}} \quad \Gamma_{38}/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	CRONIN-HEN..09	CLEO	$e^+ e^- \rightarrow D_s^{*+} D_s^{*-}$

NODE=M074R21
NODE=M074R21

• • • 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	$e^+ e^- \rightarrow D_s^{*+} D_s^{*-} \gamma$

$$\Gamma(D_s^{*+} D_s^{*-})/\Gamma(J/\psi \pi^+ \pi^-) \quad \Gamma_{38}/\Gamma_2$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
< 9.5	90	CRONIN-HEN..09	CLEO	$e^+ e^-$

NODE=M074R09
NODE=M074R09

• • • We do not use the following data for averages, fits, limits, etc. • • •

<30	95	DEL-AMO-SA..10N	BABR	10.6 $e^+ e^-$

$\Gamma(p\bar{p})/\Gamma(J/\psi\pi^+\pi^-)$ Γ_{39}/Γ_2

VALUE	CL%	DOCUMENT ID	COMMENT
<0.13	90	¹⁹ AUBERT	06B $e^+e^- \rightarrow p\bar{p}\gamma$

¹⁹ Using 4259 ± 10 MeV for the mass and 88 ± 24 MeV for the width of $X(4260)$.

NODE=M074R1
NODE=M074R1

NODE=M074R1;LINKAGE=AU

X(4260) REFERENCES

LEES	12AC	PR D86 051102	J.P. Lees <i>et al.</i>	(BABAR Collab.)
PAKHLOVA	11	PR D83 011101	G. Pakhlova <i>et al.</i>	(BELLE Collab.)
PEDLAR	11	PRL 107 041803	T. Pedlar <i>et al.</i>	(CLEO Collab.)
DEL-AMO-SA...	10N	PR D82 052004	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)
AUBERT	09M	PR D79 092001	B. Aubert <i>et al.</i>	(BABAR Collab.)
CRONIN-HEN...	09	PR D80 072001	D. Cronin-Hennessy <i>et al.</i>	(CLEO Collab.)
PAKHLOVA	09	PR D80 091101	G. Pakhlova <i>et al.</i>	(BELLE Collab.)
AUBERT	08S	PR D77 092002	B. Aubert <i>et al.</i>	(BABAR Collab.)
LIU	08H	PR D78 014032	Z.Q. Liu, X.S. Qin, C.Z. Yuan	
PAKHLOVA	08	PR D77 011103	G. Pakhlova <i>et al.</i>	(BELLE Collab.)
PAKHLOVA	08A	PRL 100 062001	G. Pakhlova <i>et al.</i>	(BELLE Collab.)
YUAN	08	PR D77 011105	C.Z. Yuan <i>et al.</i>	(BELLE Collab.)
AUBERT	07AK	PR D76 012008	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT	07BE	PR D76 111105	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT	07S	PRL 98 212001	B. Aubert <i>et al.</i>	(BABAR Collab.)
PAKHLOVA	07	PRL 98 092001	G. Pakhlova <i>et al.</i>	(BELLE Collab.)
WANG	07D	PRL 99 142002	X.L. Wang <i>et al.</i>	(BELLE Collab.)
YUAN	07	PRL 99 182004	C.Z. Yuan <i>et al.</i>	(BELLE Collab.)
AUBERT	06	PR D73 011101	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT	06B	PR D73 012005	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT,BE	06D	PR D74 091103	B. Aubert <i>et al.</i>	(BABAR Collab.)
COAN	06	PRL 96 162003	T.E. Coan <i>et al.</i>	(CLEO Collab.)
HE	06B	PR D74 091104	Q. He <i>et al.</i>	(CLEO Collab.)
AUBERT,B	05I	PRL 95 142001	B. Aubert <i>et al.</i>	(BABAR Collab.)

NODE=M074

REFID=54750
REFID=53638
REFID=16787
REFID=53532
REFID=52724
REFID=53114
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REFID=52242
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REFID=51075
REFID=51523
REFID=50776

X(4350)

$$I^G(J^{PC}) = 0^+(?^{?+})$$

OMITTED FROM SUMMARY TABLE

Seen by SHEN 10 in the $\gamma\gamma \rightarrow J/\psi\phi$. Needs confirmation.

NODE=M194

NODE=M194

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 .

NODE=M194M

NODE=M194M

NODE=M194M;LINKAGE=SH

X(4350) WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$13^{+18}_{-9} \pm 4$	$8.8^{+4.2}_{-3.2}$	² SHEN	10	BELL 10.6 $e^+e^- \rightarrow e^+e^- J/\psi\phi$

² Statistical significance of 3.2 σ .

NODE=M194W

NODE=M194W

NODE=M194W;LINKAGE=SH

X(4350) DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $J/\psi\phi$	seen
Γ_2 $\gamma\gamma$	seen

DESIG=1

DESIG=2

X(4350) $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$ $\Gamma(\gamma\gamma) \times \Gamma(J/\psi\phi)/\Gamma_{\text{total}}$ $\Gamma_2\Gamma_1/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
$6.7^{+3.2}_{-2.4} \pm 1.1$	$8.8^{+4.2}_{-3.2}$	³ 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. • • •

$1.5^{+0.7}_{-0.6} \pm 0.3$	$8.8^{+4.2}_{-3.2}$	⁴ SHEN	10	BELL 10.6 $e^+e^- \rightarrow e^+e^- J/\psi\phi$

³ For $J^P = 0^+$. Statistical significance of 3.2 σ .

⁴ For $J^P = 2^+$. Statistical significance of 3.2 σ .

NODE=M194220

NODE=M194G01
NODE=M194G01

OCCUR=2

NODE=M194G01;LINKAGE=S0
NODE=M194G01;LINKAGE=S2

X(4350) BRANCHING RATIOS

$\Gamma(J/\psi\phi)/\Gamma_{\text{total}}$					Γ_1/Γ
VALUE	DOCUMENT ID	TECN	COMMENT		
seen	⁵ SHEN	10	BELL	10.6 $e^+e^- \rightarrow e^+e^- J/\psi\phi$	
⁵ Statistical significance of 3.2 σ .					

$\Gamma(\gamma\gamma)/\Gamma_{\text{total}}$					Γ_2/Γ
VALUE	DOCUMENT ID	TECN	COMMENT		
seen	⁶ SHEN	10	BELL	10.6 $e^+e^- \rightarrow e^+e^- J/\psi\phi$	
⁶ Statistical significance of 3.2 σ .					

X(4350) REFERENCES

SHEN	10	PRL 104 112004	C.P. Shen <i>et al.</i>	(BELLE Collab.)

X(4360)

$$J^G(J^{PC}) = ?^?(1^{--})$$

Seen in radiative return from e^+e^- collisions at $\sqrt{s} = 9.54\text{--}10.58$ GeV by AUBERT 07S and WANG 07D. See also the review under the X(3872) particle listings. (See the index for the page number.)

X(4360) MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
4361$\pm$ 9$\pm$9	¹ WANG	07D	BELL 10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
4355 $^{+9}_{-10}\pm$ 9	² LIU	08H	RVUE 10.58 $e^+e^- \rightarrow \psi(2S)\pi^+\pi^-\gamma$
4324 $\pm$ 24	³ AUBERT	07S	BABR 10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$
¹ From a two-resonance fit.			
² From a combined fit of AUBERT 07S and WANG 07D data with two resonances.			
³ From a single-resonance fit. Systematic errors not estimated.			

X(4360) WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
74$\pm$15$\pm$10	⁴ WANG	07D	BELL 10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
103 $^{+17}_{-15}\pm$ 11	⁵ LIU	08H	RVUE 10.58 $e^+e^- \rightarrow \psi(2S)\pi^+\pi^-\gamma$
172 $\pm$ 33	⁶ AUBERT	07S	BABR 10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$
⁴ From a two-resonance fit.			
⁵ From a combined fit of AUBERT 07S and WANG 07D data with two resonances.			
⁶ From a single-resonance fit. Systematic errors not estimated.			

X(4360) DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 e^+e^-	
Γ_2 $\psi(2S)\pi^+\pi^-$	seen
Γ_3 $D^0 D^{*-}\pi^+$	

X(4360) $\Gamma(i)\Gamma(e^+e^-)/\Gamma(\text{total})$

$\Gamma(\psi(2S)\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$					$\Gamma_2\Gamma_1/\Gamma$
VALUE (eV)	DOCUMENT ID	TECN	COMMENT		
• • • We do not use the following data for averages, fits, limits, etc. • • •					
11.1 $^{+1.3}_{-1.2}$	⁷ LIU	08H	RVUE 10.58 $e^+e^- \rightarrow \psi(2S)\pi^+\pi^-\gamma$		
12.3 $\pm$ 1.2	⁸ LIU	08H	RVUE 10.58 $e^+e^- \rightarrow \psi(2S)\pi^+\pi^-\gamma$		
10.4 $\pm$ 1.7 $\pm$ 1.5	⁹ WANG	07D	BELL 10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$		
11.8 $\pm$ 1.8 $\pm$ 1.4	¹⁰ WANG	07D	BELL 10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$		

NODE=M194225

NODE=M194R01
NODE=M194R01

NODE=M194R01;LINKAGE=SH

NODE=M194R02
NODE=M194R02

NODE=M194R02;LINKAGE=SH

NODE=M194

REFID=53235

NODE=M181

NODE=M181

NODE=M181M

NODE=M181M

NODE=M181M;LINKAGE=WA
NODE=M181M;LINKAGE=LI
NODE=M181M;LINKAGE=AU

NODE=M181W

NODE=M181W

NODE=M181W;LINKAGE=WA
NODE=M181W;LINKAGE=LI
NODE=M181W;LINKAGE=AU

NODE=M181215;NODE=M181

DESIG=1

DESIG=2;OUR EVAL; $\rightarrow$ UNCHECKED $\leftarrow$

DESIG=3

NODE=M181230

NODE=M181G1
NODE=M181G1

OCCUR=2

OCCUR=2

⁷ Solution I in a combined fit of AUBERT 07S and WANG 07D data with two resonances.

⁸ Solution II in a combined fit of AUBERT 07S and WANG 07D data with two resonances.

⁹ Solution I of two equivalent solutions in a fit using two interfering resonances.

¹⁰ Solution II of two equivalent solutions in a fit using two interfering resonances.

NODE=M181G1;LINKAGE=LI
 NODE=M181G1;LINKAGE=LU
 NODE=M181G1;LINKAGE=WA
 NODE=M181G1;LINKAGE=WN

X(4360) BRANCHING RATIOS

$\Gamma(D^0 D^{*-} \pi^+)/\Gamma(\psi(2S) \pi^+ \pi^-)$ Γ_3/Γ_2

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<8	90	PAKHLOVA	09	BELL $e^+ e^- \rightarrow X(4360) \rightarrow D^0 D^{*-} \pi^+$

NODE=M181225

NODE=M181R01
 NODE=M181R01

$\Gamma(D^0 D^{*-} \pi^+)/\Gamma_{\text{total}} \times \Gamma(e^+ e^-)/\Gamma_{\text{total}}$ $\Gamma_3/\Gamma \times \Gamma_1/\Gamma$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.72 × 10 ⁻⁶	90	¹¹ PAKHLOVA	09	BELL $e^+ e^- \rightarrow X(4360) \rightarrow D^0 D^{*-} \pi^+$

NODE=M181R02
 NODE=M181R02

¹¹ Using $4355^{+9}_{-10} \pm 9$ MeV for the mass of X(4360).

NODE=M181R02;LINKAGE=PA

X(4360) REFERENCES

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	
AUBERT	07S	PRL 98 212001	B. Aubert <i>et al.</i>	(BABAR Collab.)
WANG	07D	PRL 99 142002	X.L. Wang <i>et al.</i>	(BELLE Collab.)

NODE=M181

REFID=53143
 REFID=52296
 REFID=51724
 REFID=51959

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 $e^+ e^- \rightarrow$ hadrons
• • • We do not use the following data for averages, fits, limits, etc. • • •			
4412 ± 15	² MO	10	RVUE $e^+ e^- \rightarrow$ hadrons
4411 ± 7	³ PAKHLOVA	08A	BELL $10.6 e^+ e^- \rightarrow D^0 D^- \pi^+ \gamma$
4425 ± 6	⁴ SETH	05A	RVUE $e^+ e^- \rightarrow$ hadrons
4429 ± 9	⁵ SETH	05A	RVUE $e^+ e^- \rightarrow$ hadrons
4417 ± 10	BRANDELIK	78C	DASP $e^+ e^-$
4414 ± 7	SIEGRIST	76	MRK1 $e^+ e^-$

NODE=M073M

NODE=M073M
 → UNCHECKED ←

OCCUR=2

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;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 $e^+ e^- \rightarrow$ hadrons
• • • We do not use the following data for averages, fits, limits, etc. • • •			
118 ± 32	⁷ MO	10	RVUE $e^+ e^- \rightarrow$ hadrons
77 ± 20	⁸ PAKHLOVA	08A	BELL $10.6 e^+ e^- \rightarrow D^0 D^- \pi^+ \gamma$
119 ± 16	⁹ SETH	05A	RVUE $e^+ e^- \rightarrow$ hadrons
118 ± 35	¹⁰ SETH	05A	RVUE $e^+ e^- \rightarrow$ hadrons
66 ± 15	BRANDELIK	78C	DASP $e^+ e^-$
33 ± 10	SIEGRIST	76	MRK1 $e^+ e^-$

NODE=M073W

NODE=M073W
 → UNCHECKED ←

OCCUR=2

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;LINKAGE=AB

NODE=M073W;LINKAGE=MO

NODE=M073W;LINKAGE=NS

NODE=M073W;LINKAGE=ST

NODE=M073W;LINKAGE=SE

NODE=M073215;NODE=M073

NODE=M073

$\psi(4415)$ 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.

Mode	Fraction (Γ_i/Γ)	Confidence level
$\Gamma_1 \quad D\bar{D}$	not seen	
$\Gamma_2 \quad D^0\bar{D}^0$	seen	
$\Gamma_3 \quad D^+D^-$	seen	
$\Gamma_4 \quad D^*\bar{D} + \text{c.c.}$	not seen	
$\Gamma_5 \quad D^*(2007)^0\bar{D}^0 + \text{c.c.}$	seen	
$\Gamma_6 \quad D^*(2010)^+D^- + \text{c.c.}$	seen	
$\Gamma_7 \quad D^*\bar{D}^*$	not seen	
$\Gamma_8 \quad D^*(2007)^0\bar{D}^*(2007)^0 + \text{c.c.}$	seen	
$\Gamma_9 \quad D^*(2010)^+D^*(2010)^- + \text{c.c.}$	seen	
$\Gamma_{10} \quad D^0D^-\pi^+ (\text{excl. } D^*(2007)^0\bar{D}^0 + \text{c.c.}, D^*(2010)^+D^- + \text{c.c.})$	$< 2.3 \quad \%$	90%
$\Gamma_{11} \quad D\bar{D}_2^*(2460) \rightarrow D^0D^-\pi^+ + \text{c.c.}$	$(10 \pm 4) \quad \%$	
$\Gamma_{12} \quad D^0D^{*-}\pi^+ + \text{c.c.}$	$< 11 \quad \%$	90%
$\Gamma_{13} \quad D_s^+D_s^-$	not seen	
$\Gamma_{14} \quad D_s^{*+}D_s^- + \text{c.c.}$	seen	
$\Gamma_{15} \quad D_s^{*+}D_s^{*-}$	not seen	
$\Gamma_{16} \quad e^+e^-$	$(9.4 \pm 3.2) \times 10^{-6}$	

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=16

DESIG=17

DESIG=18

DESIG=1

$\psi(4415)$ PARTIAL WIDTHS

$\Gamma(e^+e^-)$

Γ_{16}

VALUE (keV)

DOCUMENT ID

TECN

COMMENT

0.58 ± 0.07 OUR ESTIMATE

0.35 ± 0.12

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.4 to 0.8

0.72 ± 0.11

0.64 ± 0.23

0.49 ± 0.13

0.44 ± 0.14

¹¹ ABLIKIM

08D

BES2

$e^+e^- \rightarrow \text{hadrons}$

¹² MO

10

RVUE

$e^+e^- \rightarrow \text{hadrons}$

¹³ SETH

05A

RVUE

$e^+e^- \rightarrow \text{hadrons}$

¹⁴ SETH

05A

RVUE

$e^+e^- \rightarrow \text{hadrons}$

BRANDELIK

78C

DASP

e^+e^-

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=M073220

NODE=M073W1

NODE=M073W1

→ UNCHECKED ←

OCCUR=2

NODE=M073W1;LINKAGE=AB

NODE=M073W1;LINKAGE=MO

NODE=M073W1;LINKAGE=ST

NODE=M073W1;LINKAGE=SE

$\psi(4415)$ BRANCHING RATIOS

NODE=M073225

$\Gamma(D^0 \bar{D}^0)/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	PAKHLOVA	08	BELL $e^+ e^- \rightarrow D^0 \bar{D}^0 \gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
not seen	AUBERT	09M	BABR $e^+ e^- \rightarrow D^0 \bar{D}^0 \gamma$

NODE=M073R04
 NODE=M073R04

 $\Gamma(D^+ D^-)/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	PAKHLOVA	08	BELL $e^+ e^- \rightarrow D^+ D^- \gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
not seen	AUBERT	09M	BABR $e^+ e^- \rightarrow D^+ D^- \gamma$

NODE=M073R05
 NODE=M073R05

 $\Gamma(D \bar{D})/\Gamma(D^* \bar{D}^*)$ Γ_1/Γ_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

 $\Gamma(D^*(2007)^0 \bar{D}^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	AUBERT	09M	BABR $e^+ e^- \rightarrow D^{*0} \bar{D}^0 \gamma$

NODE=M073R06
 NODE=M073R06

 $\Gamma(D^*(2010)^+ D^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	AUBERT	09M	BABR $e^+ e^- \rightarrow D^{*+} D^- \gamma$
seen	PAKHLOVA	07	BELL $e^+ e^- \rightarrow D^{*+} D^- \gamma$

NODE=M073R07
 NODE=M073R07

 $\Gamma(D^* \bar{D} + \text{c.c.})/\Gamma(D^* \bar{D}^*)$ Γ_4/Γ_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

 $\Gamma(D^*(2007)^0 \bar{D}^*(2007)^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	AUBERT	09M	BABR $e^+ e^- \rightarrow D^{*0} \bar{D}^{*0} \gamma$

NODE=M073R08
 NODE=M073R08

 $\Gamma(D^*(2010)^+ D^*(2010)^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	AUBERT	09M	BABR $e^+ e^- \rightarrow D^{*+} D^{*-} \gamma$
seen	PAKHLOVA	07	BELL $e^+ e^- \rightarrow D^{*+} D^{*-} \gamma$

NODE=M073R09
 NODE=M073R09

 $\Gamma(D \bar{D}_2^*(2460) \rightarrow D^0 D^- \pi^+ + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{11}/Γ

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
10.5 ± 2.4 ± 3.8	¹⁵ PAKHLOVA	08A	BELL $10.6 e^+ e^- \rightarrow D^0 D^- \pi^+ \gamma$
¹⁵ Using 4421 ± 4 MeV for the mass and 62 ± 20 MeV for the width of $\psi(4415)$.			

NODE=M073R3
 NODE=M073R3

NODE=M073R3;LINKAGE=PA

 $\Gamma(D^0 D^- \pi^+ (\text{excl. } D^*(2007)^0 \bar{D}^0 + \text{c.c.}, D^*(2010)^+ D^- + \text{c.c.})/$ $\Gamma(D \bar{D}_2^*(2460) \rightarrow D^0 D^- \pi^+ + \text{c.c.})$ Γ_{10}/Γ_{11}

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.22	90	¹⁶ PAKHLOVA	08A	BELL $10.6 e^+ e^- \rightarrow D^0 D^- \pi^+ \gamma$
¹⁶ Using 4421 ± 4 MeV for the mass and 62 ± 20 MeV for the width of $\psi(4415)$.				

NODE=M073R4
 NODE=M073R4

NODE=M073R4;LINKAGE=PA

 $\Gamma(D^0 D^{*-} \pi^+ + \text{c.c.})/\Gamma_{\text{total}} \times \Gamma(e^+ e^-)/\Gamma_{\text{total}}$ $\Gamma_{12}/\Gamma \times \Gamma_{16}/\Gamma$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.99 × 10⁻⁶	90	¹⁷ PAKHLOVA	09	BELL $e^+ e^- \rightarrow D^0 D^{*-} \pi^+$
¹⁷ Using 4421 ± 4 MeV for the mass of $\psi(4415)$.				

NODE=M073R01
 NODE=M073R01

NODE=M073R01;LINKAGE=PA

 $\Gamma(D_s^+ D_s^-)/\Gamma_{\text{total}}$ Γ_{13}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	PAKHLOVA	11	BELL $e^+ e^- \rightarrow D_s^+ D_s^- \gamma$
not seen	DEL-AMO-SA...10N	BABR	$e^+ e^- \rightarrow D_s^+ D_s^- \gamma$

NODE=M073R10
 NODE=M073R10

 $\Gamma(D_s^{*+} D_s^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{14}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	PAKHLOVA	11	BELL $e^+ e^- \rightarrow D_s^{*+} D_s^- \gamma$
seen	DEL-AMO-SA...10N	BABR	$e^+ e^- \rightarrow D_s^{*+} D_s^- \gamma$

NODE=M073R11
 NODE=M073R11

$\Gamma(D_s^{*+} D_s^{*-})/\Gamma_{\text{total}}$

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 $e^+ e^- \rightarrow D_s^{*+} D_s^{*-} \gamma$ NODE=M073R12
NODE=M073R12 $\psi(4415)$ REFERENCES

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=53638
REFID=53532
REFID=53540
REFID=52724
REFID=53143
REFID=52142
REFID=52132
REFID=52134
REFID=51628
REFID=50813
REFID=50506
REFID=50503
REFID=51064
REFID=22232
REFID=22243 $X(4430)^\pm$ $I(J^P) = ?(??)$

OMITTED FROM SUMMARY TABLE

Seen by CHOI 08 in $B \rightarrow K \pi^+ \psi(2S)$ decays and confirmed by reanalysis of the same data sample in MIZUK 09. Not seen by AUBERT 09AA.

NODE=M195

NODE=M195

 $X(4430)^\pm$ MASS

VALUE (MeV)

DOCUMENT ID

TECN

COMMENT

 4443^{+15+19}_{-12-13} ¹ MIZUK 09 BELL $B \rightarrow K \pi^+ \psi(2S)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

 $4433 \pm 4 \pm 2$ ² CHOI 08 BELL $B \rightarrow K \pi^+ \psi(2S)$ ¹ From a Dalitz plot analysis.² Superseded by MIZUK 09.

NODE=M195M

NODE=M195M

NODE=M195M;LINKAGE=MI
NODE=M195M;LINKAGE=CH $X(4430)^\pm$ WIDTH

VALUE (MeV)

DOCUMENT ID

TECN

COMMENT

 107^{+86+74}_{-43-56} ³ MIZUK 09 BELL $B \rightarrow K \pi^+ \psi(2S)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

 45^{+18+30}_{-13-13} ⁴ CHOI 08 BELL $B \rightarrow K \pi^+ \psi(2S)$ ³ From a Dalitz plot analysis.⁴ Superseded by MIZUK 09.

NODE=M195W

NODE=M195W

NODE=M195W;LINKAGE=MI
NODE=M195W;LINKAGE=CH $X(4430)^\pm$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \pi^+ \psi(2S)$	seen
$\Gamma_2 \quad \pi^+ J/\psi$	not seen

NODE=M195215;NODE=M195

DESIG=1

DESIG=2

 $X(4430)^\pm$ BRANCHING RATIOS $\Gamma(\pi^+ \psi(2S))/\Gamma_{\text{total}}$

VALUE

DOCUMENT ID

TECN

COMMENT

 Γ_1/Γ

seen

⁵ MIZUK 09 BELL $B \rightarrow K \pi^+ \psi(2S)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

not seen

⁶ AUBERT 09AA BABR $B \rightarrow K \pi^+ \psi(2S)$

⁵ Measured a product of branching fractions $B(\bar{B}^0 \rightarrow K^- X(4430)^+) \times B(X(4430)^+ \rightarrow \pi^+ \psi(2S)) = (3.2^{+1.8+5.3}_{-0.9-1.6}) \times 10^{-5}$.

⁶ AUBERT 09AA quotes $B(B^+ \rightarrow \bar{K}^0 X(4430)^+) \times B(X(4430)^+ \rightarrow \pi^+ \psi(2S)) < 4.7 \times 10^{-5}$ and $B(\bar{B}^0 \rightarrow K^- X(4430)^+) \times B(X(4430)^+ \rightarrow \pi^+ \psi(2S)) < 3.1 \times 10^{-5}$ at 95% CL.

NODE=M195225

NODE=M195R01
NODE=M195R01

NODE=M195R01;LINKAGE=MI

NODE=M195R01;LINKAGE=AU

$\Gamma(\pi^+ J/\psi)/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	⁷ AUBERT	09AA BABR	$B \rightarrow K \pi^+ J/\psi$
⁷ AUBERT 09AA quotes $B(B^+ \rightarrow \bar{K}^0 X(4430)^+) \times B(X(4430)^+ \rightarrow \pi^+ J/\psi) < 1.5 \times 10^{-5}$ and $B(\bar{B}^0 \rightarrow K^- X(4430)^+) \times B(X(4430)^+ \rightarrow \pi^+ J/\psi) < 0.4 \times 10^{-5}$ at 95% CL.			

NODE=M195R02
 NODE=M195R02

NODE=M195R02;LINKAGE=AU

 $X(4430)^\pm$ REFERENCES

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=52940
 REFID=52960
 REFID=52178

NODE=M189

 $X(4660)$

$$J^G(J^{PC}) = ?^?(1^{--})$$

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 and AUBERT 07S. See also the review under the $X(3872)$ particle listings. (See the index for the page number.)

NODE=M189

 $X(4660)$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$4664 \pm 11 \pm 5$	WANG	07D BELL	$10.58 e^+ e^- \rightarrow \psi(2S) \pi^+ \pi^- \gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$4661^{+9}_{-8} \pm 6$	¹ LIU	08H RVUE	$10.58 e^+ e^- \rightarrow \psi(2S) \pi^+ \pi^- \gamma$
¹ From a combined fit of AUBERT 07S and WANG 07D data with two resonances.			

NODE=M189M

NODE=M189M

NODE=M189M;LINKAGE=LI

 $X(4660)$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$48 \pm 15 \pm 3$	WANG	07D BELL	$10.58 e^+ e^- \rightarrow \psi(2S) \pi^+ \pi^- \gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$42^{+17}_{-12} \pm 6$	² LIU	08H RVUE	$10.58 e^+ e^- \rightarrow \psi(2S) \pi^+ \pi^- \gamma$
² From a combined fit of AUBERT 07S and WANG 07D data with two resonances.			

NODE=M189W

NODE=M189W

NODE=M189W;LINKAGE=LI

 $X(4660)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $e^+ e^-$	seen
Γ_2 $\psi(2S) \pi^+ \pi^-$	
Γ_3 $D^0 D^{*-} \pi^+$	

DESIG=1

DESIG=2;OUR EVAL; $\rightarrow$ UNCHECKED $\leftarrow$
 DESIG=3

 $X(4660) \Gamma(i) \Gamma(e^+ e^-) / \Gamma(\text{total})$ $\Gamma(\psi(2S) \pi^+ \pi^-) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$ $\Gamma_2 \Gamma_1 / \Gamma$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$2.2^{+0.7}_{-0.6}$	³ LIU	08H RVUE	$10.58 e^+ e^- \rightarrow \psi(2S) \pi^+ \pi^- \gamma$
5.9 ± 1.6	⁴ LIU	08H RVUE	$10.58 e^+ e^- \rightarrow \psi(2S) \pi^+ \pi^- \gamma$
$3.0 \pm 0.9 \pm 0.3$	⁵ WANG	07D BELL	$10.58 e^+ e^- \rightarrow \psi(2S) \pi^+ \pi^- \gamma$
$7.6 \pm 1.8 \pm 0.8$	⁶ WANG	07D BELL	$10.58 e^+ e^- \rightarrow \psi(2S) \pi^+ \pi^- \gamma$

NODE=M189230

NODE=M189G1
 NODE=M189G1

OCCUR=2

OCCUR=2

NODE=M189G1;LINKAGE=LI
 NODE=M189G1;LINKAGE=LU
 NODE=M189G1;LINKAGE=WA
 NODE=M189G1;LINKAGE=WN

³ Solution I in a combined fit of AUBERT 07S and WANG 07D data with two resonances.⁴ Solution II in a combined fit of AUBERT 07S and WANG 07D data with two resonances.⁵ Solution I of two equivalent solutions in a fit using two interfering resonances.⁶ Solution II of two equivalent solutions in a fit using two interfering resonances.

X(4660) BRANCHING RATIOS

$$\Gamma(D^0 D^{*-} \pi^+)/\Gamma(\psi(2S) \pi^+ \pi^-)$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<10	90	PAKHLOVA	09 BELL	$e^+ e^- \rightarrow X(4660) \rightarrow D^0 D^{*-} \pi^+$

NODE=M189225

$$\Gamma(D^0 D^{*-} \pi^+)/\Gamma_{\text{total}} \times \Gamma(e^+ e^-)/\Gamma_{\text{total}}$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.37 × 10⁻⁶	90	⁷ PAKHLOVA	09 BELL	$e^+ e^- \rightarrow X(4660) \rightarrow D^0 D^{*-} \pi^+$

 NODE=M189R01
 NODE=M189R01

 NODE=M189R02
 NODE=M189R02

⁷ Using $4664 \pm 11 \pm 5$ MeV for the mass of X(4660).

NODE=M189R02;LINKAGE=PA

X(4660) REFERENCES

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	
AUBERT	07S	PRL 98 212001	B. Aubert <i>et al.</i>	(BABAR Collab.)
WANG	07D	PRL 99 142002	X.L. Wang <i>et al.</i>	(BELLE Collab.)

NODE=M189

 REFID=53143
 REFID=52296
 REFID=51724
 REFID=51959

$b\bar{b}$ MESONS

NODE=MXXX030

 A REVIEW GOES HERE – Check our WWW List of
 Reviews

NODE=M849

 A REVIEW GOES HERE – Check our WWW List of
 Reviews

NODE=M849

 $\eta_b(1S)$

$$J^{PC} = 0^+(0^-+)$$

NODE=M171

OMITTED FROM SUMMARY TABLE

 Quantum numbers shown are quark-model predictions. Observed in
 radiative decay of the $\Upsilon(3S)$, therefore $C = +$.

NODE=M171

 $\eta_b(1S)$ MASS

NODE=M171M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
9398.0 ± 3.2 OUR AVERAGE		Error includes scale factor of 1.8. See the ideogram below.		
[9391.0 ± 2.8 MeV OUR 2012 AVERAGE]				

 NODE=M171M
 NEW

9402.4 ± 1.5 ± 1.8	34k	¹ MIZUK	12 BELL	$e^+ e^- \rightarrow \gamma \pi^+ \pi^-$ + hadrons
9391.8 ± 6.6 ± 2.0	2.3 ± 0.5k	² BONVICINI	10 CLEO	$\Upsilon(3S) \rightarrow \gamma X$
9394.2 ⁺ _{-4.9} ± 2.0	13 ± 5k	² AUBERT	09AQ BABR	$\Upsilon(2S) \rightarrow \gamma X$
9388.9 ⁺ _{-2.3} ± 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. • • •				
9393.2 ± 3.4 ± 2.3	10 ⁺⁵ ₋₄	^{2,3} DOBBS	12	$\Upsilon(2S) \rightarrow \gamma$ hadrons
9300 ± 20 ± 20		HEISTER	02D ALEP	181–209 $e^+ e^-$

¹ With floating width. Not independent of the corresponding mass difference measurement.

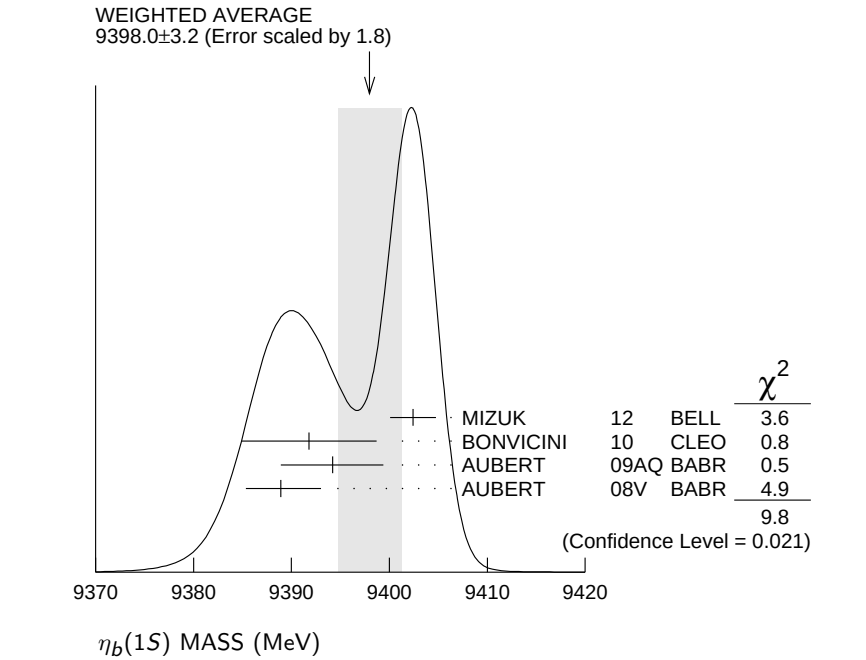
NODE=M171M;LINKAGE=MI

² Assuming $\Gamma_{\eta_b(1S)} = 10$ MeV. Not independent of the corresponding γ energy or mass difference measurements.

NODE=M171M;LINKAGE=AU

³ Obtained by analyzing CLEO III data but not authored by the CLEO Collaboration.

NODE=M171M;LINKAGE=DO



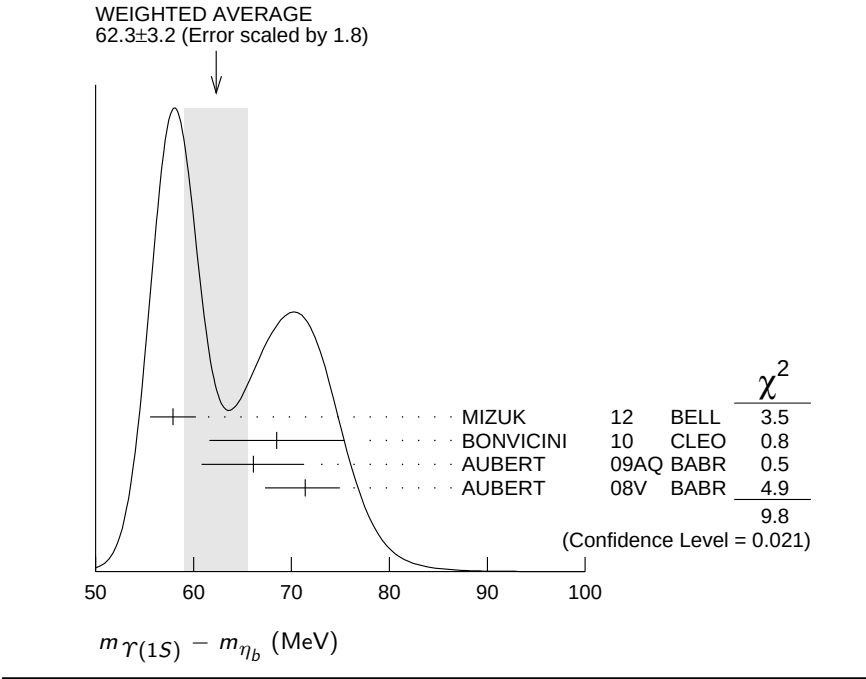
$m_{\Upsilon(1S)} - m_{\eta_b}$

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
62.3±3.2 OUR AVERAGE Error includes scale factor of 1.8. See the ideogram below. [69.3 ± 2.8 MeV OUR 2012 AVERAGE]				
57.9±1.5±1.8	34k	⁴ MIZUK	12 BELL	$e^+e^- \rightarrow \gamma\pi^+\pi^-$ + hadrons
68.5±6.6±2.0	2.3 ± 0.5k	⁵ BONVICINI	10 CLEO	$\Upsilon(3S) \rightarrow \gamma X$
66.1 ^{+4.8} _{-4.9} ±2.0	13 ± 5k	⁵ AUBERT	09AQ BABR	$\Upsilon(2S) \rightarrow \gamma X$
71.4 ^{+2.3} _{-3.1} ±2.7	19 ± 3k	⁵ 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	^{5,6} DOBBS	12	$\Upsilon(2S) \rightarrow \gamma$ hadrons
⁴ With floating width. Not independent of the corresponding mass measurement.				
⁵ Assuming $\Gamma_{\eta_b(1S)} = 10$ MeV. Not independent of the corresponding γ energy or mass measurements.				
⁶ Obtained by analyzing CLEO III data but not authored by the CLEO Collaboration.				

