

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 $I = 0$ ($\eta, \eta', h, h', \omega, \phi, f, f'$): $c_1(u\bar{u} + d\bar{d}) + c_2(s\bar{s})$

$f_0(500)$ or σ
was $f_0(600)$

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

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

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

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
(400–550)–i(200–350) OUR ESTIMATE				
• • • We do not use the following data for averages, fits, limits, etc. • • •				
512 $\pm$ 15– i (188 $\pm$ 12)	8595	¹ ABLIKIM	17	BES3 $J/\psi \rightarrow \gamma 3\pi$
(440 $\pm$ 10)– i (238 $\pm$ 10)		² ALBALADEJO	12	RVUE Compilation
(445 $\pm$ 25)– i (278 $\pm$ ⁺²² _{–18})		^{3,4} GARCIA-MAR..	11	RVUE Compilation
(457 $\pm$ ⁺¹⁴ _{–13})– i (279 $\pm$ ⁺¹¹ _{–7})		^{3,5} GARCIA-MAR..	11	RVUE Compilation
(442 $\pm$ ⁺⁵ _{–8})– i (274 $\pm$ ⁺⁶ _{–5})		⁶ MOUSSALLAM	11	RVUE Compilation
(452 $\pm$ 13)– i (259 $\pm$ 16)		⁷ MENNESSIER	10	RVUE Compilation
(448 $\pm$ 43)– i (266 $\pm$ 43)		⁸ MENNESSIER	10	RVUE Compilation
(455 $\pm$ 6 $\pm$ ⁺³¹ _{–13})– i (278 $\pm$ 6 $\pm$ ⁺³⁴ _{–43})		⁹ CAPRINI	08	RVUE Compilation
(463 $\pm$ 6 $\pm$ ⁺³¹ _{–17})– i (259 $\pm$ 6 $\pm$ ⁺³³ _{–34})		¹⁰ CAPRINI	08	RVUE Compilation
(552 $\pm$ ⁺⁸⁴ _{–106})– i (232 $\pm$ ⁺⁸¹ _{–72})		¹¹ ABLIKIM	07A	BES2 $\psi(2S) \rightarrow \pi^+\pi^- J/\psi$
(466 $\pm$ 18)– i (223 $\pm$ 28)		¹² BONVICINI	07	CLEO $D^+ \rightarrow \pi^-\pi^+\pi^+$
(472 $\pm$ 30)– i (271 $\pm$ 30)		¹³ BUGG	07A	RVUE Compilation
(484 $\pm$ 17)– i (255 $\pm$ 10)		GARCIA-MAR..	07	RVUE Compilation
(430)– i (325)		¹⁴ ANISOVICH	06	RVUE Compilation
(441 $\pm$ ⁺¹⁶ _{–8})– i (272 $\pm$ ⁺⁹ _{–12.5})		¹⁵ CAPRINI	06	RVUE $\pi\pi \rightarrow \pi\pi$
(470 $\pm$ 50)– i (285 $\pm$ 25)		¹⁶ ZHOU	05	RVUE
(541 $\pm$ 39)– i (252 $\pm$ 42)		¹⁷ ABLIKIM	04A	BES2 $J/\psi \rightarrow \omega\pi^+\pi^-$
(528 $\pm$ 32)– i (207 $\pm$ 23)		¹⁸ GALLEGOS	04	RVUE Compilation
(440 $\pm$ 8)– i (212 $\pm$ 15)		¹⁹ PELAEZ	04A	RVUE $\pi\pi \rightarrow \pi\pi$
(533 $\pm$ 25)– i (249 $\pm$ 25)		²⁰ BUGG	03	RVUE
517 – i 240		BLACK	01	RVUE $\pi^0\pi^0 \rightarrow \pi^0\pi^0$
(470 $\pm$ 30)– i (295 $\pm$ 20)		¹⁵ COLANGELO	01	RVUE $\pi\pi \rightarrow \pi\pi$
(535 $\pm$ ⁺⁴⁸ _{–36})– i (155 $\pm$ ⁺⁷⁶ _{–53})		²¹ ISHIDA	01	$\Upsilon(3S) \rightarrow \Upsilon\pi\pi$
610 $\pm$ 14 – i 620 $\pm$ 26		²² SUROVTSEV	01	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}$
(540 $\pm$ ⁺³⁶ _{–29})– i (193 $\pm$ ⁺³² _{–40})		ISHIDA	00B	$\rho\bar{\rho} \rightarrow \pi^0\pi^0\pi^0$
445 – i 235		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 – i 227		OLLER	99	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}$
469 – i 203		OLLER	99B	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}$
445 – i 221		OLLER	99C	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}, \eta\eta$
(1530 $\pm$ ⁺⁹⁰ _{–250})– i (560 $\pm$ 40)		ANISOVICH	98B	RVUE Compilation
420 – i 212		LOCHER	98	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}$
440 – i 245		²³ DOBADO	97	RVUE Compilation
(602 $\pm$ 26)– i (196 $\pm$ 27)		²⁴ ISHIDA	97	$\pi\pi \rightarrow \pi\pi$
(537 $\pm$ 20)– i (250 $\pm$ 17)		²⁵ KAMINSKI	97B	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}, 4\pi$
470 – i 250		^{26,27} TORNQVIST	96	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}, K\pi, \eta\pi$

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387 – $i305$	27,28 JANSSEN	95	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$
420 – $i370$	29 ACHASOV	94	RVUE	$\pi\pi \rightarrow \pi\pi$
$(506 \pm 10) - i(247 \pm 3)$	KAMINSKI	94	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$
370 – $i356$	30 ZOU	94B	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$
408 – $i342$	27,30 ZOU	93	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$
470 – $i208$	31 VANBEVEREN	86	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}, \eta\eta,$
$(750 \pm 50) - i(450 \pm 50)$	32 ESTABROOKS	79	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$
$(660 \pm 100) - i(320 \pm 70)$	PROTOPOP...	73	HBC	$\pi\pi \rightarrow \pi\pi, K\bar{K}$
650 – $i370$	33 BASDEVANT	72	RVUE	$\pi\pi \rightarrow \pi\pi$
1 S-matrix pole.				
2 Applying the chiral unitary approach at NLO to the K_{e4} data of BATLEY 10 and $\pi N \rightarrow \pi\pi N$ data of HYAMS 73, GRAYER 74, and PROTOPOPESCU 73.				
3 Uses the K_{e4} data of BATLEY 10C and the $\pi N \rightarrow \pi\pi N$ data of HYAMS 73, GRAYER 74, and PROTOPOPESCU 73.				
4 Analytic continuation using Roy equations.				
5 Analytic continuation using GKPY equations.				
6 Using Roy equations.				
7 Average of three variants of the analytic K-matrix model. Uses the K_{e4} data of BATLEY 08A and the $\pi N \rightarrow \pi\pi N$ data of HYAMS 73 and GRAYER 74.				
8 Average of the analyses of three data sets in the K-matrix model. Uses the data of BATLEY 08A, HYAMS 73, and GRAYER 74, partially of COHEN 80 or ETKIN 82B.				
9 From the K_{e4} data of BATLEY 08A and $\pi N \rightarrow \pi\pi N$ data of HYAMS 73.				
10 From the K_{e4} data of BATLEY 08A and $\pi N \rightarrow \pi\pi N$ data of PROTOPOPESCU 73, GRAYER 74, and ESTABROOKS 74.				
11 From a mean of three different $f_0(500)$ parametrizations. Uses 40k events.				
12 From an isobar model using 2.6k events.				
13 Reanalysis of ABLIKIM 04A, PISLAK 01, and HYAMS 73 data.				
14 Using the N/D method.				
15 From the solution of the Roy equation (ROY 71) for the isoscalar S-wave and using a phase-shift analysis of HYAMS 73 and PROTOPOPESCU 73 data.				
16 Reanalysis of the data from PROTOPOPESCU 73, ESTABROOKS 74, GRAYER 74, ROSSELET 77, PISLAK 03, and AKHMETSHIN 04.				
17 From a mean of six different analyses and $f_0(500)$ parameterizations.				
18 Using data on $\psi(2S) \rightarrow J/\psi\pi\pi$ from BAI 00E and on $\Upsilon(nS) \rightarrow \Upsilon(mS)\pi\pi$ from BUTLER 94B and ALEXANDER 98.				
19 Reanalysis of data from PROTOPOPESCU 73, ESTABROOKS 74, GRAYER 74, and COHEN 80 in the unitarized ChPT model.				
20 From a combined analysis of HYAMS 73, AUGUSTIN 89, AITALA 01B, and PISLAK 01.				
21 A similar analysis (KOMADA 01) finds $(580^{+79}_{-30}) - i(190^{+107}_{-49})$ MeV.				
22 Coupled channel reanalysis of BATON 70, BENSINGER 71, BAILLON 72, HYAMS 73, HYAMS 75, ROSSELET 77, COHEN 80, and ETKIN 82B using the uniformizing variable.				
23 Using the inverse amplitude method and data of ESTABROOKS 73, GRAYER 74, and PROTOPOPESCU 73.				
24 Reanalysis of data from HYAMS 73, GRAYER 74, SRINIVASAN 75, and ROSSELET 77 using the interfering amplitude method.				
25 Average and spread of 4 variants (“up” and “down”) of KAMINSKI 97B 3-channel model.				
26 Uses data from BEIER 72B, OCHS 73, HYAMS 73, GRAYER 74, ROSSELET 77, CASON 83, ASTON 88, and ARMSTRONG 91B. Coupled channel analysis with flavor symmetry and all light two-pseudoscalars systems.				
27 Demonstrates explicitly that $f_0(500)$ and $f_0(1370)$ are two different poles.				
28 Analysis of data from FALVARD 88.				
29 Analysis of data from OCHS 73, ESTABROOKS 75, ROSSELET 77, and MUKHIN 80.				
30 Analysis of data from OCHS 73, GRAYER 74, and ROSSELET 77.				
31 Coupled-channel analysis using data from PROTOPOPESCU 73, HYAMS 73, HYAMS 75, GRAYER 74, ESTABROOKS 74, ESTABROOKS 75, FROGGATT 77, CORDEN 79, BISWAS 81.				
32 Analysis of data from ??? BAD REFERENCE = APEL 1973 ???, GRAYER 74, CASON 76, PAWLICKI 77. Includes spread and errors of 4 solutions.				
33 Analysis of data from BATON 70, BENSINGER 71, COLTON 71, BAILLON 72, PROTOPOPESCU 73, and WALKER 67.				

$f_0(500)$ 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. • • •

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→ UNCHECKED ←

513±32	34	MURAMATSU	02	CLEO	$e^+e^- \approx 10 \text{ GeV}$
478 ⁺²⁴ ₋₂₃ ±17		AITALA	01B	E791	$D^+ \rightarrow \pi^- \pi^+ \pi^+$
563 ⁺⁵⁸ ₋₂₉	35	ISHIDA	01		$\Upsilon(3S) \rightarrow \Upsilon \pi \pi$
555	36	ASNER	00	CLE2	$\tau^- \rightarrow \pi^- \pi^0 \pi^0 \nu_\tau$
540±36		ISHIDA	00B		$p\bar{p} \rightarrow \pi^0 \pi^0 \pi^0$
750±4		ALEKSEEV	99	SPEC	$1.78 \pi^- p_{\text{polar}} \rightarrow \pi^- \pi^+ n$
744±5		ALEKSEEV	98	SPEC	$1.78 \pi^- p_{\text{polar}} \rightarrow \pi^- \pi^+ n$
759±5	37	TROYAN	98		$5.2 np \rightarrow np \pi^+ \pi^-$
780±30		ALDE	97	GAM2	$450 pp \rightarrow pp \pi^0 \pi^0$
585±20	38	ISHIDA	97		$\pi\pi \rightarrow \pi\pi$
761±12	39	SVEC	96	RVUE	$6-17 \pi N_{\text{polar}} \rightarrow \pi^+ \pi^- N$
~ 860	40,41	TORNQVIST	96	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}, K\pi, \eta\pi$
1165±50	42,43	ANISOVICH	95	RVUE	$\pi^- p \rightarrow \pi^0 \pi^0 n,$ $\bar{p}p \rightarrow \pi^0 \pi^0 \pi^0, \pi^0 \pi^0 \eta, \pi^0 \eta\eta$
~ 1000	44	ACHASOV	94	RVUE	$\pi\pi \rightarrow \pi\pi$
414±20	39	AUGUSTIN	89	DM2	

34 Statistical uncertainty only.

35 A similar analysis (KOMADA 01) finds 526⁺⁴⁸₋₃₇ MeV.

36 From the best fit of the Dalitz plot.

37 6σ effect, no PWA.