NODE=M171M2

NODE=M171M2
NEW

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

NODE=M171DM

920.6^{+2.8}_{-3.2} OUR AVERAGE918.6 $\pm$ 6.0 $\pm$ 1.9 2.3 $\pm$ 0.5k ⁷ BONVICINI 10 CLEO $\Upsilon(3S) \rightarrow \gamma X$ 921.2^{+2.1}_{-2.8} $\pm$ 2.4 19 $\pm$ 3k ⁷ AUBERT 08v BABR $\Upsilon(3S) \rightarrow \gamma X$ ⁷ 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

NODE=M171U2S

609.3^{+4.6}_{-4.5} $\pm$ 1.9 13 $\pm$ 5k ⁸ AUBERT 09AQ BABR $\Upsilon(2S) \rightarrow \gamma X$ ⁸ 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

NODE=M171W

10.8^{+4.0+4.5}_{-3.7-2.0} 34k ⁹ MIZUK 12 BELL $e^+e^- \rightarrow \gamma\pi^+\pi^- + \text{hadrons}$ ⁹ 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 $4h^+4h^-$		
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; $\rightarrow$ UNCHECKED $\leftarrow$ DESIG=2;OUR EST; $\rightarrow$ UNCHECKED $\leftarrow$

DESIG=4

DESIG=3;OUR EST; $\rightarrow$ UNCHECKED $\leftarrow$

DESIG=5

DESIG=6

 $\eta_b(1S)$ $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

NODE=M171230

 $\Gamma(3h^+3h^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ **$\Gamma_2\Gamma_5/\Gamma$**

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT

NODE=M171G1

NODE=M171G1

• • • We do not use the following data for averages, fits, limits, etc. • • •

<470 95 ABDALLAH 06 DLPH 161–209 e^+e^- <132 95 HEISTER 02D ALEP 181–209 e^+e^- **$\Gamma(2h^+2h^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$** **$\Gamma_3\Gamma_5/\Gamma$**

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT

NODE=M171G2

NODE=M171G2

• • • We do not use the following data for averages, fits, limits, etc. • • •

<190 95 ABDALLAH 06 DLPH 161–209 e^+e^- < 48 95 HEISTER 02D ALEP 181–209 e^+e^- **$\Gamma(4h^+4h^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$** **$\Gamma_4\Gamma_5/\Gamma$**

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT

NODE=M171G3

NODE=M171G3

• • • We do not use the following data for averages, fits, limits, etc. • • •

<660 95 ABDALLAH 06 DLPH 161–209 e^+e^- $\eta_b(1S)$ BRANCHING RATIOS

NODE=M171235

 $\Gamma(\text{hadrons})/\Gamma_{\text{total}}$ **Γ_1/Γ**

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

NODE=M171R03

NODE=M171R03

seen 34k MIZUK 12 BELL $e^+e^- \rightarrow \gamma\pi^+\pi^- + \text{hadrons}$

$\Gamma(\mu^+\mu^-)/\Gamma_{\text{total}}$					Γ_6/Γ
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
$<9 \times 10^{-3}$	90	¹⁰ AUBERT	09Z BABR	$e^+e^- \rightarrow \Upsilon(2S, 3S) \rightarrow \gamma\eta_b$	
¹⁰ Obtained using $B(\Upsilon(2S) \rightarrow \gamma\eta_b) = (4.2^{+1.1}_{-1.0} \pm 0.9) \times 10^{-4}$ and $B(\Upsilon(3S) \rightarrow \gamma\eta_b) = (4.8 \pm 0.5 \pm 0.6) \times 10^{-4}$. This limit is equivalent to $B(\eta_b \rightarrow \mu^+\mu^-) = (-0.25 \pm 0.51 \pm 0.33)\%$ measurement.					

NODE=M171R01
NODE=M171R01

NODE=M171R01;LINKAGE=AU

$\Gamma(\tau^+\tau^-)/\Gamma_{\text{total}}$					Γ_7/Γ
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
$<8 \times 10^{-2}$	90	AUBERT	09P BABR	$e^+e^- \rightarrow \gamma\tau^+\tau^-$	

NODE=M171R02
NODE=M171R02

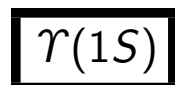
$\eta_b(1S)$ REFERENCES

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.)

NODE=M171

REFID=54288
REFID=54718
REFID=53231
REFID=53106
REFID=53062
REFID=52930
REFID=52262
REFID=51042
REFID=48577

NODE=M049



$$J^G(J^{PC}) = 0^-(1^{--})$$

$\Upsilon(1S)$ MASS

NODE=M049M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
9460.30$\pm$0.26 OUR AVERAGE	Error includes scale factor of 3.3.		
9460.51 $\pm$ 0.09 $\pm$ 0.05	¹ ARTAMONOV 00	MD1	$e^+e^- \rightarrow \text{hadrons}$
9459.97 $\pm$ 0.11 $\pm$ 0.07	MACKAY 84	REDE	$e^+e^- \rightarrow \text{hadrons}$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
9460.60 $\pm$ 0.09 $\pm$ 0.05	^{2,3} BARU 92B	REDE	$e^+e^- \rightarrow \text{hadrons}$
9460.59 $\pm$ 0.12	BARU 86	REDE	$e^+e^- \rightarrow \text{hadrons}$
9460.6 $\pm$ 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;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$\pm$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)	Confidence level
$\Gamma_1 \quad \tau^+\tau^-$	(2.60 $\pm$ 0.10) %	DESIG=3
$\Gamma_2 \quad e^+e^-$	(2.38 $\pm$ 0.11) %	DESIG=2
$\Gamma_3 \quad \mu^+\mu^-$	(2.48 $\pm$ 0.05) %	DESIG=1

Hadronic decays

$\Gamma_4 \quad ggg$	(81.7 $\pm$ 0.7) %	
$\Gamma_5 \quad \gamma gg$	(2.2 $\pm$ 0.6) %	
$\Gamma_6 \quad \eta'(958) \text{ anything}$	(2.94 $\pm$ 0.24) %	
$\Gamma_7 \quad J/\psi(1S) \text{ anything}$	(6.5 $\pm$ 0.7) $\times 10^{-4}$	
$\Gamma_8 \quad \chi_{c0} \text{ anything}$	< 5 $\times 10^{-3}$	90%
$\Gamma_9 \quad \chi_{c1} \text{ anything}$	(2.3 $\pm$ 0.7) $\times 10^{-4}$	
$\Gamma_{10} \quad \chi_{c2} \text{ anything}$	(3.4 $\pm$ 1.0) $\times 10^{-4}$	
$\Gamma_{11} \quad \psi(2S) \text{ anything}$	(2.7 $\pm$ 0.9) $\times 10^{-4}$	

NODE=M049;CLUMP=A
DESIG=117
DESIG=118
DESIG=73
DESIG=12
DESIG=5
DESIG=6
DESIG=7
DESIG=8

Γ ₁₂	$\rho\pi$	$< 2 \times 10^{-4}$	90%	DESIG=11
Γ ₁₃	$\pi^+\pi^-$	$< 5 \times 10^{-4}$	90%	DESIG=23
Γ ₁₄	K^+K^-	$< 5 \times 10^{-4}$	90%	DESIG=24
Γ ₁₅	$p\bar{p}$	$< 5 \times 10^{-4}$	90%	DESIG=25
Γ ₁₆	$\pi^0\pi^+\pi^-$	$< 1.84 \times 10^{-5}$	90%	DESIG=72
Γ ₁₇	$D^*(2010)^\pm$ anything	$(2.52 \pm 0.20) \%$		DESIG=30
Γ ₁₈	$\bar{d}$ anything	$(2.86 \pm 0.28) \times 10^{-5}$		DESIG=107
Γ ₁₉	Sum of 100 exclusive modes	$(1.200 \pm 0.017) \%$		DESIG=128

Radiative decays

NODE=M049;CLUMP=B

Γ ₂₀	$\gamma\pi^+\pi^-$	$(6.3 \pm 1.8) \times 10^{-5}$		DESIG=70
Γ ₂₁	$\gamma\pi^0\pi^0$	$(1.7 \pm 0.7) \times 10^{-5}$		DESIG=71
Γ ₂₂	$\gamma\pi^0\eta$	$< 2.4 \times 10^{-6}$	90%	DESIG=111
Γ ₂₃	γK^+K^-	[a] $(1.14 \pm 0.13) \times 10^{-5}$		DESIG=102
Γ ₂₄	$\gamma p\bar{p}$	[b] $< 6 \times 10^{-6}$	90%	DESIG=103
Γ ₂₅	$\gamma 2h^+2h^-$	$(7.0 \pm 1.5) \times 10^{-4}$		DESIG=20
Γ ₂₆	$\gamma 3h^+3h^-$	$(5.4 \pm 2.0) \times 10^{-4}$		DESIG=21
Γ ₂₇	$\gamma 4h^+4h^-$	$(7.4 \pm 3.5) \times 10^{-4}$		DESIG=22
Γ ₂₈	$\gamma\pi^+\pi^-K^+K^-$	$(2.9 \pm 0.9) \times 10^{-4}$		DESIG=14
Γ ₂₉	$\gamma 2\pi^+2\pi^-$	$(2.5 \pm 0.9) \times 10^{-4}$		DESIG=13
Γ ₃₀	$\gamma 3\pi^+3\pi^-$	$(2.5 \pm 1.2) \times 10^{-4}$		DESIG=17
Γ ₃₁	$\gamma 2\pi^+2\pi^-K^+K^-$	$(2.4 \pm 1.2) \times 10^{-4}$		DESIG=18
Γ ₃₂	$\gamma\pi^+\pi^-p\bar{p}$	$(1.5 \pm 0.6) \times 10^{-4}$		DESIG=15
Γ ₃₃	$\gamma 2\pi^+2\pi^-p\bar{p}$	$(4 \pm 6) \times 10^{-5}$		DESIG=19
Γ ₃₄	$\gamma 2K^+2K^-$	$(2.0 \pm 2.0) \times 10^{-5}$		DESIG=16
Γ ₃₅	$\gamma\eta'(958)$	$< 1.9 \times 10^{-6}$	90%	DESIG=55
Γ ₃₆	$\gamma\eta$	$< 1.0 \times 10^{-6}$	90%	DESIG=54
Γ ₃₇	$\gamma f_0(980)$	$< 3 \times 10^{-5}$	90%	DESIG=105
Γ ₃₈	$\gamma f_2'(1525)$	$(3.8 \pm 0.9) \times 10^{-5}$		DESIG=52
Γ ₃₉	$\gamma f_2(1270)$	$(1.01 \pm 0.09) \times 10^{-4}$		DESIG=51
Γ ₄₀	$\gamma\eta(1405)$	$< 8.2 \times 10^{-5}$	90%	DESIG=65
Γ ₄₁	$\gamma f_0(1500)$	$< 1.5 \times 10^{-5}$	90%	DESIG=108
Γ ₄₂	$\gamma f_0(1710)$	$< 2.6 \times 10^{-4}$	90%	DESIG=53
Γ ₄₃	$\gamma f_0(1710) \rightarrow \gamma K^+K^-$	$< 7 \times 10^{-6}$	90%	DESIG=112
Γ ₄₄	$\gamma f_0(1710) \rightarrow \gamma\pi^0\pi^0$	$< 1.4 \times 10^{-6}$	90%	DESIG=109
Γ ₄₅	$\gamma f_0(1710) \rightarrow \gamma\eta\eta$	$< 1.8 \times 10^{-6}$	90%	DESIG=110
Γ ₄₆	$\gamma f_4(2050)$	$< 5.3 \times 10^{-5}$	90%	DESIG=104
Γ ₄₇	$\gamma f_0(2200) \rightarrow \gamma K^+K^-$	$< 2 \times 10^{-4}$	90%	DESIG=69
Γ ₄₈	$\gamma f_J(2220) \rightarrow \gamma K^+K^-$	$< 8 \times 10^{-7}$	90%	DESIG=60
Γ ₄₉	$\gamma f_J(2220) \rightarrow \gamma\pi^+\pi^-$	$< 6 \times 10^{-7}$	90%	DESIG=61
Γ ₅₀	$\gamma f_J(2220) \rightarrow \gamma p\bar{p}$	$< 1.1 \times 10^{-6}$	90%	DESIG=62
Γ ₅₁	$\gamma\eta(2225) \rightarrow \gamma\phi\phi$	$< 3 \times 10^{-3}$	90%	DESIG=68
Γ ₅₂	$\gamma\eta_c(1S)$	$< 5.7 \times 10^{-5}$	90%	DESIG=119
Γ ₅₃	$\gamma\chi_{c0}$	$< 6.5 \times 10^{-4}$	90%	DESIG=120
Γ ₅₄	$\gamma\chi_{c1}$	$< 2.3 \times 10^{-5}$	90%	DESIG=121
Γ ₅₅	$\gamma\chi_{c2}$	$< 7.6 \times 10^{-6}$	90%	DESIG=122
Γ ₅₆	$\gamma X(3872) \rightarrow \pi^+\pi^-J/\psi$	$< 1.6 \times 10^{-6}$	90%	DESIG=123
Γ ₅₇	$\gamma X(3872) \rightarrow \pi^+\pi^-\pi^0J/\psi$	$< 2.8 \times 10^{-6}$	90%	DESIG=124
Γ ₅₈	$\gamma X(3915) \rightarrow \omega J/\psi$	$< 3.0 \times 10^{-6}$	90%	DESIG=125
Γ ₅₉	$\gamma X(4140) \rightarrow \phi J/\psi$	$< 2.2 \times 10^{-6}$	90%	DESIG=126
Γ ₆₀	γX	[c] $< 4.5 \times 10^{-6}$	90%	DESIG=66
Γ ₆₁	$\gamma X\bar{X} (m_X < 3.1 \text{ GeV})$	[d] $< 1 \times 10^{-3}$	90%	DESIG=67
Γ ₆₂	$\gamma X\bar{X} (m_X < 4.5 \text{ GeV})$	[e] $< 2.4 \times 10^{-4}$	90%	DESIG=127
Γ ₆₃	$\gamma X \rightarrow \gamma + \geq 4 \text{ prongs}$	[f] $< 1.78 \times 10^{-4}$	95%	DESIG=113
Γ ₆₄	$\gamma a_1^0 \rightarrow \gamma\mu^+\mu^-$	[g] $< 9 \times 10^{-6}$	90%	DESIG=114
Γ ₆₅	$\gamma a_1^0 \rightarrow \gamma\tau^+\tau^-$	[a] $< 5.0 \times 10^{-5}$	90%	DESIG=115

Lepton Family number (LF) violating modes

NODE=M049;CLUMP=C

Γ ₆₆	$\mu^\pm\tau^\mp$	LF $< 6.0 \times 10^{-6}$	95%	DESIG=116

Other decays

Γ_{67} invisible $< 3.0 \times 10^{-4}$ 90%

NODE=M049;CLUMP=D
DESIG=106

[a] $2m_\tau < M(\tau^+\tau^-) < 7500$ MeV

LINKAGE=E49

[b] $2 < m_{K^+K^-} < 3$ GeV

LINKAGE=G49

[c] X = scalar with $m < 8.0$ GeV

LINKAGE=A49

[d] $X\bar{X}$ = vectors with $m < 3.1$ GeV

LINKAGE=B49

[e] X and $\bar{X}$ = zero spin with $m < 4.5$ GeV

LINKAGE=F49

[f] $1.5 \text{ GeV} < m_X < 5.0 \text{ GeV}$

LINKAGE=C49

[g] $201 < M(\mu^+\mu^-) < 3565$ MeV

LINKAGE=D49

 $\mathcal{T}(1S) \Gamma(i) \Gamma(e^+e^-) / \Gamma(\text{total})$

NODE=M049218

$\Gamma(e^+e^-) \times \Gamma(\mu^+\mu^-) / \Gamma_{\text{total}}$

$\Gamma_2 \Gamma_3 / \Gamma$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
$31.2 \pm 1.6 \pm 1.7$	KOBEL	92	CBAL $e^+e^- \rightarrow \mu^+\mu^-$

NODE=M049G1
NODE=M049G1

$\Gamma(\text{hadrons}) \times \Gamma(e^+e^-) / \Gamma_{\text{total}}$

$\Gamma_0 \Gamma_2 / \Gamma$

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
1.240 ± 0.016 OUR AVERAGE			
$1.252 \pm 0.004 \pm 0.019$	⁵ ROSNER	06	CLEO $9.5 e^+e^- \rightarrow \text{hadrons}$
$1.187 \pm 0.023 \pm 0.031$	⁵ BARU	92B	MD1 $e^+e^- \rightarrow \text{hadrons}$
$1.23 \pm 0.02 \pm 0.05$	⁵ JAKUBOWSKI	88	CBAL $e^+e^- \rightarrow \text{hadrons}$
$1.37 \pm 0.06 \pm 0.09$	⁶ GILES	84B	CLEO $e^+e^- \rightarrow \text{hadrons}$
$1.23 \pm 0.08 \pm 0.04$	⁶ ALBRECHT	82	DASP $e^+e^- \rightarrow \text{hadrons}$
$1.13 \pm 0.07 \pm 0.11$	⁶ NICZYPORUK	82	LENA $e^+e^- \rightarrow \text{hadrons}$
1.09 ± 0.25	⁶ BOCK	80	CNTR $e^+e^- \rightarrow \text{hadrons}$
1.35 ± 0.14	⁷ BERGER	79	PLUT $e^+e^- \rightarrow \text{hadrons}$

NODE=M049G2
NODE=M049G2

⁵ Radiative corrections evaluated following KURAEV 85.

⁶ Radiative corrections reevaluated by BUCHMUELLER 88 following KURAEV 85.

⁷ Radiative corrections reevaluated by ALEXANDER 89 using $B(\mu\mu) = 0.026$.

NODE=M049G2;LINKAGE=B
NODE=M049G2;LINKAGE=R
NODE=M049G2;LINKAGE=P

 $\mathcal{T}(1S)$ PARTIAL WIDTHS

NODE=M049220

$\Gamma(e^+e^-)$

Γ_2

VALUE (keV)	DOCUMENT ID
1.340 ± 0.018 OUR EVALUATION	

NODE=M049W2
NODE=M049W2
 $\rightarrow$ UNCHECKED $\leftarrow$

 $\mathcal{T}(1S)$ 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				
$2.53 \pm 0.13 \pm 0.05$	60k	⁸ BESSON	07	CLEO $e^+e^- \rightarrow \mathcal{T}(1S) \rightarrow \tau^+\tau^-$
$2.61 \pm 0.12^{+0.09}_{-0.13}$	25k	CINABRO	94B	CLE2 $e^+e^- \rightarrow \tau^+\tau^-$
$2.7 \pm 0.4 \pm 0.2$		⁹ ALBRECHT	85C	ARG $\mathcal{T}(2S) \rightarrow \pi^+\pi^-\tau^+\tau^-$
$3.4 \pm 0.4 \pm 0.4$		GILES	83	CLEO $e^+e^- \rightarrow \tau^+\tau^-$

NODE=M049R3
NODE=M049R3

⁸ BESSON 07 reports $[\Gamma(\mathcal{T}(1S) \rightarrow \tau^+\tau^-) / \Gamma_{\text{total}}] / [B(\mathcal{T}(1S) \rightarrow \mu^+\mu^-)] = 1.02 \pm 0.02 \pm 0.05$ which we multiply by our best value $B(\mathcal{T}(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.05) \times 10^{-2}$. 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

⁹ Using $B(\mathcal{T}(1S) \rightarrow ee) = B(\mathcal{T}(1S) \rightarrow \mu\mu) = 0.0256$; 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				
$2.29 \pm 0.08 \pm 0.11$		ALEXANDER	98	CLE2 $\mathcal{T}(2S) \rightarrow \pi^+\pi^-\pi^+e^-$
$2.42 \pm 0.14 \pm 0.14$	307	ALBRECHT	87	ARG $\mathcal{T}(2S) \rightarrow \pi^+\pi^-\pi^+e^-$
$2.8 \pm 0.3 \pm 0.2$	826	BESSON	84	CLEO $\mathcal{T}(2S) \rightarrow \pi^+\pi^-\pi^+e^-$
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 NODE=M049R1
NODE=M049R1

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		¹⁰ BARU	92	MD1 $e^+e^- \rightarrow \mu^+\mu^-$
0.0231±0.0012±0.0010		¹⁰ 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	BESSION	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 $e^+e^- \rightarrow \mu^+\mu^-$

¹⁰ Taking into account interference between the resonance and continuum.

NODE=M049R1;LINKAGE=G

 $\Gamma(\tau^+\tau^-)/\Gamma(\mu^+\mu^-)$ Γ_1/Γ_3 NODE=M049R43
NODE=M049R43

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
1.008±0.023 OUR AVERAGE				
1.005±0.013±0.022	0.7M	¹¹ DEL-AMO-SA...10C	BABR	$\Upsilon(3S) \rightarrow \pi^+\pi^- \Upsilon(1S)$
1.02 ±0.02 ±0.05	60k	BESSION	07	CLEO $e^+e^- \rightarrow \Upsilon(1S)$

¹¹ Allows any number of extra photons with total energy < 500 MeV.

NODE=M049R43;LINKAGE=DE

 $\Gamma(gg)/\Gamma_{\text{total}}$ Γ_4/Γ NODE=M049R35
NODE=M049R35

VALUE (units 10 ⁻²)	EVTS	DOCUMENT ID	TECN	COMMENT
81.7±0.7	20M	¹² BESSION	06A	CLEO $\Upsilon(1S) \rightarrow \text{hadrons}$

¹² Calculated using the value $\Gamma(\gamma gg)/\Gamma(gg) = (2.70 \pm 0.01 \pm 0.13 \pm 0.24)\%$ from BESSION 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 BESSION 06A.

NODE=M049R35;LINKAGE=BE

 $\Gamma(\gamma gg)/\Gamma_{\text{total}}$ Γ_5/Γ NODE=M049R36
NODE=M049R36

VALUE (units 10 ⁻²)	EVTS	DOCUMENT ID	TECN	COMMENT
2.20±0.60	400k	¹³ BESSION	06A	CLEO $\Upsilon(1S) \rightarrow \gamma + \text{hadrons}$

¹³ Calculated using BESSION 06A values of $\Gamma(\gamma gg)/\Gamma(gg) = (2.70 \pm 0.01 \pm 0.13 \pm 0.24)\%$ and $\Gamma(gg)/\Gamma_{\text{total}}$. The statistical error is negligible and the systematic error is partially correlated with that of $\Gamma(gg)/\Gamma_{\text{total}}$ measurement of BESSION 06A.

NODE=M049R36;LINKAGE=BE

 $\Gamma(\gamma gg)/\Gamma(gg)$ Γ_5/Γ_4 NODE=M049R37
NODE=M049R37

VALUE (units 10 ⁻²)	EVTS	DOCUMENT ID	TECN	COMMENT
2.70±0.01±0.27	20M	BESSION	06A	CLEO $\Upsilon(1S) \rightarrow (\gamma +) \text{hadrons}$

 $\Gamma(\eta'(958) \text{ anything})/\Gamma_{\text{total}}$ Γ_6/Γ NODE=M049R73
NODE=M049R73

VALUE	DOCUMENT ID	TECN	COMMENT
0.0294±0.0024 OUR AVERAGE			
0.030 ±0.002 ±0.002	AQUINES	06A	CLE3 $\Upsilon(1S) \rightarrow \eta' \text{ anything}$
0.028 ±0.004 ±0.002	ARTUSO	03	CLE2 $\Upsilon(1S) \rightarrow \eta' \text{ anything}$

 $\Gamma(J/\psi(1S) \text{ anything})/\Gamma_{\text{total}}$ Γ_7/Γ NODE=M049R12
NODE=M049R12

VALUE (units 10 ⁻³)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
0.65±0.07 OUR AVERAGE					
0.64±0.04±0.06		730 ± 40	BRIERE	04	CLEO $e^+e^- \rightarrow J/\psi X$
1.1 ±0.4 ±0.2			¹⁴ FULTON	89	CLEO $e^+e^- \rightarrow \mu^+\mu^- X$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.68	90		ALBRECHT	92J	ARG $e^+e^- \rightarrow e^+e^- X, \mu^+\mu^- X$
<1.7	90		MASCHMANN	90	CBAL $e^+e^- \rightarrow \text{hadrons}$
<20	90		NICZYPORUK	83	LENA

¹⁴ Using $B((J/\psi) \rightarrow \mu^+\mu^-) = (6.9 \pm 0.9)\%$.

NODE=M049R12;LINKAGE=K

$\Gamma(\chi_{c0} \text{ anything})/\Gamma(J/\psi(1S) \text{ anything})$ Γ_8/Γ_7

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<7.4	90	BRIERE	04	CLEO $e^+e^- \rightarrow J/\psi X$

NODE=M049R25
 NODE=M049R25

 $\Gamma(\chi_{c1} \text{ anything})/\Gamma(J/\psi(1S) \text{ anything})$ Γ_9/Γ_7

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
$0.35 \pm 0.08 \pm 0.06$	52 ± 12	BRIERE	04	CLEO $e^+e^- \rightarrow J/\psi X$

NODE=M049R26
 NODE=M049R26

 $\Gamma(\chi_{c2} \text{ anything})/\Gamma(J/\psi(1S) \text{ anything})$ Γ_{10}/Γ_7

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
$0.52 \pm 0.12 \pm 0.09$	47 ± 11	BRIERE	04	CLEO $e^+e^- \rightarrow J/\psi X$

NODE=M049R27
 NODE=M049R27

 $\Gamma(\psi(2S) \text{ anything})/\Gamma(J/\psi(1S) \text{ anything})$ Γ_{11}/Γ_7

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
$0.41 \pm 0.11 \pm 0.08$	42 ± 11	BRIERE	04	CLEO $e^+e^- \rightarrow J/\psi \pi^+ \pi^- X$

NODE=M049R28
 NODE=M049R28

 $\Gamma(\rho\pi)/\Gamma_{\text{total}}$ Γ_{12}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 2	90	FULTON	90B	$\Upsilon(1S) \rightarrow \rho^0 \pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<10	90	BLINOV	90	MD1 $\Upsilon(1S) \rightarrow \rho^0 \pi^0$
<21	90	NICZYPORUK	83	LENA $\Upsilon(1S) \rightarrow \rho^0 \pi^0$

NODE=M049R11
 NODE=M049R11

 $\Gamma(\pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{13}/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_{14}/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_{15}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<5	90	¹⁵ BARU	96	MD1 $\Upsilon(1S) \rightarrow \rho\bar{\rho}$

¹⁵ Supersedes BARU 92 in this node.

NODE=M049R59
 NODE=M049R59

NODE=M049R59;LINKAGE=A

 $\Gamma(\pi^0 \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{16}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<1.84	90	ANASTASSOV	99	CLE2 $e^+e^- \rightarrow \text{hadrons}$

NODE=M049R72
 NODE=M049R72

 $\Gamma(D^*(2010)^\pm \text{ anything})/\Gamma_{\text{total}}$ Γ_{17}/Γ

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$25.2 \pm 1.3 \pm 1.5$	$\approx 2k$	¹⁶	AUBERT	10C	BABR $\Upsilon(2S) \rightarrow \pi^+ \pi^- \Upsilon(1S)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<19 90 ¹⁷ ALBRECHT 92J ARG $e^+e^- \rightarrow D^0 \pi^\pm X$

¹⁶ For $x_p > 0.1$.

¹⁷ For $x_p > 0.2$.

NODE=M049R32
 NODE=M049R32

NODE=M049R32;LINKAGE=AU

NODE=M049R32;LINKAGE=B

 $\Gamma(\bar{d} \text{ anything})/\Gamma_{\text{total}}$ Γ_{18}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
$2.86 \pm 0.19 \pm 0.21$	455	ASNER	07	CLEO $e^+e^- \rightarrow \bar{d} X$

NODE=M049R33
 NODE=M049R33

 $\Gamma(\text{Sum of 100 exclusive modes})/\Gamma_{\text{total}}$ Γ_{19}/Γ

VALUE (units 10^{-2})	DOCUMENT ID	COMMENT
1.200 ± 0.017	^{18,19} DOBBS 12A	$\Upsilon(1S) \rightarrow \text{hadrons}$

¹⁸ DOBBS 12A presents individual exclusive branching fractions or upper limits for 100 modes of four to ten pions, kaons, or protons.

¹⁹ Obtained by analyzing CLEO III data but not authored by the CLEO Collaboration.

NODE=M049R02
 NODE=M049R02

NODE=M049R02;LINKAGE=DO

NODE=M049R02;LINKAGE=NC

 $\Gamma(ggg, \gamma g g \rightarrow \bar{d} \text{ anything})/\Gamma(ggg, \gamma g g \rightarrow \text{anything})$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
$3.36 \pm 0.23 \pm 0.25$	455	ASNER	07	CLEO $e^+e^- \rightarrow \bar{d} X$

NODE=M049R34
 NODE=M049R34

$\Gamma(\gamma\pi^+\pi^-)/\Gamma_{\text{total}}$
 $VALUE (units 10^{-5})$
 $6.3 \pm 1.2 \pm 1.3$
²⁰ For $m_{\pi\pi} > 1$ GeV.

DOCUMENT ID	TECN	COMMENT
20 ANASTASSOV 99	CLE2	$e^+e^- \rightarrow \text{hadrons}$

 Γ_{20}/Γ

 NODE=M049R70
 NODE=M049R70

NODE=M049R70;LINKAGE=A

 $\Gamma(\gamma\pi^0\pi^0)/\Gamma_{\text{total}}$
 $VALUE (units 10^{-5})$
 $1.7 \pm 0.6 \pm 0.3$
²¹ For $m_{\pi\pi} > 1$ GeV.

DOCUMENT ID	TECN	COMMENT
21 ANASTASSOV 99	CLE2	$e^+e^- \rightarrow \text{hadrons}$

 Γ_{21}/Γ

 NODE=M049R71
 NODE=M049R71

NODE=M049R71;LINKAGE=A

 $\Gamma(\gamma\pi^0\eta)/\Gamma_{\text{total}}$
 $VALUE (units 10^{-6})$
 < 2.4
 $CL\%$
 90

DOCUMENT ID	TECN	COMMENT
22 BESSON 07A	CLEO	$e^+e^- \rightarrow \gamma(1S)$

 Γ_{22}/Γ

 NODE=M049R47
 NODE=M049R47

²² BESSON 07A obtained this limit for $0.7 < m_{\pi^0\eta} < 3$ GeV.

NODE=M049R47;LINKAGE=BE

 $\Gamma(\gamma K^+K^-)/\Gamma_{\text{total}}$
 $(2 < m_{K^+K^-} < 3 \text{ GeV})$
 $VALUE (units 10^{-5})$
 $1.14 \pm 0.08 \pm 0.10$
 $CL\%$
 90

DOCUMENT ID	TECN	COMMENT
ATHAR 06	CLE3	$\gamma(1S) \rightarrow \gamma K^+K^-$

 Γ_{23}/Γ

 NODE=M049R24
 NODE=M049R24
 NODE=M049R24

 $\Gamma(\gamma p\bar{p})/\Gamma_{\text{total}}$
 $(2 < m_{p\bar{p}} < 3 \text{ GeV})$
 $VALUE (units 10^{-5})$
 < 0.6
 $CL\%$
 90

DOCUMENT ID	TECN	COMMENT
ATHAR 06	CLE3	$\gamma(1S) \rightarrow \gamma p\bar{p}$

 Γ_{24}/Γ

 NODE=M049R29
 NODE=M049R29
 NODE=M049R29

 $\Gamma(\gamma 2h^+2h^-)/\Gamma_{\text{total}}$
 $VALUE (units 10^{-4})$
 $7.0 \pm 1.1 \pm 1.0$
 $EVTS$
 80 ± 12

DOCUMENT ID	TECN	COMMENT
FULTON 90B	CLEO	$e^+e^- \rightarrow \text{hadrons}$

 Γ_{25}/Γ

 NODE=M049R20
 NODE=M049R20

 $\Gamma(\gamma 3h^+3h^-)/\Gamma_{\text{total}}$
 $VALUE (units 10^{-4})$
 $5.4 \pm 1.5 \pm 1.3$
 $EVTS$
 39 ± 11

DOCUMENT ID	TECN	COMMENT
FULTON 90B	CLEO	$e^+e^- \rightarrow \text{hadrons}$

 Γ_{26}/Γ

 NODE=M049R21
 NODE=M049R21

 $\Gamma(\gamma 4h^+4h^-)/\Gamma_{\text{total}}$
 $VALUE (units 10^{-4})$
 $7.4 \pm 2.5 \pm 2.5$
 $EVTS$
 36 ± 12

DOCUMENT ID	TECN	COMMENT
FULTON 90B	CLEO	$e^+e^- \rightarrow \text{hadrons}$

 Γ_{27}/Γ

 NODE=M049R22
 NODE=M049R22

 $\Gamma(\gamma\pi^+\pi^-K^+K^-)/\Gamma_{\text{total}}$
 $VALUE (units 10^{-4})$
 $2.9 \pm 0.7 \pm 0.6$
 $EVTS$
 29 ± 8

DOCUMENT ID	TECN	COMMENT
FULTON 90B	CLEO	$e^+e^- \rightarrow \text{hadrons}$

 Γ_{28}/Γ

 NODE=M049R14
 NODE=M049R14

 $\Gamma(\gamma 2\pi^+2\pi^-)/\Gamma_{\text{total}}$
 $VALUE (units 10^{-4})$
 $2.5 \pm 0.7 \pm 0.5$
 $EVTS$
 26 ± 7

DOCUMENT ID	TECN	COMMENT
FULTON 90B	CLEO	$e^+e^- \rightarrow \text{hadrons}$

 Γ_{29}/Γ

 NODE=M049R13
 NODE=M049R13

 $\Gamma(\gamma 3\pi^+3\pi^-)/\Gamma_{\text{total}}$
 $VALUE (units 10^{-4})$
 $2.5 \pm 0.9 \pm 0.8$
 $EVTS$
 17 ± 5

DOCUMENT ID	TECN	COMMENT
FULTON 90B	CLEO	$e^+e^- \rightarrow \text{hadrons}$

 Γ_{30}/Γ

 NODE=M049R17
 NODE=M049R17

 $\Gamma(\gamma 2\pi^+2\pi^-K^+K^-)/\Gamma_{\text{total}}$
 $VALUE (units 10^{-4})$
 $2.4 \pm 0.9 \pm 0.8$
 $EVTS$
 18 ± 7

DOCUMENT ID	TECN	COMMENT
FULTON 90B	CLEO	$e^+e^- \rightarrow \text{hadrons}$

 Γ_{31}/Γ

 NODE=M049R18
 NODE=M049R18

 $\Gamma(\gamma\pi^+\pi^-\rho\bar{\rho})/\Gamma_{\text{total}}$
 $VALUE (units 10^{-4})$
 $1.5 \pm 0.5 \pm 0.3$
 $EVTS$
 22 ± 6

DOCUMENT ID	TECN	COMMENT
FULTON 90B	CLEO	$e^+e^- \rightarrow \text{hadrons}$

 Γ_{32}/Γ

 NODE=M049R15
 NODE=M049R15

 $\Gamma(\gamma 2\pi^+2\pi^-\rho\bar{\rho})/\Gamma_{\text{total}}$
 $VALUE (units 10^{-4})$
 $0.4 \pm 0.4 \pm 0.4$
 $EVTS$
 7 ± 6

DOCUMENT ID	TECN	COMMENT
FULTON 90B	CLEO	$e^+e^- \rightarrow \text{hadrons}$

 Γ_{33}/Γ

 NODE=M049R19
 NODE=M049R19

$\Gamma(\gamma 2K^+ 2K^-)/\Gamma_{\text{total}}$ Γ_{34}/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_{35}/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_{36}/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_{37}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
< 3	90	²³ ATHAR 06	CLE3	$\Upsilon(1S) \rightarrow \gamma \pi^+ \pi^-$
²³ 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_{38}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
3.8 ± 0.9 OUR AVERAGE					
$4.0 \pm 1.4 \pm 0.1$	17 ± 5	²⁴	BESSON	11	CLEO $\Upsilon(1S) \rightarrow K_S^0 K_S^0$
$3.7^{+0.9}_{-0.7} \pm 0.8$			ATHAR	06	CLE3 $\Upsilon(1S) \rightarrow \gamma K^+ K^-$

NODE=M049R52
 NODE=M049R52

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 14	90	²⁵	FULTON	90B	CLEO $\Upsilon(1S) \rightarrow \gamma K^+ K^-$
< 19.4	90	²⁵	ALBRECHT	89	ARG $\Upsilon(1S) \rightarrow \gamma K^+ K^-$

²⁴ BESSON 11 reports $(4.0 \pm 1.3 \pm 0.6) \times 10^{-5}$ from a measurement of $[\Gamma(\Upsilon(1S) \rightarrow \gamma f'_2(1525))/\Gamma_{\text{total}}] \times [B(f'_2(1525) \rightarrow K \bar{K})]$ assuming $B(f'_2(1525) \rightarrow K \bar{K}) = (88.8 \pm 3.1) \times 10^{-2}$, which we rescale to our best value $B(f'_2(1525) \rightarrow K \bar{K}) = (88.7 \pm 2.2) \times 10^{-2}$. 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 $B(f'_2(1525) \rightarrow K \bar{K}) = 4 B(f'_2(1525) \rightarrow K_S^0 K_S^0)$.

²⁵ Assuming $B(f'_2(1525) \rightarrow K \bar{K}) = 0.71$.

NODE=M049R52;LINKAGE=BE

NODE=M049R52;LINKAGE=D

 $\Gamma(\gamma f_2(1270))/\Gamma_{\text{total}}$ Γ_{39}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
10.1 ± 0.9 OUR AVERAGE				
$10.5 \pm 1.6^{+1.9}_{-1.8}$		²⁶	BESSON	07A CLE3 $\Upsilon(1S) \rightarrow \gamma \pi^0 \pi^0$
$10.2 \pm 0.8 \pm 0.7$			ATHAR	06 CLE3 $\Upsilon(1S) \rightarrow \gamma \pi^+ \pi^-$
$8.1 \pm 2.3^{+2.9}_{-2.7}$		²⁷	ANASTASSOV	99 CLE2 $e^+ e^- \rightarrow \text{hadrons}$

NODE=M049R51
 NODE=M049R51

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 21	90	²⁷	FULTON	90B	CLEO $\Upsilon(1S) \rightarrow \gamma \pi^+ \pi^-$
< 13	90	²⁷	ALBRECHT	89	ARG $\Upsilon(1S) \rightarrow \gamma \pi^+ \pi^-$
< 81	90		SCHMITT	88	CBAL $\Upsilon(1S) \rightarrow \gamma X$

²⁶ Using $B(f_2(1270) \rightarrow \pi^0 \pi^0) = B(f_2(1270) \rightarrow \pi \pi)/3$ and $B(f_2(1270) \rightarrow \pi \pi) = (0.845^{+0.025}_{-0.012})\%$.

²⁷ Using $B(f_2(1270) \rightarrow \pi \pi) = 0.84$.

NODE=M049R51;LINKAGE=BE

NODE=M049R51;LINKAGE=C

 $\Gamma(\gamma \eta(1405))/\Gamma_{\text{total}}$ Γ_{40}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
< 8.2	90	²⁸	FULTON	90B CLEO $\Upsilon(1S) \rightarrow \gamma K^\pm \pi^\mp K_S^0$

NODE=M049R23
 NODE=M049R23

²⁸ Includes unknown branching ratio of $\eta(1405) \rightarrow K^\pm \pi^\mp K_S^0$.

NODE=M049R23;LINKAGE=J

$\Gamma(\gamma f_0(1500))/\Gamma_{\text{total}}$ Γ_{41}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<1.5	90	²⁹ 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	³⁰ BESSON	07A CLEO	$e^+e^- \rightarrow \Upsilon(1S) \rightarrow \gamma \eta \eta$
²⁹ Using $B(f_0(1500) \rightarrow \pi^0 \pi^0) = B(f_0(1500) \rightarrow \pi \pi)/3$ and $B(f_0(1500) \rightarrow \pi \pi) = (0.349 \pm 0.023)\%$.				
³⁰ 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

 $\Gamma(\gamma f_0(1710))/\Gamma_{\text{total}}$ Γ_{42}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 2.6	90	³¹ ALBRECHT	89 ARG	$\Upsilon(1S) \rightarrow \gamma K^+ K^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
< 6.3	90	³¹ FULTON	90B CLEO	$\Upsilon(1S) \rightarrow \gamma K^+ K^-$
<19	90	³¹ FULTON	90B CLEO	$\Upsilon(1S) \rightarrow \gamma K_S^0 K_S^0$
< 8	90	³² ALBRECHT	89 ARG	$\Upsilon(1S) \rightarrow \gamma \pi^+ \pi^-$
<24	90	³³ SCHMITT	88 CBAL	$\Upsilon(1S) \rightarrow \gamma X$
³¹ Assuming $B(f_0(1710) \rightarrow K \bar{K}) = 0.38$.				
³² Assuming $B(f_0(1710) \rightarrow \pi \pi) = 0.04$.				
³³ 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

 $\Gamma(\gamma f_0(1710) \rightarrow \gamma K^+ K^-)/\Gamma_{\text{total}}$ Γ_{43}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<0.7	90	ATHAR	06 CLEO	$e^+e^- \rightarrow \Upsilon(1S) \rightarrow \gamma K^+ K^-$

NODE=M049R50
 NODE=M049R50

 $\Gamma(\gamma f_0(1710) \rightarrow \gamma \pi^0 \pi^0)/\Gamma_{\text{total}}$ Γ_{44}/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_{45}/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_{46}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<5.3	90	³⁴ ATHAR	06 CLE3	$\Upsilon(1S) \rightarrow \gamma \pi^+ \pi^-$
³⁴ 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_{47}/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_{48}/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_{49}/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_{50}/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_{51}/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_{52}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<5.7	90	SHEN	10A BELL	$\Upsilon(1S) \rightarrow \gamma X$

NODE=M049R38
NODE=M049R38

 $\Gamma(\gamma\chi_{c0})/\Gamma_{\text{total}}$ Γ_{53}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<6.5	90	SHEN	10A BELL	$\Upsilon(1S) \rightarrow \gamma X$

NODE=M049R39
NODE=M049R39

 $\Gamma(\gamma\chi_{c1})/\Gamma_{\text{total}}$ Γ_{54}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<2.3	90	SHEN	10A BELL	$\Upsilon(1S) \rightarrow \gamma X$

NODE=M049R40
NODE=M049R40

 $\Gamma(\gamma\chi_{c2})/\Gamma_{\text{total}}$ Γ_{55}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<7.6	90	SHEN	10A BELL	$\Upsilon(1S) \rightarrow \gamma X$

NODE=M049R48
NODE=M049R48

 $\Gamma(\gamma X(3872) \rightarrow \pi^+ \pi^- J/\psi)/\Gamma_{\text{total}}$ Γ_{56}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<1.6	90	SHEN	10A BELL	$\Upsilon(1S) \rightarrow \gamma X$

NODE=M049R49
NODE=M049R49

 $\Gamma(\gamma X(3872) \rightarrow \pi^+ \pi^- \pi^0 J/\psi)/\Gamma_{\text{total}}$ Γ_{57}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<2.8	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_{58}/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

 $\Gamma(\gamma X(4140) \rightarrow \phi J/\psi)/\Gamma_{\text{total}}$ Γ_{59}/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_{60}/Γ

(X = scalar with $m < 8.0$ GeV)

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
< 4.5	90	³⁵ DEL-AMO-SA...11J	BABR	$e^+ e^- \rightarrow \gamma + X$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<30	90	³⁶ BALEST	95 CLEO	$e^+ e^- \rightarrow \gamma + X$

³⁵ For a noninteracting scalar X with mass $m < 8.0$ GeV.

³⁶ For a noninteracting pseudoscalar X with mass < 7.2 GeV.

NODE=M049R60
NODE=M049R60
NODE=M049R60

 $\Gamma(\gamma X \bar{X}(m_X < 3.1 \text{ GeV}))/\Gamma_{\text{total}}$ Γ_{61}/Γ

($X \bar{X}$ = vectors with $m < 3.1$ GeV)

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<1	90	³⁷ BALEST	95 CLEO	$e^+ e^- \rightarrow \gamma + X \bar{X}$

³⁷ For a noninteracting vector X with mass < 3.1 GeV.

NODE=M049R61
NODE=M049R61
NODE=M049R61

 $\Gamma(\gamma X \bar{X}(m_X < 4.5 \text{ GeV}))/\Gamma_{\text{total}}$ Γ_{62}/Γ

X and $\bar{X}$ = zero spin with $m < 4.5$ GeV

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<24	90	³⁸ DEL-AMO-SA...11J	BABR	$e^+ e^- \rightarrow \gamma + X \bar{X}$

³⁸ For a noninteracting scalar X with mass $m < 4.5$ GeV.

NODE=M049R01
NODE=M049R01
NODE=M049R01

 $\Gamma(\gamma X \rightarrow \gamma + \geq 4 \text{ prongs})/\Gamma_{\text{total}}$ Γ_{63}/Γ

($1.5 \text{ GeV} < m_X < 5.0 \text{ GeV}$)

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.78	95	ROSNER	07A CLEO	$e^+ e^- \rightarrow \gamma X$

NODE=M049R64
NODE=M049R64
NODE=M049R64

NODE=M049R60;LINKAGE=DA
NODE=M049R60;LINKAGE=A

NODE=M049R61;LINKAGE=A

NODE=M049R01;LINKAGE=DA

$\Gamma(\gamma a_1^0 \rightarrow \gamma \mu^+ \mu^-) / \Gamma_{\text{total}}$
 Γ_{64} / Γ
 $(201 < M(\mu^+ \mu^-) < 3565 \text{ MeV})$

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<9	90	39 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	40 LEES	13C BABR	$e^+ e^- \rightarrow \gamma a_1^0 \rightarrow \gamma \mu^+ \mu^-$

39 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 $1-9 \times 10^{-6}$.

40 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 $0.28-9.7 \times 10^{-6}$.

 $\Gamma(\gamma a_1^0 \Rightarrow \gamma \tau^+ \tau^-) / \Gamma_{\text{total}}$
 Γ_{65} / Γ
 $(2m_\tau < M(\tau^+ \tau^-) < 7500 \text{ MeV})$

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<50	90	41 LOVE	08 CLEO	$e^+ e^- \rightarrow \gamma a_1^0 \rightarrow \gamma \tau^+ \tau^-$

41 For a narrow scalar or pseudoscalar a_1^0 with $2m_\tau < M(\tau^+ \tau^-) < 7500 \text{ MeV}$. Measured 90% CL limits as a function of $M(\tau^+ \tau^-)$ range from $1-5 \times 10^{-5}$.

LEPTON FAMILY NUMBER (LF) VIOLATING MODES

 $\Gamma(\mu^\pm \tau^\mp) / \Gamma_{\text{total}}$
 Γ_{66} / Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<6.0	95	LOVE	08A CLEO	$e^+ e^- \rightarrow \mu^\pm \tau^\mp$

OTHER DECAYS

 $\Gamma(\text{invisible}) / \Gamma_{\text{total}}$
 Γ_{67} / 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	$\Upsilon(3S) \rightarrow \pi^+ \pi^- \Upsilon(1S)$

$\Upsilon(1S)$ REFERENCES

LEES	13C	PR D87 031102	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=54949
DOBBS	12A	PR D86 052003	S. Dobbs <i>et al.</i>		REFID=54746
BESSION	11	PR D83 037101	D. Besson <i>et al.</i>	(CLEO Collab.)	REFID=16737
DEL-AMO-SA...	11J	PRL 107 021804	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)	REFID=16495
AUBERT	10C	PR D81 011102	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=53211
DEL-AMO-SA...	10C	PRL 104 191801	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)	REFID=53354
SHEN	10A	PR D82 051504	C.P. Shen <i>et al.</i>	(BELLE Collab.)	REFID=53545
AUBERT	09AX	PRL 103 251801	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=53201
LOVE	08	PRL 101 151802	W. Love <i>et al.</i>	(CLEO Collab.)	REFID=52565
LOVE	08A	PRL 101 201601	W. Love <i>et al.</i>	(CLEO Collab.)	REFID=52592
PDG	08	PL B667 1	C. Amsler <i>et al.</i>	(PDG Collab.)	REFID=52166
ASNER	07	PR D75 012009	D.M. Asner <i>et al.</i>	(CLEO Collab.)	REFID=51617
ATHAR	07A	PR D76 072003	S.B. Athar <i>et al.</i>	(CLEO Collab.)	REFID=51945
BESSION	07	PRL 98 052002	D. Besson <i>et al.</i>	(CLEO Collab.)	REFID=51620
BESSION	07A	PR D75 072001	D. Besson <i>et al.</i>	(CLEO Collab.)	REFID=51638
ROSNER	07A	PR D76 117102	J.L. Rosner <i>et al.</i>	(CLEO Collab.)	REFID=52079
RUBIN	07	PR D75 031104	P. Rubin <i>et al.</i>	(CLEO Collab.)	REFID=51629
TAJIMA	07	PRL 98 132001	O. Tajima <i>et al.</i>	(BELLE Collab.)	REFID=51645
AQUINES	06A	PR D74 092006	O. Aquines <i>et al.</i>	(CLEO Collab.)	REFID=51510
ATHAR	06	PR D73 032001	S.B. Athar <i>et al.</i>	(CLEO Collab.)	REFID=50993
BESSION	06A	PR D74 012003	D. Besson <i>et al.</i>	(CLEO Collab.)	REFID=51147
ROSNER	06	PRL 96 092003	J.L. Rosner <i>et al.</i>	(CLEO Collab.)	REFID=51035
ADAMS	05	PRL 94 012001	G.S. Adams <i>et al.</i>	(CLEO Collab.)	REFID=50452
BRIERE	04	PR D70 072001	R.A. Briere <i>et al.</i>	(CLEO Collab.)	REFID=50183
ARTUSO	03	PR D67 052003	M. Artuso <i>et al.</i>	(CLEO Collab.)	REFID=49395
MASEK	02	PR D65 072002	G. Masek <i>et al.</i>	(CLEO Collab.)	REFID=48846
RICHICHI	01B	PRL 87 141801	S.J. Richichi <i>et al.</i>	(CLEO Collab.)	REFID=48345
ARTAMONOV	00	PL B474 427	A.S. Artamonov <i>et al.</i>		REFID=47424
ANASTASSOV	99	PRL 82 286	A. Anastassov <i>et al.</i>	(CLEO Collab.)	REFID=46609
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
BALEST	95	PR D51 2053	R. Balest <i>et al.</i>	(CLEO Collab.)	REFID=44146
CINABRO	94B	PL B340 129	D. Cinabro <i>et al.</i>	(CLEO Collab.)	REFID=44102
ALBRECHT	92J	ZPHY C55 25	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=42167
BARU	92	ZPHY C54 229	S.E. Baru <i>et al.</i>	(NOVO)	REFID=41860

NODE=M049R65

NODE=M049R65

NODE=M049R65

NODE=M049R65;LINKAGE=LO

NODE=M049R65;LINKAGE=LE

NODE=M049R66

NODE=M049R66

NODE=M049R66

NODE=M049R66;LINKAGE=LO

NODE=M049230

NODE=M049R67

NODE=M049R67

NODE=M049235

NODE=M049R10

NODE=M049R10

NODE=M049

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.)
BUCHMUELLER	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)
BESSON	84	PR D30 1433	D. Besson <i>et al.</i>	(CLEO Collab.)
GILES	84B	PR D29 1285	R. Giles <i>et al.</i>	(CLEO Collab.)
MACKAY	84	PR D29 2483	W.W. MacKay <i>et al.</i>	(CUSB Collab.)
ANDREWS	83	PRL 50 807	D.E. Andrews <i>et al.</i>	(CLEO Collab.)
GILES	83	PRL 50 877	R. Giles <i>et al.</i>	(HARV, OSU, ROCH, RUTG+)
NICZYPORUK	83	ZPHY C17 197	B. Niczyporuk <i>et al.</i>	(LENA Collab.)
ALBRECHT	82	PL 116B 383	H. Albrecht <i>et al.</i>	(DESY, DORT, HEIDH+)
ARTAMONOV	82	PL 118B 225	A.S. Artamonov <i>et al.</i>	(NOVO)
NICZYPORUK	82	ZPHY C15 299	B. Niczyporuk <i>et al.</i>	(LENA Collab.)
BERGER	80C	PL 93B 497	C. Berger <i>et al.</i>	(PLUTO Collab.)
BOCK	80	ZPHY C6 125	P. Bock <i>et al.</i>	(HEIDP, MPIM, DESY, HAMB)
BERGER	79	ZPHY C1 343	C. Berger <i>et al.</i>	(PLUTO Collab.)

REFID=42168
REFID=41861
REFID=41361
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REFID=40731
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REFID=22264
REFID=22259

NODE=M076

$\chi_{b0}(1P)$

$$J^G(J^{PC}) = 0^+(0^{++})$$

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

$\chi_{b0}(1P)$ MASS

VALUE (MeV)	DOCUMENT ID
$9859.44 \pm 0.42 \pm 0.31$ OUR EVALUATION	From average γ energy below, using $\Upsilon(2S)$
mass = 10023.26 ± 0.31 MeV	

NODE=M076M

NODE=M076M
→ UNCHECKED ←

γ ENERGY IN $\Upsilon(2S)$ DECAY

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
162.5 ± 0.4 OUR AVERAGE			
$162.56 \pm 0.19 \pm 0.42$	ARTUSO	05	CLEO $\Upsilon(2S) \rightarrow \gamma X$
$162.0 \pm 0.8 \pm 1.2$	EDWARDS	99	CLE2 $\Upsilon(2S) \rightarrow \gamma \chi(1P)$
$162.1 \pm 0.5 \pm 1.4$	ALBRECHT	85E	ARG $\Upsilon(2S) \rightarrow \text{conv.} \gamma X$
$163.8 \pm 1.6 \pm 2.7$	NERNST	85	CBAL $\Upsilon(2S) \rightarrow \gamma X$
$158.0 \pm 7 \pm 1$	HAAS	84	CLEO $\Upsilon(2S) \rightarrow \text{conv.} \gamma X$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$149.4 \pm 0.7 \pm 5.0$	KLOPFEN...	83	CUSB $\Upsilon(2S) \rightarrow \gamma X$

NODE=M076DM

NODE=M076DM

$\chi_{b0}(1P)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)	Confidence level
$\Gamma_1 \quad \gamma \Upsilon(1S)$	(1.76 ± 0.35) %	
$\Gamma_2 \quad D^0 X$	< 10.4 %	90%
$\Gamma_3 \quad \pi^+ \pi^- K^+ K^- \pi^0$	< 1.6 $\times 10^{-4}$	90%
$\Gamma_4 \quad 2\pi^+ \pi^- K^- K_S^0$	< 5 $\times 10^{-5}$	90%
$\Gamma_5 \quad 2\pi^+ \pi^- K^- K_S^0 2\pi^0$	< 5 $\times 10^{-4}$	90%
$\Gamma_6 \quad 2\pi^+ 2\pi^- 2\pi^0$	< 2.1 $\times 10^{-4}$	90%
$\Gamma_7 \quad 2\pi^+ 2\pi^- K^+ K^-$	(1.1 ± 0.6) $\times 10^{-4}$	
$\Gamma_8 \quad 2\pi^+ 2\pi^- K^+ K^- \pi^0$	< 2.7 $\times 10^{-4}$	90%
$\Gamma_9 \quad 2\pi^+ 2\pi^- K^+ K^- 2\pi^0$	< 5 $\times 10^{-4}$	90%
$\Gamma_{10} \quad 3\pi^+ 2\pi^- K^- K_S^0 \pi^0$	< 1.6 $\times 10^{-4}$	90%
$\Gamma_{11} \quad 3\pi^+ 3\pi^-$	< 8 $\times 10^{-5}$	90%
$\Gamma_{12} \quad 3\pi^+ 3\pi^- 2\pi^0$	< 6 $\times 10^{-4}$	90%
$\Gamma_{13} \quad 3\pi^+ 3\pi^- K^+ K^-$	(2.4 ± 1.2) $\times 10^{-4}$	
$\Gamma_{14} \quad 3\pi^+ 3\pi^- K^+ K^- \pi^0$	< 1.0 $\times 10^{-3}$	90%
$\Gamma_{15} \quad 4\pi^+ 4\pi^-$	< 8 $\times 10^{-5}$	90%
$\Gamma_{16} \quad 4\pi^+ 4\pi^- 2\pi^0$	< 2.1 $\times 10^{-3}$	90%

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

$\chi_{b0}(1P)$ BRANCHING RATIOS

NODE=M076220

 $\Gamma(\gamma \Upsilon(1S))/\Gamma_{\text{total}}$ Γ_1/Γ

VALUE (%)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$1.76 \pm 0.30 \pm 0.18$		87	^{1,2} KORNICER	11 CLEO	$e^+e^- \rightarrow \gamma \gamma \ell^+ \ell^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 4.6	90		³ 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 Assuming $B(\Upsilon(1S) \rightarrow \ell^+ \ell^-) = (2.48 \pm 0.05)\%$.² 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.³ 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=KA

NODE=M076R1;LINKAGE=KR

NODE=M076R1;LINKAGE=LE

 $\Gamma(D^0 X)/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 10.4 \times 10^{-2}$	90	^{4,5} BRIERE	08 CLEO	$\Upsilon(2S) \rightarrow \gamma D^0 X$

⁴ For $p_{D^0} > 2.5$ GeV/c.⁵ 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	⁶ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^- \pi^0$

⁶ ASNER 08A reports $[\Gamma(\chi_{b0}(1P) \rightarrow \pi^+ \pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))] < 6 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P)) = 3.8 \times 10^{-2}$.

NODE=M076R02

NODE=M076R02

NODE=M076R02;LINKAGE=AS

 $\Gamma(2\pi^+ \pi^- K^- K_S^0)/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 0.5	90	⁷ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+ \pi^- K^- K_S^0$

⁷ ASNER 08A reports $[\Gamma(\chi_{b0}(1P) \rightarrow 2\pi^+ \pi^- K^- K_S^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))] < 2 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P)) = 3.8 \times 10^{-2}$.

NODE=M076R03

NODE=M076R03

NODE=M076R03;LINKAGE=AS

 $\Gamma(2\pi^+ \pi^- K^- K_S^0 2\pi^0)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 5	90	⁸ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+ \pi^- K^- 2\pi^0$

⁸ ASNER 08A reports $[\Gamma(\chi_{b0}(1P) \rightarrow 2\pi^+ \pi^- K^- K_S^0 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))] < 18 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P)) = 3.8 \times 10^{-2}$.

NODE=M076R04

NODE=M076R04

NODE=M076R04;LINKAGE=AS

 $\Gamma(2\pi^+ 2\pi^- 2\pi^0)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 2.1	90	⁹ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+ 2\pi^- 2\pi^0$

⁹ ASNER 08A reports $[\Gamma(\chi_{b0}(1P) \rightarrow 2\pi^+ 2\pi^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))] < 8 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P)) = 3.8 \times 10^{-2}$.

NODE=M076R05

NODE=M076R05

NODE=M076R05;LINKAGE=AS

 $\Gamma(2\pi^+ 2\pi^- K^+ K^-)/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.1 \pm 0.6 \pm 0.1$	7	¹⁰ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+ 2\pi^- K^+ K^-$

¹⁰ 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	11 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+ 2\pi^- K^+ K^- \pi^0$ 11 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	12 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+ 2\pi^- K^+ K^- 2\pi^0$ 12 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	13 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+ 2\pi^- K^- K_S^0 \pi^0$ 13 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	14 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+ 3\pi^-$ 14 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	15 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+ 3\pi^- 2\pi^0$ 15 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	16 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+ 3\pi^- K^+ K^-$ 16 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	17 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+ 3\pi^- K^+ K^- \pi^0$ 17 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	18 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 4\pi^+ 4\pi^-$ 18 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	19 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 4\pi^+ 4\pi^- 2\pi^0$ 19 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

$\chi_{b0}(1P)$ CROSS-PARTICLE BRANCHING RATIOS

NODE=M076230

$$\Gamma(\chi_{b0}(1P) \rightarrow \gamma \Upsilon(1S)) / \Gamma_{\text{total}} \times \Gamma(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P)) / \Gamma_{\text{total}} \Gamma_1 / \Gamma \times \Gamma_{16}^{\Upsilon(2S)} / \Gamma \Upsilon(2S)$$

NODE=M076B02
NODE=M076B02

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<1.7 \times 10^{-3}$	90	²⁰ LEES	11J BABR	$\Upsilon(2S) \rightarrow X\gamma$
²⁰ 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 $B(\Upsilon(4S) \rightarrow \gamma \chi_{b0}(1P)) = (3.8 \pm 0.4)\%$.				

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
$1.63 \pm 0.24 \pm 0.15$	87	KORNICER	11 CLEO	$e^+ e^- \rightarrow \gamma \gamma \ell^+ \ell^-$

 $\chi_{b0}(1P)$ REFERENCES

NODE=M076

KORNICER	11	PR D83 054003	M. Kornicer <i>et al.</i>	(CLEO Collab.)	REFID=16769
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
ARTUSO	05	PRL 94 032001	M. Artuso <i>et al.</i>	(CLEO Collab.)	REFID=50454
EDWARDS	99	PR D59 032003	K.W. Edwards <i>et al.</i>	(CLEO Collab.)	REFID=46612
WALK	86	PR D34 2611	W.S. Walk <i>et al.</i>	(Crystal Ball Collab.)	REFID=22290
ALBRECHT	85E	PL 160B 331	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=22288
NERNST	85	PRL 54 2195	R. Nernst <i>et al.</i>	(Crystal Ball Collab.)	REFID=22289
HAAS	84	PRL 52 799	J. Haas <i>et al.</i>	(CLEO Collab.)	REFID=22287
KLOPFEN...	83	PRL 51 160	C. Klopstein <i>et al.</i>	(CUSB Collab.)	REFID=22285
PAUSS	83	PL 130B 439	F. Pauss <i>et al.</i>	(MPIM, COLU, CORN, LSU+)	REFID=22286

NODE=M077

 $\chi_{b1}(1P)$

$$J^G(J^{PC}) = 0^+(1^{++})$$

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

 $\chi_{b1}(1P)$ MASS

NODE=M077M

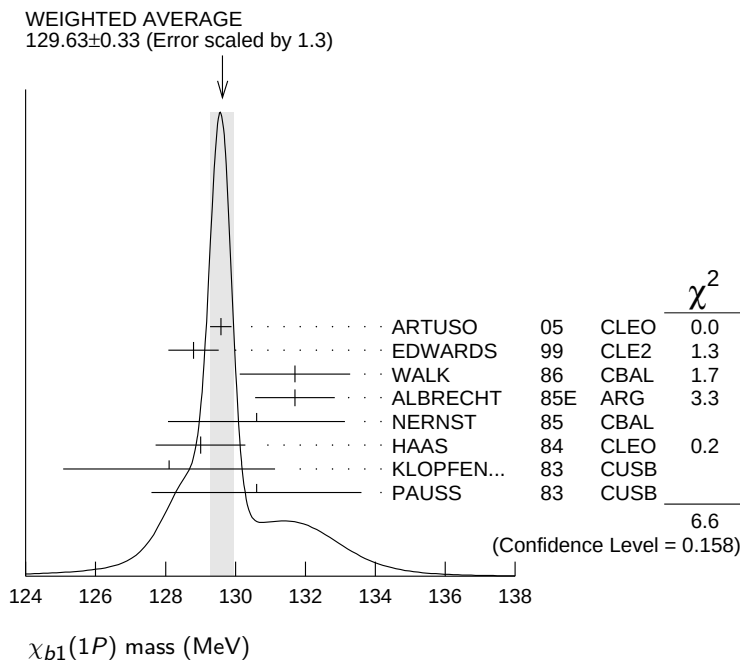
VALUE (MeV)	DOCUMENT ID
$9892.78 \pm 0.26 \pm 0.31$ OUR EVALUATION	From average γ energy below, using $\Upsilon(2S)$
mass = 10023.26 ± 0.31 MeV	

NODE=M077M
→ UNCHECKED ← γ ENERGY IN $\Upsilon(2S)$ DECAY

NODE=M077DM

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
129.63 ± 0.33 OUR AVERAGE	Error includes scale factor of 1.3. See the ideogram below.		
$129.58 \pm 0.09 \pm 0.29$	ARTUSO	05 CLEO	$\Upsilon(2S) \rightarrow \gamma X$
$128.8 \pm 0.4 \pm 0.6$	EDWARDS	99 CLE2	$\Upsilon(2S) \rightarrow \gamma \chi(1P)$
$131.7 \pm 0.9 \pm 1.3$	WALK	86 CBAL	$\Upsilon(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$
$131.7 \pm 0.3 \pm 1.1$	ALBRECHT	85E ARG	$\Upsilon(2S) \rightarrow \text{conv.} \gamma X$
$130.6 \pm 0.8 \pm 2.4$	NERNST	85 CBAL	$\Upsilon(2S) \rightarrow \gamma X$
$129 \pm 0.8 \pm 1$	HAAS	84 CLEO	$\Upsilon(2S) \rightarrow \text{conv.} \gamma X$
$128.1 \pm 0.4 \pm 3.0$	KLOPFEN...	83 CUSB	$\Upsilon(2S) \rightarrow \gamma X$
130.6 ± 3.0	PAUSS	83 CUSB	$\Upsilon(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$

NODE=M077DM



$\chi_{b1}(1P)$ DECAY MODES

NODE=M077215;NODE=M077

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 $\gamma \Upsilon(1S)$	(33.9±2.2) %	DESIG=1
Γ_2 $D^0 X$	(12.6±2.2) %	DESIG=2
Γ_3 $\pi^+ \pi^- K^+ K^- \pi^0$	(2.0±0.6) × 10 ⁻⁴	DESIG=3
Γ_4 $2\pi^+ \pi^- K^- K_S^0$	(1.3±0.5) × 10 ⁻⁴	DESIG=4
Γ_5 $2\pi^+ \pi^- K^- K_S^0 2\pi^0$	< 6 × 10 ⁻⁴	90% DESIG=5
Γ_6 $2\pi^+ 2\pi^- 2\pi^0$	(8.0±2.5) × 10 ⁻⁴	DESIG=6
Γ_7 $2\pi^+ 2\pi^- K^+ K^-$	(1.5±0.5) × 10 ⁻⁴	DESIG=7
Γ_8 $2\pi^+ 2\pi^- K^+ K^- \pi^0$	(3.5±1.2) × 10 ⁻⁴	DESIG=8
Γ_9 $2\pi^+ 2\pi^- K^+ K^- 2\pi^0$	(8.6±3.2) × 10 ⁻⁴	DESIG=9
Γ_{10} $3\pi^+ 2\pi^- K^- K_S^0 \pi^0$	(9.3±3.3) × 10 ⁻⁴	DESIG=10
Γ_{11} $3\pi^+ 3\pi^-$	(1.9±0.6) × 10 ⁻⁴	DESIG=11
Γ_{12} $3\pi^+ 3\pi^- 2\pi^0$	(1.7±0.5) × 10 ⁻³	DESIG=12
Γ_{13} $3\pi^+ 3\pi^- K^+ K^-$	(2.6±0.8) × 10 ⁻⁴	DESIG=13
Γ_{14} $3\pi^+ 3\pi^- K^+ K^- \pi^0$	(7.5±2.6) × 10 ⁻⁴	DESIG=14
Γ_{15} $4\pi^+ 4\pi^-$	(2.6±0.9) × 10 ⁻⁴	DESIG=15
Γ_{16} $4\pi^+ 4\pi^- 2\pi^0$	(1.4±0.6) × 10 ⁻³	DESIG=16

$\chi_{b1}(1P)$ BRANCHING RATIOS

NODE=M077220

$\Gamma(\gamma \Upsilon(1S))/\Gamma_{\text{total}}$	Γ_1/Γ
VALUE	COMMENT
0.339±0.022 OUR AVERAGE	
0.331±0.018±0.017 3222	^{1,2} KORNICER 11 CLEO $e^+ e^- \rightarrow \gamma \gamma \ell^+ \ell^-$
0.350±0.023±0.018 13k	³ LEES 11J BABR $\Upsilon(2S) \rightarrow X \gamma$
0.32 ±0.06 ±0.07	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

¹ Assuming $B(\Upsilon(1S) \rightarrow \ell^+ \ell^-) = (2.48 \pm 0.05)\%$.

² KORNICER 11 reports $[\Gamma(\chi_{b1}(1P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))]$
 $= (22.8 \pm 0.4 \pm 1.2) \times 10^{-3}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))$
 $= (6.9 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

³ LEES 11J reports $[\Gamma(\chi_{b1}(1P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))]$
 $= (24.1 \pm 0.6 \pm 1.5) \times 10^{-3}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))$
 $= (6.9 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M077R1;LINKAGE=KA
NODE=M077R1;LINKAGE=KR

NODE=M077R1;LINKAGE=LE

$\Gamma(D^0 X)/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE (units 10^{-2})	EVTs	DOCUMENT ID	TECN	COMMENT
12.6±1.9±1.1	2310	⁴ BRIERE	08 CLEO	$\Upsilon(2S) \rightarrow \gamma D^0 X$

⁴ For $p_{D^0} > 2.5$ GeV/c.NODE=M077R01
NODE=M077R01

NODE=M077R01;LINKAGE=BR

 $\Gamma(\pi^+ \pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
2.0±0.6±0.1	18	⁵ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^- \pi^0$

⁵ ASNER 08A reports $[\Gamma(\chi_{b1}(1P) \rightarrow \pi^+ \pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))] = (14 \pm 3 \pm 3) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M077R02
NODE=M077R02

NODE=M077R02;LINKAGE=AS

 $\Gamma(2\pi^+ \pi^- K^- K_S^0)/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
1.3±0.5±0.1	11	⁶ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+ \pi^- K^- K_S^0$

⁶ ASNER 08A reports $[\Gamma(\chi_{b1}(1P) \rightarrow 2\pi^+ \pi^- K^- K_S^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))] = (9 \pm 3 \pm 2) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M077R03
NODE=M077R03

NODE=M077R03;LINKAGE=AS

 $\Gamma(2\pi^+ \pi^- K^- K_S^0 2\pi^0)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<6	90	⁷ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+ \pi^- K^- 2\pi^0$

⁷ ASNER 08A reports $[\Gamma(\chi_{b1}(1P) \rightarrow 2\pi^+ \pi^- K^- K_S^0 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))] < 42 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = 6.9 \times 10^{-2}$.

NODE=M077R04
NODE=M077R04

NODE=M077R04;LINKAGE=AS

 $\Gamma(2\pi^+ 2\pi^- 2\pi^0)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
8.0±2.4±0.4	46	⁸ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+ 2\pi^- 2\pi^0$

⁸ ASNER 08A reports $[\Gamma(\chi_{b1}(1P) \rightarrow 2\pi^+ 2\pi^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))] = (55 \pm 9 \pm 14) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M077R05
NODE=M077R05

NODE=M077R05;LINKAGE=AS

 $\Gamma(2\pi^+ 2\pi^- K^+ K^-)/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
1.5±0.5±0.1	18	⁹ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+ 2\pi^- K^+ K^-$

⁹ ASNER 08A reports $[\Gamma(\chi_{b1}(1P) \rightarrow 2\pi^+ 2\pi^- K^+ K^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))] = (10 \pm 3 \pm 2) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M077R06
NODE=M077R06

NODE=M077R06;LINKAGE=AS

 $\Gamma(2\pi^+ 2\pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
3.5±1.2±0.2	22	¹⁰ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+ 2\pi^- K^+ K^- \pi^0$

¹⁰ ASNER 08A reports $[\Gamma(\chi_{b1}(1P) \rightarrow 2\pi^+ 2\pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))] = (24 \pm 6 \pm 6) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M077R07
NODE=M077R07

NODE=M077R07;LINKAGE=AS

 $\Gamma(2\pi^+ 2\pi^- K^+ K^- 2\pi^0)/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
8.6±3.2±0.4	26	¹¹ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+ 2\pi^- K^+ K^- 2\pi^0$

¹¹ ASNER 08A reports $[\Gamma(\chi_{b1}(1P) \rightarrow 2\pi^+ 2\pi^- K^+ K^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))] = (59 \pm 14 \pm 17) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M077R08
NODE=M077R08

NODE=M077R08;LINKAGE=AS

$$\Gamma(3\pi^+ 2\pi^- K^- K_S^0 \pi^0)/\Gamma_{\text{total}}$$

 Γ_{10}/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
9.3±3.3±0.5	21	12 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+ 2\pi^- K^- K_S^0 \pi^0$

NODE=M077R09
NODE=M077R09

¹²ASNER 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	13 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+ 3\pi^-$

NODE=M077R10
NODE=M077R10

¹³ASNER 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±5±1	56	14 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+ 3\pi^- 2\pi^0$

NODE=M077R11
NODE=M077R11

¹⁴ASNER 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;LINKAGE=AS

$$\Gamma(3\pi^+ 3\pi^- K^+ K^-)/\Gamma_{\text{total}}$$

 Γ_{13}/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
2.6±0.8±0.1	21	15 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+ 3\pi^- K^+ K^-$

NODE=M077R12
NODE=M077R12

¹⁵ASNER 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;LINKAGE=AS

$$\Gamma(3\pi^+ 3\pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}$$

 Γ_{14}/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
7.5±2.6±0.4	28	16 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+ 3\pi^- K^+ K^- \pi^0$

NODE=M077R13
NODE=M077R13

¹⁶ASNER 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;LINKAGE=AS

$$\Gamma(4\pi^+ 4\pi^-)/\Gamma_{\text{total}}$$

 Γ_{15}/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
2.6±0.9±0.1	24	17 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 4\pi^+ 4\pi^-$

NODE=M077R14
NODE=M077R14

¹⁷ASNER 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;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±5±1	26	18 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 4\pi^+ 4\pi^- 2\pi^0$

NODE=M077R15
NODE=M077R15

¹⁸ASNER 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;LINKAGE=AS

$\chi_{b1}(1P)$ Cross-Particle Branching Ratios

NODE=M077230

$$\Gamma(\chi_{b1}(1P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))/\Gamma_{\text{total}}$$

$$\Gamma_1/\Gamma \times \Gamma_{14}^{\Upsilon(2S)}/\Gamma \Upsilon(2S)$$

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
24.1±0.6±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
5.65±0.11±0.27	3222	KORNICER	11	CLEO $e^+e^- \rightarrow \gamma\gamma\ell^+\ell^-$

NODE=M077B01
NODE=M077B01

$$B(\chi_{b1}(1P) \rightarrow \gamma \Upsilon(1S)) \times B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(1P)) \times B(\Upsilon(1S) \rightarrow \ell^+ \ell^-)$$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
1.33±0.30±0.23	50	KORNICER	11	CLEO $e^+e^- \rightarrow \gamma\gamma\ell^+\ell^-$

NODE=M077B02
NODE=M077B02

$$B(\chi_{b2}(1P) \rightarrow \rho X + \bar{\rho} X)/B(\chi_{b1}(1P) \rightarrow \rho X + \bar{\rho} X)$$

VALUE	DOCUMENT ID	TECN	COMMENT
1.068±0.010±0.040	BRIERE	07	CLEO $\Upsilon(2S) \rightarrow \gamma\chi_{bJ}(1P)$

NODE=M077R20
NODE=M077R20

$$B(\chi_{b0}(1P) \rightarrow \rho X + \bar{\rho} X)/B(\chi_{b1}(1P) \rightarrow \rho X + \bar{\rho} X)$$

VALUE	DOCUMENT ID	TECN	COMMENT
1.11±0.15±0.20	BRIERE	07	CLEO $\Upsilon(2S) \rightarrow \gamma\chi_{bJ}(1P)$

NODE=M077R21
NODE=M077R21

$\chi_{b1}(1P)$ REFERENCES

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=16769
REFID=53936
REFID=52574
REFID=52577
REFID=51887
REFID=50454
REFID=46612
REFID=40019
REFID=22290
REFID=22288
REFID=22289
REFID=22287
REFID=22285
REFID=22286

$$h_b(1P)$$

$$I^G(J^{PC}) = ?^?(1^{+-})$$

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±1.0 OUR AVERAGE

[9898.6 ± 1.4 MeV OUR 2012 AVERAGE]

9899.1±0.4±1.0	70k	MIZUK	12	BELL $e^+e^- \rightarrow \pi^+\pi^-\text{ hadrons}$
9902 ±4 ±2	10.8k	LEES	11K	BABR $\Upsilon(3S) \rightarrow \eta_b\gamma\pi^0$

• • • We do not use the following data for averages, fits, limits, etc. • • •

9898.2 ^{+1.1+1.0} _{-1.0-1.1}	50.0k	¹ ADACHI	12	BELL 10.86 $e^+e^- \rightarrow \pi^+\pi^-\text{ MM}$

¹ Superseded by MIZUK 12.