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

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

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

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

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

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

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

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$f_0(500)$ BREIT-WIGNER WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

(400–700) OUR ESTIMATE

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

335±67	45	MURAMATSU	02	CLEO	$e^+e^- \approx 10 \text{ GeV}$
324 ⁺⁴² ₋₄₀ ±21		AITALA	01B	E791	$D^+ \rightarrow \pi^- \pi^+ \pi^+$
372 ⁺²²⁹ ₋₉₅	46	ISHIDA	01		$\Upsilon(3S) \rightarrow \Upsilon \pi \pi$
540	47	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	48	TROYAN	98		$5.2 np \rightarrow np \pi^+ \pi^-$
780±60		ALDE	97	GAM2	$450 pp \rightarrow pp \pi^0 \pi^0$
385±70	49	ISHIDA	97		$\pi\pi \rightarrow \pi\pi$
290±54	50	SVEC	96	RVUE	$6-17 \pi N_{\text{polar}} \rightarrow \pi^+ \pi^- N$
~ 880	51,52	TORNQVIST	96	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}, K\pi, \eta\pi$
460±40	53,54	ANISOVICH	95	RVUE	$\pi^- p \rightarrow \pi^0 \pi^0 n,$ $\bar{p}p \rightarrow \pi^0 \pi^0 \pi^0, \pi^0 \pi^0 \eta, \pi^0 \eta\eta$
~ 3200	55	ACHASOV	94	RVUE	$\pi\pi \rightarrow \pi\pi$
494±58	50	AUGUSTIN	89	DM2	

45 Statistical uncertainty only.

46 A similar analysis (KOMADA 01) finds 301⁺¹⁴⁵₋₁₀₀ MeV.

47 From the best fit of the Dalitz plot.

48 6σ effect, no PWA.

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

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

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- ⁵¹ 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.
- ⁵² Also observed by ASNER 00 in $\tau^- \rightarrow \pi^- \pi^0 \pi^0 \nu_\tau$ decays.
- ⁵³ 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.
- ⁵⁴ The pole is on Sheet III. Demonstrates explicitly that $f_0(500)$ and $f_0(1370)$ are two different poles.
- ⁵⁵ Analysis of data from OCHS 73, ESTABROOKS 75, ROSSELET 77, and MUKHIN 80.

$f_0(500)$ DECAY MODES

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

$f_0(500)$ PARTIAL WIDTHS

$\Gamma(\gamma\gamma)$

VALUE (keV)	DOCUMENT ID	TECN	COMMENT

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

2.05 ± 0.21	⁵⁶ DAI	14A	RVUE	Compilation
1.7 ± 0.4	⁵⁷ HOFERICHTER11		RVUE	Compilation
3.08 ± 0.82	⁵⁸ MENNESSIER	11	RVUE	Compilation
2.08 ± 0.2 ^{+0.07} _{-0.04}	⁵⁹ MOUSSALLAM11		RVUE	Compilation
2.08	⁶⁰ MAO	09	RVUE	Compilation
1.2 ± 0.4	⁶¹ BERNABEU	08	RVUE	
3.9 ± 0.6	⁵⁸ MENNESSIER	08	RVUE	$\gamma\gamma \rightarrow \pi^+ \pi^-, \pi^0 \pi^0$
1.8 ± 0.4	⁶² OLLER	08	RVUE	Compilation
1.68 ± 0.15	^{62,63} OLLER	08A	RVUE	Compilation
3.1 ± 0.5	^{64,65} PENNINGTON	08	RVUE	Compilation
2.4 ± 0.4	^{65,66} PENNINGTON	08	RVUE	Compilation
4.1 ± 0.3	⁶⁷ PENNINGTON	06	RVUE	$\gamma\gamma \rightarrow \pi^0 \pi^0$
3.8 ± 1.5	^{68,69} BOGLIONE	99	RVUE	$\gamma\gamma \rightarrow \pi^+ \pi^-, \pi^0 \pi^0$
5.4 ± 2.3	⁶⁸ MORGAN	90	RVUE	$\gamma\gamma \rightarrow \pi^+ \pi^-, \pi^0 \pi^0$
10 ± 6	COURAU	86	DM1	$e^+ e^- \rightarrow \pi^+ \pi^- e^+ e^-$

⁵⁶ Using dispersive analysis with phases from GARCIA-MARTIN 11A and BUETTAKER 04 as input.

⁵⁷ Using Roy-Steiner equations with $\pi\pi$ phase shifts from an update of COLANGELO 01 and from GARCIA-MARTIN 11A.

⁵⁸ Using an analytic K-matrix model.

⁵⁹ Using dispersion integral with phase input from Roy equations and data from MARSISKE 90, BOYER 90, BEHREND 92, UEHARA 08A, and MORI 07.

⁶⁰ Used dispersion theory. The value quoted used the $f_0(500)$ pole position of 457 - $i276$ MeV.

⁶¹ 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.

⁶² Using twice-subtracted dispersion integrals.

⁶³ Supersedes OLLER 08.

⁶⁴ Solution A (preferred solution based on χ^2 -analysis).

⁶⁵ Dispersion theory based amplitude analysis of BOYER 90, MARSISKE 90, BEHREND 92, and MORI 07.

⁶⁶ Solution B (worse than solution A; still acceptable when systematic uncertainties are included).

⁶⁷ Using unitarity and the σ pole position from CAPRINI 06.

⁶⁸ 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 $f_2(1270)$.

⁶⁹ Supersedes MORGAN 90.

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$\eta(500)$ REFERENCES

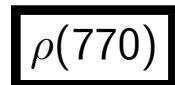
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ABLIKIM	17	PRL 118 012001	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=57650
DAI	14A	PR D90 036004	L.-Y. Dai, M.R. Pennington	(CEBAF)	REFID=55923
ALBALADEJO	12	PR D86 034003	M. Albaladejo, J.A. Oller	(MURC)	REFID=54277
GARCIA-MAR...	11	PRL 107 072001	R. Garcia-Martin <i>et al.</i>	(MADR, CRAC)	REFID=16761
GARCIA-MAR...	11A	PR D83 074004	R. Garcia-Martin <i>et al.</i>	(MADR, CRAC)	REFID=54121
HOERICHTER	11	EPJ C71 1743	M. Hoferichter, D.R. Phillips, C. Schat	(BONN+)	REFID=53966
MENNESSIER	11	PL B696 40	G. Mennessier, S. Narison, X.-G. Wang		REFID=53637
MOUSSALLAM	11	EPJ C71 1814	B. Moussallam		REFID=53975
BATLEY	10	PL B686 101	J.R. Batley <i>et al.</i>	(CERN NA48/2 Collab.)	REFID=53285
BATLEY	10C	EPJ C70 635	J.R. Batley <i>et al.</i>	(CERN NA48/2 Collab.)	REFID=53567
MENNESSIER	10	PL B688 59	G. Mennessier, S. Narison, X.-G. Wang		REFID=53657
MAO	09	PR D79 116008	Y. Mao <i>et al.</i>		REFID=52992
BATLEY	08A	EPJ C54 411	J.R. Batley <i>et al.</i>	(CERN NA48/2 Collab.)	REFID=52487
BERNABEU	08	PRL 100 241804	J. Bernabeu, J. Prades	(IFIC, GRAN)	REFID=52271
CAPRINI	08	PR D77 114019	I. Caprini		REFID=52273
MENNESSIER	08	PL B665 205	G. Mennessier, S. Narison, W. Ochs		REFID=52299
OLLER	08	PL B659 201	J.A. Oller, L. Roca, C. Schat	(MURC, UBA)	REFID=53976
OLLER	08A	EPJ A37 15	J.A. Oller, L. Roca	(MURC)	REFID=53977
PENNINGTON	08	EPJ C56 1	M.R. Pennington <i>et al.</i>		REFID=52303
UEHARA	08A	PR D78 052004	S. Uehara <i>et al.</i>	(BELLE Collab.)	REFID=52309
ABLIKIM	07A	PL B645 19	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51614
BONVICINI	07	PR D76 012001	G. Bonvicini <i>et al.</i>	(CLEO Collab.)	REFID=51721
BUGG	07A	JP G34 151	D.V. Bugg <i>et al.</i>		REFID=53252
GARCIA-MAR...	07	PR D76 074034	R. Garcia-Martin, J.R. Pelaez, F.J. Yndurain		REFID=51949
MORI	07	PR D75 051101	T. Mori <i>et al.</i>	(BELLE Collab.)	REFID=51652
ANISOVICH	06	IJMP A21 3615	V.V. Anisovich		REFID=51137
CAPRINI	06	PRL 96 132001	I. Caprini, G. Colangelo, H. Leutwyler	(BCIP+)	REFID=51076
PDG	06	JP G33 1	W.-M. Yao <i>et al.</i>	(PDG Collab.)	REFID=51004
PENNINGTON	06	PRL 97 011601	M.R. Pennington		REFID=51184
ZHOU	05	JHEP 0502 043	Z.Y. Zhou <i>et al.</i>		REFID=50823
ABLIKIM	04A	PL B598 149	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=49740
AKHMETSHIN	04	PL B578 285	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=49609
BUETTIKER	04	EPJ C33 409	P. Buettiker, S. Descotes-Genon, B. Moussallam		REFID=56428; ERROR=3
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 (err.)	H. Muramatsu <i>et al.</i>	(CLEO Collab.)	REFID=49385
AITALA	01B	PRL 86 770	E.M. Aitala <i>et al.</i>	(FNAL E791 Collab.)	REFID=48005
BLACK	01	PR D64 014031	D. Black <i>et al.</i>		REFID=48314
COLANGELO	01	NP B603 125	G. Colangelo, J. Gasser, H. Leutwyler		REFID=49180
ISHIDA	01	PL B518 47	M. Ishida <i>et al.</i>		REFID=48354
KOMADA	01	PL B508 31	T. Komada <i>et al.</i>		REFID=48541
PISLAK	01	PRL 87 221801	S. Pislak <i>et al.</i>	(BNL E865 Collab.)	REFID=48433
Also		PR D67 072004	S. Pislak <i>et al.</i>	(BNL E865 Collab.)	REFID=49344
Also		PRL 105 019901E	S. Pislak <i>et al.</i>	(BNL E865 Collab.)	REFID=53338
SUROVTSEV	01	PR D63 054024	Y.S. Surovtsev, D. Krupa, M. Nagy		REFID=48310
ASNER	00	PR D61 012002	D.M. Asner <i>et al.</i>	(CLEO Collab.)	REFID=47339
BAI	00E	PR D62 032002	J. Bai <i>et al.</i>	(BES Collab.)	REFID=47955
ISHIDA	00B	PTP 104 203	M. Ishida <i>et al.</i>		REFID=48358
ALEKSEEV	99	NP B541 3	I.G. Alekseev <i>et al.</i>		REFID=46614
BOGLIONE	99	EPJ C9 11	M. Boglione, M.R. Pennington		REFID=46931
HANNAH	99	PR D60 017502	T. Hannah		REFID=46935
KAMINSKI	99	EPJ C9 141	R. Kaminski, L. Lesniak, B. Loiseau	(CRAC, PARIN)	REFID=46927
OLLER	99	PR D60 099906 (erratum)	J.A. Oller <i>et al.</i>		REFID=46899
OLLER	99B	NP A652 407 (erratum)	J.A. Oller, E. Oset		REFID=46924
OLLER	99C	PR D60 074023	J.A. Oller, E. Oset		REFID=47386
ALEKSEEV	98	PAN 61 174	I.G. Alekseev <i>et al.</i>		REFID=46328
ALEXANDER	98	PR D58 052004	J.P. Alexander <i>et al.</i>	(CLEO Collab.)	REFID=46329
ANISOVICH	98B	SPU 41 419	V.V. Anisovich <i>et al.</i>		REFID=46331
LOCHER	98	Translated from UFN 168 481.	M.P. Locher <i>et al.</i>	(PSI)	REFID=46372
TROYAN	98	EPJ C4 317	Yu. Troyan <i>et al.</i>		REFID=46615
ALDE	97	JINRRC 5-91 33	D.M. Alde <i>et al.</i>	(GAMS Collab.)	REFID=45392
DOBADO	97	PL B397 350	A. Dobado, J.R. Pelaez		REFID=53964
ISHIDA	97	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 D38 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
ESTABROOKS	79	PR D19 2678	P. Estabrooks	(CARL)
FROGGATT	77	NP B129 89	C.D. Froggatt, J.L. Petersen	(GLAS, NORD)
PAWLICKI	77	PR D15 3196	A.J. Pawlicki <i>et al.</i>	(ANL) IJ
ROSSELET	77	PR D15 574	L. Rosselet <i>et al.</i>	(GEVA, SACL)
CASON	76	PRL 36 1485	N.M. Cason <i>et al.</i>	(NDAM, ANL) IJ
ESTABROOKS	75	NP B95 322	P.G. Estabrooks, A.D. Martin	(DURH)
HYAMS	75	NP B100 205	B.D. Hyams <i>et al.</i>	(CERN, MPIM)
SRINIVASAN	75	PR D12 681	V. Srinivasan <i>et al.</i>	(NDAM, ANL)
ESTABROOKS	74	NP B79 301	P.G. Estabrooks, A.D. Martin	(DURH)
GRAYER	74	NP B75 189	G. Grayer <i>et al.</i>	(CERN, MPIM)
ESTABROOKS	73	Tallahassee	P.G. Estabrooks <i>et al.</i>	(CERN, MPIM)
HYAMS	73	NP B64 134	B.D. Hyams <i>et al.</i>	(CERN, MPIM)
OCHS	73	Thesis	W. Ochs	(MPIM, MUNI)
PROTOPOP...	73	PR D7 1279	S.D. Protopopescu <i>et al.</i>	(LBL)
BAILLON	72	PL 38B 555	P.H. Baillon <i>et al.</i>	(SLAC)
BASDEVANT	72	PL 41B 178	J.L. Basdevant, C.D. Froggatt, J.L. Petersen	(CERN)
BEIER	72B	PRL 29 511	E.W. Beier <i>et al.</i>	(PENN)
BENSINGER	71	PL 36B 134	J.R. Bensinger <i>et al.</i>	(WISC)
COLTON	71	PR D3 2028	E.P. Colton <i>et al.</i>	(LBL, FNAL, UCLA+)
ROY	71	PL 36B 353	S.M. Roy	
BATON	70	PL 33B 528	J.P. Baton, G. Laurens, J. Reigner	(SACL)
WALKER	67	RMP 39 695	W.D. Walker	(WISC)

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NODE=M009



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

A REVIEW GOES HERE – Check our WWW List of Reviews

NODE=M009

$\rho(770)$ MASS

NODE=M009205

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

NODE=M009205

NEUTRAL ONLY, e^+e^-

NODE=M009M0
NODE=M009M0

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
775.26 ± 0.25 OUR AVERAGE				
775.02 ± 0.35		1 LEES	12G BABR	$e^+e^- \rightarrow \pi^+\pi^-\gamma$
775.97 ± 0.46 ± 0.70	900k	2 AKHMETSHIN 07		$e^+e^- \rightarrow \pi^+\pi^-$
774.6 ± 0.4 ± 0.5	800k	3,4 ACHASOV 06	SND	$e^+e^- \rightarrow \pi^+\pi^-$
775.65 ± 0.64 ± 0.50	114k	5,6 AKHMETSHIN 04	CMD2	$e^+e^- \rightarrow \pi^+\pi^-$
775.9 ± 0.5 ± 0.5	1.98M	7 ALOISIO 03	KLOE	$1.02 e^+e^- \rightarrow \pi^+\pi^-\pi^0$
775.8 ± 0.9 ± 2.0	500k	7 ACHASOV 02	SND	$1.02 e^+e^- \rightarrow \pi^+\pi^-\pi^0$
775.9 ± 1.1		8 BARKOV 85	OLYA	$e^+e^- \rightarrow \pi^+\pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
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	$e^+e^- \rightarrow \pi^+\pi^-$

OCCUR=2

OCCUR=3

OCCUR=3

CHARGED ONLY, τ DECAYS and e^+e^-

NODE=M009M5
NODE=M009M5

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 SCHAEAL 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-CILLERO03	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		$\tau^- \rightarrow \pi^-\pi^0\nu_\tau$

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

<u>VALUE (MeV)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
769.0± 1.0 OUR AVERAGE				
771 ± 2 $\begin{smallmatrix} +2 \\ -1 \end{smallmatrix}$	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 $\gamma + \text{Pb}$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
771 ± 2	79k	³⁰ BREITWEG	98B	ZEUS 50–100 γp

NODE=M009M0P
NODE=M009M0P

OCCUR=2

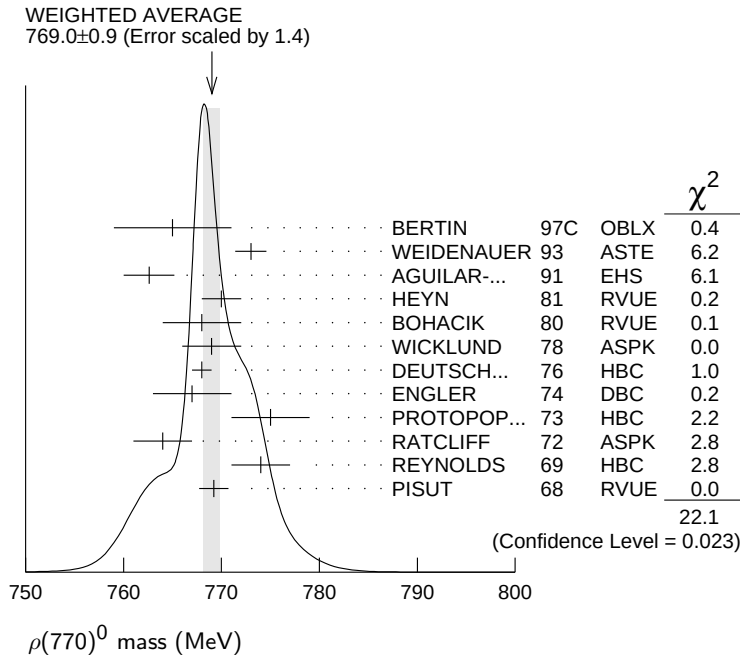
OCCUR=2

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 π^+p , $t < 0.4$
764 ±3	6800	RATCLIFF	72	ASPK	0 15 π^-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 π^-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



- 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, GOLDBERGER 64, ABOLINS 63.
- ³⁵ Breit-Wigner mass from a phase-shift analysis of HYAMS 73 and PROTOPOPESCU 73 data.

NODE=M009M0;LINKAGE=LE

NODE=M009M0;LINKAGE=AK
NODE=M009M0;LINKAGE=AC
NODE=M009M0;LINKAGE=SN

NODE=M009M5;LINKAGE=GS
NODE=M009M5;LINKAGE=PT

NODE=M009M0;LINKAGE=CH
NODE=M009M;LINKAGE=K

NODE=M009M;LINKAGE=DF
NODE=M009M;LINKAGE=WO

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NODE=M009M;LINKAGE=K2
NODE=M009M;LINKAGE=G8

NODE=M009M;LINKAGE=AB
NODE=M009M;LINKAGE=AA
NODE=M009M;LINKAGE=F
NODE=M009M5;LINKAGE=FU
NODE=M009M5;LINKAGE=GO
NODE=M009M5;LINKAGE=SC
NODE=M009M;LINKAGE=A6
NODE=M009M;LINKAGE=K1

NODE=M009M5;LINKAGE=Z
NODE=M009M;LINKAGE=PC

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NODE=M009M;LINKAGE=A

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NODE=M009M;LINKAGE=B
NODE=M009M;LINKAGE=C
NODE=M009M;LINKAGE=H
NODE=M009M;LINKAGE=R

NODE=M009M;LINKAGE=CL

- 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=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 SCHAEI	05C	ALEP	$\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$
$0.4 \pm 0.7 \pm 0.6$	1.98M	⁴¹ ALOISIO	03	KLOE	$1.02 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
$1.3 \pm 1.1 \pm 2.0$	500k	⁴¹ ACHASOV	02	SND	$1.02 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
$1.6 \pm 0.6 \pm 1.7$	600k	ABELE	99E	CBAR	$0.0 \bar{p} p \rightarrow \pi^+ \pi^- \pi^0$
-4 ± 4	3000	⁴² REYNOLDS	69	HBC	$-0.0 \pi^- p$
-5 ± 5	3600	⁴² FOSTER	68	HBC	$0.0 \bar{p} p$
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 SCHAEI 05C and $e^+ e^-$ data from the compilation of BARKOV 85, AKHMETSHIN 04, and ALOISIO 05. Supersedes BARATE 97M.

NODE=M009D;LINKAGE=SC

⁴¹ Assuming $m_{\rho^+} = m_{\rho^-}$, $\Gamma_{\rho^+} = \Gamma_{\rho^-}$.

NODE=M009D;LINKAGE=CH

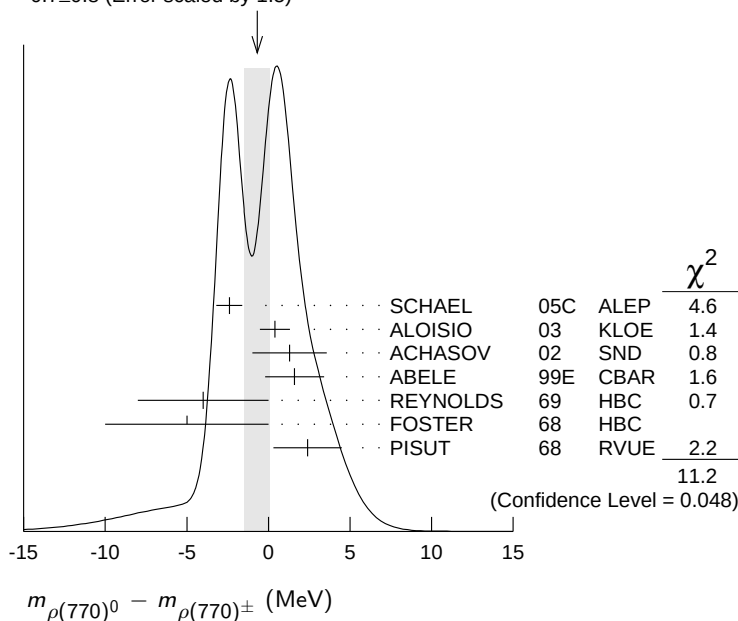
⁴² From quoted masses of charged and neutral modes.

NODE=M009D;LINKAGE=A

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, GOLDBERGER 64, ABOLINS 63.

NODE=M009D;LINKAGE=R

WEIGHTED AVERAGE
 -0.7 ± 0.8 (Error scaled by 1.5)



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

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$1.5 \pm 0.8 \pm 0.7$	1.98M	⁴⁴ ALOISIO	03	KLOE $1.02 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
⁴⁴ Without limitations on masses and widths.				

NODE=M009D1

NODE=M009D1

NODE=M009D;LINKAGE=WO

$\rho(770)$ 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, $q = q_r$.

<u>VALUE (GeV⁻¹)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>CHG</u>	<u>COMMENT</u>	
5.3^{+0.9}_{-0.7}	CHABAUD	83	ASPK	0	17 $\pi^- p$ polar- ized

NODE=M009R

 $\rho(770)$ WIDTH

NODE=M009220

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

NODE=M009220

NEUTRAL ONLY, e^+e^- NODE=M009W0
NODE=M009W0

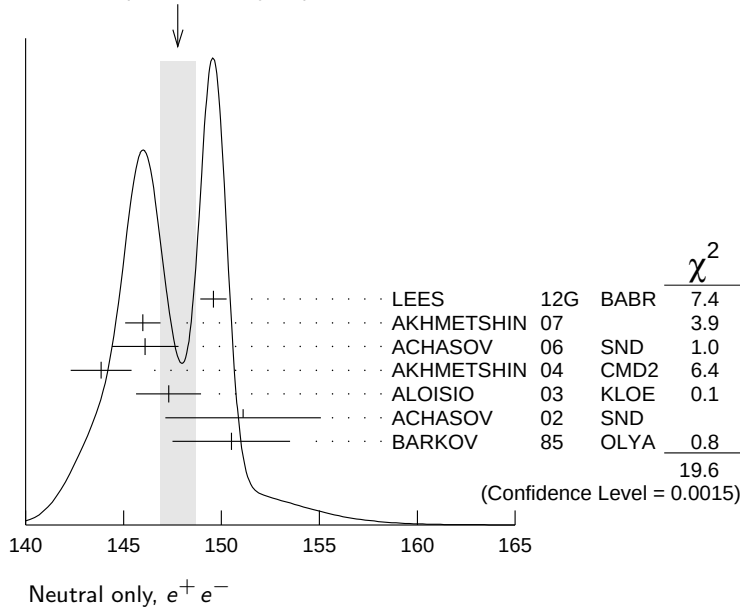
VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
147.8 ± 0.9 OUR AVERAGE		Error includes scale factor of 2.0. See the ideogram below.			
149.59 ± 0.67		46 LEES	12G	BABR	$e^+e^- \rightarrow \pi^+\pi^-\gamma$
145.98 ± 0.75 ± 0.50	900k	47 AKHMETSHIN	07		$e^+e^- \rightarrow \pi^+\pi^-$
146.1 ± 0.8 ± 1.5	800k	48,49 ACHASOV	06	SND	$e^+e^- \rightarrow \pi^+\pi^-$
143.85 ± 1.33 ± 0.80	114k	50,51 AKHMETSHIN	04	CMD2	$e^+e^- \rightarrow \pi^+\pi^-$
147.3 ± 1.5 ± 0.7	1.98M	52 ALOISIO	03	KLOE	1.02 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
151.1 ± 2.6 ± 3.0	500k	52 ACHASOV	02	SND	0 1.02 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
150.5 ± 3.0		53 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	54 ALOISIO	03	KLOE	1.02 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
147.4 ± 1.5 ± 0.7	1.98M	55 ALOISIO	03	KLOE	1.02 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
149.8 ± 2.2 ± 2.0	500k	56 ACHASOV	02	SND	1.02 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
147.9 ± 1.5 ± 7.5		57 BENAYOUN	98	RVUE	$e^+e^- \rightarrow \pi^+\pi^-, \mu^+\mu^-$
153.5 ± 1.3 ± 4.6		58 GARDNER	98	RVUE	0.28–0.92 $e^+e^- \rightarrow \pi^+\pi^-$
145.0 ± 1.7		59 O'CONNELL	97	RVUE	$e^+e^- \rightarrow \pi^+\pi^-$
142.5 ± 3.5		60 BERNICHA	94	RVUE	$e^+e^- \rightarrow \pi^+\pi^-$
138 ± 1		61 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^-** NODE=M009W5
NODE=M009W5

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	62,63 FUJIKAWA	08	BELL	$\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$
149.0 ± 1.2		63,64 SCHAELE	05C	ALEP	$\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$
149.9 ± 2.3 ± 2.0	500k	52 ACHASOV	02	SND	$1.02 e^+e^- \rightarrow \pi^+\pi^-\pi^0$
150.4 ± 1.4 ± 1.4	87k	65,66 ANDERSON	00A	CLE2	$\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$