NODE=M204M

NODE=M204M
NEW

NODE=M204M;LINKAGE=AD

$h_b(1P)$ DECAY MODES

NODE=M204215;NODE=M204

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \eta_b(1S)\gamma$	(49 ⁺⁸ ₋₇) %

DESIG=1

$h_b(1P)$ BRANCHING RATIOS

NODE=M204225

$$\Gamma(\eta_b(1S)\gamma)/\Gamma_{\text{total}}$$

$$\Gamma_1/\Gamma$$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
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 $\Upsilon(3S) \rightarrow \eta_b\gamma\pi^0$

NODE=M204R01
NODE=M204R01

$h_b(1P)$ REFERENCES

NODE=M204

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.)

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

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

NODE=M078M

→ UNCHECKED ←

 γ ENERGY IN $\Upsilon(2S)$ DECAY

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

NODE=M078DM

 $\chi_{b2}(1P)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)	Confidence level
$\Gamma_1 \quad \gamma \Upsilon(1S)$	(19.1 ± 1.2) %	
$\Gamma_2 \quad D^0 X$	< 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	

NODE=M078215;NODE=M078

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

 $\chi_{b2}(1P)$ BRANCHING RATIOS $\Gamma(\gamma \Upsilon(1S))/\Gamma_{\text{total}}$ Γ_1/Γ

VALUE

EVTS

DOCUMENT ID

TECN

COMMENT

0.191 ± 0.012 OUR AVERAGE

0.186 ± 0.011 ± 0.009	1770	^{1,2} KORNICER	11	CLEO	$e^+ e^- \rightarrow \gamma \gamma \ell^+ \ell^-$
0.194 ^{+0.014} _{-0.017} ± 0.009	8k	³ LEES	11J	BABR	$\Upsilon(2S) \rightarrow X \gamma$
0.27 ± 0.06 ± 0.06		WALK	86	CBAL	$\Upsilon(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$
0.20 ± 0.05		KLOPFEN...	83	CUSB	$\Upsilon(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$

¹ Assuming $B(\Upsilon(1S) \rightarrow \ell^+ \ell^-) = (2.48 \pm 0.05)\%$.

² 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.

³ 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=M078220

NODE=M078R1

NODE=M078R1

NODE=M078R1;LINKAGE=KA

NODE=M078R1;LINKAGE=KR

NODE=M078R1;LINKAGE=LE

$\Gamma(D^0 X)/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<7.9 \times 10^{-2}$	90	4,5 BRIERE	08 CLEO	$\Upsilon(2S) \rightarrow \gamma D^0 X$

⁴ For $p_{D^0} > 2.5$ GeV/c.⁵ The authors also present their result as $(5.4 \pm 1.9 \pm 0.5) \times 10^{-2}$.NODE=M078R01
NODE=M078R01NODE=M078R01;LINKAGE=BR
NODE=M078R01;LINKAGE=RI $\Gamma(\pi^+ \pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$0.84 \pm 0.50 \pm 0.04$	8	⁶ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^- \pi^0$

⁶ 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
NODE=M078R02

NODE=M078R02;LINKAGE=AS

 $\Gamma(2\pi^+ \pi^- K^- K_S^0)/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.0	90	⁷ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+ \pi^- K^- K_S^0$

⁷ 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
NODE=M078R03

NODE=M078R03;LINKAGE=AS

 $\Gamma(2\pi^+ \pi^- K^- K_S^0 2\pi^0)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$5.3 \pm 2.4 \pm 0.3$	11	⁸ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+ \pi^- K^- 2\pi^0$

⁸ ASNER 08A reports $[\Gamma(\chi_{b2}(1P) \rightarrow 2\pi^+ \pi^- K^- K_S^0 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P))] = (38 \pm 14 \pm 10) \times 10^{-6}$ 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
$3.5 \pm 1.4 \pm 0.2$	19	⁹ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+ 2\pi^- 2\pi^0$

⁹ 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
$1.1 \pm 0.4 \pm 0.1$	14	¹⁰ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+ 2\pi^- K^+ K^-$

¹⁰ 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
$2.1 \pm 0.9 \pm 0.1$	13	¹¹ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+ 2\pi^- K^+ K^- \pi^0$

¹¹ 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
$3.9 \pm 1.8 \pm 0.2$	11	¹² ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+ 2\pi^- K^+ K^- 2\pi^0$

¹² 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	13 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+ 2\pi^- K^- K_S^0 \pi^0$
13 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	14 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+ 3\pi^-$
14 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	15 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+ 3\pi^- 2\pi^0$
15 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	16 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+ 3\pi^- K^+ K^-$
16 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±1.5±0.2	14	17 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+ 3\pi^- K^+ K^- \pi^0$
17 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±0.40±0.04	7	18 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 4\pi^+ 4\pi^-$
18 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±7±1	29	19 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 4\pi^+ 4\pi^- 2\pi^0$
19 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

 $\chi_{b2}(1P)$ Cross-Particle Branching Ratios

NODE=M078230

$$\Gamma(\chi_{b2}(1P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P))/\Gamma_{\text{total}}$$

$$\Gamma_1/\Gamma \times \Gamma_{15}^{\Upsilon(2S)}/\Gamma \Upsilon(2S)$$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
13.9±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
$3.29 \pm 0.09 \pm 0.16$	1770	KORNICER	11	CLEO $e^+ e^- \rightarrow \gamma \gamma \ell^+ \ell^-$

NODE=M078B01
NODE=M078B01

$$B(\chi_{b2}(1P) \rightarrow \gamma \Upsilon(1S)) \times B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(1P)) \times B(\Upsilon(1S) \rightarrow \ell^+ \ell^-)$$

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT
$3.56 \pm 0.40 \pm 0.41$	126	KORNICER	11	CLEO $e^+ e^- \rightarrow \gamma \gamma \ell^+ \ell^-$

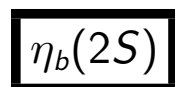
NODE=M078B02
NODE=M078B02

$\chi_{b2}(1P)$ REFERENCES

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.) J
WALK	86	PR D34 2611	W.S. Walk <i>et al.</i>	(Crystal Ball Collab.)
ALBRECHT	85E	PL 160B 331	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
NERNST	85	PRL 54 2195	R. Nernst <i>et al.</i>	(Crystal Ball Collab.)
HAAS	84	PRL 52 799	J. Haas <i>et al.</i>	(CLEO Collab.)
KLOPFEN...	83	PRL 51 160	C. Klopfenstein <i>et al.</i>	(CUSB Collab.)
PAUSS	83	PL 130B 439	F. Pauss <i>et al.</i>	(MPIM, COLU, CORN, LSU+)

NODE=M078

REFID=16769
REFID=53936
REFID=52574
REFID=52577
REFID=50454
REFID=46612
REFID=40019
REFID=22290
REFID=22288
REFID=22289
REFID=22287
REFID=22285
REFID=22286



$$I^G(J^{PC}) = 0^+(0^{-+})$$

OMITTED FROM SUMMARY TABLE

Quantum numbers shown are quark-model predictions.

NODE=M200

NODE=M200

$\eta_b(2S)$ MASS

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
$9999.0 \pm 3.5^{+2.8}_{-1.9}$	26k	¹ MIZUK	12	BELL $e^+ e^- \rightarrow \gamma \pi^+ \pi^- +$ hadrons

• • • We do not use the following data for averages, fits, limits, etc. • • •

$9974.6 \pm 2.3 \pm 2.1$	11 ± 4	^{2,3} DOBBS	12	$\Upsilon(2S) \rightarrow \gamma$ hadrons

¹ Assuming $\Gamma_{\eta_b(2S)} = 4.9$ MeV. Not independent of the corresponding mass difference measurement.

² Obtained by analyzing CLEO III data but not authored by the CLEO Collaboration.

³ Assuming $\Gamma_{\eta_b(2S)} = 5$ MeV. Not independent of the corresponding mass difference measurement.

NODE=M200M

NODE=M200M

NODE=M200M;LINKAGE=MI

NODE=M200M;LINKAGE=DO

NODE=M200M;LINKAGE=NI

$m_{\Upsilon(2S)} - m_{\eta_b(2S)}$

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
$24.3 \pm 3.5^{+2.8}_{-1.9}$	26k	⁴ 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	^{5,6} DOBBS	12	$\Upsilon(2S) \rightarrow \gamma$ hadrons

⁴ Assuming $\Gamma_{\eta_b(2S)} = 4.9$ MeV. Not independent of the corresponding mass measurement.

⁵ Obtained by analyzing CLEO III data but not authored by the CLEO Collaboration.

⁶ Assuming $\Gamma_{\eta_b(2S)} = 5$ MeV. Not independent of the corresponding mass measurement.

NODE=M200DM

NODE=M200DM

NODE=M200DM;LINKAGE=MI

NODE=M200DM;LINKAGE=DO

NODE=M200DM;LINKAGE=NI

$\eta_b(2S)$ WIDTH

VALUE (MeV)	CL%	DOCUMENT ID	TECN	COMMENT
<24	90	MIZUK	12	BELL $e^+ e^- \rightarrow \gamma \pi^+ \pi^-$ hadrons

NODE=M200W

NODE=M200W

$\eta_b(2S)$ DECAY MODES

NODE=M200215;NODE=M200

Mode	Fraction (Γ_i/Γ)
Γ_1 hadrons	seen

DESIG=1

$\eta_b(2S)$ 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	⁷	DOBBS	12 $\Upsilon(2S) \rightarrow \gamma$ hadrons
⁷ Obtained by analyzing CLEO III data but not authored by the CLEO Collaboration.			

NODE=M200225

NODE=M200R01
NODE=M200R01

NODE=M200R01;LINKAGE=DO

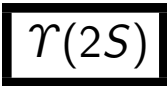
$\eta_b(2S)$ REFERENCES

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=M200

REFID=54288
REFID=54718

NODE=M052



$I^G(J^{PC}) = 0^-(1^--)$

$\Upsilon(2S)$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
10023.26±0.31 OUR AVERAGE [10.02326 ± 0.00031 GeV OUR 2012 AVERAGE]			
10023.5 ±0.5	¹ ARTAMONOV	00 MD1	$e^+e^- \rightarrow$ hadrons
10023.1 ±0.4	BARBER	84 REDE	$e^+e^- \rightarrow$ hadrons
• • • We do not use the following data for averages, fits, limits, etc. • • •			
10023.6 ±0.5	^{2,3} BARU	86B REDE	$e^+e^- \rightarrow$ 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
NEW

NODE=M052M;LINKAGE=AR
NODE=M052M;LINKAGE=C
NODE=M052M;LINKAGE=RZ

$m\Upsilon(3S) - m\Upsilon(2S)$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
331.50±0.02±0.13	LEES	11C BABR	$e^+e^- \rightarrow \pi^+\pi^-X$

NODE=M052DM3

NODE=M052DM3

$\Upsilon(2S)$ WIDTH

VALUE (keV)	DOCUMENT ID
31.98±2.63 OUR EVALUATION	See the Note on "Width Determinations of the Υ States"

NODE=M052W

NODE=M052W
→ UNCHECKED ←

$\Upsilon(2S)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
$\Gamma_1 \Upsilon(1S)\pi^+\pi^-$	(17.85 ± 0.26) %	
$\Gamma_2 \Upsilon(1S)\pi^0\pi^0$	(8.6 ± 0.4) %	
$\Gamma_3 \tau^+\tau^-$	(2.00 ± 0.21) %	
$\Gamma_4 \mu^+\mu^-$	(1.93 ± 0.17) %	S=2.2
$\Gamma_5 e^+e^-$	(1.91 ± 0.16) %	
$\Gamma_6 \Upsilon(1S)\pi^0$	< 4 × 10 ⁻⁵	CL=90%
$\Gamma_7 \Upsilon(1S)\eta$	(2.9 ± 0.4) × 10 ⁻⁴	S=2.0
$\Gamma_8 J/\psi(1S)$ anything	< 6 × 10 ⁻³	CL=90%
$\Gamma_9 \bar{d}$ anything	(3.4 ± 0.6) × 10 ⁻⁵	
Γ_{10} hadrons	(94 ± 11) %	
$\Gamma_{11} gg$	(58.8 ± 1.2) %	
$\Gamma_{12} \gamma gg$	(8.8 ± 1.1) %	
Γ_{13} Sum of 100 exclusive modes	(2.90 ± 0.30) × 10 ⁻³	

NODE=M052215;NODE=M052

DESIG=4

DESIG=5

DESIG=3

DESIG=1

DESIG=2

DESIG=10

DESIG=6

DESIG=20

DESIG=16

DESIG=101

DESIG=105

DESIG=106

DESIG=121

Radiative decays

Γ_{14}	$\gamma\chi_{b1}(1P)$	(6.9 $\pm$ 0.4) %		
Γ_{15}	$\gamma\chi_{b2}(1P)$	(7.15 $\pm$ 0.35) %		
Γ_{16}	$\gamma\chi_{b0}(1P)$	(3.8 $\pm$ 0.4) %		
Γ_{17}	$\gamma f_0(1710)$	< 5.9	$\times 10^{-4}$	CL=90%
Γ_{18}	$\gamma f_2'(1525)$	< 5.3	$\times 10^{-4}$	CL=90%
Γ_{19}	$\gamma f_2(1270)$	< 2.41	$\times 10^{-4}$	CL=90%
Γ_{20}	$\gamma f_J(2220)$			
Γ_{21}	$\gamma\eta_c(1S)$	< 2.7	$\times 10^{-5}$	CL=90%
Γ_{22}	$\gamma\chi_{c0}$	< 1.0	$\times 10^{-4}$	CL=90%
Γ_{23}	$\gamma\chi_{c1}$	< 3.6	$\times 10^{-6}$	CL=90%
Γ_{24}	$\gamma\chi_{c2}$	< 1.5	$\times 10^{-5}$	CL=90%
Γ_{25}	$\gamma X(3872) \rightarrow \pi^+\pi^-\psi$	< 8	$\times 10^{-7}$	CL=90%
Γ_{26}	$\gamma X(3872) \rightarrow \pi^+\pi^-\pi^0\psi$	< 2.4	$\times 10^{-6}$	CL=90%
Γ_{27}	$\gamma X(3915) \rightarrow \omega\psi$	< 2.8	$\times 10^{-6}$	CL=90%
Γ_{28}	$\gamma X(4140) \rightarrow \phi\psi$	< 1.2	$\times 10^{-6}$	CL=90%
Γ_{29}	$\gamma X(4350) \rightarrow \phi\psi$	< 1.3	$\times 10^{-6}$	CL=90%
Γ_{30}	$\gamma\eta_b(1S)$	(3.9 $\pm$ 1.5) $\times 10^{-4}$		
Γ_{31}	$\gamma\eta_b(2S)$			
Γ_{32}	$\gamma X \rightarrow \gamma + \geq 4$ prongs	[a] < 1.95	$\times 10^{-4}$	CL=95%
Γ_{33}	$\gamma A^0 \rightarrow \gamma$ hadrons	< 8	$\times 10^{-5}$	CL=90%
Γ_{34}	$\gamma a_1^0 \rightarrow \gamma\mu^+\mu^-$	< 8.3	$\times 10^{-6}$	CL=90%

NODE=M052;CLUMP=A

DESIG=8

DESIG=7

DESIG=9

DESIG=13

DESIG=12

DESIG=11

DESIG=14

DESIG=111

DESIG=112

DESIG=113

DESIG=114

DESIG=115

DESIG=116

DESIG=117

DESIG=118

DESIG=119

DESIG=102

DESIG=120

DESIG=103

DESIG=108

DESIG=123

Lepton Family number (LF) violating modes

Γ_{35}	$e^\pm\tau^\mp$	LF	< 3.2	$\times 10^{-6}$	CL=90%
Γ_{36}	$\mu^\pm\tau^\mp$	LF	< 3.3	$\times 10^{-6}$	CL=90%

NODE=M052;CLUMP=B

DESIG=107

DESIG=104

[a] 1.5 GeV < m_X < 5.0 GeV

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.

$$x_7 \begin{vmatrix} & 2 \\ & x_1 \end{vmatrix}$$

 $\mathcal{T}(2S) \Gamma(i) \Gamma(e^+e^-) / \Gamma(\text{total})$

NODE=M052218

$\Gamma(\mu^+\mu^-) \times \Gamma(e^+e^-) / \Gamma_{\text{total}}$	$\Gamma_4 \Gamma_5 / \Gamma$
VALUE (eV)	DOCUMENT ID TECN COMMENT
6.5$\pm$1.5$\pm$1.0	KOBEL 92 CBAL $e^+e^- \rightarrow \mu^+\mu^-$

NODE=M052G1

NODE=M052G1

$\Gamma(\mathcal{T}(1S)\pi^+\pi^-) \times \Gamma(e^+e^-) / \Gamma_{\text{total}}$	$\Gamma_1 \Gamma_5 / \Gamma$
VALUE (eV)	EVTS DOCUMENT ID TECN COMMENT
105.4$\pm$1.0$\pm$4.2	11.8K ¹ AUBERT 08BP BABR 10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^-\ell^+\ell^-$

NODE=M052G03

NODE=M052G03

¹ Using $B(\mathcal{T}(1S) \rightarrow e^+e^-) = (2.38 \pm 0.11)\%$ and $B(\mathcal{T}(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.05)\%$.

NODE=M052G03;LINKAGE=AU

$\Gamma(\text{hadrons}) \times \Gamma(e^+e^-) / \Gamma_{\text{total}}$	$\Gamma_{10} \Gamma_5 / \Gamma$
VALUE (keV)	DOCUMENT ID TECN COMMENT
0.577$\pm$0.009 OUR AVERAGE	

NODE=M052G2

NODE=M052G2

0.581 $\pm$ 0.004 $\pm$ 0.009	¹ ROSNER	06	CLEO	10.0 $e^+e^- \rightarrow$ hadrons
0.552 $\pm$ 0.031 $\pm$ 0.017	¹ BARU	96	MD1	$e^+e^- \rightarrow$ hadrons
0.54 $\pm$ 0.04 $\pm$ 0.02	¹ JAKUBOWSKI	88	CBAL	$e^+e^- \rightarrow$ hadrons
0.58 $\pm$ 0.03 $\pm$ 0.04	² GILES	84B	CLEO	$e^+e^- \rightarrow$ hadrons
0.60 $\pm$ 0.12 $\pm$ 0.07	² ALBRECHT	82	DASP	$e^+e^- \rightarrow$ hadrons
0.54 $\pm$ 0.07 $\pm$ 0.09	² NICZYPORUK	81C	LENA	$e^+e^- \rightarrow$ hadrons
0.41 $\pm$ 0.18	² BOCK	80	CNTR	$e^+e^- \rightarrow$ hadrons

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 **$\Upsilon(2S)$ PARTIAL WIDTHS** **$\Gamma(e^+e^-)$** **Γ_5**

VALUE (keV)

DOCUMENT ID

0.612±0.011 OUR EVALUATION

NODE=M052220

NODE=M052W2
NODE=M052W2

→ UNCHECKED ←

 $\Upsilon(2S)$ BRANCHING RATIOS **$\Gamma(\Upsilon(1S)\pi^+\pi^-)/\Gamma_{\text{total}}$** **$\Gamma_1/\Gamma$**

Abbreviation MM in the COMMENT field below stands for missing mass.

VALUE (units 10^{-2})

EVTS

DOCUMENT ID

TECN

COMMENT

17.85±0.26 OUR FIT**17.92±0.26 OUR AVERAGE**

16.8 ±1.1 ±1.3	906k	¹ LEES	11C	BABR	$e^+e^- \rightarrow \pi^+\pi^- X$
17.80±0.05±0.37	170k	² LEES	11L	BABR	$\Upsilon(2S) \rightarrow \pi^+\pi^-\mu^+\mu^-$
18.02±0.02±0.61	851k	³ BHARI	09	CLEO	$e^+e^- \rightarrow \pi^+\pi^- \text{MM}$
17.22±0.17±0.75	11.8K	⁴ AUBERT	08BP	BABR	$e^+e^- \rightarrow \gamma\pi^+\pi^-\ell^+\ell^-$
19.2 ±0.2 ±1.0	52.6k	⁵ ALEXANDER	98	CLE2	$\pi^+\pi^-\ell^+\ell^-, \pi^+\pi^- \text{MM}$
18.1 ±0.5 ±1.0	11.6k	ALBRECHT	87	ARG	$e^+e^- \rightarrow \pi^+\pi^- \text{MM}$
16.9 ±4.0		GELPHMAN	85	CBAL	$e^+e^- \rightarrow e^+e^-\pi^+\pi^-$
19.1 ±1.2 ±0.6		BESSON	84	CLEO	$\pi^+\pi^- \text{MM}$
18.9 ±2.6		FONSECA	84	CUSB	$e^+e^- \rightarrow \ell^+\ell^-\pi^+\pi^-$
21 ±7	7	NICZYPORUK	81B	LENA	$e^+e^- \rightarrow \ell^+\ell^-\pi^+\pi^-$

¹ LEES 11C reports $[\Gamma(\Upsilon(2S) \rightarrow \Upsilon(1S)\pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \Upsilon(2S)\text{anything})] = (1.78 \pm 0.02 \pm 0.11) \times 10^{-2}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \Upsilon(2S)\text{anything}) = (10.6 \pm 0.8) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² Using $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.05)\%$.

³ A weighted average of the inclusive and exclusive results.

⁴ Using $B(\Upsilon(2S) \rightarrow e^+e^-) = (1.91 \pm 0.16)\%$, $B(\Upsilon(2S) \rightarrow \mu^+\mu^-) = (1.93 \pm 0.17)\%$ and, $\Gamma_{ee}(\Upsilon(2S)) = 0.612 \pm 0.011$ keV.

⁵ Using $B(\Upsilon(1S) \rightarrow e^+e^-) = (2.52 \pm 0.17)\%$ and $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.07)\%$.

NODE=M052R4;LINKAGE=ES

NODE=M052R4;LINKAGE=LE
NODE=M052R4;LINKAGE=BH
NODE=M052R4;LINKAGE=AU

NODE=M052R4;LINKAGE=T

 $\Gamma(\Upsilon(1S)\pi^0\pi^0)/\Gamma_{\text{total}}$ **Γ_2/Γ** VALUE (units 10^{-2})

EVTS

DOCUMENT ID

TECN

COMMENT

8.6 ±0.4 OUR AVERAGE

8.43±0.16±0.42	38k	¹ BHARI	09	CLEO	$e^+e^- \rightarrow \pi^0\pi^0\ell^+\ell^-$
9.2 ±0.6 ±0.8	275	² ALEXANDER	98	CLE2	$e^+e^- \rightarrow \pi^0\pi^0\ell^+\ell^-$
9.5 ±1.9 ±1.9	25	ALBRECHT	87	ARG	$e^+e^- \rightarrow \pi^0\pi^0\ell^+\ell^-$
8.0 ±1.5		GELPHMAN	85	CBAL	$e^+e^- \rightarrow \pi^0\pi^0\ell^+\ell^-$
10.3 ±2.3		FONSECA	84	CUSB	$e^+e^- \rightarrow \pi^0\pi^0\ell^+\ell^-$

¹ Authors assume $B(\Upsilon(1S) \rightarrow e^+e^-) + B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = 4.96\%$.

² Using $B(\Upsilon(1S) \rightarrow e^+e^-) = (2.52 \pm 0.17)\%$ and $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.07)\%$.

NODE=M052R5
NODE=M052R5NODE=M052R5;LINKAGE=BH
NODE=M052R5;LINKAGE=T **$\Gamma(\Upsilon(1S)\pi^0\pi^0)/\Gamma(\Upsilon(1S)\pi^+\pi^-)$** **$\Gamma_2/\Gamma_1$**

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	$e^+e^- \rightarrow \tau^+\tau^-$

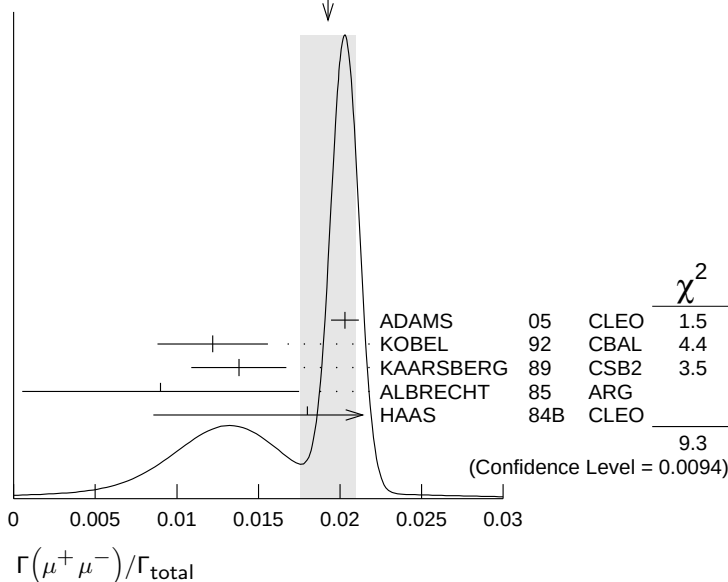
¹ BESSON 07 reports $[\Gamma(\Upsilon(2S) \rightarrow \tau^+\tau^-)/\Gamma_{\text{total}}] / [B(\Upsilon(2S) \rightarrow \mu^+\mu^-)] = 1.04 \pm 0.04 \pm 0.05$ which we multiply by our best value $B(\Upsilon(2S) \rightarrow \mu^+\mu^-) = (1.93 \pm 0.17) \times 10^{-2}$. Our first error is their experiment's 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=M052R1NODE=M052R1;LINKAGE=A
NODE=M052R1;LINKAGE=RWEIGHTED AVERAGE
0.0193±0.0017 (Error scaled by 2.2) $\Gamma(\tau^+\tau^-)/\Gamma(\mu^+\mu^-)$ Γ_3/Γ_4

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
1.04±0.04±0.05	22k	BESSION	07	CLEO $e^+e^- \rightarrow \Upsilon(2S)$

NODE=M052R17
NODE=M052R17 $\Gamma(\Upsilon(1S)\pi^0)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
< 4	90	¹ TAMPONI	13	BELL $e^+e^- \rightarrow \Upsilon(1S)\pi^0$
< 18	90	² HE	08A	CLEO $e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$
<110	90	ALEXANDER	98	CLE2 $e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$
<800	90	LURZ	87	CBAL $e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$

NODE=M052R10
NODE=M052R10¹ TAMPONI 13 reports $[\Gamma(\Upsilon(2S) \rightarrow \Upsilon(1S)\pi^0)/\Gamma_{\text{total}}] / [B(\Upsilon(2S) \rightarrow \Upsilon(1S)\pi^+\pi^-)] < 2.3 \times 10^{-4}$ which we multiply by our best value $B(\Upsilon(2S) \rightarrow \Upsilon(1S)\pi^+\pi^-) = 17.85 \times 10^{-2}$.² Authors assume $B(\Upsilon(1S) \rightarrow e^+e^-) + B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = 4.96\%$.

NODE=M052R10;LINKAGE=TA

NODE=M052R10;LINKAGE=HE

 $\Gamma(\Upsilon(1S)\pi^0)/\Gamma(\Upsilon(1S)\pi^+\pi^-)$ Γ_6/Γ_1

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<2.3	90	TAMPONI	13	BELL $e^+e^- \rightarrow \Upsilon(1S)\pi^0$

NODE=M052R09
NODE=M052R09 $\Gamma(\Upsilon(1S)\eta)/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
2.9 ±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.
$[(2.34 \pm 0.31) \times 10^{-4}]$					OUR 2012 AVERAGE]
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 $e^+e^- \rightarrow \Upsilon(1S)\eta$

NODE=M052R6
NODE=M052R6

NEW

NOTFITTED

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 9	90	1,4 AUBERT	08BP BABR	$e^+e^- \rightarrow \gamma\pi^+\pi^-\pi^0\ell^+\ell^-$
< 28	90	ALEXANDER98	CLE2	$e^+e^- \rightarrow \ell^+\ell^-\eta$
< 50	90	ALBRECHT	87 ARG	$e^+e^- \rightarrow \pi^+\pi^-\ell^+\ell^-$ MM
< 70	90	LURZ	87 CBAL	$e^+e^- \rightarrow \ell^+\ell^-(\gamma\gamma, 3\pi^0)$
< 100	90	BESSON	84 CLEO	$e^+e^- \rightarrow \pi^+\pi^-\ell^+\ell^-$ MM
< 20	90	FONSECA	84 CUSB	$e^+e^- \rightarrow \ell^+\ell^-(\gamma\gamma, \pi^+\pi^-\pi^0)$

¹ Using $B(\Upsilon(1S) \rightarrow e^+e^-) = (2.38 \pm 0.11)\%$ and $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.05)\%$.

² Authors assume $B(\Upsilon(1S) \rightarrow e^+e^-) + B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = 4.96\%$.

³ TAMPONI 13 reports $[\Gamma(\Upsilon(2S) \rightarrow \Upsilon(1S)\eta)/\Gamma_{\text{total}}] / [B(\Upsilon(2S) \rightarrow \Upsilon(1S)\pi^+\pi^-)] = (1.99 \pm 0.14 \pm 0.11) \times 10^{-3}$ which we multiply by our best value $B(\Upsilon(2S) \rightarrow \Upsilon(1S)\pi^+\pi^-) = (17.85 \pm 0.26) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

⁴ Using $\Gamma_{ee}(\Upsilon(2S)) = 0.612 \pm 0.011$ keV.

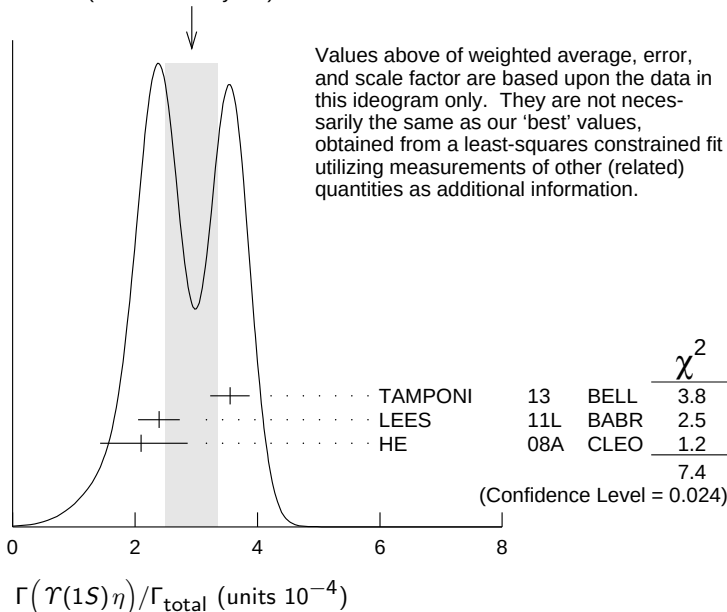
NODE=M052R6;LINKAGE=AU

NODE=M052R6;LINKAGE=HE

NODE=M052R6;LINKAGE=TA

NODE=M052R6;LINKAGE=UB

WEIGHTED AVERAGE
2.9±0.4 (Error scaled by 1.9)



$\Gamma(\Upsilon(1S)\eta)/\Gamma(\Upsilon(1S)\pi^+\pi^-)$

Γ_7/Γ_1

VALUE (units 10^{-3})	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
1.64±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	90		² AUBERT	08BP BABR	$e^+e^- \rightarrow \gamma\pi^+\pi^-(\pi^0)\ell^+\ell^-$

¹ Not independent of other values reported by LEES 11L.

² Not independent of other values reported by AUBERT 08BP.

NODE=M052R22
NODE=M052R22

NODE=M052R22;LINKAGE=LE
NODE=M052R22;LINKAGE=AU

$\Gamma(\Upsilon(1S)\pi^0)/\Gamma(\Upsilon(1S)\eta)$

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	$e^+e^- \rightarrow \Upsilon(1S)\pi^0$

$\Gamma(J/\psi(1S) \text{ anything})/\Gamma_{\text{total}}$

Γ_8/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.006	90	MASCHMANN 90	CBAL	$e^+e^- \rightarrow \text{hadrons}$

NODE=M052R16
NODE=M052R16

$\Gamma(\bar{d} \text{ anything})/\Gamma_{\text{total}}$

Γ_9/Γ

<u>VALUE (units 10^{-5})</u>	<u>EVTs</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
3.37±0.50±0.25	58	ASNER	07	CLEO $e^+e^- \rightarrow \bar{d}X$

NODE=M052R18
NODE=M052R18

$\Gamma(gg)/\Gamma_{\text{total}}$ Γ_{11}/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 $\Gamma(\gamma gg)/\Gamma(gg) = (3.18 \pm 0.04 \pm 0.22 \pm 0.41)\%$ from BESSON 06A and PDG 08 values of $B(\pi^+\pi^-\Upsilon(1S)) = (18.1 \pm 0.4)\%$, $B(\pi^0\pi^0\Upsilon(1S)) = (8.6 \pm 0.4)\%$, $B(\mu^+\mu^-) = (1.93 \pm 0.17)\%$, and $R_{\text{hadrons}} = 3.51$. The statistical error is negligible and the systematic error is partially correlated with that of $\Gamma(\gamma gg)/\Gamma_{\text{total}}$ measurement of BESSON 06A.

NODE=M052R01;LINKAGE=BE

 $\Gamma(\gamma gg)/\Gamma_{\text{total}}$ Γ_{12}/Γ

VALUE (units 10^{-2})	EVTs	DOCUMENT ID	TECN	COMMENT
8.79±1.05	100k	¹ BESSON	06A CLEO	$\Upsilon(2S) \rightarrow \gamma + \text{hadrons}$

NODE=M052R02
 NODE=M052R02

¹ Calculated using BESSON 06A values of $\Gamma(\gamma gg)/\Gamma(gg) = (3.18 \pm 0.04 \pm 0.22 \pm 0.41)\%$ and $\Gamma(gg)/\Gamma_{\text{total}}$. The statistical error is negligible and the systematic error is partially correlated with that of $\Gamma(gg)/\Gamma_{\text{total}}$ measurement of BESSON 06A.