OCCUR=2

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

143.7±1.3±1.2	1.98M	52	ALOISIO	03	KLOE	±	$1.02 \frac{e^+e^- \rightarrow \pi^+\pi^-\pi^0}{\pi^+\pi^-\pi^0}$	
142.9±1.3±1.4	1.98M	55	ALOISIO	03	KLOE	−	$1.02 \frac{e^+e^- \rightarrow \pi^+\pi^-\pi^0}{\pi^+\pi^-\pi^0}$	OCCUR=2
144.7±1.4±1.2	1.98M	55	ALOISIO	03	KLOE	+	$1.02 \frac{e^+e^- \rightarrow \pi^+\pi^-\pi^0}{\pi^+\pi^-\pi^0}$	OCCUR=3
150.2±2.0 ^{+0.7} _{−1.6}		67	SANZ-CILLERO	03	RVUE		$\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$	
150.9±2.2±2.0	500k	56	ACHASOV	02	SND		$1.02 \frac{e^+e^- \rightarrow \pi^+\pi^-\pi^0}{\pi^+\pi^-\pi^0}$	OCCUR=4

MIXED CHARGES, OTHER REACTIONS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
149.5±1.3	600k	68 ABELE	99E	CBAR	0± $0.0 \bar{p}p \rightarrow \pi^+\pi^-\pi^0$

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	69 CAPRARO	87	SPEC	− $200 \pi^-\pi^0 \text{Cu} \rightarrow \pi^-\pi^0 \text{Cu}$
154 ±20	967	69 CAPRARO	87	SPEC	− $200 \pi^-\pi^0 \text{Pb} \rightarrow \pi^-\pi^0 \text{Pb}$
150 ± 5		HUSTON	86	SPEC	+
146 ±12	6500	70 BYERLY	73	OSPK	− $5 \pi^- p$
148.2± 4.1	9650	71 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

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

137.0± 0.4		45 ABLIKIM	17	BES3	$J/\psi \rightarrow \gamma 3\pi$

ERROR=4

⁴⁵S-matrix pole at a fixed ρ meson mass of 775.49 MeV.

NODE=M009W2;LINKAGE=A

NEUTRAL ONLY, PHOTOPRODUCED

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
151.7± 2.6				OUR AVERAGE
155 ± 5 ± 2	63.5k	72 ABRAMOWICZ	12	ZEUS $ep \rightarrow e\pi^+\pi^-p$
146 ± 3 ±13	79k	73 BREITWEG	98B	ZEUS $50\text{--}100 \gamma p$
150.9± 3.0		BARTALUCCI	78	CNTR $\gamma p \rightarrow e^+e^-p$
138 ± 3	79k	74 BREITWEG	98B	ZEUS $50\text{--}100 \gamma p$
147 ±11		GLADDING	73	CNTR $2.9\text{--}4.7 \gamma p$
155 ±12	2430	BALLAM	72	HBC $4.7 \gamma p$
145 ±13	1930	BALLAM	72	HBC $2.8 \gamma p$
140 ± 5		ALVENSLEB...	70	CNTR $\gamma A, t < 0.01$
146.1± 2.9	140k	BIGGS	70	CNTR $<4.1 \gamma C \rightarrow \pi^+\pi^-C$
160 ±10		LANZEROTTI	68	CNTR γp
130 ± 5	4000	ASBURY	67B	CNTR $\gamma + \text{Pb}$

NODE=M009W0P
NODE=M009W0P

NEUTRAL ONLY, OTHER REACTIONS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
150.9± 1.7					OUR AVERAGE
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		75,76 BOHACIK	80	RVUE	0
152 ± 9		70 WICKLUND	78	ASPK	0 $3,4,6 \pi^\pm p N$
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 $2.26 \pi^- p$
147.0± 2.5	600k	77 ABELE	99E	CBAR	0 $0.0 \bar{p}p \rightarrow \pi^+\pi^-\pi^0$
146 ± 3	4943	78 ADAMS	97	E665	$470 \mu p \rightarrow \mu X B$
160.0 ^{+4.1} _{−4.0}		79 CHABAUD	83	ASPK	0 $17 \pi^- p$ polarized
155 ± 1		80 HEYN	81	RVUE	0 π form factor
148.0± 1.3		75,76 LANG	79	RVUE	0
146 ±14	4100	ENGLER	74	DBC	0 $6 \pi^+ n \rightarrow \pi^+\pi^-p$
143 ±13		76 ESTABROOKS	74	RVUE	0 $17 \pi^- p \rightarrow \pi^+\pi^-n$
160 ±10	32000	75 PROTOPOP...	73	HBC	0 $7.1 \pi^+ p, t < 0.4$
145 ±12	2250	69 HYAMS	68	OSPK	0 $11.2 \pi^- p$
163 ±15	13300	81 PISUT	68	RVUE	0 $1.7\text{--}3.2 \pi^- p, t < 10$

NODE=M009W0R
NODE=M009W0R

- 46 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.
- 47 A combined fit of AKHMETSHIN 07, AULCHENKO 06, and AULCHENKO 05.
- 48 Supersedes ACHASOV 05A.
- 49 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.
- 50 Using the GOUNARIS 68 parametrization with the complex phase of the ρ - ω interference.
- 51 From a fit in the energy range 0.61 to 0.96 GeV. Update of AKHMETSHIN 02.
- 52 Assuming $m_{\rho^+} = m_{\rho^-}$, $\Gamma_{\rho^+} = \Gamma_{\rho^-}$.
- 53 From the GOUNARIS 68 parametrization of the pion form factor.
- 54 Assuming $m_{\rho^+} = m_{\rho^-} = m_{\rho^0}$, $\Gamma_{\rho^+} = \Gamma_{\rho^-} = \Gamma_{\rho^0}$.
- 55 Without limitations on masses and widths.
- 56 Assuming $m_{\rho^0} = m_{\rho^\pm}$, $g_{\rho^0\pi\pi} = g_{\rho^\pm\pi\pi}$.
- 57 Using the data of BARKOV 85 in the hidden local symmetry model.
- 58 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.
- 59 A fit of BARKOV 85 data assuming the direct $\omega\pi\pi$ coupling.
- 60 Applying the S-matrix formalism to the BARKOV 85 data.
- 61 Includes BARKOV 85 data. Model-dependent width definition.
- 62 $|F_\pi(0)|^2$ fixed to 1.
- 63 From the GOUNARIS 68 parametrization of the pion form factor.
- 64 The error combines statistical and systematic uncertainties. Supersedes BARATE 97M.
- 65 $\rho(1700)$ mass and width fixed at 1700 MeV and 235 MeV respectively.
- 66 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.
- 67 Using the data of BARATE 97M and the effective chiral Lagrangian.
- 68 Assuming the equality of ρ^+ and ρ^- masses and widths.
- 69 Width errors enlarged by us to $4\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.
- 70 Phase shift analysis. Systematic errors added corresponding to spread of different fits.
- 71 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.
- 72 Using the KUHN 90 parametrization of the pion form factor, neglecting ρ - ω interference.
- 73 From the parametrization according to SOEDING 66.
- 74 From the parametrization according to ROSS 66.
- 75 From pole extrapolation.
- 76 From phase shift analysis of GRAYER 74 data.
- 77 Using relativistic Breit-Wigner and taking into account ρ - ω interference.
- 78 Systematic errors not evaluated.
- 79 From fit of 3-parameter relativistic Breit-Wigner to helicity-zero part of P -wave intensity. CHABAUD 83 includes data of GRAYER 74.
- 80 HEYN 81 includes all spacelike and timelike F_π values until 1978.
- 81 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.

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

NODE=M009W;LINKAGE=AB
 NODE=M009W;LINKAGE=AA
 NODE=M009W;LINKAGE=F
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 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
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 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		82 SCHAEEL	05C ALEP	$\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$
3.6±1.8±1.7	1.98M	83 ALOISIO	03 KLOE	$1.02 \frac{e^+e^- \rightarrow \pi^+\pi^-\pi^0}{\pi^+\pi^-\pi^0}$

NODE=M009W6
 NODE=M009W6

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

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
1.8±2.0±0.5	1.98M	84 ALOISIO	03 KLOE	$1.02 \frac{e^+e^- \rightarrow \pi^+\pi^-\pi^0}{\pi^+\pi^-\pi^0}$

NODE=M009W16
 NODE=M009W16

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

NODE=M009W6;LINKAGE=SC

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

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

- 84 Without limitations on masses and widths.

$\rho(770)$ DECAY MODES

NODE=M009225;NODE=M009

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
$\Gamma_1 \quad \pi\pi$	~ 100	%

DESIG=1;OUR EVAL;→ UNCHECKED ←

$\rho(770)^\pm$ decays

Γ_2	$\pi^\pm \pi^0$	~ 100	%	
Γ_3	$\pi^\pm \gamma$	(4.5 ± 0.5)	$\times 10^{-4}$	S=2.2
Γ_4	$\pi^\pm \eta$	< 6	$\times 10^{-3}$	CL=84%
Γ_5	$\pi^\pm \pi^+ \pi^- \pi^0$	< 2.0	$\times 10^{-3}$	CL=84%

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 ± 1.6)	$\times 10^{-3}$	
Γ_8	$\pi^0 \gamma$	(4.7 ± 0.6)	$\times 10^{-4}$	S=1.4
Γ_9	$\eta \gamma$	(3.00 ± 0.21)	$\times 10^{-4}$	
Γ_{10}	$\pi^0 \pi^0 \gamma$	(4.5 ± 0.8)	$\times 10^{-5}$	
Γ_{11}	$\mu^+ \mu^-$	[a] (4.55 ± 0.28)	$\times 10^{-5}$	
Γ_{12}	$e^+ e^-$	[a] (4.72 ± 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 ± 0.9)	$\times 10^{-5}$	
Γ_{15}	$\pi^+ \pi^- \pi^0 \pi^0$	(1.6 ± 0.8)	$\times 10^{-5}$	
Γ_{16}	$\pi^0 e^+ e^-$	< 1.2	$\times 10^{-5}$	CL=90%
Γ_{17}	$\eta e^+ e^-$			

NODE=M009;CLUMP=B

DESIG=12;OUR EVAL;→ UNCHECKED ←

DESIG=60

DESIG=40

DESIG=8

DESIG=80

DESIG=6

DESIG=4

DESIG=7;OUR EVAL;→ UNCHECKED ←

DESIG=22

DESIG=30

DESIG=9

DESIG=10

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

LINKAGE=MD2

CONSTRAINED FIT INFORMATION

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

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

x_3	$\left \begin{array}{cc} -100 & \\ 15 & -15 \end{array} \right $
Γ	$\begin{array}{cc} & x_2 \quad x_3 \end{array}$

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

DESIG=11

DESIG=3

CONSTRAINED FIT INFORMATION

An overall fit to the total width, a partial width, and 7 branching ratios uses 22 measurements and one constraint to determine 9 parameters. The overall fit has a $\chi^2 = 9.5$ for 14 degrees of freedom.

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

x_7	-100								
x_8	-4	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)	Scale factor
Γ_6	$\pi^+ \pi^-$	147.5 $\pm$ 0.9	
Γ_7	$\pi^+ \pi^- \gamma$	1.48 $\pm$ 0.24	
Γ_8	$\pi^0 \gamma$	0.070 $\pm$ 0.009	1.4
Γ_9	$\eta \gamma$	0.0447 $\pm$ 0.0032	
Γ_{10}	$\pi^0 \pi^0 \gamma$	0.0066 $\pm$ 0.0012	
Γ_{11}	$\mu^+ \mu^-$	[a] 0.0068 $\pm$ 0.0004	
Γ_{12}	$e^+ e^-$	[a] 0.00704 $\pm$ 0.00006	
Γ_{14}	$\pi^+ \pi^- \pi^+ \pi^-$	0.0027 $\pm$ 0.0014	

DESIG=12

DESIG=60

DESIG=40

DESIG=8

DESIG=80

DESIG=6

DESIG=4

DESIG=22

$\rho(770)$ PARTIAL WIDTHS

NODE=M009230

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

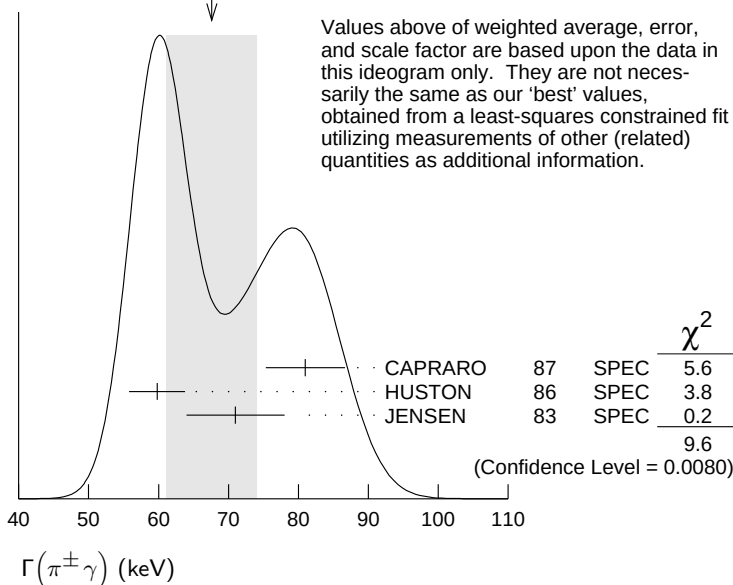
Γ_3

VALUE (keV)	DOCUMENT ID	TECN	CHG	COMMENT
68 $\pm$ 7 OUR FIT	Error includes scale factor of 2.3.			
68 $\pm$ 7 OUR AVERAGE	Error includes scale factor of 2.2. See the ideogram below.			
81 $\pm$ 4 $\pm$ 4	CAPRARO	87	SPEC	- 200 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	⁸⁵ AKHMETSHIN 07		$e^+e^- \rightarrow \pi^+\pi^-$
7.06 ±0.11 ±0.05	114k	^{86,87} 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	⁸⁸ ACHASOV 06	SND	$e^+e^- \rightarrow \pi^+\pi^-$
6.3 ±0.1		⁸⁹ 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	⁹⁰ 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	⁹¹ 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

- ⁸⁵ A combined fit of AKHMETSHIN 07, AULCHENKO 06, and AULCHENKO 05.
⁸⁶ Using the GOUNARIS 68 parametrization with the complex phase of the ρ - ω interference.
⁸⁷ From a fit in the energy range 0.61 to 0.96 GeV. Update of AKHMETSHIN 02.
⁸⁸ Supersedes ACHASOV 05A.
⁸⁹ Using the data of BARKOV 85 in the hidden local symmetry model.
⁹⁰ Using $\Gamma_{\text{total}} = 147.9 \pm 1.3$ MeV and $B(\rho \rightarrow \pi^0\gamma)$ from ACHASOV 03.
⁹¹ 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	^{92,93} ACHASOV 06	SND	$e^+e^- \rightarrow \pi^+\pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
4.72 ±0.02		⁹⁴ BENAYOUN 10	RVUE	0.4-1.05 e^+e^-
⁹² Supersedes ACHASOV 05A.				
⁹³ 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.				
⁹⁴ A simultaneous fit of $e^+e^- \rightarrow \pi^+\pi^-, \pi^+\pi^-\pi^0, \pi^0\gamma, \eta\gamma$ data.				

NODE=M009G4
 NODE=M009G4

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

NODE=M009G4;LINKAGE=BE

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

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	⁹⁵ ACHASOV 07B	SND	0.6-1.38 $e^+e^- \rightarrow \eta\gamma$
1.50±0.65±0.09	17.4k	⁹⁶ AKHMETSHIN 05	CMD2	0.60-1.38 $e^+e^- \rightarrow \eta\gamma$
1.61±0.20±0.11	23k	^{97,98} AKHMETSHIN 01B	CMD2	$e^+e^- \rightarrow \eta\gamma$
1.85±0.49		⁹⁹ DOLINSKY 89	ND	$e^+e^- \rightarrow \eta\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1.05±0.02		¹⁰⁰ BENAYOUN 10	RVUE	0.4-1.05 e^+e^-
⁹⁵ 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.				
⁹⁶ From the $\eta \rightarrow 2\gamma$ decay and using $B(\eta \rightarrow \gamma\gamma) = 39.43 \pm 0.26\%$.				
⁹⁷ From the $\eta \rightarrow 3\pi^0$ decay and using $B(\eta \rightarrow 3\pi^0) = (32.24 \pm 0.29) \times 10^{-2}$.				
⁹⁸ 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).				
⁹⁹ Recalculated by us from the cross section in the peak.				
¹⁰⁰ A simultaneous fit of $e^+e^- \rightarrow \pi^+\pi^-, \pi^+\pi^-\pi^0, \pi^0\gamma, \eta\gamma$ data.				

NODE=M009G1
 NODE=M009G1

NODE=M009G1;LINKAGE=AH

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

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

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

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

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

2.22 ± 0.29 OUR FIT Error includes scale factor of 1.4. $[(2.8 \pm 0.4) \times 10^{-8}$ OUR 2016 FIT]

2.22 ± 0.26 OUR AVERAGE Error includes scale factor of 1.3. See the ideogram below. $[(2.8 \pm 0.4) \times 10^{-8}$ OUR 2016 AVERAGE]

1.98 ± 0.22 ± 0.10 101 ACHASOV 16A SND 0.60-1.38 $e^+e^- \rightarrow \pi^0\gamma$

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 102 ACHASOV 03 SND 0.60-0.97 $e^+e^- \rightarrow \pi^0\gamma$

3.61 ± 0.74 ± 0.49 10625 103 DOLINSKY 89 ND $e^+e^- \rightarrow \pi^0\gamma$

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

1.875 ± 0.026 104 BENAYOUN 10 RVUE 0.4-1.05 e^+e^-

101 From the VMD model with the $\rho(770)$, $\omega(782)$, $\phi(1020)$ resonances, and an additional resonance describing the total contribution of the $\rho(1450)$ and $\omega(1420)$ states. Supersedes ACHASOV 2003.

102 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 $(-10.2 \pm 7.0)^\circ$.

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

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

NODE=M009G2
NODE=M009G2

NEW

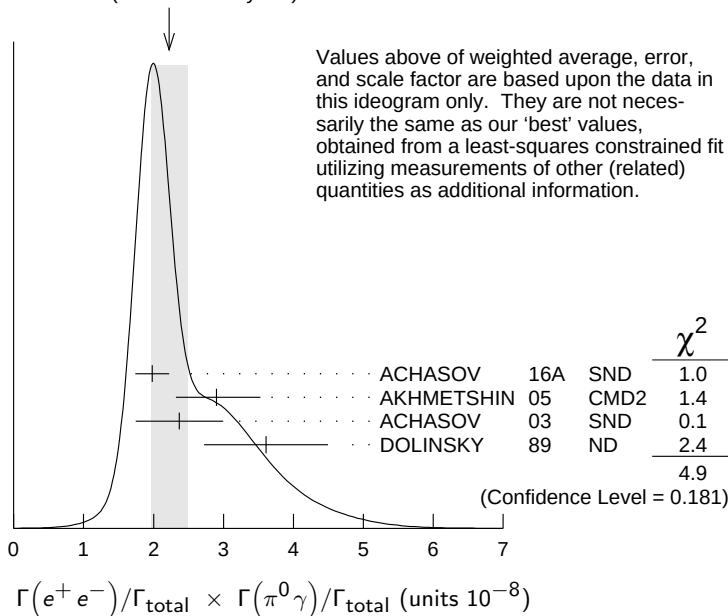
NEW

NODE=M009G2;LINKAGE=B

NODE=M009G;LINKAGE=SH

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

WEIGHTED AVERAGE
2.22±0.26 (Error scaled by 1.3)



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

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

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

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

0.903 ± 0.076 105 BENAYOUN 10 RVUE 0.4-1.05 e^+e^-

4.58 $^{+2.46}_{-1.64}$ ± 1.56 1.2M 106 ACHASOV 03D RVUE 0.44-2.00 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$

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

106 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 $\pm$ $\pi^\pm p$ above 2.5

NODE=M009R4
NODE=M009R4

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

 Γ_5/Γ_1

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

NODE=M009R1
NODE=M009R1

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

 Γ_{11}/Γ_6

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
4.60$\pm$0.28 OUR FIT			
4.6 $\pm$0.2 $\pm$0.2	ANTIPOV	89	SIGM $\pi^- \text{Cu} \rightarrow \mu^+ \mu^- \pi^- \text{Cu}$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
8.2 $\begin{smallmatrix} +1.6 \\ -3.6 \end{smallmatrix}$	108 ROTHWELL	69	CNTR Photoproduction
5.6 $\pm$ 1.5	109 WEHMANN	69	OSPK 12 $\pi^- \text{C, Fe}$
9.7 $\begin{smallmatrix} +3.1 \\ -3.3 \end{smallmatrix}$	110 HYAMS	67	OSPK 11 $\pi^- \text{Li, H}$

NODE=M009R5
NODE=M009R5

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

 Γ_{12}/Γ_1

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.40 $\pm$ 0.05	111 BENAKSAS	72	OSPK $e^+e^- \rightarrow \pi^+ \pi^-$

NODE=M009R3
NODE=M009R3

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

 Γ_9/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
3.00$\pm$0.21 OUR FIT					
2.90$\pm$0.32 OUR AVERAGE					
2.79 $\pm$ 0.34 $\pm$ 0.03	33k	112 ACHASOV	07B	SND	0.6–1.38 $e^+e^- \rightarrow \eta\gamma$
3.6 $\pm$ 0.9		113 ANDREWS	77	CNTR 0	6.7–10 γCu
• • • We do not use the following data for averages, fits, limits, etc. • • •					
3.21 $\pm$ 1.39 $\pm$ 0.20	17.4k	114,115 AKHMETSHIN	05	CMD2	0.60–1.38 $e^+e^- \rightarrow \eta\gamma$
3.39 $\pm$ 0.42 $\pm$ 0.23		113,116,117 AKHMETSHIN	01B	CMD2	$e^+e^- \rightarrow \eta\gamma$
1.9 $\begin{smallmatrix} +0.6 \\ -0.8 \end{smallmatrix}$		118 BENAYOUN	96	RVUE	0.54–1.04 $e^+e^- \rightarrow \eta\gamma$
4.0 $\pm$ 1.1		113,115 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$\pm$0.9 OUR FIT					
1.8$\pm$0.9$\pm$0.3	153		AKHMETSHIN 00	CMD2	0.6–0.97 $e^+e^- \rightarrow \pi^+\pi^-\pi^+\pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<20	90		KURDADZE	88	OLYA $e^+e^- \rightarrow \pi^+\pi^-\pi^+\pi^-$

NODE=M009R13
NODE=M009R13

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

 Γ_{14}/Γ_1

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

NODE=M009R11
NODE=M009R11

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

 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 $\begin{smallmatrix} +0.54 \\ -0.36 \end{smallmatrix}$ $\pm$ 0.34	1.2M	119 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. • • •					
$\sim$ 0.01		BRAMON	86	RVUE	0 $J/\psi \rightarrow \omega \pi^0$
<0.01	84	120 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
$1.60 \pm 0.74 \pm 0.18$		121 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		122 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		123 VASSERMAN 88	ND	$e^+e^- \rightarrow \pi^+\pi^-\gamma$
<0.005	90	124 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. • • •				
4.20 ± 0.52		107 ACHASOV 16A	SND	$0.60-1.38 \pi^0 e^+e^- \rightarrow \pi^0\gamma$
$6.21^{+1.28}_{-1.18} \pm 0.39$	18680	125,126 AKHMETSHIN 05	CMD2	$0.60-1.38 \pi^0 e^+e^- \rightarrow \pi^0\gamma$
$5.22 \pm 1.17 \pm 0.75$	36500	126,127 ACHASOV 03	SND	$0.60-0.97 \pi^0 e^+e^- \rightarrow \pi^0\gamma$
6.8 ± 1.7		128 BENAYOUN 96	RVUE	$0.54-1.04 \pi^0 e^+e^- \rightarrow \pi^0\gamma$
7.9 ± 2.0		126 DOLINSKY 89	ND	$e^+e^- \rightarrow \pi^0\gamma$
107 Using $B(\rho \rightarrow e^+e^-)$ from PDG15. Supersedes ACHASOV 2003.				

NODE=M009R9
 NODE=M009R9

ERROR=5

NODE=M009R9;LINKAGE=C

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

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<1.2	90	ACHASOV 08	SND	$0.36-0.97 \pi^0 e^+e^- \rightarrow \pi^0 e^+e^-$
• • • 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
• • • We do not use the following data for averages, fits, limits, etc. • • •			
<0.7	AKHMETSHIN 05A	CMD2	$0.72-0.84 e^+e^-$

NODE=M009R16
 NODE=M009R16

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

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
4.5 ± 0.8 OUR FIT				

NODE=M009R14
 NODE=M009R14

 $4.5^{+0.9}_{-0.8}$ OUR AVERAGE

$5.2^{+1.5}_{-1.3} \pm 0.6$	190	129 AKHMETSHIN 04B	CMD2	$0.6-0.97 \pi^0\pi^0\gamma e^+e^- \rightarrow \pi^0\pi^0\gamma$
$4.1^{+1.0}_{-0.9} \pm 0.3$	295	130 ACHASOV 02F	SND	$0.36-0.97 \pi^0\pi^0\gamma e^+e^- \rightarrow \pi^0\pi^0\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$4.8^{+3.4}_{-1.8} \pm 0.5$	63	131 ACHASOV 00G	SND	$e^+e^- \rightarrow \pi^0\pi^0\gamma$

OCCUR=2

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

109 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.

110 HYAMS 67's mass resolution is 20 MeV. The ω region was excluded.111 The ρ' contribution is not taken into account.

112 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.

113 Solution corresponding to constructive ω - ρ interference.114 Using $B(\rho \rightarrow e^+e^-) = (4.67 \pm 0.09) \times 10^{-5}$ and $B(\eta \rightarrow \gamma\gamma) = 39.43 \pm 0.26\%$.