NODE=M052R02;LINKAGE=BE

 $\Gamma(\text{Sum of 100 exclusive modes})/\Gamma_{\text{total}}$ Γ_{13}/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

 $\Gamma(\gamma gg)/\Gamma(gg)$ Γ_{12}/Γ_{11}

VALUE (units 10^{-2})	EVTs	DOCUMENT ID	TECN	COMMENT
3.18±0.04±0.47	6M	BESSON	06A CLEO	$\Upsilon(2S) \rightarrow (\gamma +) \text{hadrons}$

NODE=M052R03
 NODE=M052R03

 $\Gamma(\gamma\chi_{b1}(1P))/\Gamma_{\text{total}}$ Γ_{14}/Γ

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
0.069 ±0.004 OUR AVERAGE				
0.0693±0.0012±0.0041	407k	ARTUSO	05 CLEO	$e^+e^- \rightarrow \gamma X$
0.069 ±0.005 ±0.009		EDWARDS	99 CLE2	$\Upsilon(2S) \rightarrow \gamma\chi(1P)$
0.091 ±0.018 ±0.022		ALBRECHT	85E ARG	$e^+e^- \rightarrow \gamma \text{conv. } X$
0.065 ±0.007 ±0.012		NERNST	85 CBAL	$e^+e^- \rightarrow \gamma X$
0.080 ±0.017 ±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_{15}/Γ

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
0.0715±0.0035 OUR AVERAGE				
0.0724±0.0011±0.0040	410k	ARTUSO	05 CLEO	$e^+e^- \rightarrow \gamma X$
0.074 ±0.005 ±0.008		EDWARDS	99 CLE2	$\Upsilon(2S) \rightarrow \gamma\chi(1P)$
0.098 ±0.021 ±0.024		ALBRECHT	85E ARG	$e^+e^- \rightarrow \gamma \text{conv. } X$
0.058 ±0.007 ±0.010		NERNST	85 CBAL	$e^+e^- \rightarrow \gamma X$
0.102 ±0.018 ±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_{16}/Γ

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
0.038 ±0.004 OUR AVERAGE				
0.0375±0.0012±0.0047	198k	ARTUSO	05 CLEO	$e^+e^- \rightarrow \gamma X$
0.034 ±0.005 ±0.006		EDWARDS	99 CLE2	$\Upsilon(2S) \rightarrow \gamma\chi(1P)$
0.064 ±0.014 ±0.016		ALBRECHT	85E ARG	$e^+e^- \rightarrow \gamma \text{conv. } X$
0.036 ±0.008 ±0.009		NERNST	85 CBAL	$e^+e^- \rightarrow \gamma X$
0.044 ±0.023 ±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_{17}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<59	90	¹ ALBRECHT	89 ARG	$\Upsilon(2S) \rightarrow \gamma K^+ K^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
< 5.9	90	² ALBRECHT	89 ARG	$\Upsilon(2S) \rightarrow \gamma \pi^+ \pi^-$

NODE=M052R13
 NODE=M052R13

¹ Re-evaluated assuming $B(f_0(1710) \rightarrow K^+ K^-) = 0.19$.

OCCUR=2

² Includes unknown branching ratio of $f_0(1710) \rightarrow \pi^+ \pi^-$.

NODE=M052R13;LINKAGE=M
 NODE=M052R13;LINKAGE=N

$\Gamma(\gamma f'_2(1525))/\Gamma_{\text{total}}$ Γ_{18}/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_{19}/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_{20}/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_{21}/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_{22}/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_{23}/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_{24}/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 $\Gamma(\gamma X(3872) \rightarrow \pi^+ \pi^- J/\psi)/\Gamma_{\text{total}}$ Γ_{25}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.8 $\times 10^{-6}$	90	WANG 11B	BELL	$\Upsilon(2S) \rightarrow \gamma X$

NODE=M052R35
NODE=M052R35 $\Gamma(\gamma X(3872) \rightarrow \pi^+ \pi^- \pi^0 J/\psi)/\Gamma_{\text{total}}$ Γ_{26}/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_{27}/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 $\Gamma(\gamma X(4140) \rightarrow \phi J/\psi)/\Gamma_{\text{total}}$ Γ_{28}/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_{29}/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_{30}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$3.9 \pm 1.1^{+1.1}_{-0.9}$	13 $\pm$ 5k		¹ AUBERT	09AQ BABR	$\Upsilon(2S) \rightarrow \gamma X$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<21	90	LEES	11J	BABR	$\Upsilon(2S) \rightarrow X \gamma$
< 8.4	90	¹ BONVICINI	10	CLEO	$\Upsilon(2S) \rightarrow \gamma X$
< 5.1	90	² ARTUSO	05	CLEO	$e^+ e^- \rightarrow \gamma X$

¹ Assuming $\Gamma_{\eta_b(1S)} = 10$ MeV.² Superseded by BONVICINI 10.NODE=M052R15
NODE=M052R15NODE=M052R15;LINKAGE=BO
NODE=M052R15;LINKAGE=SU

$\Gamma(\gamma\eta_b(2S))/\Gamma_{\text{total}}$

VALUE	EVTs	DOCUMENT ID	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

seen 11 ± 4 ¹ DOBBS 12 $\Upsilon(2S) \rightarrow \gamma$ hadrons

¹ Obtained by analyzing CLEO III data but not authored by the CLEO Collaboration.

 Γ_{31}/Γ

NODE=M052R07
NODE=M052R07

NODE=M052R07;LINKAGE=DO

 $\Gamma(\gamma X \rightarrow \gamma + \geq 4 \text{ prongs})/\Gamma_{\text{total}}$

(1.5 GeV < m_X < 5.0 GeV)

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT

<1.95 95 ROSNER 07A CLEO $e^+e^- \rightarrow \gamma X$

 Γ_{32}/Γ

NODE=M052R19

NODE=M052R19
NODE=M052R19

 $\Gamma(\gamma A^0 \rightarrow \gamma \text{ hadrons})/\Gamma_{\text{total}}$

(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} .

 Γ_{33}/Γ

NODE=M052R06

NODE=M052R06
NODE=M052R06

NODE=M052R06;LINKAGE=LE

 $\Gamma(\gamma a_1^0 \rightarrow \gamma \mu^+ \mu^-)/\Gamma_{\text{total}}$

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 $0.26\text{--}8.3 \times 10^{-6}$.

 Γ_{34}/Γ

NODE=M052R24
NODE=M052R24

NODE=M052R24;LINKAGE=AU

LEPTON FAMILY NUMBER (LF) VIOLATING MODES

 $\Gamma(e^\pm \tau^\mp)/\Gamma_{\text{total}}$

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT

<3.2 90 LEES 10B BABR $e^+e^- \rightarrow e^\pm \tau^\mp$

 Γ_{35}/Γ

NODE=M052R04
NODE=M052R04

 $\Gamma(\mu^\pm \tau^\mp)/\Gamma_{\text{total}}$

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 $e^+e^- \rightarrow \mu^\pm \tau^\mp$

 Γ_{36}/Γ

NODE=M052R20
NODE=M052R20

 $\Upsilon(2S)$ Cross-Particle Branching Ratios $B(\Upsilon(2S) \rightarrow \pi^+ \pi^-) \times B(\Upsilon(3S) \rightarrow \Upsilon(2S) X)$

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=M052240

NODE=M052R05
NODE=M052R05

 $\Upsilon(2S)$ REFERENCES

TAMPONI	13	PR D87 011104	U. Tamponi <i>et al.</i>	(BELLE Collab.)
DOBBS	12	PRL 109 082001	S. Dobbs <i>et al.</i>	
DOBBS	12A	PR D86 052003	S. Dobbs <i>et al.</i>	
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	11L	PR D84 092003	J.P. Lees <i>et al.</i>	(BABAR Collab.)
WANG	11B	PR D84 071107	X.L. Wang <i>et al.</i>	(BELLE 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	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.)
AUBERT	08BP	PR D78 112002	B. Aubert <i>et al.</i>	(BABAR Collab.)
HE	08A	PRL 101 192001	Q. He <i>et al.</i>	(CLEO Collab.)
LOVE	08A	PRL 101 201601	W. Love <i>et al.</i>	(CLEO Collab.)
PDG	08	PL B667 1	C. Amsler <i>et al.</i>	(PDG Collab.)
ASNER	07	PR D75 012009	D.M. Asner <i>et al.</i>	(CLEO Collab.)
BESSION	07	PRL 98 052002	D. Besson <i>et al.</i>	(CLEO Collab.)
ROSNER	07A	PR D76 117102	J.L. Rosner <i>et al.</i>	(CLEO Collab.)
BESSION	06A	PR D74 012003	D. Besson <i>et al.</i>	(CLEO Collab.)
ROSNER	06	PRL 96 092003	J.L. Rosner <i>et al.</i>	(CLEO Collab.)
ADAMS	05	PRL 94 012001	G.S. Adams <i>et al.</i>	(CLEO Collab.)
ARTUSO	05	PRL 94 032001	M. Artuso <i>et al.</i>	(CLEO Collab.)
ARTAMONOV	00	PL B474 427	A.S. Artamonov <i>et al.</i>	
EDWARDS	99	PR D59 032003	K.W. Edwards <i>et al.</i>	(CLEO Collab.)

NODE=M052

REFID=54919
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REFID=52079
REFID=51147
REFID=51035
REFID=50452
REFID=50454
REFID=47424
REFID=46612

ALEXANDER	98	PR D58 052004	J.P. Alexander <i>et al.</i>	(CLEO Collab.)	
BARU	96	PRPL 267 71	S.E. Baru <i>et al.</i>	(NOVO)	
KOBEL	92	ZPHY C53 193	M. Kobel <i>et al.</i>	(Crystal Ball Collab.)	
MASCHMANN	90	ZPHY C46 555	W.S. Maschmann <i>et al.</i>	(Crystal Ball Collab.)	
ALBRECHT	89	ZPHY C42 349	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	
KAARSBERG	89	PRL 62 2077	T.M. Kaarsberg <i>et al.</i>	(CUSB Collab.)	
BUCHMUEL...	88	HE e^+e^- Physics 412	W. Buchmueller, S. Cooper	(HANN, DESY, MIT)	
Editors: A. Ali and P. Soeding, World Scientific, Singapore					
JAKUBOWSKI	88	ZPHY C40 49	Z. Jakubowski <i>et al.</i>	(Crystal Ball Collab.)	IGJPC
ALBRECHT	87	ZPHY C35 283	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	
COHEN	87	RMP 59 1121	E.R. Cohen, B.N. Taylor	(RISC, NBS)	
LURZ	87	ZPHY C36 383	B. Lurz <i>et al.</i>	(Crystal Ball Collab.)	
BARU	86B	ZPHY C32 622 (erratum)	S.E. Baru <i>et al.</i>	(NOVO)	
ALBRECHT	85	ZPHY C28 45	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	
ALBRECHT	85E	PL 160B 331	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	
GELPHMAN	85	PR D32 2893	D. Gelphman <i>et al.</i>	(Crystal Ball Collab.)	
KURAEV	85	SJNP 41 466	E.A. Kuraev, V.S. Fadin	(NOVO)	
Translated from YAF 41 733.					
NERNST	85	PRL 54 2195	R. Nernst <i>et al.</i>	(Crystal Ball Collab.)	
ARTAMONOV	84	PL 137B 272	A.S. Artamonov <i>et al.</i>	(NOVO)	
BARBER	84	PL 135B 498	D.P. Barber <i>et al.</i>	(DESY, ARGUS Collab.)	
BESSON	84	PR D30 1433	D. Besson <i>et al.</i>	(CLEO Collab.)	
FONSECA	84	NP B242 31	V. Fonseca <i>et al.</i>	(CUSB Collab.)	
GILES	84B	PR D29 1285	R. Giles <i>et al.</i>	(CLEO Collab.)	
HAAS	84	PRL 52 799	J. Haas <i>et al.</i>	(CLEO Collab.)	
HAAS	84B	PR D30 1996	J. Haas <i>et al.</i>	(CLEO Collab.)	
KLOPFEN...	83	PRL 51 160	C. Klopstein <i>et al.</i>	(CUSB Collab.)	
ALBRECHT	82	PL 116B 383	H. Albrecht <i>et al.</i>	(DESY, DORT, HEIDH+)	
NICZYPORUK	81B	PL 100B 95	B. Niczyporuk <i>et al.</i>	(LENA Collab.)	
NICZYPORUK	81C	PL 99B 169	B. Niczyporuk <i>et al.</i>	(LENA Collab.)	
BOCK	80	ZPHY C6 125	P. Bock <i>et al.</i>	(HEIDP, MPIM, DESY, HAMB)	

REFID=46329
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NODE=M177

$\Upsilon(1D)$

$$I^G(J^{PC}) = 0^-(2^{--})$$

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

$\Upsilon(1D)$ MASS

NODE=M177M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
10163.7 ± 1.4 OUR AVERAGE		Error includes scale factor of 1.7.		
10164.5 ± 0.8 ± 0.5		DEL-AMO-SA..10R	BABR	$\Upsilon(3S) \rightarrow \gamma\gamma\pi^+\pi^-\ell^+\ell^-$
10161.1 ± 0.6 ± 1.6	38	BONVICINI	04	CLE3 $\Upsilon(3S) \rightarrow 4\gamma\ell^+\ell^-$

NODE=M177M

$\Upsilon(1D)$ 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

$\Upsilon(1D)$ 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})	CL%	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 $B(\chi_{bJ}(2P) \rightarrow \gamma \Upsilon(1D))$.

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

$\Upsilon(1D)$ REFERENCES

NODE=M177

DEL-AMO-SA... 10R	PR D82 111102	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)	REFID=53634
BONVICINI 04	PR D70 032001	G. Bonvicini <i>et al.</i>	(CLEO Collab.)	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 [10.2325 ± 0.0004 ± 0.0005 GeV OUR 2012 EVALUATION]

NODE=M079M

NODE=M079M

NEW; → UNCHECKED ←

 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

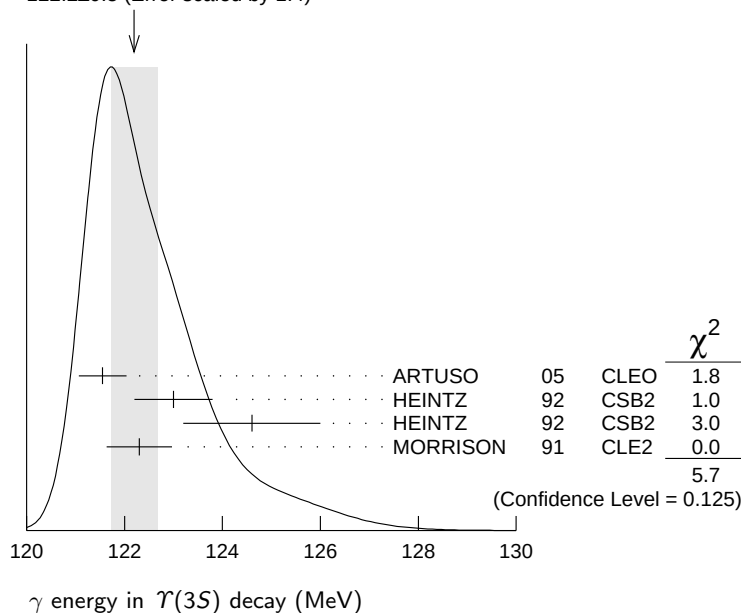
→ UNCHECKED ←

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

NODE=M079215;NODE=M079

Mode	Fraction (Γ_i/Γ)	Confidence level
$\Gamma_1 \quad \gamma \Upsilon(2S)$	$(4.6 \pm 2.1) \%$	DESIG=2
$\Gamma_2 \quad \gamma \Upsilon(1S)$	$(9 \pm 6) \times 10^{-3}$	DESIG=1
$\Gamma_3 \quad D^0 X$	$< 8.2 \%$	DESIG=3
$\Gamma_4 \quad \pi^+ \pi^- K^+ K^- \pi^0$	$< 3.4 \times 10^{-5}$	DESIG=4
$\Gamma_5 \quad 2\pi^+ \pi^- K^- K_S^0$	$< 5 \times 10^{-5}$	DESIG=5
$\Gamma_6 \quad 2\pi^+ \pi^- K^- K_S^0 2\pi^0$	$< 2.2 \times 10^{-4}$	DESIG=6
$\Gamma_7 \quad 2\pi^+ 2\pi^- 2\pi^0$	$< 2.4 \times 10^{-4}$	DESIG=7
$\Gamma_8 \quad 2\pi^+ 2\pi^- K^+ K^-$	$< 1.5 \times 10^{-4}$	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
$0.046 \pm 0.020 \pm 0.007$		³ HEINTZ	92 CSB2	$e^+ e^- \rightarrow \ell^+ \ell^- \gamma \gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 0.028	90	⁴ LEES	11J BABR	$\Upsilon(3S) \rightarrow X \gamma$
< 0.089	90	⁵ CRAWFORD	92B CLE2	$e^+ e^- \rightarrow \ell^+ \ell^- \gamma \gamma$

³ Using $B(\Upsilon(2S) \rightarrow \mu^+ \mu^-) = (1.44 \pm 0.10)\%$, $B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P)) = (6.0 \pm 0.4 \pm 0.6)\%$ and assuming $e\mu$ universality. Supersedes HEINTZ 91.

⁴ LEES 11J quotes a central value of $\Gamma(\chi_{b0}(2P) \rightarrow \gamma \Upsilon(2S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P))/\Gamma_{\text{total}} = (-0.3 \pm 0.2^{+0.5}_{-0.4})\%$.

⁵ 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
NODE=M079R2

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
$0.009 \pm 0.006 \pm 0.001$		⁶ HEINTZ	92 CSB2	$e^+ e^- \rightarrow \ell^+ \ell^- \gamma \gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 0.012	90	⁷ LEES	11J BABR	$\Upsilon(3S) \rightarrow X \gamma$
< 0.025	90	⁸ CRAWFORD	92B CLE2	$e^+ e^- \rightarrow \ell^+ \ell^- \gamma \gamma$

⁶ Using $B(\Upsilon(1S) \rightarrow \mu^+ \mu^-) = (2.57 \pm 0.07)\%$, $B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P)) = (6.0 \pm 0.4 \pm 0.6)\%$ and assuming $e\mu$ universality. Supersedes HEINTZ 91.

⁷ LEES 11J quotes a central value of $\Gamma(\chi_{b0}(2P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P))/\Gamma_{\text{total}} = (3.9 \pm 2.2^{+1.2}_{-0.6}) \times 10^{-4}$.

⁸ 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
NODE=M079R1

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
$< 8.2 \times 10^{-2}$	90	^{9,10} BRIERE	08 CLEO	$\Upsilon(3S) \rightarrow \gamma D^0 X$

⁹ For $p_{D^0} > 2.5$ GeV/c.

¹⁰ The authors also present their result as $(4.1 \pm 3.0 \pm 0.4) \times 10^{-2}$.

NODE=M079R01
NODE=M079R01

NODE=M079R01;LINKAGE=BR
NODE=M079R01;LINKAGE=RI

$\Gamma(\pi^+ \pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}$

 Γ_4/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 0.34	90	¹¹ ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma \pi^+ \pi^- K^+ K^- \pi^0$

¹¹ 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

$\Gamma(2\pi^+ \pi^- K^- K_S^0)/\Gamma_{\text{total}}$

 Γ_5/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 0.5	90	¹² ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+ \pi^- K^- K_S^0$

¹² 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

$\Gamma(2\pi^+\pi^-K^-K_S^02\pi^0)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<2.2	90	13 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+\pi^-K^-2\pi^0$
13 ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \rightarrow 2\pi^+\pi^-K^-K_S^02\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P))]$ < 13×10^{-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

 $\Gamma(2\pi^+2\pi^-2\pi^0)/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<2.4	90	14 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+2\pi^-2\pi^0$
14 ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \rightarrow 2\pi^+2\pi^-2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P))]$ < 14×10^{-6} which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P)) = 5.9 \times 10^{-2}$.				

NODE=M079R05
 NODE=M079R05

NODE=M079R05;LINKAGE=AS

 $\Gamma(2\pi^+2\pi^-K^+K^-)/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.5	90	15 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+2\pi^-K^+K^-$
15 ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \rightarrow 2\pi^+2\pi^-K^+K^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P))]$ < 9×10^{-6} which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P)) = 5.9 \times 10^{-2}$.				

NODE=M079R06
 NODE=M079R06

NODE=M079R06;LINKAGE=AS

 $\Gamma(2\pi^+2\pi^-K^+K^-\pi^0)/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<2.2	90	16 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+2\pi^-K^+K^-\pi^0$
16 ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \rightarrow 2\pi^+2\pi^-K^+K^-\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P))]$ < 13×10^{-6} which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P)) = 5.9 \times 10^{-2}$.				

NODE=M079R07
 NODE=M079R07

NODE=M079R07;LINKAGE=AS

 $\Gamma(2\pi^+2\pi^-K^+K^-2\pi^0)/\Gamma_{\text{total}}$ Γ_{10}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<11	90	17 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+2\pi^-K^+K^-2\pi^0$
17 ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \rightarrow 2\pi^+2\pi^-K^+K^-2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P))]$ < 63×10^{-6} which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P)) = 5.9 \times 10^{-2}$.				

NODE=M079R08
 NODE=M079R08

NODE=M079R08;LINKAGE=AS

 $\Gamma(3\pi^+2\pi^-K^-K_S^0\pi^0)/\Gamma_{\text{total}}$ Γ_{11}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<7	90	18 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+2\pi^-K^-K_S^0\pi^0$
18 ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \rightarrow 3\pi^+2\pi^-K^-K_S^0\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P))]$ < 39×10^{-6} which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P)) = 5.9 \times 10^{-2}$.				

NODE=M079R09
 NODE=M079R09

NODE=M079R09;LINKAGE=AS

 $\Gamma(3\pi^+3\pi^-)/\Gamma_{\text{total}}$ Γ_{12}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<0.7	90	19 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+3\pi^-$
19 ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \rightarrow 3\pi^+3\pi^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P))]$ < 4×10^{-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	20 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+3\pi^-2\pi^0$
20 ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \rightarrow 3\pi^+3\pi^-2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P))]$ < 72×10^{-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	21 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+3\pi^-K^+K^-$
21 ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \rightarrow 3\pi^+3\pi^-K^+K^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P))]$ < 9×10^{-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	22 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+ 3\pi^- K^+ K^- \pi^0$ 22 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	23 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 4\pi^+ 4\pi^-$ 23 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	24 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 4\pi^+ 4\pi^- 2\pi^0$ 24 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

 $\Gamma(\chi_{b0}(2P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P))/\Gamma_{\text{total}}$
 $\Gamma_2/\Gamma \times \Gamma_{21}^{\Upsilon(3S)}/\Gamma \Upsilon(3S)$

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<8.2	90	25 LEES	11J BABR	$\Upsilon(3S) \rightarrow X\gamma$ 25 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

 $\Gamma(\chi_{b0}(2P) \rightarrow \gamma \Upsilon(2S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P))/\Gamma_{\text{total}}$
 $\Gamma_1/\Gamma \times \Gamma_{21}^{\Upsilon(3S)}/\Gamma \Upsilon(3S)$

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<1.6	90	26 LEES	11J BABR	$\Upsilon(3S) \rightarrow X\gamma$ 26 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

 $\chi_{b0}(2P)$ REFERENCES

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, R. Fulton	(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=53936
 REFID=52574
 REFID=52577
 REFID=50454
 REFID=43177
 REFID=43604
 REFID=41580
 REFID=41634
 REFID=41586

$\chi_{b1}(2P)$

$I^G(J^{PC}) = 0^+(1^{++})$
 J needs confirmation.

Observed in radiative decay of the $\Upsilon(3S)$, therefore $C = +$. Branching ratio requires E1 transition, M1 is strongly disfavored, therefore $P = +$.

NODE=M080

NODE=M080

$\chi_{b1}(2P)$ MASS

NODE=M080M

NODE=M080M

NEW;→ UNCHECKED ←

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 [10.25546 ± 0.00022 ± 0.00050 GeV OUR 2012 EVALUATION]

$m_{\chi_{b1}(2P)} - m_{\chi_{b0}(2P)}$

NODE=M080M2

NODE=M080M2

NODE=M080M2;LINKAGE=A

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
23.5±0.7±0.7	¹ 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.			

γ ENERGY IN $\Upsilon(3S)$ DECAY

NODE=M080DM

NODE=M080DM

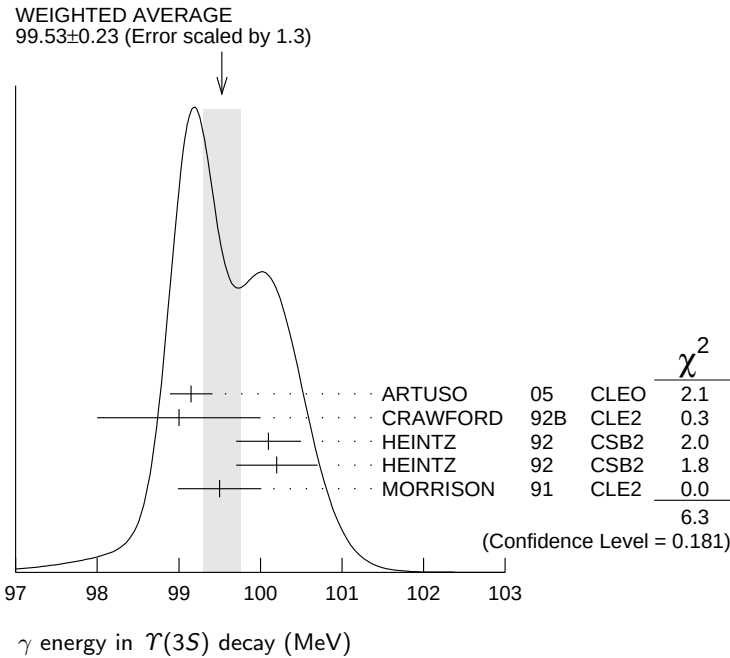
→ UNCHECKED ←

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
99.26±0.22 OUR EVALUATION	Treating systematic errors as correlated			
99.53±0.23 OUR AVERAGE	Error includes scale factor of 1.3. See the ideogram below.			
99.15±0.07±0.25		ARTUSO	05	CLEO $\Upsilon(3S) \rightarrow \gamma X$
99 ±1	169	CRAWFORD	92B	CLE2 $e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$
100.1 ±0.4	11147	² HEINTZ	92	CSB2 $e^+e^- \rightarrow \gamma X$
100.2 ±0.5	223	³ HEINTZ	92	CSB2 $e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$
99.5 ±0.1 ±0.5	25759	MORRISON	91	CLE2 $e^+e^- \rightarrow \gamma X$
² A systematic uncertainty on the energy scale of 0.9% not included. Supersedes NARAIN 91.				
³ A systematic uncertainty on the energy scale of 0.9% not included. Supersedes HEINTZ 91.				

OCCUR=2

NODE=M080DM;LINKAGE=A

NODE=M080DM;LINKAGE=B



$\chi_{b1}(2P)$ DECAY MODES

NODE=M080215;NODE=M080

Mode	Fraction (Γ_i/Γ)	Scale factor	
$\Gamma_1 \quad \omega \mathcal{T}(1S)$	$(1.63^{+0.40}_{-0.34})\%$		DESIG=3
$\Gamma_2 \quad \gamma \mathcal{T}(2S)$	$(19.9 \pm 1.9)\%$		DESIG=2
$\Gamma_3 \quad \gamma \mathcal{T}(1S)$	$(9.2 \pm 0.8)\%$	1.1	DESIG=1
$\Gamma_4 \quad \pi\pi\chi_{b1}(1P)$	$(9.1 \pm 1.3) \times 10^{-3}$		DESIG=4
$\Gamma_5 \quad D^0 X$	$(8.8 \pm 1.7)\%$		DESIG=5
$\Gamma_6 \quad \pi^+\pi^-K^+K^-\pi^0$	$(3.1 \pm 1.0) \times 10^{-4}$		DESIG=6
$\Gamma_7 \quad 2\pi^+\pi^-K^-K_S^0$	$(1.1 \pm 0.5) \times 10^{-4}$		DESIG=7
$\Gamma_8 \quad 2\pi^+\pi^-K^-K_S^0 2\pi^0$	$(7.7 \pm 3.2) \times 10^{-4}$		DESIG=8
$\Gamma_9 \quad 2\pi^+2\pi^-2\pi^0$	$(5.9 \pm 2.0) \times 10^{-4}$		DESIG=9
$\Gamma_{10} \quad 2\pi^+2\pi^-K^+K^-$	$(10 \pm 4) \times 10^{-5}$		DESIG=10
$\Gamma_{11} \quad 2\pi^+2\pi^-K^+K^-\pi^0$	$(5.5 \pm 1.8) \times 10^{-4}$		DESIG=11
$\Gamma_{12} \quad 2\pi^+2\pi^-K^+K^-\pi^0$	$(10 \pm 4) \times 10^{-4}$		DESIG=12
$\Gamma_{13} \quad 3\pi^+2\pi^-K^-K_S^0\pi^0$	$(6.7 \pm 2.6) \times 10^{-4}$		DESIG=13
$\Gamma_{14} \quad 3\pi^+3\pi^-$	$(1.2 \pm 0.4) \times 10^{-4}$		DESIG=14
$\Gamma_{15} \quad 3\pi^+3\pi^-2\pi^0$	$(1.2 \pm 0.4) \times 10^{-3}$		DESIG=15
$\Gamma_{16} \quad 3\pi^+3\pi^-K^+K^-$	$(2.0 \pm 0.8) \times 10^{-4}$		DESIG=16
$\Gamma_{17} \quad 3\pi^+3\pi^-K^+K^-\pi^0$	$(6.1 \pm 2.2) \times 10^{-4}$		DESIG=17
$\Gamma_{18} \quad 4\pi^+4\pi^-$	$(1.7 \pm 0.6) \times 10^{-4}$		DESIG=18
$\Gamma_{19} \quad 4\pi^+4\pi^-2\pi^0$	$(1.9 \pm 0.7) \times 10^{-3}$		DESIG=19

 $\chi_{b1}(2P)$ BRANCHING RATIOS

NODE=M080220

 $\Gamma(\omega \mathcal{T}(1S))/\Gamma_{\text{total}}$ 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	$\mathcal{T}(3S) \rightarrow \gamma\omega \mathcal{T}(1S)$

⁴ Using $B(\mathcal{T}(3S) \rightarrow \gamma\chi_{b1}(2P)) = (11.3 \pm 0.6)\%$ and $B(\mathcal{T}(1S) \rightarrow \ell^+\ell^-) = 2$
 $B(\mathcal{T}(1S) \rightarrow \mu^+\mu^-) = 2 (2.48 \pm 0.06)\%$.

NODE=M080R3
NODE=M080R3

NODE=M080R3;LINKAGE=CR

 $\Gamma(\gamma \mathcal{T}(2S))/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.199 ± 0.019 OUR AVERAGE				
$0.190 \pm 0.018 \pm 0.017$	4.3k	⁵ LEES	11J BABR	$\mathcal{T}(3S) \rightarrow X\gamma$
$0.356 \pm 0.042 \pm 0.092$		⁶ CRAWFORD	92B CLE2	$e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$
$0.199 \pm 0.020 \pm 0.022$		⁷ HEINTZ	92 CSB2	$e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$

⁵ LEES 11J reports $[\Gamma(\chi_{b1}(2P) \rightarrow \gamma \mathcal{T}(2S))/\Gamma_{\text{total}}] \times [B(\mathcal{T}(3S) \rightarrow \gamma\chi_{b1}(2P))] = (2.4 \pm 0.1 \pm 0.2) \times 10^{-2}$ which we divide by our best value $B(\mathcal{T}(3S) \rightarrow \gamma\chi_{b1}(2P)) = (12.6 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

⁶ Using $B(\mathcal{T}(2S) \rightarrow \mu^+\mu^-) = (1.37 \pm 0.26)\%$, $B(\mathcal{T}(3S) \rightarrow \gamma\gamma \mathcal{T}(2S)) \times 2 B(\mathcal{T}(2S) \rightarrow \mu^+\mu^-) = (10.23 \pm 1.20 \pm 1.26) \times 10^{-4}$, and $B(\mathcal{T}(3S) \rightarrow \gamma\chi_{b1}(2P)) = 0.105^{+0.003}_{-0.002} \pm 0.013$.

⁷ Using $B(\mathcal{T}(2S) \rightarrow \mu^+\mu^-) = (1.44 \pm 0.10)\%$, $B(\mathcal{T}(3S) \rightarrow \gamma\chi_{b1}(2P)) = (11.5 \pm 0.5 \pm 0.5)\%$ and assuming $e\mu$ universality. Supersedes HEINTZ 91.

NODE=M080R2
NODE=M080R2

NODE=M080R2;LINKAGE=LE

NODE=M080R2;LINKAGE=B

NODE=M080R2;LINKAGE=C

 $\Gamma(\gamma \mathcal{T}(1S))/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.092 ± 0.008 OUR AVERAGE				Error includes scale factor of 1.1.
$0.098 \pm 0.005 \pm 0.009$	15k	⁸ LEES	11J BABR	$\mathcal{T}(3S) \rightarrow X\gamma$
$0.120 \pm 0.021 \pm 0.021$		⁹ CRAWFORD	92B CLE2	$e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$
$0.080 \pm 0.009 \pm 0.007$		¹⁰ HEINTZ	92 CSB2	$e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$

⁸ LEES 11J reports $[\Gamma(\chi_{b1}(2P) \rightarrow \gamma \mathcal{T}(1S))/\Gamma_{\text{total}}] \times [B(\mathcal{T}(3S) \rightarrow \gamma\chi_{b1}(2P))] = (12.4 \pm 0.3 \pm 0.6) \times 10^{-3}$ which we divide by our best value $B(\mathcal{T}(3S) \rightarrow \gamma\chi_{b1}(2P)) = (12.6 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

⁹ Using $B(\mathcal{T}(1S) \rightarrow \mu^+\mu^-) = (2.57 \pm 0.07)\%$, $B(\mathcal{T}(3S) \rightarrow \gamma\gamma \mathcal{T}(1S)) \times 2 B(\mathcal{T}(1S) \rightarrow \mu^+\mu^-) = (6.47 \pm 1.12 \pm 0.82) \times 10^{-4}$ and $B(\mathcal{T}(3S) \rightarrow \gamma\chi_{b1}(2P)) = 0.105^{+0.003}_{-0.002} \pm 0.013$.

¹⁰ Using $B(\mathcal{T}(1S) \rightarrow \mu^+\mu^-) = (2.57 \pm 0.07)\%$, $B(\mathcal{T}(3S) \rightarrow \gamma\chi_{b1}(2P)) = (11.5 \pm 0.5 \pm 0.5)\%$ and assuming $e\mu$ universality. Supersedes HEINTZ 91.

NODE=M080R1
NODE=M080R1

NODE=M080R1;LINKAGE=LE

NODE=M080R1;LINKAGE=B

NODE=M080R1;LINKAGE=C

$\Gamma(\pi\pi\chi_{b1}(1P))/\Gamma_{\text{total}}$ 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	11 LEES	11C BABR	$e^+e^- \rightarrow \pi^+\pi^-X$
8.6±2.3±2.1		12 CAWLFIELD	06 CLE3	$\Upsilon(3S) \rightarrow 2(\gamma\pi\ell)$

NODE=M080R4
 NODE=M080R4

¹¹LEES 11C measures $B(\Upsilon(3S) \rightarrow \chi_{b1}(2P)X) \times B(\chi_{b1}(2P) \rightarrow \chi_{b1}(1P)\pi^+\pi^-) = (1.16 \pm 0.07 \pm 0.12) \times 10^{-3}$. We derive the value assuming $B(\Upsilon(3S) \rightarrow \chi_{b1}(2P)X) = B(\Upsilon(3S) \rightarrow \chi_{b1}(2P)\gamma) = (12.6 \pm 1.2) \times 10^{-2}$.

NODE=M080R4;LINKAGE=LE

¹²CAWLFIELD 06 quote $\Gamma(\chi_{b1}(2P) \rightarrow \pi\pi\chi_{b1}(1P)) = 0.83 \pm 0.22 \pm 0.08 \pm 0.19$ keV assuming l-spin conservation, no D-wave contribution, $\Gamma(\chi_{b1}(2P)) = 96 \pm 16$ keV, and $\Gamma(\chi_{b2}(2P)) = 138 \pm 19$ keV.

NODE=M080R4;LINKAGE=CA

 $\Gamma(D^0X)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
8.8±1.5±0.8	2243	13 BRIERE	08 CLEO	$\Upsilon(3S) \rightarrow \gamma D^0X$

NODE=M080R01
 NODE=M080R01

¹³For $p_{D^0} > 2.5$ GeV/c.