NODE=M009R5;LINKAGE=R
 NODE=M009R5;LINKAGE=W

NODE=M009R5;LINKAGE=H
 NODE=M009R;LINKAGE=KS
 NODE=M009R7;LINKAGE=AO

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

- 115 Not independent of the corresponding $\Gamma(e^+e^-) \times \Gamma(\eta\gamma)/\Gamma_{\text{total}}^2$.
- 116 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).
- 117 Using $B(\rho \rightarrow e^+e^-) = (4.75 \pm 0.10) \times 10^{-5}$ from AKHMETSHIN 02 and $B(\eta \rightarrow 3\pi^0) = (32.24 \pm 0.29) \times 10^{-2}$.
- 118 Reanalysis of DRUZHININ 84, DOLINSKY 89, and DOLINSKY 91 taking into account a triangle anomaly contribution. Constructive ρ - ω interference solution.
- 119 Statistical significance is less than 3σ .
- 120 Model dependent, assumes $l = 1, 2$, or 3 for the 3π system.
- 121 Assuming no interference between the ρ and ω contributions.
- 122 Bremsstrahlung from a decay pion and for photon energy above 50 MeV.
- 123 Superseded by DOLINSKY 91.
- 124 Structure radiation due to quark rearrangement in the decay.
- 125 Using $B(\rho \rightarrow e^+e^-) = (4.67 \pm 0.09) \times 10^{-5}$.
- 126 Not independent of the corresponding $\Gamma(e^+e^-) \times \Gamma(\pi^0\gamma)/\Gamma_{\text{total}}^2$.
- 127 Using $B(\rho \rightarrow e^+e^-) = (4.54 \pm 0.10) \times 10^{-5}$.
- 128 Reanalysis of DRUZHININ 84, DOLINSKY 89, and DOLINSKY 91 taking into account a triangle anomaly contribution.
- 129 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.
- 130 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.
- 131 Superseded by ACHASOV 02F.

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$\rho(770)$ REFERENCES

ABLIKIM	17	PRL 118 012001	M. Ablikim <i>et al.</i>	(BES III Collab.)
ACHASOV	16A	PR D93 092001	M.N. Achasov <i>et al.</i>	(SND Collab.)
ABRAMOWICZ	12	EPJ C72 1869	H. Abramowicz <i>et al.</i>	(ZEUS Collab.)
LEES	12G	PR D86 032013	J.P. Lees <i>et al.</i>	(BABAR Collab.)
BENAYOUN	10	EPJ C65 211	M. Benayoun <i>et al.</i>	
ACHASOV	09A	JETP 109 379	M.N. Achasov <i>et al.</i>	(SND Collab.)
ACHASOV	08	Translated from ZETF 136 442. JETP 107 61	M.N. Achasov <i>et al.</i>	(SND Collab.)
FUJIKAWA	08	PR D78 072006	M. Fujikawa <i>et al.</i>	(BELLE Collab.)
ACHASOV	07B	PR D76 077101	M.N. Achasov <i>et al.</i>	(SND Collab.)
AKHMETSHIN	07	PL B648 28	R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)
ACHASOV	06	JETP 103 380	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)
ACHASOV	06A	Translated from ZETF 130 437. PR D74 014016	M.N. Achasov <i>et al.</i>	(SND Collab.)
AULCHENKO	06	JETPL 84 413	V.M. Aulchenko <i>et al.</i>	(Novosibirsk CMD-2 Collab.)
ACHASOV	05A	Translated from ZETFP 84 491. JETP 101 1053	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)
AKHMETSHIN	05	PL B605 26	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)
AKHMETSHIN	05A	PL B613 29	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)
ALOISIO	05	PL B606 12	A. Aloisio <i>et al.</i>	(KLOE Collab.)
AULCHENKO	05	JETPL 82 743	V.M. Aulchenko <i>et al.</i>	(Novosibirsk CMD-2 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.)
AKHMETSHIN	04B	PL B580 119	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)
ACHASOV	03	PL B559 171	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)
ACHASOV	03D	PR D68 052006	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)
ALOISIO	03	PL B561 55	A. Aloisio <i>et al.</i>	(KLOE Collab.)
SANZ-CILLERO	03	EPJ C27 587	J.J. Sanz-Cillero, A. Pich	
ACHASOV	02	PR D65 032002	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)
ACHASOV	02F	PL B537 201	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)
AKHMETSHIN	02	PL B527 161	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)
AKHMETSHIN	01B	PL B509 217	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)
COLANGELO	01	NP B603 125	G. Colangelo, J. Gasser, H. Leytwyler	
PICH	01	PR D63 093005	A. Pich, J. Portoles	
ACHASOV	00	EPJ C12 25	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)
ACHASOV	00D	JETPL 72 282	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)
ACHASOV	00G	Translated from ZETFP 72 411. JETPL 71 355	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)
AKHMETSHIN	00	PL B475 190	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)
ANDERSON	00A	PR D61 112002	S. Anderson <i>et al.</i>	(CLEO Collab.)
ABELE	99E	PL B469 270	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
BENAYOUN	98	EPJ C2 269	M. Benayoun <i>et al.</i>	(IPNP, NOVO, ADLD+)
BREITWEG	98B	EPJ C2 247	J. Breitweg <i>et al.</i>	(ZEUS Collab.)
GARDNER	98	PR D57 2716	S. Gardner, H.B. O'Connell	
ABELE	97	Also PR D62 019903 (err.) PL B391 191	S. Gardner, H.B. O'Connell A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
ADAMS	97	ZPHY C74 237	M.R. Adams <i>et al.</i>	(E665 Collab.)
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.)
BOGOLYUB...	97	PAN 60 46	M.Y. Bogolyubsky <i>et al.</i>	(MOSU, SERP)
		Translated from YAF 60 53.		

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O'CONNELL	97	NP A623 559	H.B. O'Connell <i>et al.</i>	(ADLD)	REFID=45860
BENAYOUN	96	ZPHY C72 221	M. Benayoun <i>et al.</i>	(IPNP, NOVO)	REFID=45753
BERNICA	94	PR D50 4454	A. Bernica, G. Lopez Castro, J. Pestieau	(LOUV+)	REFID=44097
WEIDENAUER	93	ZPHY C59 387	P. Weidenauer <i>et al.</i>	(ASTERIX Collab.)	REFID=43585
AGUILAR-...	91	ZPHY C50 405	M. Aguilar-Benitez <i>et al.</i>	(LEBC-EHS Collab.)	REFID=41637
DOLINSKY	91	PRPL 202 99	S.I. Dolinsky <i>et al.</i>	(NOVO)	REFID=41369
KUHN	90	ZPHY C48 445	J.H. Kuhn <i>et al.</i>	(MPIM)	REFID=45862
ANTIPOV	89	ZPHY C42 185	Y.M. Antipov <i>et al.</i>	(SERP, JINR, BGNA+)	REFID=40739
BISELLO	89	PL B220 321	D. Bisello <i>et al.</i>	(DM2 Collab.)	REFID=40740
DOLINSKY	89	ZPHY C42 511	S.I. Dolinsky <i>et al.</i>	(NOVO)	REFID=41003
DUBNICKA	89	JP G15 1349	S. Dubnicka <i>et al.</i>	(JINR, SLOV)	REFID=44082
GESHKEN...	89	ZPHY C45 351	B.V. Geshkenbein	(ITEP)	REFID=41017
KURDADZE	88	JETPL 47 512	L.M. Kurdadze <i>et al.</i>	(NOVO)	REFID=41121
VASSERMAN	88	Translated from ZETFP 47 432. SJNP 47 1035	I.B. Vasserman <i>et al.</i>	(NOVO)	REFID=41019
VASSERMAN	88B	Translated from YAF 47 1635. SJNP 48 480	I.B. Vasserman <i>et al.</i>	(NOVO)	REFID=41020
AULCHENKO	87C	Translated from YAF 48 753. IYF 87-90 Preprint	V.M. Aulchenko <i>et al.</i>	(NOVO)	REFID=41370
CAPRARO	87	NP B288 659	L. Capraro <i>et al.</i>	(CLER, FRAS, MILA+)	REFID=40003
BRAMON	86	PL B173 97	A. Bramon, J. Casulleras	(BARC)	REFID=22102
HUSTON	86	PR D33 3199	J. Huston <i>et al.</i>	(ROCH, FNAL, MINN)	REFID=20137
KURDADZE	86	JETPL 43 643	L.M. Kurdadze <i>et al.</i>	(NOVO)	REFID=40287
BARKOV	85	NP B256 365	L.M. Barkov <i>et al.</i>	(NOVO)	REFID=20134
DRUZHININ	84	PL 144B 136	V.P. Druzhinin <i>et al.</i>	(NOVO)	REFID=20561
CHABAUD	83	NP B223 1	V. Chabaud <i>et al.</i>	(CERN, CRAC, MPIM)	REFID=20131
JENSEN	83	PR D27 26	T. Jensen <i>et al.</i>	(ROCH, FNAL, MINN)	REFID=20132
HEYN	81	ZPHY C7 169	M.F. Heyn, C.B. Lang	(GRAZ)	REFID=20129
BOHACIK	80	PR D21 1342	J. Bohacik, H. Kuhnelt	(SLOW, WIEN)	REFID=20128
LANG	79	PR D19 956	C.B. Lang, A. Mas-Parareda	(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

$\omega(782)$

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

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 $\omega(782)$ 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 $\pi^+ p \rightarrow \rho \pi^+ \pi^+ \pi^- \pi^0$
784.1 ±1.2	750	ABRAMOVI... 70	HBC	3.9 $\pi^- p$
783.2 ±1.6		⁹ BIGGS 70B	CNTR	<4.1 $\gamma C \rightarrow \pi^+ \pi^- C$
782.4 ±0.5	2400	BIZZARRI 69	HBC	0.0 $\bar{p} p$

OCCUR=2

OCCUR=2

OCCUR=2

¹ Update of AKHMETSHIN 00C.² From the combined fit of ANTONELLI 92, ACHASOV 01E, ACHASOV 02E, and ACHASOV 03D data on the $\pi^+\pi^-\pi^0$ and ANTONELLI 92 on the $\omega\pi^+\pi^-$ final states. Supersedes ACHASOV 99E and ACHASOV 02E.³ From the $\eta \rightarrow \gamma\gamma$ decay.⁴ From the $\eta \rightarrow 3\pi^0$ decay.⁵ Observed by threshold-crossing technique. Mass resolution = 4.8 MeV FWHM.⁶ From the $\rho-\omega$ interference in the $\pi^+\pi^-$ mass spectrum using the Breit-Wigner for the ω and leaving its mass and width as free parameters of the fit.⁷ Systematic uncertainties underestimated.⁸ From best-resolution sample of COYNE 71.⁹ From $\omega-\rho$ interference in the $\pi^+\pi^-$ mass spectrum assuming ω width 12.6 MeV.

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NODE=M001M;LINKAGE=S2

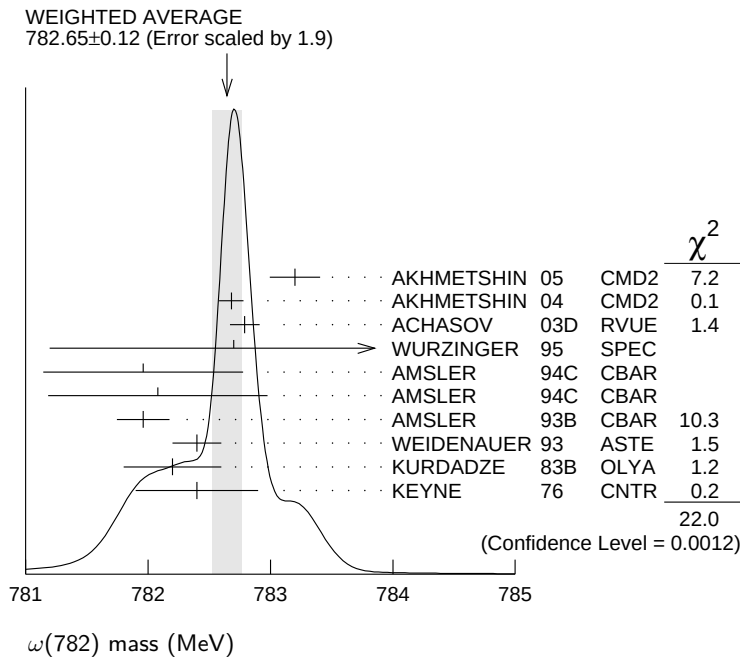
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$\omega(782)$ WIDTH

NODE=M001W

NODE=M001W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
8.49±0.08 OUR AVERAGE				
8.68±0.23±0.10	11200	¹ AKHMETSHIN 04	CMD2	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
8.68±0.04±0.15	1.2M	² ACHASOV 03D	RVUE	0.44–2.00 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
8.2 ±0.3	19500	WURZINGER 95	SPEC	1.33 $pd \rightarrow {}^3\text{He}\omega$
8.4 ±0.1		³ AULCHENKO 87	ND	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
8.30±0.40		BARKOV 87	CMD	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
9.8 ±0.9	1488	KURDADZE 83B	OLYA	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
9.0 ±0.8	433	CORDIER 80	DM1	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
9.1 ±0.8	451	BENAKSAS 72B	OSPK	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
8.13±0.45		⁴ LEES 12G	BABR	$e^+e^- \rightarrow \pi^+\pi^-\gamma$
12 ±2	1430	COOPER 78B	HBC	0.7–0.8 $\bar{p}p \rightarrow 5\pi$
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 $\pi^-p \rightarrow nMM$
10.3 ±1.4	510	BIZZARRI 71	HBC	0.0 $p\bar{p} \rightarrow K_1^0 K_1^0 \omega$
12.8 ±3.0	248	BIZZARRI 71	HBC	0.0 $p\bar{p} \rightarrow K^+ K^- \omega$
9.5 ±1.0	3583	COYNE 71	HBC	3.7 $\pi^+p \rightarrow \rho\pi^+\pi^+\pi^-\pi^0$