NODE=M080R01;LINKAGE=BR

 $\Gamma(\pi^+\pi^-K^+K^-\pi^0)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
3.1±1.0±0.3	30	14 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma\pi^+\pi^-K^+K^-\pi^0$

NODE=M080R02
 NODE=M080R02

¹⁴ASNER 08A reports $[\Gamma(\chi_{b1}(2P) \rightarrow \pi^+\pi^-K^+K^-\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P))] = (39 \pm 8 \pm 9) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P)) = (12.6 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M080R02;LINKAGE=AS

 $\Gamma(2\pi^+\pi^-K^-K_S^0)/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.1±0.5±0.1	10	15 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+\pi^-K^-K_S^0$

NODE=M080R03
 NODE=M080R03

¹⁵ASNER 08A reports $[\Gamma(\chi_{b1}(2P) \rightarrow 2\pi^+\pi^-K^-K_S^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P))] = (14 \pm 5 \pm 3) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P)) = (12.6 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M080R03;LINKAGE=AS

 $\Gamma(2\pi^+\pi^-K^-K_S^02\pi^0)/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
7.7±3.1±0.7	15	16 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+\pi^-K^-2\pi^0$

NODE=M080R04
 NODE=M080R04

¹⁶ASNER 08A reports $[\Gamma(\chi_{b1}(2P) \rightarrow 2\pi^+\pi^-K^-K_S^02\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P))] = (97 \pm 30 \pm 26) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P)) = (12.6 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M080R04;LINKAGE=AS

 $\Gamma(2\pi^+2\pi^-2\pi^0)/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
5.9±2.0±0.5	36	17 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+2\pi^-2\pi^0$

NODE=M080R05
 NODE=M080R05

¹⁷ASNER 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;LINKAGE=AS

 $\Gamma(2\pi^+2\pi^-K^+K^-)/\Gamma_{\text{total}}$ Γ_{10}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.0±0.4±0.1	12	18 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+2\pi^-K^+K^-$

NODE=M080R06
 NODE=M080R06

¹⁸ASNER 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;LINKAGE=AS

 $\Gamma(2\pi^+2\pi^-K^+K^-\pi^0)/\Gamma_{\text{total}}$ Γ_{11}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
5.5±1.7±0.5	38	19 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+2\pi^-K^+K^-\pi^0$

NODE=M080R07
 NODE=M080R07

¹⁹ASNER 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;LINKAGE=AS

$\Gamma(2\pi^+ 2\pi^- K^+ K^- 2\pi^0)/\Gamma_{\text{total}}$ Γ_{12}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
9.6$\pm$3.5$\pm$0.9	27	20 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+ 2\pi^- K^+ K^- 2\pi^0$ 20 ASNER 08A reports $[\Gamma(\chi_{b1}(2P) \rightarrow 2\pi^+ 2\pi^- K^+ K^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P))]$ = $(121 \pm 29 \pm 33) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P)) = (12.6 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M080R08
 NODE=M080R08

NODE=M080R08;LINKAGE=AS

 $\Gamma(3\pi^+ 2\pi^- K^- K_S^0 \pi^0)/\Gamma_{\text{total}}$ Γ_{13}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
6.7$\pm$2.5$\pm$0.6	17	21 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+ 2\pi^- K^- K_S^0 \pi^0$ 21 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	22 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+ 3\pi^-$ 22 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	23 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+ 3\pi^- 2\pi^0$ 23 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	24 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+ 3\pi^- K^+ K^-$ 24 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	25 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+ 3\pi^- K^+ K^- \pi^0$ 25 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	26 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 4\pi^+ 4\pi^-$ 26 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	27 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 4\pi^+ 4\pi^- 2\pi^0$ 27 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

$$\Gamma(\chi_{b1}(2P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P))/\Gamma_{\text{total}} \Gamma_3/\Gamma \times \Gamma_{20}^{\Upsilon(3S)}/\Gamma \Upsilon(3S)$$

NODE=M080B01
NODE=M080B01

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
12.4±0.3±0.6	15k	LEES	11J BABR	$\Upsilon(3S) \rightarrow X\gamma$

$$\Gamma(\chi_{b1}(2P) \rightarrow \gamma \Upsilon(2S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P))/\Gamma_{\text{total}} \Gamma_2/\Gamma \times \Gamma_{20}^{\Upsilon(3S)}/\Gamma \Upsilon(3S)$$

NODE=M080B02
NODE=M080B02

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
2.4±0.1±0.2	4.3k	LEES	11J BABR	$\Upsilon(3S) \rightarrow X\gamma$

$$B(\chi_{b1}(2P) \rightarrow \chi_{b1}(1P)\pi^+\pi^-) \times B(\Upsilon(3S) \rightarrow \chi_{b1}(2P)X)$$

NODE=M080R16
NODE=M080R16

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.16±0.07±0.12	31k	LEES	11C BABR	$e^+e^- \rightarrow \pi^+\pi^-X$

$$B(\chi_{b2}(2P) \rightarrow \rho X + \bar{\rho} X)/B(\chi_{b1}(2P) \rightarrow \rho X + \bar{\rho} X)$$

NODE=M080R20
NODE=M080R20

VALUE	DOCUMENT ID	TECN	COMMENT
1.109±0.007±0.040	BRIERE 07 CLEO		$\Upsilon(3S) \rightarrow \gamma \chi_{bJ}(2P)$

$$B(\chi_{b0}(2P) \rightarrow \rho X + \bar{\rho} X)/B(\chi_{b1}(2P) \rightarrow \rho X + \bar{\rho} X)$$

NODE=M080R21
NODE=M080R21

VALUE	DOCUMENT ID	TECN	COMMENT
1.082±0.025±0.060	BRIERE 07 CLEO		$\Upsilon(3S) \rightarrow \gamma \chi_{bJ}(2P)$

 $\chi_{b1}(2P)$ REFERENCES

NODE=M080

LEES	11C	PR D84 011104	J.P. Lees <i>et al.</i>	(BABAR Collab.)
LEES	11J	PR D84 072002	J.P. Lees <i>et al.</i>	(BABAR Collab.)
ASNER	08A	PR D78 091103	D.M. Asner <i>et al.</i>	(CLEO Collab.)
BRIERE	08	PR D78 092007	R.A. Briere <i>et al.</i>	(CLEO Collab.)
BRIERE	07	PR D76 012005	R.A. Briere <i>et al.</i>	(CLEO Collab.)
CAWLFIELD	06	PR D73 012003	C. Cawfield <i>et al.</i>	(CLEO Collab.)
ARTUSO	05	PRL 94 032001	M. Artuso <i>et al.</i>	(CLEO Collab.)
CRONIN-HEN...	04	PRL 92 222002	D. Cronin-Hennessy <i>et al.</i>	(CLEO Collab.)
CRAWFORD	92B	PL B294 139	G. Crawford, R. Fulton	(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.)

REFID=16775
REFID=53936
REFID=52574
REFID=52577
REFID=51887
REFID=50997
REFID=50454
REFID=49766
REFID=43177
REFID=43604
REFID=41580
REFID=41634
REFID=41586

$$h_b(2P)$$

$$I^G(J^{PC}) = ?^?(1^{+-})$$

OMITTED FROM SUMMARY TABLE

Quantum numbers are quark model predictions.

NODE=M205

NODE=M205

 $h_b(2P)$ MASS

NODE=M205M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
10259.8±1.2 OUR AVERAGE		[10.2598 ^{+0.0015} _{-0.0012} GeV OUR 2012 AVERAGE]		

NODE=M205M

10259.8±0.5±1.1	90k	MIZUK	12 BELL	$e^+e^- \rightarrow \pi^+\pi^-$ hadrons

NEW

• • • 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

¹Superseded by MIZUK 12.

NODE=M205M;LINKAGE=AD

 $h_b(2P)$ DECAY MODES

NODE=M205215;NODE=M205

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) %

DESIG=1

DESIG=2

DESIG=3

 $h_b(2P)$ BRANCHING RATIOS

NODE=M205225

$\Gamma(\text{hadrons})/\Gamma_{\text{total}}$	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_1/Γ
not seen	83.9k	ADACHI	12 BELL	10.86 $e^+e^- \rightarrow \pi^+\pi^-$ MM	

NODE=M205R01
NODE=M205R01

$\Gamma(\eta_b(1S)\gamma)/\Gamma_{\text{total}}$ Γ_2/Γ VALUE (units 10^{-2}) EVTS

DOCUMENT ID

TECN

COMMENT

 $22.3 \pm 3.8^{+3.1}_{-3.3}$ 10k

MIZUK

12

BELL

 $e^+e^- \rightarrow (\gamma)\pi^+\pi^-$ hadronsNODE=M205R02
NODE=M205R02 $\Gamma(\eta_b(2S)\gamma)/\Gamma_{\text{total}}$ Γ_3/Γ VALUE (units 10^{-2}) EVTS

DOCUMENT ID

TECN

COMMENT

 $47.5 \pm 10.5^{+6.8}_{-7.7}$ 26k

MIZUK

12

BELL

 $e^+e^- \rightarrow (\gamma)\pi^+\pi^-$ hadronsNODE=M205R03
NODE=M205R03 $h_b(2P)$ REFERENCES

ADACHI

12

PRL 108 032001

I. Adachi *et al.*

(BELLE Collab.)

MIZUK

12

PRL 109 232002

R. Mizuk *et al.*

(BELLE Collab.)

NODE=M205

REFID=53962

REFID=54718

NODE=M081

 $\chi_{b2}(2P)$ $I^G(J^{PC}) = 0^+(2^{++})$ 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

 $\chi_{b2}(2P)$ MASS

VALUE (MeV)

DOCUMENT ID

102686.5 $\pm$ 0.22 $\pm$ 0.50 OUR EVALUATION From γ energy below, using $\Upsilon(3S)$ mass = 10355.2 $\pm$ 0.5 MeV [10.26865 $\pm$ 0.00022 $\pm$ 0.00050 GeV OUR 2012 EVALUATION]

NODE=M081M

NODE=M081M

NEW; $\rightarrow$ UNCHECKED $\leftarrow$ $m_{\chi_{b2}(2P)} - m_{\chi_{b1}(2P)}$

VALUE (MeV)

DOCUMENT ID

TECN

COMMENT

13.5 $\pm$ 0.4 $\pm$ 0.5¹ HEINTZ

92

CSB2

 $e^+e^- \rightarrow \gamma X, \ell^+\ell^-\gamma\gamma$

NODE=M081M2

NODE=M081M2

¹ From the average photon energy for inclusive and exclusive events. Supersedes NARAIN 91.

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 $\pm$ 0.2786 $\pm$ 1

101

ARTUSO

05

CLEO

 $\Upsilon(3S) \rightarrow \gamma X$

CRAWFORD

92B

CLE2

 $e^+e^- \rightarrow$ $\ell^+\ell^-\gamma\gamma$ 86.7 $\pm$ 0.4

10319

² HEINTZ

92

CSB2

 $e^+e^- \rightarrow \gamma X$ 86.9 $\pm$ 0.4

157

³ HEINTZ

92

CSB2

 $e^+e^- \rightarrow$ $\ell^+\ell^-\gamma\gamma$ 86.4 $\pm$ 0.1 $\pm$ 0.4

30741

MORRISON

91

CLE2

 $e^+e^- \rightarrow \gamma X$

² A systematic uncertainty on the energy scale of 0.9% not included. Supersedes NARAIN 91.

³ A systematic uncertainty on the energy scale of 0.9% not included. Supersedes HEINTZ 91.

NODE=M081DM

NODE=M081DM

 $\rightarrow$ UNCHECKED $\leftarrow$

OCCUR=2

NODE=M081DM;LINKAGE=A

NODE=M081DM;LINKAGE=B

 $\chi_{b2}(2P)$ DECAY MODES

NODE=M081215;NODE=M081

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
$\Gamma_1 \quad \omega \Upsilon(1S)$	(1.10 $^{+0.34}_{-0.30}$) %	
$\Gamma_2 \quad \gamma \Upsilon(2S)$	(10.6 $\pm$ 2.6) %	S=2.0
$\Gamma_3 \quad \gamma \Upsilon(1S)$	(7.0 $\pm$ 0.7) %	
$\Gamma_4 \quad \pi\pi\chi_{b2}(1P)$	(5.1 $\pm$ 0.9) $\times 10^{-3}$	
$\Gamma_5 \quad D^0 X$	< 2.4 %	CL=90%
$\Gamma_6 \quad \pi^+\pi^- K^+ K^- \pi^0$	< 1.1 $\times 10^{-4}$	CL=90%
$\Gamma_7 \quad 2\pi^+\pi^- K^- K_S^0$	< 9 $\times 10^{-5}$	CL=90%
$\Gamma_8 \quad 2\pi^+\pi^- K^- K_S^0 2\pi^0$	< 7 $\times 10^{-4}$	CL=90%
$\Gamma_9 \quad 2\pi^+ 2\pi^- 2\pi^0$	(3.9 $\pm$ 1.6) $\times 10^{-4}$	

DESIG=3

DESIG=2

DESIG=1

DESIG=4

DESIG=5

DESIG=6

DESIG=7

DESIG=8

DESIG=9

Γ_{10}	$2\pi^+ 2\pi^- K^+ K^-$	$(9 \pm 4) \times 10^{-5}$	DESIG=10
Γ_{11}	$2\pi^+ 2\pi^- K^+ K^- \pi^0$	$(2.4 \pm 1.1) \times 10^{-4}$	DESIG=11
Γ_{12}	$2\pi^+ 2\pi^- K^+ K^- 2\pi^0$	$(4.7 \pm 2.3) \times 10^{-4}$	DESIG=12
Γ_{13}	$3\pi^+ 2\pi^- K^- K_S^0 \pi^0$	$< 4 \times 10^{-4}$	DESIG=13
Γ_{14}	$3\pi^+ 3\pi^-$	$(9 \pm 4) \times 10^{-5}$	DESIG=14
Γ_{15}	$3\pi^+ 3\pi^- 2\pi^0$	$(1.2 \pm 0.4) \times 10^{-3}$	DESIG=15
Γ_{16}	$3\pi^+ 3\pi^- K^+ K^-$	$(1.4 \pm 0.7) \times 10^{-4}$	DESIG=16
Γ_{17}	$3\pi^+ 3\pi^- K^+ K^- \pi^0$	$(4.2 \pm 1.7) \times 10^{-4}$	DESIG=17
Γ_{18}	$4\pi^+ 4\pi^-$	$(9 \pm 5) \times 10^{-5}$	DESIG=18
Γ_{19}	$4\pi^+ 4\pi^- 2\pi^0$	$(1.3 \pm 0.5) \times 10^{-3}$	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
$1.10^{+0.32+0.11}_{-0.28-0.10}$	$20.1^{+5.8}_{-5.1}$	⁴ CRONIN-HEN..04	CLE3	$\Upsilon(3S) \rightarrow \gamma \omega \Upsilon(1S)$

NODE=M081R3
NODE=M081R3

⁴ Using $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) = (11.4 \pm 0.8)\%$ and $B(\Upsilon(1S) \rightarrow \ell^+ \ell^-) = 2$
 $B(\Upsilon(1S) \rightarrow \mu^+ \mu^-) = 2 (2.48 \pm 0.06)\%$.

NODE=M081R3;LINKAGE=CR

 $\Gamma(\gamma \Upsilon(2S))/\Gamma_{\text{total}}$ **Γ_2/Γ**

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.106 ± 0.026 OUR AVERAGE		Error includes scale factor of 2.0. See the ideogram below.		
$0.084 \pm 0.011 \pm 0.010$	2.5k	⁵ LEES	11J BABR	$\Upsilon(3S) \rightarrow X \gamma$
$0.135 \pm 0.025 \pm 0.035$		⁶ CRAWFORD	92B CLE2	$e^+ e^- \rightarrow \ell^+ \ell^- \gamma \gamma$
$0.173 \pm 0.021 \pm 0.019$		⁷ HEINTZ	92 CSB2	$e^+ e^- \rightarrow \ell^+ \ell^- \gamma \gamma$

NODE=M081R2
NODE=M081R2

⁵ LEES 11J reports $[\Gamma(\chi_{b2}(2P) \rightarrow \gamma \Upsilon(2S))/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))] = (1.1 \pm 0.1 \pm 0.1) \times 10^{-2}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) = (13.1 \pm 1.6) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M081R2;LINKAGE=LE

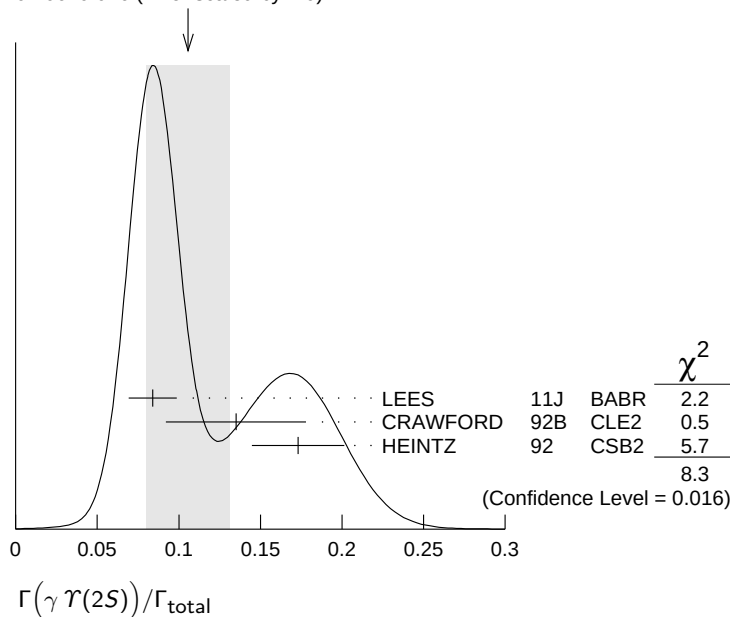
⁶ Using $B(\Upsilon(2S) \rightarrow \mu^+ \mu^-) = (1.37 \pm 0.26)\%$, $B(\Upsilon(3S) \rightarrow \gamma \gamma \Upsilon(2S)) \times 2 B(\Upsilon(2S) \rightarrow \mu^+ \mu^-) = (4.98 \pm 0.94 \pm 0.62) \times 10^{-4}$, and $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) = 0.135 \pm 0.003 \pm 0.017$.

NODE=M081R2;LINKAGE=B

⁷ Using $B(\Upsilon(2S) \rightarrow \mu^+ \mu^-) = (1.44 \pm 0.10)\%$, $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) = (11.1 \pm 0.5 \pm 0.4)\%$ and assuming $e\mu$ universality. Supersedes HEINTZ 91.

NODE=M081R2;LINKAGE=C

WEIGHTED AVERAGE
 0.106 ± 0.026 (Error scaled by 2.0)



$\Gamma(\gamma \Upsilon(1S))/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.070±0.007 OUR AVERAGE				
0.070±0.004±0.008	11k	⁸ LEES	11J BABR	$\Upsilon(3S) \rightarrow X\gamma$
0.072±0.014±0.013		⁹ CRAWFORD	92B CLE2	$e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$
0.070±0.010±0.006		¹⁰ HEINTZ	92 CSB2	$e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$

NODE=M081R1
 NODE=M081R1

⁸ LEES 11J reports $[\Gamma(\chi_{b2}(2P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))] = (9.2 \pm 0.3 \pm 0.4) \times 10^{-3}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) = (13.1 \pm 1.6) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M081R1;LINKAGE=LE

⁹ Using $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.57 \pm 0.07)\%$, $B(\Upsilon(3S) \rightarrow \gamma\gamma \Upsilon(2S)) \times 2 B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (5.03 \pm 0.94 \pm 0.63) \times 10^{-4}$, and $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) = 0.135 \pm 0.003 \pm 0.017$.

NODE=M081R1;LINKAGE=B

¹⁰ Using $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.57 \pm 0.07)\%$, $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) = (11.1 \pm 0.5 \pm 0.4)\%$ and assuming $e\mu$ universality. Supersedes HEINTZ 91.

NODE=M081R1;LINKAGE=C

 $\Gamma(\pi\pi\chi_{b2}(1P))/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
5.1±0.9 OUR AVERAGE				
4.9±0.7±0.6	17k	¹¹ LEES	11C BABR	$e^+e^- \rightarrow \pi^+\pi^-X$
6.0±1.6±1.4		¹² CAWLFIELD	06 CLE3	$\Upsilon(3S) \rightarrow 2(\gamma\pi\ell)$

NODE=M081R4
 NODE=M081R4

¹¹ $(0.64 \pm 0.05 \pm 0.08) \times 10^{-3}$. We derive the value assuming $B(\Upsilon(3S) \rightarrow \chi_{b2}(2P)X) = B(\Upsilon(3S) \rightarrow \chi_{b2}(2P)\gamma) = (13.1 \pm 1.6) \times 10^{-2}$.

NODE=M081R4;LINKAGE=LE

¹² 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=CA

 $\Gamma(D^0X)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<2.4 × 10⁻²	90	^{13,14} BRIERE	08 CLEO	$\Upsilon(3S) \rightarrow \gamma D^0X$

NODE=M081R01
 NODE=M081R01

¹³ For $p_{D^0} > 2.5$ GeV/c.

NODE=M081R01;LINKAGE=BR

¹⁴ The authors also present their result as $(0.2 \pm 1.4 \pm 0.1) \times 10^{-2}$.

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	¹⁵ ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma\pi^+\pi^-K^+K^-\pi^0$

NODE=M081R02
 NODE=M081R02

¹⁵ 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;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	¹⁶ ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+\pi^-K^-K_S^0$

NODE=M081R03
 NODE=M081R03

¹⁶ 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;LINKAGE=AS

 $\Gamma(2\pi^+\pi^-K^-K_S^02\pi^0)/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<7	90	¹⁷ ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+\pi^-K^-2\pi^0$

NODE=M081R04
 NODE=M081R04

¹⁷ ASNER 08A reports $[\Gamma(\chi_{b2}(2P) \rightarrow 2\pi^+\pi^-K^-K_S^02\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))] < 87 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) = 13.1 \times 10^{-2}$.

NODE=M081R04;LINKAGE=AS

 $\Gamma(2\pi^+2\pi^-2\pi^0)/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
3.9±1.6±0.5	23	¹⁸ ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+2\pi^-2\pi^0$

NODE=M081R05
 NODE=M081R05

¹⁸ 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;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
0.9±0.4±0.1	11	19 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+ 2\pi^- K^+ K^-$ 19 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

$$\Gamma(2\pi^+ 2\pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}} \quad \Gamma_{11}/\Gamma$$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.4±1.0±0.3	16	20 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+ 2\pi^- K^+ K^- \pi^0$ 20 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

$$\Gamma(2\pi^+ 2\pi^- K^+ K^- 2\pi^0)/\Gamma_{\text{total}} \quad \Gamma_{12}/\Gamma$$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
4.7±2.2±0.6	14	21 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+ 2\pi^- K^+ K^- 2\pi^0$ 21 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

$$\Gamma(3\pi^+ 2\pi^- K^- K_S^0 \pi^0)/\Gamma_{\text{total}} \quad \Gamma_{13}/\Gamma$$

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<4	90	22 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+ 2\pi^- K^- K_S^0 \pi^0$ 22 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

$$\Gamma(3\pi^+ 3\pi^-)/\Gamma_{\text{total}} \quad \Gamma_{14}/\Gamma$$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
0.9±0.4±0.1	14	23 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+ 3\pi^-$ 23 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

$$\Gamma(3\pi^+ 3\pi^- 2\pi^0)/\Gamma_{\text{total}} \quad \Gamma_{15}/\Gamma$$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
12±4±1	45	24 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+ 3\pi^- 2\pi^0$ 24 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

$$\Gamma(3\pi^+ 3\pi^- K^+ K^-)/\Gamma_{\text{total}} \quad \Gamma_{16}/\Gamma$$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.4±0.7±0.2	12	25 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+ 3\pi^- K^+ K^-$ 25 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

$$\Gamma(3\pi^+ 3\pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}} \quad \Gamma_{17}/\Gamma$$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
4.2±1.7±0.5	16	26 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+ 3\pi^- K^+ K^- \pi^0$ 26 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
$0.9 \pm 0.4 \pm 0.1$	9	27 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 4\pi^+ 4\pi^-$

NODE=M081R14
 NODE=M081R14

²⁷ 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;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
$13 \pm 5 \pm 2$	27	28 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 4\pi^+ 4\pi^- 2\pi^0$

NODE=M081R15
 NODE=M081R15

²⁸ 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;LINKAGE=AS

 $\chi_{b2}(2P)$ Cross-Particle Branching Ratios

NODE=M081230

$$\Gamma(\chi_{b2}(2P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))/\Gamma_{\text{total}}$$

$$\Gamma_3/\Gamma \times \Gamma_{19}^{\Upsilon(3S)}/\Gamma \Upsilon(3S)$$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$9.2 \pm 0.3 \pm 0.4$	11k	LEES	11J BABR	$\Upsilon(3S) \rightarrow X \gamma$

NODE=M081B01
 NODE=M081B01

$$\Gamma(\chi_{b2}(2P) \rightarrow \gamma \Upsilon(2S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))/\Gamma_{\text{total}}$$

$$\Gamma_2/\Gamma \times \Gamma_{19}^{\Upsilon(3S)}/\Gamma \Upsilon(3S)$$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.1 \pm 0.1 \pm 0.1$	2.5k	LEES	11J BABR	$\Upsilon(3S) \rightarrow X \gamma$

NODE=M081B02
 NODE=M081B02

 $B(\chi_{b2}(2P) \rightarrow \chi_{b2}(1P)\pi^+\pi^-) \times B(\Upsilon(3S) \rightarrow \chi_{b2}(2P)X)$

NODE=M081R16
 NODE=M081R16

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$0.64 \pm 0.05 \pm 0.08$	17k	LEES	11C BABR	$e^+e^- \rightarrow \pi^+\pi^-X$

 $\chi_{b2}(2P)$ REFERENCES

NODE=M081

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
CAWLFIELD	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-HEN...	04	PRL 92 222002	D. Cronin-Hennessy <i>et al.</i>	(CLEO Collab.)	REFID=49766
CRAWFORD	92B	PL B294 139	G. Crawford, R. Fulton	(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

$\Upsilon(3S)$

$$J^{PC} = 0^{-}(1^{-}-)$$

NODE=M048

 $\Upsilon(3S)$ MASS

NODE=M048M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
10355.2±0.5 OUR AVERAGE	[10.3552 ± 0.0005 GeV OUR 2012 AVERAGE]		
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

NEW

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^-	seen	
Γ_{16} hadrons		
Γ_{17} ggg	(35.7 ± 2.6) %	
Γ_{18} γgg	(9.7 ± 1.8) × 10 ⁻³	

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;OUR EVAL;→ UNCHECKED ←

DESIG=101

DESIG=109

DESIG=110

Radiative decays

NODE=M048;CLUMP=B

Γ_{19} $\gamma\chi_{b2}(2P)$	(13.1 ± 1.6) %	S=3.4
Γ_{20} $\gamma\chi_{b1}(2P)$	(12.6 ± 1.2) %	S=2.4
Γ_{21} $\gamma\chi_{b0}(2P)$	(5.9 ± 0.6) %	S=1.4
Γ_{22} $\gamma\chi_{b2}(1P)$	(9.9 ± 1.3) × 10 ⁻³	S=2.0
Γ_{23} $\gamma A^0 \rightarrow \gamma \text{hadrons}$	< 8 × 10 ⁻⁵	CL=90%
Γ_{24} $\gamma\chi_{b1}(1P)$	(9 ± 5) × 10 ⁻⁴	S=1.9
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} $\gamma X \rightarrow \gamma + \geq 4 \text{ prongs}$	[a] < 2.2 × 10 ⁻⁴	CL=95%
Γ_{29} $\gamma a_1^0 \rightarrow \gamma \mu^+\mu^-$	< 5.5 × 10 ⁻⁶	CL=90%
Γ_{30} $\gamma a_1^0 \rightarrow \gamma \tau^+\tau^-$	[b] < 1.6 × 10 ⁻⁴	CL=90%

DESIG=5

DESIG=6

DESIG=7

DESIG=103

DESIG=115

DESIG=104

DESIG=13

DESIG=14

DESIG=15

DESIG=102

DESIG=116

DESIG=108

Lepton Family number (LF) violating modes

Γ_{31}	$e^{\pm}\tau^{\mp}$	LF	< 4.2	$\times 10^{-6}$	CL=90%
Γ_{32}	$\mu^{\pm}\tau^{\mp}$	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.

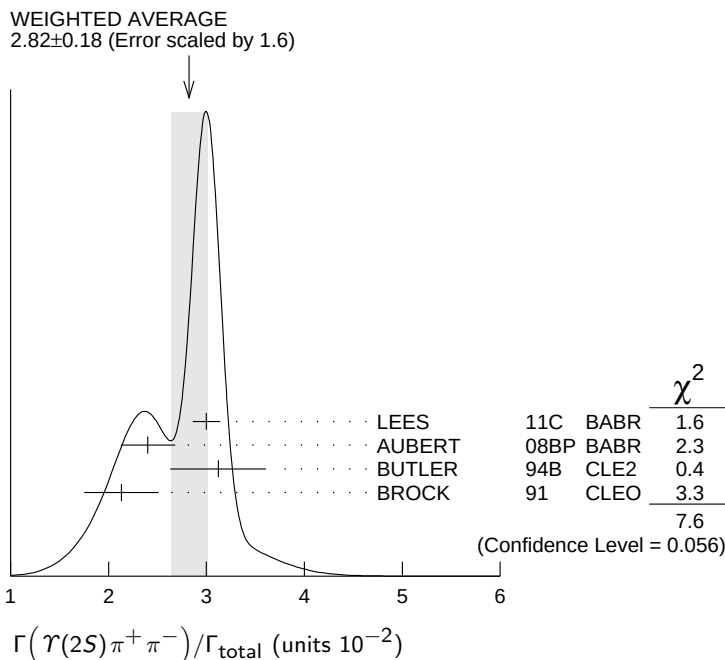
NODE=M048R;LINKAGE=M

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



$\Gamma(\tau(2S)\pi^0\pi^0)/\Gamma_{\text{total}}$ 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 $B(\tau(1S) \rightarrow e^+e^-) + B(\tau(1S) \rightarrow \mu^+\mu^-) = 4.06\%$.				
¹⁵ $B(\tau(2S) \rightarrow \mu^+\mu^-) = (1.31 \pm 0.21)\%$ and assuming $e\mu$ universality.				
¹⁶ From the exclusive mode.				
¹⁷ $B(\tau(2S) \rightarrow \mu^+\mu^-) = (1.44 \pm 0.10)\%$ 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

$\Gamma(\tau(2S)\gamma\gamma)/\Gamma_{\text{total}}$ 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

$\Gamma(\tau(2S)\pi^0)/\Gamma_{\text{total}}$ 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 $B(\tau(2S) \rightarrow e^+e^-) + B(\tau(1S) \rightarrow \mu^+\mu^-) = 4.06\%$.

NODE=M048R25
NODE=M048R25

NODE=M048R25;LINKAGE=HE

$\Gamma(\tau(1S)\pi^+\pi^-)/\Gamma_{\text{total}}$ 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	$\tau(3S) \rightarrow \pi^+\pi^-\ell^+\ell^-$
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	$\tau(3S) \rightarrow \pi^+\pi^-\ell^+\ell^-$
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	$\tau(3S) \rightarrow \pi^+\pi^-\ell^+\ell^-$
3.9 ±1.3	26	MAGERAS	82 CUSB	$\tau(3S) \rightarrow \pi^+\pi^-\ell^+\ell^-$

²⁰ Using $B(\tau(1S) \rightarrow e^+e^-) = (2.38 \pm 0.11)\%$ and $B(\tau(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.05)\%$.

²¹ A weighted average of the inclusive and exclusive results.

²² Using $B(\tau(2S) \rightarrow e^+e^-) = (1.91 \pm 0.16)\%$, $B(\tau(2S) \rightarrow \mu^+\mu^-) = (1.93 \pm 0.17)\%$, and $\Gamma_{ee}(\tau(3S)) = 0.443 \pm 0.008$ keV.

²³ Using $B(\tau(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.06)\%$. 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

$\Gamma(h_b(1P)\pi^+\pi^-)/\Gamma_{\text{total}}$

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

 $\Gamma(\tau^+\tau^-)/\Gamma_{\text{total}}$

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

 $\Gamma(\tau^+\tau^-)/\Gamma(\mu^+\mu^-)$

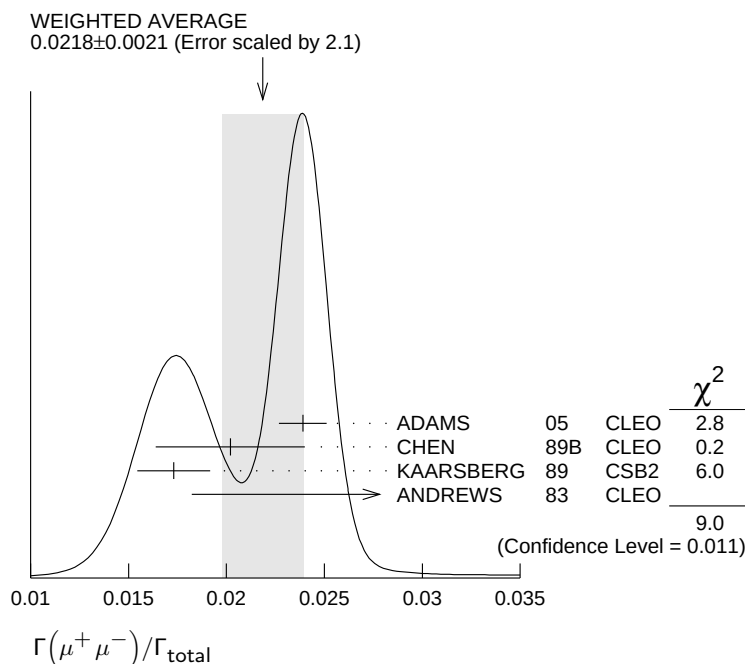
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
1.05±0.08±0.05	15k	BESSON	07 CLEO	$e^+e^- \rightarrow \Upsilon(3S)$

NODE=M048R19
 NODE=M048R19

 $\Gamma(\mu^+\mu^-)/\Gamma_{\text{total}}$

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

 $\Gamma(ggg)/\Gamma_{\text{total}}$

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 $B(\Upsilon(2S) + \text{anything}) = (10.6 \pm 0.8)\%$, $B(\pi^+\pi^-\Upsilon(1S)) = (4.40 \pm 0.10)\%$, $B(\pi^0\pi^0\Upsilon(1S)) = (2.20 \pm 0.13)\%$, $B(\gamma\chi_{b2}(2P)) = (13.1 \pm 1.6)\%$, $B(\gamma\chi_{b1}(2P)) = (12.6 \pm 1.2)\%$, $B(\gamma\chi_{b0}(2P)) = (5.9 \pm 0.6)\%$, $B(\gamma\chi_{b0}(1P)) = (0.30 \pm 0.11)\%$, $B(\mu^+\mu^-) = (2.18 \pm 0.21)\%$, 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±0.06±0.49	3M	BESSON	06A CLEO	$\Upsilon(3S) \rightarrow (\gamma +) \text{hadrons}$

 Γ_{18}/Γ_{17}

NODE=M048R32
NODE=M048R32

 $\Gamma(\gamma \chi_{b2}(2P))/\Gamma_{\text{total}}$

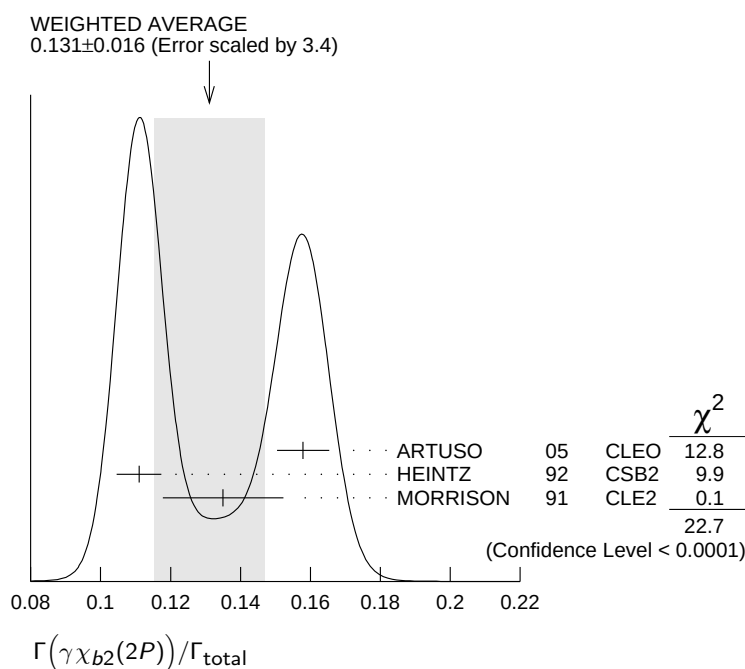
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.131 ±0.016 OUR AVERAGE		Error includes scale factor of 3.4. See the ideogram below.		

0.1579±0.0017±0.0073	568k	ARTUSO	05	CLEO	$e^+e^- \rightarrow \gamma X$
0.111 ±0.005 ±0.004	10319	⁴⁰ HEINTZ	92	CSB2	$e^+e^- \rightarrow \gamma X$
0.135 ±0.003 ±0.017	30741	MORRISON	91	CLE2	$e^+e^- \rightarrow \gamma X$

⁴⁰ Supersedes NARAIN 91.

NODE=M048R5
NODE=M048R5

NODE=M048R;LINKAGE=H

 $\Gamma(\gamma \chi_{b1}(2P))/\Gamma_{\text{total}}$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.126 ±0.012 OUR AVERAGE		Error includes scale factor of 2.4. See the ideogram below.		