OCCUR=2

¹ Update of AKHMETSHIN 00C.² From the combined fit of ANTONELLI 92, ACHASOV 01E, ACHASOV 02E, and ACHASOV 03D data on the $\pi^+\pi^-\pi^0$ and ANTONELLI 92 on the $\omega\pi^+\pi^-$ final states. Supersedes ACHASOV 99E and ACHASOV 02E.³ 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=VHNODE=M001W;LINKAGE=D
NODE=M001W;LINKAGE=LE

NODE=M001W;LINKAGE=B

$\omega(782)$ DECAY MODES

NODE=M001215;NODE=M001

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
Γ_1 $\pi^+\pi^-\pi^0$	(89.2 ±0.7) %	
Γ_2 $\pi^0\gamma$	(8.40±0.22) %	S=1.8
Γ_3 $\pi^+\pi^-$	(1.53 ^{+0.11} _{-0.13}) %	S=1.2
Γ_4 neutrals (excluding $\pi^0\gamma$)	(7 ⁺⁷ ₋₄) × 10 ⁻³	S=1.1

DESIG=1

DESIG=3

DESIG=2

DESIG=13

Γ_5	$\eta\gamma$	$(4.5 \pm 0.4) \times 10^{-4}$	S=1.1	DESIG=6
Γ_6	$\pi^0 e^+ e^-$	$(7.7 \pm 0.6) \times 10^{-4}$		DESIG=14
Γ_7	$\pi^0 \mu^+ \mu^-$	$(1.34 \pm 0.18) \times 10^{-4}$	S=1.5	DESIG=11
Γ_8	$\eta e^+ e^-$			DESIG=18
Γ_9	$e^+ e^-$	$(7.36 \pm 0.15) \times 10^{-5}$	S=1.5	DESIG=7
Γ_{10}	$\pi^+ \pi^- \pi^0 \pi^0$	$< 2 \times 10^{-4}$	CL=90%	DESIG=12
Γ_{11}	$\pi^+ \pi^- \gamma$	$< 3.6 \times 10^{-3}$	CL=95%	DESIG=4
Γ_{12}	$\pi^+ \pi^- \pi^+ \pi^-$	$< 1 \times 10^{-3}$	CL=90%	DESIG=15
Γ_{13}	$\pi^0 \pi^0 \gamma$	$(6.7 \pm 1.1) \times 10^{-5}$		DESIG=5
Γ_{14}	$\eta \pi^0 \gamma$	$< 3.3 \times 10^{-5}$	CL=90%	DESIG=17
Γ_{15}	$\mu^+ \mu^-$	$(9.0 \pm 3.1) \times 10^{-5}$		DESIG=8
Γ_{16}	3γ	$< 1.9 \times 10^{-4}$	CL=95%	DESIG=10

Charge conjugation (C) violating modes

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

CONSTRAINED FIT INFORMATION

An overall fit to 15 branching ratios uses 53 measurements and one constraint to determine 10 parameters. The overall fit has a $\chi^2 = 56.6$ for 44 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	29								
x_3	-18	-5							
x_4	-94	-55	1						
x_5	7	16	-1	-12					
x_6	-1	0	0	0	0				
x_7	0	0	0	0	0	0			
x_9	-36	-70	6	52	-22	0	0		
x_{13}	1	3	0	-2	0	0	0	-2	
x_{15}	0	0	0	0	0	0	0	0	0
	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_9	x_{13}

$\omega(782)$ PARTIAL WIDTHS

NODE=M001218

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

 Γ_2

VALUE (keV)	EVTs	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
880 ± 50	7815	¹ ACHASOV	13	SND $1.05\text{--}2.00 e^+ e^- \rightarrow \pi^0 \pi^0 \gamma$
$788 \pm 12 \pm 27$	36500	² ACHASOV	03	SND $0.60\text{--}0.97 e^+ e^- \rightarrow \pi^0 \gamma$
764 ± 51	10625	DOLINSKY	89	ND $e^+ e^- \rightarrow \pi^0 \gamma$

¹ Systematic uncertainty not estimated.

² Using $\Gamma_\omega = 8.44 \pm 0.09$ MeV and $B(\omega \rightarrow \pi^0 \gamma)$ from ACHASOV 03.

NODE=M001W1
NODE=M001W1NODE=M001W1;LINKAGE=AC
NODE=M001W1;LINKAGE=AD

$\Gamma(\eta \gamma)$

 Γ_5

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
6.1 ± 2.5	¹ DOLINSKY	89	ND $e^+ e^- \rightarrow \eta \gamma$

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

NODE=M001W2
NODE=M001W2

NODE=M001W2;LINKAGE=DA

$\Gamma(e^+e^-)$ Γ_9

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT

0.60 ±0.02 OUR EVALUATION

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

0.591±0.015	11200	^{1,2} AKHMETSHIN 04	CMD2	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
0.653±0.003±0.021	1.2M	³ ACHASOV 03D	RVUE	$0.44-2.00 e^+e^- \rightarrow \pi^+\pi^-\pi^0\gamma$
0.600±0.031	10625	DOLINSKY 89	ND	$e^+e^- \rightarrow \pi^0\gamma$

¹ Using $B(\omega \rightarrow \pi^+\pi^-\pi^0) = 0.891 \pm 0.007$ and $\Gamma_{\text{total}} = 8.44 \pm 0.09$ MeV.² Update of AKHMETSHIN 00C.³ Using ACHASOV 03, ACHASOV 03D and $B(\omega \rightarrow \pi^+\pi^-) = (1.70 \pm 0.28)\%$.

NODE=M001W7

NODE=M001W7

→ UNCHECKED ←

NODE=M001W7;LINKAGE=3P

NODE=M001W7;LINKAGE=PT

NODE=M001W;LINKAGE=VF

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

NODE=M001225

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

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

6.56±0.12 OUR FIT Error includes scale factor of 1.6. $[(6.49 \pm 0.11) \times 10^{-5}$ OUR 2016 FIT Scale factor = 1.3]**6.38±0.10 OUR AVERAGE** Error includes scale factor of 1.1.

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

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

6.20±0.13 ⁴ BENAYOUN 10 RVUE 0.4-1.05 e^+e^- ¹ Update of AKHMETSHIN 00C.² Recalculated by us from the cross section in the peak.³ From the combined fit of ANTONELLI 92, ACHASOV 01E, ACHASOV 02E, and ACHASOV 03D data on the $\pi^+\pi^-\pi^0$ and ANTONELLI 92 on the $\omega\pi^+\pi^-$ final states. Supersedes ACHASOV 99E and ACHASOV 02E.⁴ A simultaneous fit of $e^+e^- \rightarrow \pi^+\pi^-, \pi^+\pi^-\pi^0, \pi^0\gamma, \eta\gamma$ data.

NODE=M001G2

NODE=M001G2

NEW

NODE=M001G;LINKAGE=PT

NODE=M001G;LINKAGE=LP

NODE=M001G;LINKAGE=VH

NODE=M001G2;LINKAGE=BE

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

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

6.18 ±0.11 OUR FIT Error includes scale factor of 1.6. $[(6.02 \pm 0.20) \times 10^{-6}$ OUR 2016 FIT Scale factor = 1.9]**6.37 ±0.09 OUR AVERAGE** $[(6.45 \pm 0.17) \times 10^{-6}$ OUR 2016 AVERAGE]

6.336±0.056±0.089		¹ ACHASOV 16A	SND	$0.60-1.38 e^+e^- \rightarrow \pi^0\gamma$
6.47 ±0.14 ±0.39	18680	AKHMETSHIN 05	CMD2	$0.60-1.38 e^+e^- \rightarrow \pi^0\gamma$
6.50 ±0.11 ±0.20	36500	² ACHASOV 03	SND	$0.60-0.97 e^+e^- \rightarrow \pi^0\gamma$
6.34 ±0.21 ±0.21	10625	³ DOLINSKY 89	ND	$e^+e^- \rightarrow \pi^0\gamma$

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

6.80 ±0.13 ⁴ BENAYOUN 10 RVUE 0.4-1.05 e^+e^- ¹ From the VMD model with the interfering $\rho(770)$, $\omega(782)$, $\phi(1020)$, and an additional resonance describing the total contribution of the $\rho(1450)$ and $\omega(1420)$ states. Supersedes ACHASOV 2003.² Using $\sigma_{\phi \rightarrow \pi^0\gamma}$ from ACHASOV 00 and $m_\omega = 782.57$ MeV in the model with the energy-independent phase of ρ - ω interference equal to $(-10.2 \pm 7.0)^\circ$.³ Recalculated by us from the cross section in the peak.⁴ A simultaneous fit of $e^+e^- \rightarrow \pi^+\pi^-, \pi^+\pi^-\pi^0, \pi^0\gamma, \eta\gamma$ data.

NODE=M001G4

NODE=M001G4

NEW

NEW

NODE=M001G4;LINKAGE=A

NODE=M001G;LINKAGE=SH

NODE=M001G4;LINKAGE=LP

NODE=M001G4;LINKAGE=BE

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

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

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

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

1.166±0.036 ² BENAYOUN 13 RVUE 0.4-1.05 e^+e^- 1.05 ±0.08 ³ DAVIER 13 RVUE $e^+e^- \rightarrow \pi^+\pi^-(\gamma)$

NODE=M001G5

NODE=M001G5

¹Supersedes ACHASOV 05A.

²A simultaneous fit to $e^+e^- \rightarrow \pi^+\pi^-, \pi^+\pi^-\pi^0, \pi^0\gamma, \eta\gamma, K\bar{K}$, and $\tau^- \rightarrow \pi^-\pi^0\nu_\tau$ data. Supersedes BENAYOUN 10.

³From $e^+e^- \rightarrow \pi^+\pi^-(\gamma)$ data of LEES 12G.

NODE=M001G5;LINKAGE=AC

NODE=M001G5;LINKAGE=B

NODE=M001G5;LINKAGE=A

NODE=M001G3

NODE=M001G3

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

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

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

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

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

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

¹From 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.

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

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

⁴The 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).

⁵A simultaneous fit of $e^+e^- \rightarrow \pi^+\pi^-, \pi^+\pi^-\pi^0, \pi^0\gamma, \eta\gamma$ data.

NODE=M001G3;LINKAGE=AH

NODE=M001G;LINKAGE=AH

NODE=M001G;LINKAGE=AK

NODE=M001G;LINKAGE=BQ

NODE=M001G3;LINKAGE=BE

$\omega(782)$ 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 ¹AMBROSINO 08G KLOE 1.0–1.03 $e^+e^- \rightarrow \pi^+\pi^-\pi^0, 2\pi^0\gamma$

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

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

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

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

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

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

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

NODE=M001R21;LINKAGE=AM

NODE=M001R;LINKAGE=VF

NODE=M001R;LINKAGE=ZL

NODE=M001R;LINKAGE=KH

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

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

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

8.88±0.18 ¹ACHASOV 16A SND 0.60–1.38 $e^+e^- \rightarrow \pi^0\gamma$

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

9.06±0.20±0.57 18680 ^{3,4}AKHMETSHIN 05 CMD2 0.60–1.38 $e^+e^- \rightarrow \pi^0\gamma$

9.34±0.15±0.31 36500 ⁴ACHASOV 03 SND 0.60–0.97 $e^+e^- \rightarrow \pi^0\gamma$

8.65±0.16±0.42 1.2M ^{5,6}ACHASOV 03D RVUE 0.44–2.00 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$

8.39±0.24 9975 ⁷BENAYOUN 96 RVUE $e^+e^- \rightarrow \pi^0\gamma$

8.88±0.62 10625 ⁴DOLINSKY 89 ND $e^+e^- \rightarrow \pi^0\gamma$

¹Using $B(\omega \rightarrow e^+e^-)$ from PDG15. Supersedes ACHASOV 2003.

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

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

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

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

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

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

NODE=M001R28

NODE=M001R28

NODE=M001R28;LINKAGE=A

NODE=M001R28;LINKAGE=AM

NODE=M001R;LINKAGE=AH

NODE=M001R;LINKAGE=VL

NODE=M001R28;LINKAGE=VF

NODE=M001R28;LINKAGE=ZL

NODE=M001R28;LINKAGE=A1

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

DOCUMENT ID

TECN

COMMENT

9.41±0.23 OUR FIT Error includes scale factor of 2.0. $[(9.28 \pm 0.31) \times 10^{-2}$ OUR 2016 FIT Scale factor = 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

NEW

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.