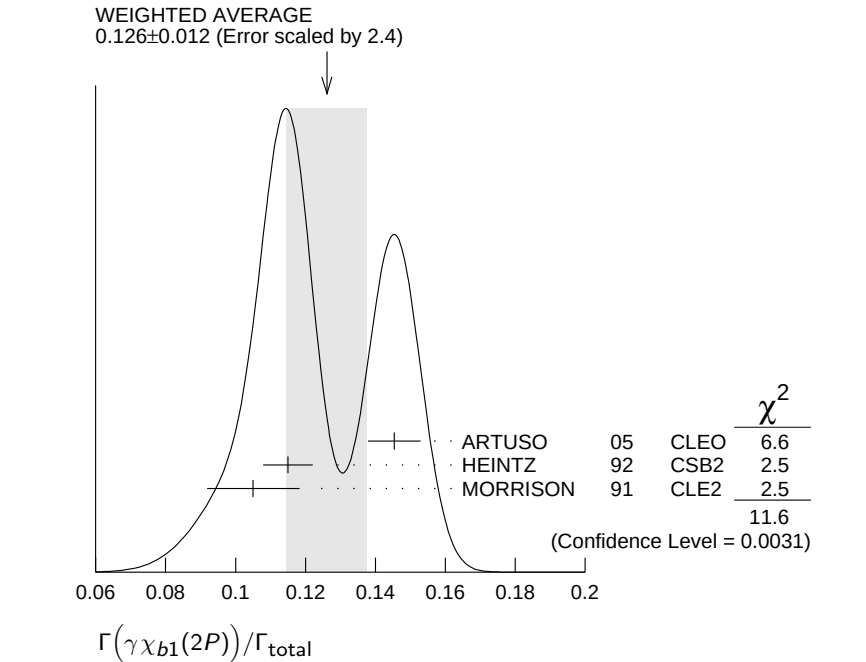
0.1454±0.0018±0.0073	537k	ARTUSO	05	CLEO	$e^+e^- \rightarrow \gamma X$
0.115 ±0.005 ±0.005	11147	⁴¹ HEINTZ	92	CSB2	$e^+e^- \rightarrow \gamma X$
0.105 $\begin{smallmatrix} +0.003 \\ -0.002 \end{smallmatrix}$ ±0.013	25759	MORRISON	91	CLE2	$e^+e^- \rightarrow \gamma X$

⁴¹ Supersedes NARAIN 91.

 Γ_{20}/Γ

NODE=M048R6
NODE=M048R6

NODE=M048R6;LINKAGE=H

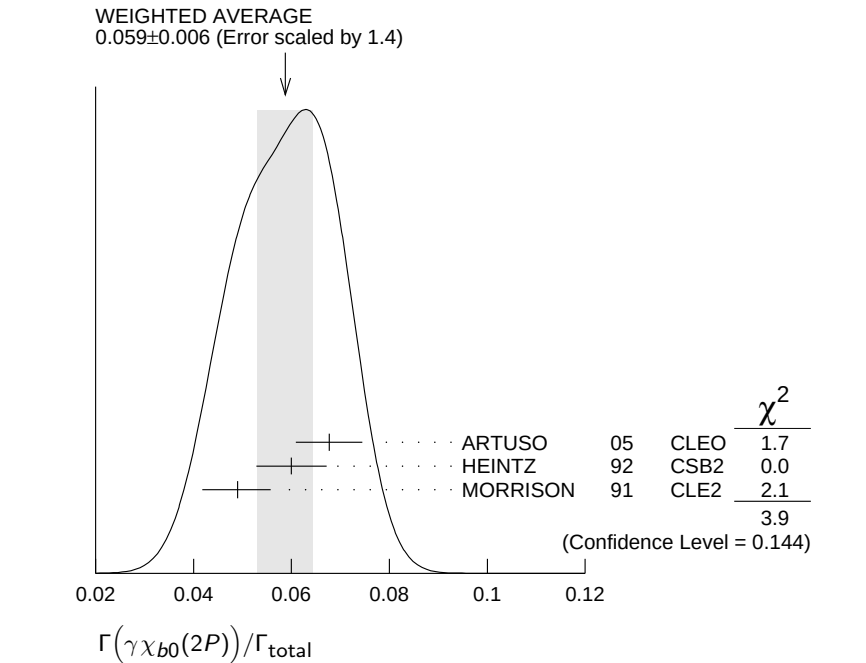


$\Gamma(\gamma\chi_{b0}(2P))/\Gamma_{\text{total}}$					Γ_{21}/Γ	
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT		
0.059 ± 0.006 OUR AVERAGE					Error includes scale factor of 1.4. See the ideogram below.	
0.0677 ± 0.0020 ± 0.0065	225k	ARTUSO	05	CLEO	$e^+e^- \rightarrow \gamma X$	
0.060 ± 0.004 ± 0.006	4959	42 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_{22}/Γ	
VALUE (units 10 ⁻³)	CL% EVTS	DOCUMENT ID	TECN	COMMENT		
9.9±1.3 OUR AVERAGE					Error includes scale factor of 2.0.	
7.5±1.2±0.5	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 $B(\chi_{b2}(1P) \rightarrow \gamma \Upsilon(1S)) = (19.1 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

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 1.9.					
1.6±0.5±0.1		50	^{47,48} KORNICER	11 CLEO	$e^+ e^- \rightarrow \gamma \gamma \ell^+ \ell^-$
0.5±0.3 ^{+0.2} _{-0.1}			LEES	11J BABR	$\Upsilon(3S) \rightarrow X \gamma$

NODE=M048R22
NODE=M048R22

• • • We do not use the following data for averages, fits, limits, etc. • • •

<1.7 seen	90	⁴⁹ ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma + \text{hadrons}$
		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 $B(\chi_{b1}(1P) \rightarrow \gamma \Upsilon(1S)) = (33.9 \pm 2.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

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±0.04±0.02		2.3k	LEES	11J BABR	$\Upsilon(3S) \rightarrow X \gamma$
0.30±0.04±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±1.8±1.3		2.3±0.5k	⁵² BONVICINI	10 CLEO	$\Upsilon(3S) \rightarrow \gamma X$
4.8±0.5±0.6		19±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±0.5±1.2		19±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

$\Gamma(\gamma X \rightarrow \gamma + \geq 4 \text{ prongs})/\Gamma_{\text{total}}$ (1.5 GeV < m_X < 5.0 GeV) Γ_{28}/Γ

NODE=M048R20

NODE=M048R20

NODE=M048R20

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<2.2	95	ROSNER	07A CLEO	$e^+e^- \rightarrow \gamma X$

 $\Gamma(\gamma a_1^0 \rightarrow \gamma \mu^+ \mu^-)/\Gamma_{\text{total}}$ Γ_{29}/Γ

NODE=M048R04

NODE=M048R04

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<5.5	90	⁵⁵ AUBERT	09Z BABR	$e^+e^- \rightarrow \gamma a_1^0 \rightarrow \gamma \mu^+ \mu^-$

⁵⁵ 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 $0.27\text{--}5.5 \times 10^{-6}$.

NODE=M048R04;LINKAGE=AU

 $\Gamma(\gamma a_1^0 \rightarrow \gamma \tau^+ \tau^-)/\Gamma_{\text{total}}$ Γ_{30}/Γ

NODE=M048R29

NODE=M048R29

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<1.6 $\times 10^{-4}$	90	⁵⁶ AUBERT	09P BABR	$e^+e^- \rightarrow \gamma a_1^0 \rightarrow \gamma \tau^+ \tau^-$

⁵⁶ 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 $1.5\text{--}16 \times 10^{-5}$.

NODE=M048R29;LINKAGE=AU

 $\Gamma(\gamma A^0 \rightarrow \gamma \text{hadrons})/\Gamma_{\text{total}}$ (0.3 GeV < m_{A^0} < 7 GeV) Γ_{23}/Γ

NODE=M048R02

NODE=M048R02

NODE=M048R02

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<8 $\times 10^{-5}$	90	⁵⁷ LEES	11H BABR	$\Upsilon(3S) \rightarrow \gamma \text{hadrons}$

⁵⁷ For a narrow scalar or pseudoscalar A^0 , excluding known resonances, with mass in the range 0.3–7 GeV. Measured 90% CL limits as a function of m_{A^0} range from 1×10^{-6} to 8×10^{-5} .

NODE=M048R02;LINKAGE=LE

LEPTON FAMILY NUMBER (L_F) VIOLATING MODES

NODE=M048230

 $\Gamma(e^\pm \tau^\mp)/\Gamma_{\text{total}}$ Γ_{31}/Γ

NODE=M048R01

NODE=M048R01

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<4.2	90	LEES	10B BABR	$e^+e^- \rightarrow e^\pm \tau^\mp$

 $\Gamma(\mu^\pm \tau^\mp)/\Gamma_{\text{total}}$ Γ_{32}/Γ

NODE=M048R23

NODE=M048R23

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	$e^+e^- \rightarrow \mu^\pm \tau^\mp$

 $\Upsilon(3S)$ REFERENCES

NODE=M048

GE	11	PR D84 032008	J.Y. Ge <i>et al.</i>	(CLEO Collab.)	REFID=53960
KORNICER	11	PR D83 054003	M. Kornicer <i>et al.</i>	(CLEO Collab.)	REFID=16769
LEES	11C	PR D84 011104	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=16775
LEES	11H	PRL 107 221803	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=53877
LEES	11J	PR D84 072002	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=53936
LEES	11K	PR D84 091101	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=53937
LEES	11L	PR D84 092003	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=53938
BONVICINI	10	PR D81 031104	G. Bonvicini <i>et al.</i>	(CLEO Collab.)	REFID=53231
LEES	10B	PRL 104 151802	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=53355
AUBERT	09AQ	PRL 103 161801	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=53106
AUBERT	09P	PRL 103 181801	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=53062
AUBERT	09Z	PRL 103 081803	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52930
BHARI	09	PR D79 011103	S.R. Bhari <i>et al.</i>	(CLEO Collab.)	REFID=52662
ASNER	08A	PR D78 091103	D.M. Asner <i>et al.</i>	(CLEO Collab.)	REFID=52574
AUBERT	08BP	PR D78 112002	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52660
AUBERT	08V	PRL 101 071801	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52262
HE	08A	PRL 101 192001	Q. He <i>et al.</i>	(CLEO Collab.)	REFID=52587
LOVE	08A	PRL 101 201601	W. Love <i>et al.</i>	(CLEO Collab.)	REFID=52592
PDG	08	PL B667 1	C. Amsler <i>et al.</i>	(PDG Collab.)	REFID=52166
BESSION	07	PRL 98 052002	D. Besson <i>et al.</i>	(CLEO Collab.)	REFID=51620
ROSNER	07A	PR D76 117102	J.L. Rosner <i>et al.</i>	(CLEO Collab.)	REFID=52079
BESSION	06A	PR D74 012003	D. Besson <i>et al.</i>	(CLEO Collab.)	REFID=51147
ROSNER	06	PRL 96 092003	J.L. Rosner <i>et al.</i>	(CLEO Collab.)	REFID=51035
ADAMS	05	PRL 94 012001	G.S. Adams <i>et al.</i>	(CLEO Collab.)	REFID=50452
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
BUTLER	94B	PR D49 40	F. Butler <i>et al.</i>	(CLEO Collab.)	REFID=43799

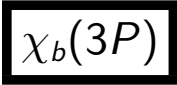
WU	93	PL B301 307	Q.W. Wu <i>et al.</i>	(CUSB Collab.)
HEINTZ	92	PR D46 1928	U. Heintz <i>et al.</i>	(CUSB II Collab.)
BROCK	91	PR D43 1448	I.C. Brock <i>et al.</i>	(CLEO Collab.)
HEINTZ	91	PRL 66 1563	U. Heintz <i>et al.</i>	(CUSB Collab.)
MORRISON	91	PRL 67 1696	R.J. Morrison <i>et al.</i>	(CLEO Collab.)
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+)

REFID=43313
REFID=43604
REFID=41579
REFID=41580
REFID=41634
REFID=41586
REFID=40919
REFID=40733
REFID=40034

REFID=11616
REFID=22338
REFID=40033

REFID=22278
REFID=22280
REFID=22273
REFID=22321
REFID=22359

NODE=M206



$I^G(J^{PC}) = ?^?(?^{?+})$

A mixture of $J = 0, 1$, and 2 spin components observed in the radiative decay to $\Upsilon(1S)$ and $\Upsilon(2S)$, therefore $C = +$.

NODE=M206

$\chi_b(3P)$ MASS

NODE=M206M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
10534 ± 9 OUR AVERAGE			
[10.530 ± 0.010 GeV OUR 2012 AVERAGE]			
10530 ± 5 ± 9	¹ AAD	12A ATLS	$pp \rightarrow \gamma \mu^+ \mu^- X$
10551 ± 14 ± 17	¹ ABAZOV	12Q D0	$p\bar{p} \rightarrow \gamma \mu^+ \mu^- X$
¹ The mass barycenter of the merged lineshapes from the $J = 1$ and 2 states.			

NODE=M206M
NEW

NODE=M206M;LINKAGE=AA

$\chi_b(3P)$ DECAY MODES

NODE=M206215;NODE=M206

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \Upsilon(1S)\gamma$	seen
$\Gamma_2 \quad \Upsilon(2S)\gamma$	seen

DESIG=1
DESIG=2

$\chi_b(3P)$ BRANCHING RATIOS

NODE=M206225

$\Gamma(\Upsilon(1S)\gamma)/\Gamma_{\text{total}}$				Γ_1/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
seen	AAD	12A	ATLS	$pp \rightarrow \gamma \mu^+ \mu^- X$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
seen	ABAZOV	12Q	D0	$p\bar{p} \rightarrow \gamma \mu^+ \mu^- X$
$\Gamma(\Upsilon(2S)\gamma)/\Gamma_{\text{total}}$				Γ_2/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
seen	AAD	12A	ATLS	$pp \rightarrow \gamma \mu^+ \mu^- X$

NODE=M206R01
NODE=M206R01

NODE=M206R02
NODE=M206R02

$\chi_b(3P)$ REFERENCES

NODE=M206

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.)

REFID=54037
REFID=54264

$\Upsilon(4S)$
or $\Upsilon(10580)$

$$I^G(J^{PC}) = 0^-(1^{--})$$

NODE=M047

 $\Upsilon(4S)$ MASS

NODE=M047M

VALUE (MeV)

DOCUMENT ID

TECN

COMMENT

10579.4±1.2 OUR AVERAGE

[10.5794 ± 0.0012 GeV OUR 2012 AVERAGE]

10579.3±0.4±1.2

AUBERT

05Q

BABR

 $e^+e^- \rightarrow \text{hadrons}$

10580.0±3.5

¹ BEBEK

87

CLEO

 $e^+e^- \rightarrow \text{hadrons}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

10577.4±1.0

² LOVELOCK

85

CUSB

 $e^+e^- \rightarrow \text{hadrons}$ ¹ Reanalysis of BESSON 85.² No systematic error given.

NODE=M047M

NODE=M047M

NEW

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

 $e^+e^- \rightarrow \text{hadrons}$

20 ±2 ±4

BESSON

85

CLEO

 $e^+e^- \rightarrow \text{hadrons}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

25 ±2.5

LOVELOCK

85

CUSB

 $e^+e^- \rightarrow \text{hadrons}$

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^-	(51.3 ±0.6) %	
Γ_3	D_s^+ anything + c.c.	(17.8 ±2.6) %	
Γ_4	$B^0\bar{B}^0$	(48.7 ±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	$J/\psi(1S)$ anything	< 1.9 × 10 ⁻⁴	95%
Γ_{10}	D^{*+} anything + c.c.	< 7.4 %	90%
Γ_{11}	ϕ anything	(7.1 ±0.6) %	
Γ_{12}	$\phi\eta$	< 1.8 × 10 ⁻⁶	90%
Γ_{13}	$\phi\eta'$	< 4.3 × 10 ⁻⁶	90%
Γ_{14}	$\rho\eta$	< 1.3 × 10 ⁻⁶	90%
Γ_{15}	$\rho\eta'$	< 2.5 × 10 ⁻⁶	90%
Γ_{16}	$\Upsilon(1S)$ anything	< 4 × 10 ⁻³	90%
Γ_{17}	$\Upsilon(1S)\pi^+\pi^-$	(8.1 ±0.6) × 10 ⁻⁵	
Γ_{18}	$\Upsilon(1S)\eta$	(1.96±0.28) × 10 ⁻⁴	
Γ_{19}	$\Upsilon(2S)\pi^+\pi^-$	(8.6 ±1.3) × 10 ⁻⁵	
Γ_{20}	$h_b(1P)\pi^+\pi^-$	not seen	
Γ_{21}	d 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=2

DESIG=3

DESIG=4

DESIG=13

DESIG=18

DESIG=19

DESIG=20

DESIG=5

DESIG=7

DESIG=17

DESIG=9

DESIG=21

DESIG=14

 $\Upsilon(4S)$ PARTIAL WIDTHS

NODE=M047220

 $\Gamma(e^+e^-)$ **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

³ 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

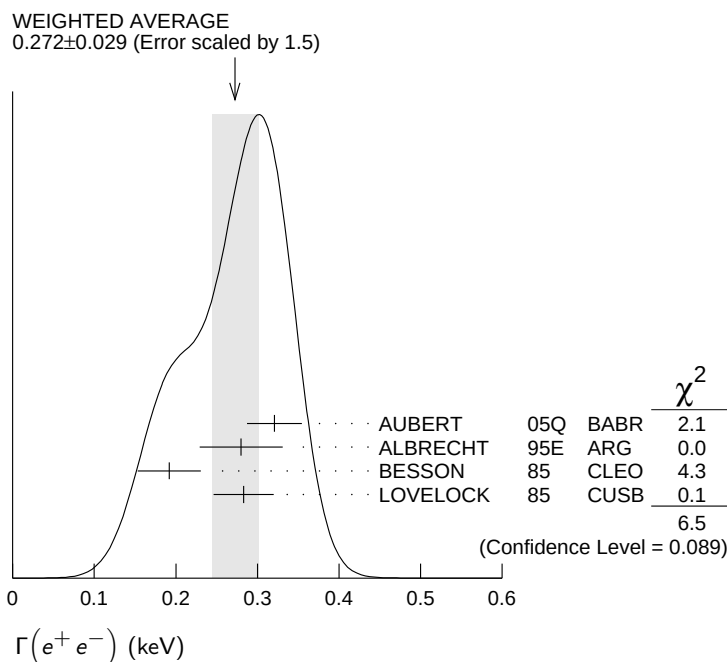
 $e^+e^- \rightarrow \text{hadrons}$

NODE=M047W1

NODE=M047W1

³ Using LEYAOUANC 77 parametrization of $\Gamma(s)$.

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 (HFAG) and are described at <http://www.slac.stanford.edu/xorg/hfag/>. 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

$\Gamma(B^+B^-)/\Gamma_{\text{total}}$

VALUE DOCUMENT ID
0.513±0.006 OUR EVALUATION Assuming $B(\Upsilon(4S) \rightarrow B\bar{B}) = 1$

Γ_2/Γ

NODE=M047R11
NODE=M047R11
→ UNCHECKED ←

$\Gamma(D_s^+ \text{ anything} + \text{c.c.})/\Gamma_{\text{total}}$

VALUE DOCUMENT ID TECN COMMENT
0.178±0.021±0.016 ⁴ ARTUSO 05B CLE3 $e^+e^- \rightarrow D_s X$

Γ_3/Γ

NODE=M047R13
NODE=M047R13

⁴ 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;LINKAGE=AR

$\Gamma(B^0\bar{B}^0)/\Gamma_{\text{total}}$

VALUE DOCUMENT ID TECN COMMENT
0.487±0.006 OUR EVALUATION Assuming $B(\Upsilon(4S) \rightarrow B\bar{B}) = 1$

Γ_4/Γ

NODE=M047R12
NODE=M047R12
→ UNCHECKED ←

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.487±0.010±0.008 ⁵ AUBERT,B 05H BABR $\Upsilon(4S) \rightarrow \bar{B}B \rightarrow D^*\ell\nu_\ell$
⁵ Direct measurement. This value is averaged with the value extracted from the $\Gamma(B^+B^-)/\Gamma(B^0\bar{B}^0)$ measurements.

NODE=M047R12;LINKAGE=AU

$\Gamma(B^+B^-)/\Gamma(B^0\bar{B}^0)$

VALUE DOCUMENT ID TECN COMMENT
1.055±0.025 OUR EVALUATION
1.006±0.036±0.031 ⁶ AUBERT 04F BABR $\Upsilon(4S) \rightarrow B\bar{B} \rightarrow J/\psi K$
1.01 ±0.03 ±0.09 ⁶ HASTINGS 03 BELL $\Upsilon(4S) \rightarrow B\bar{B} \rightarrow \text{dileptons}$
1.058±0.084±0.136 ⁷ ATHAR 02 CLEO $\Upsilon(4S) \rightarrow B\bar{B} \rightarrow D^*\ell\nu$
1.10 ±0.06 ±0.05 ⁸ AUBERT 02 BABR $\Upsilon(4S) \rightarrow B\bar{B} \rightarrow (c\bar{c})K^*$
1.04 ±0.07 ±0.04 ⁹ ALEXANDER 01 CLEO $\Upsilon(4S) \rightarrow B\bar{B} \rightarrow J/\psi K^*$

Γ_2/Γ_4

NODE=M047R10
NODE=M047R10
→ UNCHECKED ←

⁶ HASTINGS 03 and AUBERT 04F assume $\tau(B^+) / \tau(B^0) = 1.083 \pm 0.017$.

⁷ ATHAR 02 assumes $\tau(B^+) / \tau(B^0) = 1.074 \pm 0.028$. Supersedes BARISH 95.

⁸ AUBERT 02 assumes $\tau(B^+) / \tau(B^0) = 1.062 \pm 0.029$.

⁹ ALEXANDER 01 assumes $\tau(B^+) / \tau(B^0) = 1.066 \pm 0.024$.

$\Gamma(J/\psi K_S^0(J/\psi, \eta_c) K_S^0) / \Gamma_{\text{total}}$ Γ_5 / Γ

Forbidden by CP invariance.

VALUE (units 10^{-7})	CL%	DOCUMENT ID	TECN	COMMENT
<4	90	¹⁰ TAJIMA	07A BELL	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0$

¹⁰ $\Upsilon(4S)$ with $CP = +1$ decays to the final state with $CP = -1$.

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	$e^+ e^-$

$\Gamma(e^+ e^-) / \Gamma_{\text{total}}$ 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	¹¹ ALBRECHT	95E ARG	$e^+ e^- \rightarrow \text{hadrons}$

¹¹ Using LEYAOUANC 77 parametrization of $\Gamma(s)$.

$\Gamma(\rho^+ \rho^-) / \Gamma_{\text{total}}$ Γ_8 / Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<5.7 × 10 ⁻⁶	90	AUBERT	08BO BABR	$e^+ e^- \rightarrow \pi^+ \pi^- 2\pi^0$

$\Gamma(J/\psi(1S) \text{ anything}) / \Gamma_{\text{total}}$ Γ_9 / Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.9	95	¹² 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	¹² AUBERT	01C BABR	$e^+ e^- \rightarrow J/\psi X \rightarrow \ell^+ \ell^- X$

¹² Uses $B(J/\psi \rightarrow e^+ e^-) = 0.0593 \pm 0.0010$ and $B(J/\psi \rightarrow \mu^+ \mu^-) = 0.0588 \pm 0.0010$.

$\Gamma(D^{*+} \text{ anything} + \text{c.c.}) / \Gamma_{\text{total}}$ Γ_{10} / Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.074	90	¹³ ALEXANDER	90C CLEO	$e^+ e^-$

¹³ For $x > 0.473$.

$\Gamma(\phi \text{ anything}) / \Gamma_{\text{total}}$ Γ_{11} / 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	¹⁴ ALEXANDER	90C CLEO	$e^+ e^-$

¹⁴ For $x > 0.52$.

$\Gamma(\phi \eta) / \Gamma_{\text{total}}$ Γ_{12} / Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<1.8	90	¹⁵ 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	$e^+ e^- \rightarrow \phi \eta$

¹⁵ Using all intermedite branching fraction values from PDG 08.

$\Gamma(\phi \eta') / \Gamma_{\text{total}}$ Γ_{13} / Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<4.3	90	¹⁶ BELOUS	09 BELL	$e^+ e^- \rightarrow \phi \eta'$

¹⁶ Using all intermedite branching fraction values from PDG 08.

$\Gamma(\rho \eta) / \Gamma_{\text{total}}$ Γ_{14} / Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<1.3	90	¹⁷ BELOUS	09 BELL	$e^+ e^- \rightarrow \rho \eta$

¹⁷ Using all intermedite branching fraction values from PDG 08.

NODE=M047R10;LINKAGE=F

NODE=M047R10;LINKAGE=D

NODE=M047R10;LINKAGE=E

NODE=M047R10;LINKAGE=C

NODE=M047R16

NODE=M047R16

NODE=M047R16

NODE=M047R16;LINKAGE=TA

NODE=M047NBB

NODE=M047R6

NODE=M047R6

NODE=M047R5

NODE=M047R5

NODE=M047R5;LINKAGE=A

NODE=M047R17

NODE=M047R17

NODE=M047R1

NODE=M047R1

NODE=M047R;LINKAGE=AC

NODE=M047R2

NODE=M047R2

NODE=M047R2;LINKAGE=A

NODE=M047R3

NODE=M047R3

NODE=M047R3;LINKAGE=A

NODE=M047R14

NODE=M047R14

NODE=M047R14;LINKAGE=BE

NODE=M047R21

NODE=M047R21

NODE=M047R21;LINKAGE=BE

NODE=M047R22

NODE=M047R22

NODE=M047R22;LINKAGE=BE

$\Gamma(\rho\eta')/\Gamma_{\text{total}}$ Γ_{15}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<2.5	90	¹⁸ BELOUS	09 BELL	$e^+e^- \rightarrow \rho\eta'$

¹⁸ 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_{16}/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_{17}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
8.1 ± 0.6 OUR AVERAGE					
8.5 ± 1.3 ± 0.2	113 ± 16		¹⁹ SOKOLOV 09	BELL	$e^+e^- \rightarrow \pi^+\pi^-\mu^+\mu^-$
8.00 ± 0.64 ± 0.27	430		²⁰ 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			^{21,22} SOKOLOV 07	BELL	$e^+e^- \rightarrow \pi^+\pi^-\mu^+\mu^-$
9.0 ± 1.5 ± 0.2	167 ± 19		²³ AUBERT 06R BABR		$e^+e^- \rightarrow \pi^+\pi^-\mu^+\mu^-$
<12	90		GLENN 99	CLE2	e^+e^-

NODE=M047R7
NODE=M047R7

¹⁹ 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.

NODE=M047R7;LINKAGE=SK

²⁰ Using $B(\Upsilon(1S) \rightarrow e^+e^-) = (2.38 \pm 0.11)\%$ and $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.05)\%$.

NODE=M047R7;LINKAGE=UB

²¹ 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.

NODE=M047R7;LINKAGE=SO

²² According to the authors, systematic errors were underestimated.

NODE=M047R7;LINKAGE=US

²³ 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;LINKAGE=AU

 $\Gamma(\Upsilon(1S)\eta)/\Gamma_{\text{total}}$ Γ_{18}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.96 ± 0.28 OUR AVERAGE				$[(1.96 \pm 0.11) \times 10^{-4}]$ OUR 2012 AVERAGE]
1.96 ± 0.26 ± 0.09	56	²⁴ AUBERT	08BP BABR	$\Upsilon(4S) \rightarrow \pi^+\pi^-\pi^0\ell^+\ell^-$

²⁴ 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=M047R18
NODE=M047R18

NEW

NODE=M047R18;LINKAGE=UB

 $\Gamma(\Upsilon(1S)\eta)/\Gamma(\Upsilon(1S)\pi^+\pi^-)$ Γ_{18}/Γ_{17}

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 ²⁵ AUBERT 08BP BABR $\Upsilon(4S) \rightarrow \pi^+\pi^-(\pi^0)\ell^+\ell^-$

²⁵ 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_{19}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
0.86 ± 0.11 ± 0.07		220	²⁶ AUBERT	08BP BABR	$\Upsilon(4S) \rightarrow \pi^+\pi^-\ell^+\ell^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.88 ± 0.17 ± 0.08	97 ± 15		²⁷ AUBERT	06R BABR	$e^+e^- \rightarrow \pi^+\pi^-\mu^+\mu^-$
<3.9	90		GLENN	99 CLE2	e^+e^-

²⁶ Using $B(\Upsilon(2S) \rightarrow e^+e^-) = (1.91 \pm 0.16)\%$ and $B(\Upsilon(2S) \rightarrow \mu^+\mu^-) = (1.93 \pm 0.17)\%$.

NODE=M047R9
NODE=M047R9

NODE=M047R9;LINKAGE=UB

²⁷ Superseded by AUBERT 08BP. AUBERT 06R reports $[\Gamma(\Upsilon(4S) \rightarrow \Upsilon(2S)\pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \mu^+\mu^-)] = (1.69 \pm 0.26 \pm 0.20) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \mu^+\mu^-) = (1.93 \pm 0.17) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M047R9;LINKAGE=AU

$\Gamma(\Upsilon(2S)\pi^+\pi^-)/\Gamma(\Upsilon(1S)\pi^+\pi^-)$ Γ_{19}/Γ_{17}

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

$1.16 \pm 0.16 \pm 0.14$	220	²⁸ AUBERT	08BP BABR	$\Upsilon(4S) \rightarrow \pi^+\pi^-\ell^+\ell^-$

²⁸ 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_{20}/Γ

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT

not seen	$35 \pm 21k$	²⁹ ADACHI	12 BELL	$10.58 e^+e^- \rightarrow h_b(1P)\pi^+\pi^-$

²⁹ 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

 $\Gamma(\bar{d} \text{ anything})/\Gamma_{\text{total}}$ Γ_{21}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT

<1.3	90	ASNER	07 CLEO	$e^+e^- \rightarrow \bar{d}X$

NODE=M047R15
NODE=M047R15

 $\Upsilon(4S)$ REFERENCES

NODE=M047

ADACHI	12	PRL 108 032001	I. Adachi <i>et al.</i>	(BELLE Collab.)	REFID=53962
BELOUS	09	PL B681 400	K. Belous <i>et al.</i>	(BELLE Collab.)	REFID=53107
SOKOLOV	09	PR D79 051103	A. Sokolov <i>et al.</i>	(BELLE Collab.)	REFID=52760
AUBERT	08BO	PR D78 071103	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52659
AUBERT	08BP	PR D78 112002	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52660
PDG	08	PL B667 1	C. Amsler <i>et al.</i>	(PDG Collab.)	REFID=52166
ASNER	07	PR D75 012009	D.M. Asner <i>et al.</i>	(CLEO Collab.)	REFID=51617
HUANG	07	PR D75 012002	G.S. Huang <i>et al.</i>	(CLEO Collab.)	REFID=51624
SOKOLOV	07	PR D75 071103	A. Sokolov <i>et al.</i>	(BELLE Collab.)	REFID=51715
TAJIMA	07A	PRL 99 211601	O. Tajima <i>et al.</i>	(BELLE Collab.)	REFID=52066
AUBERT	06R	PRL 96 232001	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51143
AUBERT,BE	06F	PR D74 111103	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51563
ARTUSO	05B	PRL 95 261801	M. Artuso <i>et al.</i>	(CLEO Collab.)	REFID=50992
AUBERT	05Q	PR D72 032005	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=50774
AUBERT,B	05H	PRL 95 042001	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=50777
AUBERT	04F	PR D69 071101	B. Aubert <i>et al.</i>		REFID=49748
HASTINGS	03	PR D67 052004	N.C. Hastings <i>et al.</i>	(BELLE Collab.)	REFID=49209
ABE	02D	PRL 88 052001	K. Abe <i>et al.</i>	(BELLE Collab.)	REFID=48557
ATHAR	02	PR D66 052003	S.B. Athar <i>et al.</i>	(CLEO Collab.)	REFID=48832
AUBERT	02	PR D65 032001	B. Aubert <i>et al.</i>	(BaBar Collab.)	REFID=48514
ALEXANDER	01	PRL 86 2737	J.P. Alexander <i>et al.</i>	(CLEO Collab.)	REFID=48316
AUBERT	01C	PRL 87 162002	B. Aubert <i>et al.</i>	(BaBar Collab.)	REFID=48346
GLENN	99	PR D59 052003	S. Glenn <i>et al.</i>		REFID=46890
BARISH	96B	PRL 76 1570	B.C. Barish <i>et al.</i>	(CLEO Collab.)	REFID=44693
ALBRECHT	95E	ZPHY C65 619	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=44372
BARISH	95	PR D51 1014	B.C. Barish <i>et al.</i>	(CLEO Collab.)	REFID=44139
ALEXANDER	90C	PRL 64 2226	J. Alexander <i>et al.</i>	(CLEO Collab.)	REFID=41346
BEBEK	87	PR D36 1289	C. Bebek <i>et al.</i>	(CLEO Collab.)	REFID=40270
BESSON	85	PRL 54 381	D. Besson <i>et al.</i>	(CLEO Collab.)	REFID=22368
LOVELOCK	85	PRL 54 377	D.M.J. Lovelock <i>et al.</i>	(CUSB Collab.)	REFID=22369
LEYAOUANC	77	PL B71 397	A. Le Yaouanc <i>et al.</i>	(ORSAY)	REFID=44695

X(10610)[±]

$$I^G(J^P) = ?^+(1^+)$$

NODE=M207

OMITTED FROM SUMMARY TABLE

Observed by BONDAR 12 in $\Upsilon(5S)$ decays to $\Upsilon(nS)\pi^+\pi^-$ (n = 1, 2, 3) and $h_b(mP)\pi^+\pi^-$ (m = 1, 2). $J^P = 1^+$ is favored from angular analyses.

NODE=M207

X(10610)[±] 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. • • •			
10611 ± 4 ± 3	² BONDAR 12	BELL	$e^+e^- \rightarrow \Upsilon(1S)\pi^+\pi^-$
10609 ± 2 ± 3	² BONDAR 12	BELL	$e^+e^- \rightarrow \Upsilon(2S)\pi^+\pi^-$
10608 ± 2 ± 3	² BONDAR 12	BELL	$e^+e^- \rightarrow \Upsilon(3S)\pi^+\pi^-$
10605 ± 2 ⁺³ ₋₁	² BONDAR 12	BELL	$e^+e^- \rightarrow h_b(1P)\pi^+\pi^-$
10599 ⁺⁶ ₋₃ ⁺⁵ ₋₄	² BONDAR 12	BELL	$e^+e^- \rightarrow h_b(2P)\pi^+\pi^-$

NODE=M207M

¹ Average of the BONDAR 12 measurements in separate channels.

² Superseded by the average measurement of BONDAR 12.

NODE=M207M;LINKAGE=BO
NODE=M207M;LINKAGE=BN

X(10610)[±] WIDTH

NODE=M207W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
18.4 ± 2.4	³ BONDAR 12	BELL	$e^+e^- \rightarrow \text{hadrons}$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
22.3 ± 7.7 ^{+3.0} _{-4.0}	⁴ BONDAR 12	BELL	$e^+e^- \rightarrow \Upsilon(1S)\pi^+\pi^-$
24.2 ± 3.1 ^{+2.0} _{-3.0}	⁴ BONDAR 12	BELL	$e^+e^- \rightarrow \Upsilon(2S)\pi^+\pi^-$
17.6 ± 3.0 ± 3.0	⁴ BONDAR 12	BELL	$e^+e^- \rightarrow \Upsilon(3S)\pi^+\pi^-$
11.4 ^{+4.5} _{-3.9} ^{+2.1} _{-1.2}	⁴ BONDAR 12	BELL	$e^+e^- \rightarrow h_b(1P)\pi^+\pi^-$
13 ⁺¹⁰ ₋₈ ⁺⁹ ₋₇	⁴ BONDAR 12	BELL	$e^+e^- \rightarrow h_b(2P)\pi^+\pi^-$

NODE=M207W

³ Average of the BONDAR 12 measurements in separate channels.

⁴ Superseded by the average measurement of BONDAR 12.

NODE=M207W;LINKAGE=BO
NODE=M207W;LINKAGE=BN

X(10610)⁺ DECAY MODES

NODE=M207215;NODE=M207

X(10610)⁻ decay modes are charge conjugates of the modes below.

NODE=M207

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \Upsilon(1S)\pi^+$	seen
$\Gamma_2 \quad \Upsilon(2S)\pi^+$	seen
$\Gamma_3 \quad \Upsilon(3S)\pi^+$	seen
$\Gamma_4 \quad h_b(1P)\pi^+$	seen
$\Gamma_5 \quad h_b(2P)\pi^+$	seen

DESIG=1

DESIG=2

DESIG=3

DESIG=4

DESIG=5

X(10610)[±] BRANCHING RATIOS

NODE=M207225

 $\Gamma(\Upsilon(1S)\pi^+)/\Gamma_{\text{total}}$ **Γ_1/Γ**

VALUE	DOCUMENT ID	TECN	COMMENT
seen	BONDAR 12	BELL	$e^+e^- \rightarrow \Upsilon(1S)\pi^+\pi^-$

NODE=M207R01
NODE=M207R01

 $\Gamma(\Upsilon(2S)\pi^+)/\Gamma_{\text{total}}$ **Γ_2/Γ**

VALUE	DOCUMENT ID	TECN	COMMENT
seen	BONDAR 12	BELL	$e^+e^- \rightarrow \Upsilon(2S)\pi^+\pi^-$

NODE=M207R02
NODE=M207R02

 $\Gamma(\Upsilon(3S)\pi^+)/\Gamma_{\text{total}}$ **Γ_3/Γ**

VALUE	DOCUMENT ID	TECN	COMMENT
seen	BONDAR 12	BELL	$e^+e^- \rightarrow \Upsilon(3S)\pi^+\pi^-$

NODE=M207R03
NODE=M207R03

$\Gamma(h_b(1P)\pi^+)/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE

DOCUMENT ID

TECN

COMMENT

seen

BONDAR

12

BELL

 $e^+e^- \rightarrow h_b(1P)\pi^+\pi^-$ NODE=M207R04
NODE=M207R04 $\Gamma(h_b(2P)\pi^+)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE

DOCUMENT ID

TECN

COMMENT

seen

BONDAR

12

BELL

 $e^+e^- \rightarrow h_b(2P)\pi^+\pi^-$ NODE=M207R05
NODE=M207R05 **$X(10610)^\pm$ REFERENCES**

BONDAR

12

PRL 108 122001

A. Bondar *et al.*

(BELLE Collab.)

NODE=M207

REFID=53963

NODE=M208

 $X(10650)^\pm$ $I^G(J^P) = ?^+(1^+)$ **OMITTED FROM SUMMARY TABLE**

Observed by BONDAR 12 in $\Upsilon(5S)$ decays to $\Upsilon(nS)\pi^+\pi^-$ ($n = 1, 2, 3$) and $h_b(mP)\pi^+\pi^-$ ($m = 1, 2$). $J^P = 1^+$ is favored from angular analyses.

NODE=M208

 $X(10650)^\pm$ MASS

NODE=M208M

VALUE (MeV)

DOCUMENT ID

TECN

COMMENT

10652.2 $\pm$ 1.5¹

BONDAR

12

BELL

 $e^+e^- \rightarrow \text{hadrons}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

10657 ± 6 ± 3 ²

BONDAR

12

BELL

 $e^+e^- \rightarrow \Upsilon(1S)\pi^+\pi^-$

OCCUR=2

10651 ± 2 ± 3 ²

BONDAR

12

BELL

 $e^+e^- \rightarrow \Upsilon(2S)\pi^+\pi^-$

OCCUR=3

10652 ± 1 ± 2 ²

BONDAR

12

BELL

 $e^+e^- \rightarrow \Upsilon(3S)\pi^+\pi^-$

OCCUR=4

10654 ± 3 $^{+1}_{-2}$ ²

BONDAR

12

BELL

 $e^+e^- \rightarrow h_b(1P)\pi^+\pi^-$

OCCUR=5

10651 $^{+2}_{-3}$ $^{+3}_{-2}$ ²

BONDAR

12

BELL

 $e^+e^- \rightarrow h_b(2P)\pi^+\pi^-$

OCCUR=6

¹ Average of the BONDAR 12 measurements in separate channels.² Superseded by the average measurement of BONDAR 12.

NODE=M208M;LINKAGE=BO

NODE=M208M;LINKAGE=BN

 $X(10650)^\pm$ WIDTH

NODE=M208W

VALUE (MeV)

DOCUMENT ID

TECN

COMMENT

11.5 $\pm$ 2.2³

BONDAR

12

BELL

 $e^+e^- \rightarrow \text{hadrons}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

16.3 $\pm$ 9.8 $^{+6.0}_{-2.0}$ ⁴

BONDAR

12

BELL

 $e^+e^- \rightarrow \Upsilon(1S)\pi^+\pi^-$

OCCUR=2

13.3 $\pm$ 3.3 $^{+4.0}_{-3.0}$ ⁴

BONDAR

12

BELL

 $e^+e^- \rightarrow \Upsilon(2S)\pi^+\pi^-$

OCCUR=3

8.4 $\pm$ 2.0 ± 2.0 ⁴

BONDAR

12

BELL

 $e^+e^- \rightarrow \Upsilon(3S)\pi^+\pi^-$

OCCUR=4

20.9 $^{+5.4}_{-4.7}$ $^{+2.1}_{-5.7}$ ⁴

BONDAR

12

BELL

 $e^+e^- \rightarrow h_b(1P)\pi^+\pi^-$

OCCUR=5

19 ± 7 $^{+11}_{-7}$ ⁴

BONDAR

12

BELL

 $e^+e^- \rightarrow h_b(2P)\pi^+\pi^-$

OCCUR=6

³ Average of the BONDAR 12 measurements in separate channels.⁴ Superseded by the average measurement of BONDAR 12.

NODE=M208W;LINKAGE=BO

NODE=M208W;LINKAGE=BN

 $X(10650)^+$ DECAY MODES

NODE=M208215;NODE=M208

 $X(10650)^-$ decay modes are charge conjugates of the modes below.

NODE=M208

Mode	Fraction (Γ_i/Γ)
Γ_1 $\Upsilon(1S)\pi^+$	seen
Γ_2 $\Upsilon(2S)\pi^+$	seen
Γ_3 $\Upsilon(3S)\pi^+$	seen
Γ_4 $h_b(1P)\pi^+$	seen
Γ_5 $h_b(2P)\pi^+$	seen

DESIG=1

DESIG=2

DESIG=3

DESIG=4

DESIG=5

$X(10650)^\pm$ BRANCHING RATIOS

NODE=M208225

 $\Gamma(\Upsilon(1S)\pi^+)/\Gamma_{\text{total}}$ **Γ_1/Γ**

VALUE

DOCUMENT ID TECN COMMENT

seen

BONDAR 12 BELL $e^+e^- \rightarrow \Upsilon(1S)\pi^+\pi^-$ |NODE=M208R01
NODE=M208R01 **$\Gamma(\Upsilon(2S)\pi^+)/\Gamma_{\text{total}}$** **$\Gamma_2/\Gamma$**

VALUE

DOCUMENT ID TECN COMMENT

seen

BONDAR 12 BELL $e^+e^- \rightarrow \Upsilon(2S)\pi^+\pi^-$ |NODE=M208R02
NODE=M208R02 **$\Gamma(\Upsilon(3S)\pi^+)/\Gamma_{\text{total}}$** **$\Gamma_3/\Gamma$**

VALUE

DOCUMENT ID TECN COMMENT

seen

BONDAR 12 BELL $e^+e^- \rightarrow \Upsilon(3S)\pi^+\pi^-$ |NODE=M208R03
NODE=M208R03 **$\Gamma(h_b(1P)\pi^+)/\Gamma_{\text{total}}$** **$\Gamma_4/\Gamma$**

VALUE

DOCUMENT ID TECN COMMENT

seen

BONDAR 12 BELL $e^+e^- \rightarrow h_b(1P)\pi^+\pi^-$ |NODE=M208R04
NODE=M208R04 **$\Gamma(h_b(2P)\pi^+)/\Gamma_{\text{total}}$** **$\Gamma_5/\Gamma$**

VALUE

DOCUMENT ID TECN COMMENT

seen

BONDAR 12 BELL $e^+e^- \rightarrow h_b(2P)\pi^+\pi^-$ |NODE=M208R05
NODE=M208R05 **$X(10650)^\pm$ REFERENCES**

NODE=M208

BONDAR 12 PRL 108 122001

A. Bondar *et al.*

(BELLE Collab.)

REFID=53963

NODE=M092

 $\Upsilon(10860)$ $I^G(J^{PC}) = 0^-(1^{--})$ **$\Upsilon(10860)$ MASS**

NODE=M092M

VALUE (MeV) DOCUMENT ID TECN COMMENT

10876 ± 11 OUR EVALUATION Weighted-average of Belle and BaBar results, but tripling the scaling S -factors applied to the uncertainties to account for model-dependence, handling of radiative corrections, and interference effects.

• • • We do not use the following data for averages, fits, limits, etc. • • •

10879 ± 3	1,2 CHEN	10	BELL	$e^+e^- \rightarrow \text{hadrons}$
10888.4 $^{+2.7}_{-2.6} \pm 1.2$	3 CHEN	10	BELL	$e^+e^- \rightarrow \Upsilon(1S, 2S, 3S)\pi^+\pi^-$
10876 ± 2	1 AUBERT	09E	BABR	$e^+e^- \rightarrow \text{hadrons}$
10869 ± 2	4 AUBERT	09E	BABR	$e^+e^- \rightarrow \text{hadrons}$
10868 $\pm 6 \pm 5$	5 BESSON	85	CLEO	$e^+e^- \rightarrow \text{hadrons}$
10845 ± 20	6 LOVELOCK	85	CUSB	$e^+e^- \rightarrow \text{hadrons}$

NODE=M092M
→ UNCHECKED ←

OCCUR=2

OCCUR=2

¹ 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.

² The parameters of the $\Upsilon(11020)$ are fixed to those in AUBERT 09E.

³ In a model where a flat nonresonant $\Upsilon(1S, 2S, 3S)\pi^+\pi^-$ continuum interferes with a single Breit-Wigner resonance.

⁴ 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.

⁵ Assuming four Gaussians with radiative tails and a single step in R .

⁶ In a coupled-channel model with three resonances and a smooth step in R .

NODE=M092M;LINKAGE=AU

NODE=M092M;LINKAGE=CH
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

55 ± 28 OUR EVALUATION Weighted-average of Belle and BaBar results, but tripling the scaling S -factors applied to the uncertainties to account for model-dependence, handling of radiative corrections, and interference effects.

• • • We do not use the following data for averages, fits, limits, etc. • • •

46 $^{+9}_{-7}$	7,8 CHEN	10	BELL	$e^+e^- \rightarrow \text{hadrons}$

NODE=M092W
→ UNCHECKED ←

$30.7^{+8.3}_{-7.0} \pm 3.1$	⁹ CHEN	10	BELL	$e^+e^- \rightarrow \Upsilon(1S, 2S, 3S)\pi^+\pi^-$
43 ± 4	⁷ AUBERT	09E	BABR	$e^+e^- \rightarrow \text{hadrons}$
74 ± 4	¹⁰ AUBERT	09E	BABR	$e^+e^- \rightarrow \text{hadrons}$
$112 \pm 17 \pm 23$	¹¹ BESSON	85	CLEO	$e^+e^- \rightarrow \text{hadrons}$
110 ± 15	¹² LOVELOCK	85	CUSB	$e^+e^- \rightarrow \text{hadrons}$

OCCUR=2

OCCUR=2

⁷ 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

⁸ The parameters of the $\Upsilon(11020)$ are fixed to those in AUBERT 09E.

NODE=M092W;LINKAGE=CH

⁹ 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

¹⁰ 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

¹¹ Assuming four Gaussians with radiative tails and a single step in R .

NODE=M092W;LINKAGE=BE

¹² 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 $B\bar{B}X$	(75.9 $^{+2.7}_{-4.0}$) %	
Γ_2 $B\bar{B}$	(5.5 ± 1.0) %	
Γ_3 $B\bar{B}^* + \text{c.c.}$	(13.7 ± 1.6) %	
Γ_4 $B^*\bar{B}^*$	(38.1 ± 3.4) %	
Γ_5 $B\bar{B}^{(*)}\pi$	< 19.7 %	90%
Γ_6 $B\bar{B}\pi$	(0.0 ± 1.2) %	
Γ_7 $B^*\bar{B}\pi + B\bar{B}^*\pi$	(7.3 ± 2.3) %	
Γ_8 $B^*\bar{B}^*\pi$	(1.0 ± 1.4) %	
Γ_9 $B\bar{B}\pi\pi$	< 8.9 %	90%
Γ_{10} $B_s^{(*)}\bar{B}_s^{(*)}$	(19.9 ± 3.0) %	
Γ_{11} $B_s\bar{B}_s$	(5 ± 5) $\times 10^{-3}$	
Γ_{12} $B_s\bar{B}_s^* + \text{c.c.}$	(1.34 ± 0.32) %	
Γ_{13} $B_s^*\bar{B}_s^*$	(17.5 ± 2.6) %	
Γ_{14} no open-bottom	(4.2 $^{+5.0}_{-0.6}$) %	
Γ_{15} e^+e^-	(5.6 ± 3.1) $\times 10^{-6}$	
Γ_{16} $\Upsilon(1S)\pi^+\pi^-$	(5.3 ± 0.6) $\times 10^{-3}$	
Γ_{17} $\Upsilon(2S)\pi^+\pi^-$	(7.8 ± 1.3) $\times 10^{-3}$	
Γ_{18} $\Upsilon(3S)\pi^+\pi^-$	(4.8 $^{+1.9}_{-1.7}$) $\times 10^{-3}$	
Γ_{19} $\Upsilon(1S)K^+K^-$	(6.1 ± 1.8) $\times 10^{-4}$	
Γ_{20} $h_b(1P)\pi^+\pi^-$	(3.5 $^{+1.0}_{-1.3}$) $\times 10^{-3}$	
Γ_{21} $h_b(2P)\pi^+\pi^-$	(6.0 $^{+2.1}_{-1.8}$) $\times 10^{-3}$	

Inclusive Decays.

NODE=M092;CLUMP=I

These decay modes are submodes of one or more of the decay modes above.

NODE=M092

Γ_{22} ϕ anything	(13.8 $^{+2.4}_{-1.7}$) %	DESIG=12
Γ_{23} D^0 anything + c.c.	(108 ± 8) %	DESIG=13
Γ_{24} D_s anything + c.c.	(46 ± 6) %	DESIG=6
Γ_{25} J/ψ anything	(2.06 ± 0.21) %	DESIG=14
Γ_{26} B^0 anything + c.c.	(77 ± 8) %	DESIG=21
Γ_{27} 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 $\pm$ 0.07 OUR AVERAGE	Error includes scale factor of 1.3.		
0.22 $\pm$ 0.05 $\pm$ 0.07	BESSON	85 CLEO	$e^+e^- \rightarrow$ hadrons
0.365 $\pm$ 0.070	LOVELOCK	85 CUSB	$e^+e^- \rightarrow$ hadrons

NODE=M092W1
NODE=M092W1 **$\Upsilon(10860)$ BRANCHING RATIOS**

NODE=M092230

"OUR EVALUATION" is obtained based on averages of rescaled data listed below. The averages and rescaling were performed by the Heavy Flavor Averaging Group (HFAG) and are described at <http://www.slac.stanford.edu/xorg/hfag/>.

NODE=M092230

 $\Gamma(B\bar{B}X)/\Gamma_{\text{total}}$ **Γ_1/Γ**

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.759 $\pm$ 0.027 $\pm$ 0.040 OUR EVALUATION				
0.71 $\pm$ 0.06 OUR AVERAGE				
0.737 $\pm$ 0.032 $\pm$ 0.051	1063	¹³ DRUTSKOY	10 BELL	$\Upsilon(5S) \rightarrow B^+X, B^0X$
0.589 $\pm$ 0.100 $\pm$ 0.092		¹⁴ HUANG	07 CLEO	$\Upsilon(5S) \rightarrow$ hadrons

NODE=M092R13
NODE=M092R13

→ UNCHECKED ←

 $\Gamma(B\bar{B})/\Gamma_{\text{total}}$ **Γ_2/Γ**

VALUE (units 10^{-2})	CL%	DOCUMENT ID	TECN	COMMENT
5.5 $\pm$ 1.0 $\pm$ 0.9 $\pm$ 0.4		¹⁵ 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	¹⁴ HUANG	07 CLEO	$\Upsilon(5S) \rightarrow$ hadrons

NODE=M092R16
NODE=M092R16 **$\Gamma(B\bar{B})/\Gamma(B\bar{B}X)$** **$\Gamma_2/\Gamma_1$**

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.22	90	AQUINES	06 CLE3	$\Upsilon(5S) \rightarrow$ hadrons

NODE=M092R05
NODE=M092R05 **$\Gamma(B\bar{B}^* + \text{c.c.})/\Gamma_{\text{total}}$** **$\Gamma_3/\Gamma$**

VALUE	DOCUMENT ID	TECN	COMMENT
0.137 $\pm$ 0.016 OUR AVERAGE			
0.137 $\pm$ 0.013 $\pm$ 0.011	¹⁵ DRUTSKOY	10 BELL	$\Upsilon(5S) \rightarrow B^+X, B^0X$
0.143 $\pm$ 0.053 $\pm$ 0.027	¹⁴ HUANG	07 CLEO	$\Upsilon(5S) \rightarrow$ hadrons

NODE=M092R15
NODE=M092R15 **$\Gamma(B\bar{B}^* + \text{c.c.})/\Gamma(B\bar{B}X)$** **$\Gamma_3/\Gamma_1$**

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.24 $\pm$ 0.09 $\pm$ 0.03	10	AQUINES	06 CLE3	$\Upsilon(5S) \rightarrow$ hadrons

NODE=M092R06
NODE=M092R06 **$\Gamma(B^*\bar{B}^*)/\Gamma_{\text{total}}$** **$\Gamma_4/\Gamma$**

VALUE	DOCUMENT ID	TECN	COMMENT
0.381 $\pm$ 0.034 OUR AVERAGE			
0.375 $\pm$ 0.021 $\pm$ 0.030	¹⁵ DRUTSKOY	10 BELL	$\Upsilon(5S) \rightarrow B^+X, B^0X$
0.436 $\pm$ 0.083 $\pm$ 0.072	¹⁴ HUANG	07 CLEO	$\Upsilon(5S) \rightarrow$ hadrons

NODE=M092R14
NODE=M092R14 **$\Gamma(B^*\bar{B}^*)/\Gamma(B\bar{B}X)$** **$\Gamma_4/\Gamma_1$**

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.74 $\pm$ 0.15 $\pm$ 0.08	31	AQUINES	06 CLE3	$\Upsilon(5S) \rightarrow$ hadrons

NODE=M092R07
NODE=M092R07 **$\Gamma(B\bar{B}^{(*)}\pi)/\Gamma_{\text{total}}$** **$\Gamma_5/\Gamma$**

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.197	90	¹⁴ HUANG	07 CLEO	$\Upsilon(5S) \rightarrow$ hadrons

NODE=M092R17
NODE=M092R17 **$\Gamma(B\bar{B}^{(*)}\pi)/\Gamma(B\bar{B}X)$** **$\Gamma_5/\Gamma_1$**

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.32	90	AQUINES	06 CLE3	$\Upsilon(5S) \rightarrow$ hadrons

NODE=M092R08
NODE=M092R08 **$\Gamma(B\bar{B}\pi)/\Gamma_{\text{total}}$** **$\Gamma_6/\Gamma$**

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
0.0 $\pm$ 1.2 $\pm$ 0.3	0	¹⁵ DRUTSKOY	10 BELL	$\Upsilon(5S) \rightarrow B^{+,0}\pi^-X$

NODE=M092R28
NODE=M092R28

$$\frac{\Gamma(B^*\bar{B}\pi) + \Gamma(B\bar{B}^*\pi)}{\Gamma_{\text{total}}} \quad \Gamma_7/\Gamma$$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
$7.3^{+2.3}_{-2.1} \pm 0.8$	38	15 DRUTSKOY	10 BELL	$\Upsilon(5S) \rightarrow B^+, 0\pi^- X$

NODE=M092R29
NODE=M092R29

$$\Gamma(B^*\bar{B}^*\pi)/\Gamma_{\text{total}} \quad \Gamma_8/\Gamma$$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.0^{+1.4}_{-1.3} \pm 0.4$	5	15 DRUTSKOY	10 BELL	$\Upsilon(5S) \rightarrow B^+, 0\pi^- X$

NODE=M092R30
NODE=M092R30

$$\Gamma(B\bar{B}\pi\pi)/\Gamma_{\text{total}} \quad \Gamma_9/\Gamma$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.089	90	14 HUANG	07 CLEO	$\Upsilon(5S) \rightarrow \text{hadrons}$

NODE=M092R18
NODE=M092R18

$$\Gamma(B\bar{B}\pi\pi)/\Gamma(B\bar{B}X) \quad \Gamma_9/\Gamma_1$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.14	90	AQUINES	06 CLE3	$\Upsilon(5S) \rightarrow \text{hadrons}$

NODE=M092R09
NODE=M092R09

$$\Gamma(B_s^{(*)}\bar{B}_s^{(*)})/\Gamma_{\text{total}} \quad \Gamma_{10}/\Gamma = (\Gamma_{11} + \Gamma_{12} + \Gamma_{13})/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
0.199 ± 0.030 OUR EVALUATION			

NODE=M092R01
NODE=M092R01
→ UNCHECKED ←

$$0.189^{+0.027}_{-0.021} \text{ OUR AVERAGE}$$

NEW

$$[0.195^{+0.030}_{-0.023} \text{ OUR 2012 AVERAGE}]$$

$$0.172 \pm 0.030 \quad 16 \text{ ESEN} \quad 13 \text{ BELL} \quad \Upsilon(5S) \rightarrow D^0 X, D_s X$$

$$0.21^{+0.06}_{-0.03} \quad 17 \text{ HUANG} \quad 07 \text{ CLEO} \quad \Upsilon(5S) \rightarrow D_s X$$

• • • We do not use the following data for averages, fits, limits, etc. • • •

$$0.180 \pm 0.013 \pm 0.032 \quad 18 \text{ DRUTSKOY} \quad 07 \text{ BELL} \quad \Upsilon(5S) \rightarrow D^0 X, D_s X$$

$$0.160 \pm 0.026 \pm 0.058 \quad 19 \text{ ARTUSO} \quad 05B \text{ CLEO} \quad e^+ e^- \rightarrow D_X X$$

$$\Gamma(B_s^{(*)}\bar{B}_s^{(*)})/\Gamma(B\bar{B}X) \quad \Gamma_{10}/\Gamma_1$$

VALUE	DOCUMENT ID

NODE=M092R34
NODE=M092R34

$$0.262^{+0.051}_{-0.043} \text{ OUR EVALUATION}$$

→ UNCHECKED ←

$$\Gamma(B_s^*\bar{B}_s^*)/\Gamma(B_s^{(*)}\bar{B}_s^{(*)}) \quad \Gamma_{13}/\Gamma_{10} = \Gamma_{13}/(\Gamma_{11} + \Gamma_{12} + \Gamma_{13})$$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT

NODE=M092R19
NODE=M092R19

$$87.8 \pm 1.5 \text{ OUR AVERAGE}$$

NEW

$$[(90 \pm 4) \times 10^{-2} \text{ OUR 2012 AVERAGE}]$$

$$87.0 \pm 1.7 \quad 20,21 \text{ ESEN} \quad 13 \text{ BELL} \quad B_s^0 \rightarrow D_s^- \pi^+$$

$$90.5 \pm 3.2 \pm 0.1 \quad 227 \quad 21,22 \text{ LI} \quad 12 \text{ BELL} \quad B_s^0 \rightarrow J/\psi \eta^{(\prime)}$$

• • • We do not use the following data for averages, fits, limits, etc. • • •

$$90.1^{+3.8}_{-4.0} \pm 0.2 \quad 23 \text{ LOUVOT} \quad 09 \text{ BELL} \quad 10.86 e^+ e^- \rightarrow B_s^{(*)}\bar{B}_s^{(*)}$$

$$93^{+7}_{-9} \pm 1 \quad 23 \text{ DRUTSKOY} \quad 07A \text{ BELL} \quad \text{Superseded by LOUVOT 09}$$

$$\Gamma(B_s\bar{B}_s)/\Gamma(B_s^{(*)}\bar{B}_s^{(*)}) \quad \Gamma_{11}/\Gamma_{10} = \Gamma_{11}/(\Gamma_{11} + \Gamma_{12} + \Gamma_{13})$$

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT

NODE=M092R24
NODE=M092R24

$$2.6^{+2.6}_{-2.5} \quad \text{LOUVOT} \quad 09 \text{ BELL} \quad 10.86 e^+ e^- \rightarrow B_s^{(*)}\bar{B}_s^{(*)}$$

$$\Gamma(B_s\bar{B}_s)/\Gamma(B_s^*\bar{B}_s^*) \quad \Gamma_{11}/\Gamma_{13}$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.16	90	BONVICINI	06 CLE3	$e^+ e^-$

NODE=M092R03
NODE=M092R03

$$\Gamma(B_s\bar{B}_s^* + \text{c.c.})/\Gamma(B_s^{(*)}\bar{B}_s^{(*)}) \quad \Gamma_{12}/\Gamma_{10} = \Gamma_{12}/(\Gamma_{11} + \Gamma_{12} + \Gamma_{13})$$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT

NODE=M092R25
NODE=M092R25

$$6.7 \pm 1.2 \text{ OUR AVERAGE}$$

NEW

$$[(7.3 \pm 3.2) \times 10^{-2} \text{ OUR 2012 AVERAGE}]$$

$$7.3 \pm 1.4 \quad 20,21 \text{ ESEN} \quad 13 \text{ BELL} \quad B_s^0 \rightarrow D_s^- \pi^+$$

$$4.9 \pm 2.5 \pm 0.0 \quad 227 \quad 21,22 \text{ LI} \quad 12 \text{ BELL} \quad B_s^0 \rightarrow J/\psi \eta^{(\prime)}$$

• • • We do not use the following data for averages, fits, limits, etc. • • •

$$7.3^{+3.3}_{-3.0} \pm 0.1 \quad \text{LOUVOT} \quad 09 \text{ BELL} \quad 10.86 e^+ e^- \rightarrow B_s^{(*)}\bar{B}_s^{(*)}$$

$$\Gamma(B_s \bar{B}_s^* + \text{c.c.})/\Gamma(B_s^* \bar{B}_s^*)$$

$$\Gamma_{12}/\Gamma_{13}$$

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

NODE=M092R33
NODE=M092R33

$$0.042^{+0.046}_{-0.006} \text{ OUR EVALUATION}$$

→ UNCHECKED ←

$$\Gamma(\Upsilon(1S)\pi^+\pi^-)/\Gamma_{\text{total}}$$

$$\Gamma_{16}/\Gamma$$

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
$5.3 \pm 0.3 \pm 0.5$	325	²⁴ CHEN	08	BELL $10.87 e^+ e^- \rightarrow \Upsilon(1S)\pi^+\pi^-$

NODE=M092R20
NODE=M092R20

$$\Gamma(\Upsilon(2S)\pi^+\pi^-)/\Gamma_{\text{total}}$$

$$\Gamma_{17}/\Gamma$$

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
$7.8 \pm 0.6 \pm 1.1$	186	²⁴ CHEN	08	BELL $10.87 e^+ e^- \rightarrow \Upsilon(2S)\pi^+\pi^-$

NODE=M092R21
NODE=M092R21

$$\Gamma(\Upsilon(3S)\pi^+\pi^-)/\Gamma_{\text{total}}$$

$$\Gamma_{18}/\Gamma$$

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
$4.8^{+1.8}_{-1.5} \pm 0.7$	10	²⁴ CHEN	08	BELL $10.87 e^+ e^- \rightarrow \Upsilon(3S)\pi^+\pi^-$

NODE=M092R22
NODE=M092R22

$$\Gamma(\Upsilon(1S)K^+K^-)/\Gamma_{\text{total}}$$

$$\Gamma_{19}/\Gamma$$

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
$6.1^{+1.6}_{-1.4} \pm 1.0$	20	²⁴ CHEN	08	BELL $10.87 e^+ e^- \rightarrow \Upsilon(1S)K^+K^-$

NODE=M092R23
NODE=M092R23

$$\Gamma(h_b(1P)\pi^+\pi^-)/\Gamma(\Upsilon(2S)\pi^+\pi^-)$$

$$\Gamma_{20}/\Gamma_{17}$$

VALUE	DOCUMENT ID	TECN	COMMENT
$0.45 \pm 0.08^{+0.07}_{-0.12}$	ADACHI	12	BELL $10.86 e^+ e^- \rightarrow \text{hadrons}$

NODE=M092R31
NODE=M092R31

$$\Gamma(h_b(2P)\pi^+\pi^-)/\Gamma(\Upsilon(2S)\pi^+\pi^-)$$

$$\Gamma_{21}/\Gamma_{17}$$

VALUE	DOCUMENT ID	TECN	COMMENT
$0.77 \pm 0.08^{+0.22}_{-0.17}$	ADACHI	12	BELL $10.86 e^+ e^- \rightarrow \text{hadrons}$

NODE=M092R32
NODE=M092R32

$$\Gamma(\phi \text{ anything})/\Gamma_{\text{total}}$$

$$\Gamma_{22}/\Gamma$$

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

$$\Gamma(D^0 \text{ anything} + \text{c.c.})/\Gamma_{\text{total}}$$

$$\Gamma_{23}/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
$1.076 \pm 0.040 \pm 0.068$	DRUTSKOY	07	BELL $\Upsilon(5S) \rightarrow D^0 X$

NODE=M092R10
NODE=M092R10

$$\Gamma(D_s \text{ anything} + \text{c.c.})/\Gamma_{\text{total}}$$

$$\Gamma_{24}/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
0.46 ± 0.06 OUR AVERAGE			
$0.472 \pm 0.024 \pm 0.072$	¹⁸ DRUTSKOY	07	BELL $\Upsilon(5S) \rightarrow D_s X$
$0.44 \pm 0.09 \pm 0.04$	²⁵ ARTUSO	05B	CLE3 $e^+ e^- \rightarrow D_s X$

NODE=M092R02
NODE=M092R02

$$\Gamma(J/\psi \text{ anything})/\Gamma_{\text{total}}$$

$$\Gamma_{25}/\Gamma$$

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
$2.060 \pm 0.160 \pm 0.134$	DRUTSKOY	07	BELL $\Upsilon(5S) \rightarrow J/\psi X$

NODE=M092R11
NODE=M092R11

$$\Gamma(B^0 \text{ anything} + \text{c.c.})/\Gamma_{\text{total}}$$

$$\Gamma_{26}/\Gamma$$

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
$0.770^{+0.058}_{-0.056} \pm 0.061$	352	DRUTSKOY	10	BELL $\Upsilon(5S) \rightarrow B^0 X$

NODE=M092R26
NODE=M092R26

$$\Gamma(B^+ \text{ anything} + \text{c.c.})/\Gamma_{\text{total}}$$

$$\Gamma_{27}/\Gamma$$

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
$0.721^{+0.039}_{-0.038} \pm 0.050$	711	DRUTSKOY	10	BELL $\Upsilon(5S) \rightarrow B^+ X$

NODE=M092R27
NODE=M092R27

- ¹³ Not independent of DRUTSKOY 10 values for $\Upsilon(5S) \rightarrow B^{\pm,0}$ anything.
- ¹⁴ Using measurements or limits from AQUINES 06.
- ¹⁵ Assuming isospin conservation.
- ¹⁶ Supersedes DRUTSKOY 07.
- ¹⁷ Supersedes ARTUSO 05B. Combining inclusive ϕ , D_s , and B measurements. Using $B(D_s^+ \rightarrow \phi\pi^+) = 4.4 \pm 0.6\%$ from PDG 06.
- ¹⁸ Using $B(D_s^+ \rightarrow \phi\pi^+) = (4.4 \pm 0.6)\%$ from PDG 06.
- ¹⁹ Uses a model-dependent estimate $B(B_s \rightarrow D_s X) = (92 \pm 11)\%$.
- ²⁰ Supersedes LOUVOT 09.
- ²¹ With $N(B_s^{(*)}\bar{B}_s^{(*)}) = (7.11 \pm 1.30) \times 10^6$.
- ²² The 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 .
- ²³ From 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.
- ²⁴ Assuming that the observed events are solely due to the $\Upsilon(5S)$ resonance.
- ²⁵ 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=M092R13;LINKAGE=DR
 NODE=M092R;LINKAGE=HU
 NODE=M092R15;LINKAGE=DR
 NODE=M092R01;LINKAGE=ES
 NODE=M092R01;LINKAGE=HU

NODE=M092R02;LINKAGE=DR
 NODE=M092R01;LINKAGE=AR
 NODE=M092R19;LINKAGE=ES
 NODE=M092R19;LINKAGE=IL
 NODE=M092R19;LINKAGE=LI

NODE=M092R19;LINKAGE=DR
 NODE=M092R20;LINKAGE=CH
 NODE=M092R02;LINKAGE=AR

$\Upsilon(10860)$ REFERENCES

ESEN	13	PR D87 031101	S. Esen <i>et al.</i>	(BELLE Collab.)
ADACHI	12	PRL 108 032001	I. Adachi <i>et al.</i>	(BELLE Collab.)
LI	12	PRL 108 181808	J. Li <i>et al.</i>	(BELLE Collab.)
CHEN	10	PR D82 091106	K.-F. Chen <i>et al.</i>	(BELLE Collab.)
DRUTSKOY	10	PR D81 112003	A. Drutskoy <i>et al.</i>	(BELLE Collab.)
AUBERT	09E	PRL 102 012001	B. Aubert <i>et al.</i>	(BABAR Collab.)
LOUVOT	09	PRL 102 021801	R. Louvot <i>et al.</i>	(BELLE Collab.)
CHEN	08	PRL 100 112001	K.-F. Chen <i>et al.</i>	(BELLE Collab.)
DRUTSKOY	07	PRL 98 052001	A. Drutskoy <i>et al.</i>	(BELLE Collab.)
DRUTSKOY	07A	PR D76 012002	A. Drutskoy <i>et al.</i>	(BELLE Collab.)
HUANG	07	PR D75 012002	G.S. Huang <i>et al.</i>	(CLEO Collab.)
AQUINES	06	PRL 96 152001	O. Aquines <i>et al.</i>	(CLEO Collab.)
BONVICINI	06	PRL 96 022002	G. Bonvicini <i>et al.</i>	(CLEO Collab.)
PDG	06	JPG 33 1	W.-M. Yao <i>et al.</i>	(PDG Collab.)
ARTUSO	05B	PRL 95 261801	M. Artuso <i>et al.</i>	(CLEO Collab.)
BESSION	85	PRL 54 381	D. Besson <i>et al.</i>	(CLEO Collab.)
LOVELOCK	85	PRL 54 377	D.M.J. Lovelock <i>et al.</i>	(CUSB Collab.)

NODE=M092

REFID=54894
 REFID=53962
 REFID=54116
 REFID=53531
 REFID=53358
 REFID=52661
 REFID=52646
 REFID=52153
 REFID=51621
 REFID=51852
 REFID=51624
 REFID=51106
 REFID=50995
 REFID=51004
 REFID=50992
 REFID=22368
 REFID=22369

$\Upsilon(11020)$

$$J^{PC} = 0^{-}(1^{-}-)$$

NODE=M093

$\Upsilon(11020)$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
11019 ± 8 OUR AVERAGE			
[11.019 ± 0.008 GeV OUR 2012 AVERAGE]			
11019 ± 5 ± 7	BESSION	85	CLEO $e^+e^- \rightarrow \text{hadrons}$
11020 ± 30	LOVELOCK	85	CUSB $e^+e^- \rightarrow \text{hadrons}$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
10996 ± 2	¹ AUBERT	09E	BABR $e^+e^- \rightarrow \text{hadrons}$
¹ 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

NODE=M093M
 NEW

NODE=M093M;LINKAGE=AU

$\Upsilon(11020)$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
79 ± 16 OUR AVERAGE			
61 ± 13 ± 22	BESSION	85	CLEO $e^+e^- \rightarrow \text{hadrons}$
90 ± 20	LOVELOCK	85	CUSB $e^+e^- \rightarrow \text{hadrons}$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
37 ± 3	² AUBERT	09E	BABR $e^+e^- \rightarrow \text{hadrons}$
² 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

NODE=M093W

NODE=M093W;LINKAGE=AU

$\Upsilon(11020)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad e^+ e^-$	$(1.6 \pm 0.5) \times 10^{-6}$

NODE=M093215;NODE=M093

DESIG=1

$\Upsilon(11020)$ PARTIAL WIDTHS

$\Gamma(e^+ e^-)$					Γ_1
VALUE (keV)	DOCUMENT ID	TECN	COMMENT		
0.130±0.030 OUR AVERAGE					
0.095±0.03 ±0.035	BESSON	85	CLEO	$e^+ e^- \rightarrow$ hadrons	
0.156±0.040	LOVELOCK	85	CUSB	$e^+ e^- \rightarrow$ hadrons	

NODE=M093220

NODE=M093W1
NODE=M093W1

$\Upsilon(11020)$ REFERENCES

AUBERT	09E	PRL 102 012001	B. Aubert <i>et al.</i>	(BABAR Collab.)
BESSON	85	PRL 54 381	D. Besson <i>et al.</i>	(CLEO Collab.)
LOVELOCK	85	PRL 54 377	D.M.J. Lovelock <i>et al.</i>	(CUSB Collab.)

NODE=M093

REFID=52661
REFID=22368
REFID=22369

NON- $q\bar{q}$ CANDIDATES

NODE=MXXX050

Non- $q\bar{q}$ Candidates

NODE=M201

OMITTED FROM SUMMARY TABLE

For a review on gluonium and other non- $q\bar{q}$ candidates see PDG 06, Journal of Physics, G **33** 1 (2006). See also the “Note on scalar mesons” in the $f_0(500)$ Particle Listings, our note “New charmonium-like states” in PDG 08, Physics Letters **B667** 1 (2008), and the extensive chapter on Spectroscopy in N. Brambilla *et al.* (Quarkonium Working Group), The European Physical Journal **C71** 1534 (2011).

NODE=M201

BRAMBILLA	11	EPJ C71 1534	N. Brambilla <i>et al.</i>	(Quarkonium Working Group)
PDG	08	PL B667 1	C. Amsler <i>et al.</i>	(PDG Collab.)
PDG	06	JPG 33 1	W.-M. Yao <i>et al.</i>	(PDG Collab.)

REFID=53692
REFID=52166
REFID=51004