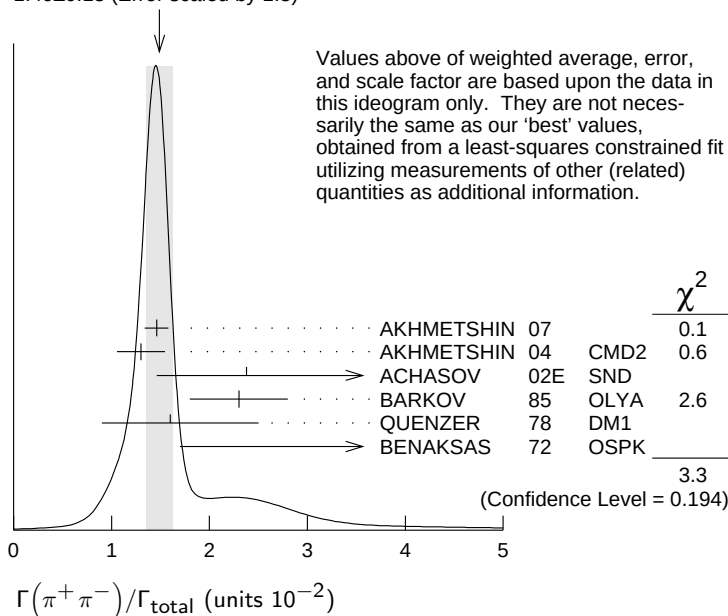
⁹ Re-evaluated under $\Gamma(\pi^+\pi^-)/\Gamma(\pi^+\pi^-\pi^0)$ by BEHREND 71 using more accurate $\omega \rightarrow \rho$ photoproduction cross-section ratio.

NODE=M001R15
NODE=M001R15
NODE=M001R15

NODE=M001R15;LINKAGE=AK
NODE=M001R15;LINKAGE=PT
NODE=M001R;LINKAGE=VE

NODE=M001R;LINKAGE=SN
NODE=M001R;LINKAGE=BY
NODE=M001R15;LINKAGE=H4
NODE=M001R15;LINKAGE=Q
NODE=M001R15;LINKAGE=F
NODE=M001R15;LINKAGE=B

WEIGHTED AVERAGE
1.49±0.13 (Error scaled by 1.3)



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

Γ_3/Γ_1

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

VALUE	DOCUMENT ID	TECN	COMMENT
0.0172±0.0014 OUR FIT	Error includes scale factor of 1.2.		
0.026 ±0.005 OUR AVERAGE			
0.021 +0.028 -0.009	^{1,2} RATCLIFF	72	ASPK 15 $\pi^- p \rightarrow n2\pi$
0.028 ±0.006	¹ BEHREND	71	ASPK Photoproduction
0.022 +0.009 -0.01	³ ROOS	70	RVUE

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

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

³ ROOS 70 combines ABRAMOVICH 70 and BIZZARRI 70.

NODE=M001R2

NODE=M001R2

NODE=M001R2

NODE=M001R2;LINKAGE=A

NODE=M001R2;LINKAGE=S

NODE=M001R2;LINKAGE=R

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

Γ_3/Γ_2

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

¹ Using the data of ALOISIO 02D.

NODE=M001R33

NODE=M001R33

NODE=M001R;LINKAGE=KL

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

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

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

NODE=M001R14

NODE=M001R14

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

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

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

NODE=M001R1

NODE=M001R1

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

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

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

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

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

NODE=M001R18
NODE=M001R18

NODE=M001R18;LINKAGE=D

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

VALUE	DOCUMENT ID	TECN	COMMENT

0.100 ± 0.008 OUR FIT

0.124 ± 0.021

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

NODE=M001R9
NODE=M001R9

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

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

4.5 ± 0.4 OUR FIT Error includes scale factor of 1.1. $[(4.6 \pm 0.4) \times 10^{-4} \text{ OUR 2016 FIT Scale factor} = 1.1]$

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

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

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

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

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

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

³ ACHASOV 07B reports $[\Gamma(\omega(782) \rightarrow \eta\gamma)/\Gamma_{\text{total}}] \times [B(\omega(782) \rightarrow e^+ e^-)] = (3.10 \pm 0.31 \pm 0.11) \times 10^{-8}$ which we divide by our best value $B(\omega(782) \rightarrow e^+ e^-) = (7.36 \pm 0.15) \times 10^{-5}$. Our first error is their experiment's error and our second error is the systematic error from using our best value. Supersedes ACHASOV 00D and ACHASOV 06A.

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

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

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

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

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

NODE=M001R19
NODE=M001R19

NEW

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

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

NODE=M001R;LINKAGE=CS

NODE=M001R19;LINKAGE=A1

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

VALUE	DOCUMENT ID	TECN	COMMENT

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

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

¹ Model independent determination.

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

NODE=M001R11
NODE=M001R11

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

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

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

7.7 ± 0.6 OUR FIT

7.7 ± 0.6 OUR AVERAGE

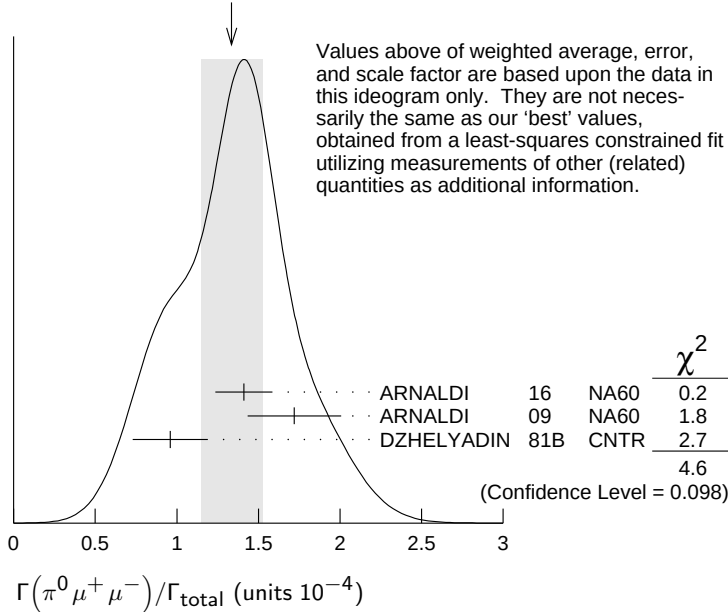
$7.61 \pm 0.53 \pm 0.64$		ACHASOV	08	SND	$0.36\text{--}0.97 e^+ e^- \rightarrow \pi^0 e^+ e^-$
$8.19 \pm 0.71 \pm 0.62$		AKHMETSHIN	05A	CMD2	$0.72\text{--}0.84 e^+ e^-$
5.9 ± 1.9	43	DOLINSKY	88	ND	$e^+ e^- \rightarrow \pi^0 e^+ e^-$

NODE=M001R23
NODE=M001R23

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

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
1.34±0.18 OUR FIT				Error includes scale factor of 1.5. $[(1.3 \pm 0.4) \times 10^{-4}$ OUR 2016 FIT Scale factor = 2.1]
1.34±0.19 OUR AVERAGE				Error includes scale factor of 1.5. See the ideogram below. $[(1.3 \pm 0.4) \times 10^{-4}$ OUR 2016 AVERAGE Scale factor = 2.1]
1.41±0.09±0.15		ARNALDI	16	NA60 400 GeV (p -A) collisions
1.72±0.25±0.14	3k	ARNALDI	09	NA60 158A In-In collisions
0.96±0.23		DZHELYADIN	81B	CNTR 25-33 $\pi^- p \rightarrow \omega n$

WEIGHTED AVERAGE
1.34±0.19 (Error scaled by 1.5)

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

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
<1.1	AKHMETSHIN 05A	CMD2	0.72-0.84 $e^+ e^-$

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

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
0.736±0.015 OUR FIT				Error includes scale factor of 1.5. $[(0.728 \pm 0.014) \times 10^{-4}$ OUR 2016 FIT Scale factor = 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.

 $\Gamma(\pi^+ \pi^- \pi^0 \pi^0)/\Gamma_{\text{total}}$ 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=M001R34
NODE=M001R34

NODE=M001R13
NODE=M001R13

NEW

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

NODE=M001R5
NODE=M001R5

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

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

NODE=M001R22
 NODE=M001R22

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

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

NODE=M001R4
 NODE=M001R4

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

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

NODE=M001R24
 NODE=M001R24

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

VALUE (units 10 ⁻⁵)	EVTS	DOCUMENT ID	TECN	COMMENT
6.7 ± 1.1 OUR FIT [(6.6 ± 1.1) × 10 ⁻⁵ OUR 2016 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 ⁻ → π ⁰ π ⁰ γ
6.6 ^{+1.4} _{-1.3} ± 0.6	295	ACHASOV 02F	SND	0.36–0.97 e ⁺ e ⁻ → π ⁰ π ⁰ γ
• • • We do not use the following data for averages, fits, limits, etc. • • •				
11.8 ^{+2.1} _{-1.9} ± 1.4	190	² AKHMETSHIN 04B	CMD2	0.6–0.97 e ⁺ e ⁻ → π ⁰ π ⁰ γ
7.8 ± 2.7 ± 2.0	63	^{1,3} ACHASOV 00G	SND	e ⁺ e ⁻ → π ⁰ π ⁰ γ
12.7 ± 2.3 ± 2.5	63	^{2,3} ACHASOV 00G	SND	e ⁺ e ⁻ → π ⁰ π ⁰ γ

NODE=M001R29
 NODE=M001R29

NEW

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 ⁻ → π ⁰ π ⁰ γ
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.08	95	JACQUET 69B	HLBC	2.05 π ⁺ ρ → π ⁺ ρω

NODE=M001R10
 NODE=M001R10

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

VALUE (units 10 ⁻⁴)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
7.9 ± 1.3 OUR FIT [(8.0 ± 1.3) × 10 ⁻⁴ OUR 2016 FIT]					
8.5 ± 2.9	40 ± 14	ALDE 94B	GAM2	38π ⁻ ρ	→ π ⁰ π ⁰ γn
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 50	90	DOLINSKY 89	ND	e ⁺ e ⁻ → π ⁰ π ⁰ γ	
<1800	95	KEYNE 76	CNTR	π ⁻ ρ → ωn	
<1500	90	BENAKSAS 72c	OSPK	e ⁺ e ⁻	
<1400		BALDIN 71	HLBC	2.9 π ⁺ ρ	
<1000	90	BARMIN 64	HLBC	1.3–2.8 π ⁻ ρ	

NODE=M001R7
 NODE=M001R7

NEW

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

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.22 ± 0.07		¹ DAKIN 72	OSPK	1.4 π ⁻ ρ → nMM
<0.19	90	DEINET 69B	OSPK	

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

NODE=M001R17
 NODE=M001R17

NODE=M001R17;LINKAGE=D

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

VALUE (units 10 ⁻⁵)	CL%	DOCUMENT ID	TECN	COMMENT
<3.3	90	AKHMETSHIN 04B	CMD2	0.6–0.97 e ⁺ e ⁻ → ηπ ⁰ γ

NODE=M001R32
 NODE=M001R32

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

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT
9.0±3.1 OUR FIT				
9.0±2.9±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	$12 \pi^- C \rightarrow \text{Fe}$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<1.7	74	FLATTE	66 HBC	$1.2 - 1.7 K^- p \rightarrow \Lambda \mu^+ \mu^-$
<1.2		BARBARO-...	65 HBC	$2.7 K^- p$

NODE=M001R6
NODE=M001R6

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

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

¹ Superseded by DZHELYADIN 81B result above.

NODE=M001R20
NODE=M001R20

NODE=M001R20;LINKAGE=S

$\Gamma(3\gamma)/\Gamma_{\text{total}}$ Γ_{16}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.9	95	¹ ABELE	97E CBAR	$0.0 \bar{p} p \rightarrow 5\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<2	90	¹ PROKOSHKIN	95 GAM2	$38 \pi^- p \rightarrow 3\gamma n$

¹ From direct 3γ decay search.

NODE=M001R27
NODE=M001R27

NODE=M001R27;LINKAGE=A

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

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

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

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	$1.2 - 1.7 K^- p \rightarrow \Lambda \pi^+ \pi^- \text{MM}$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.045	95	JACQUET	69B HLBC	$2.05 \pi^+ p \rightarrow \pi^+ p \omega$

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

NODE=M001R8
NODE=M001R8

NODE=M001R8;LINKAGE=A

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

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

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

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
<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 $\omega \rightarrow \pi^0 \mu^+ \mu^-$ DECAY

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

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

where for the parameter Λ vector dominance predicts $\Lambda = M_\rho \approx 0.770$ GeV. The ARNALDI 09 measurement is in obvious conflict with this expectation. Note that for $\eta \rightarrow \mu^+ \mu^- \gamma$ 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
0.670 ± 0.006 OUR AVERAGE				
[0.668 ± 0.009 GeV OUR 2016 AVERAGE]				
0.6707 ± 0.0039 ± 0.0056		¹ ARNALDI	16	NA60 400 GeV (p -A) collisions
0.668 ± 0.009 ± 0.003	3k	² ARNALDI	09	NA60 158A In-In collisions
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.65 ± 0.03		DZHELYADIN	81B	CNTR 25-33 $\pi^- p \rightarrow \omega n$
¹ ARNALDI 16 reports $\Lambda^{-2}(\omega) = 2.223 \pm 0.026 \pm 0.037$ GeV ⁻² which we converted to the quoted Λ value.				
² ARNALDI 09 reports $\Lambda^{-2}(\omega) = 2.24 \pm 0.06 \pm 0.02$ GeV ⁻² which we converted to the quoted Λ value.				

NODE=M001LAM

NEW

NODE=M001LAM;LINKAGE=A

NODE=M001LAM;LINKAGE=B

 $\omega(782)$ REFERENCES

NODE=M001

ACHASOV	16A	PR D93 092001	M.N. Achasov <i>et al.</i>	(SND Collab.)
ARNALDI	16	PL B757 437	R. Arnaldi <i>et al.</i>	(NA60 Collab.)
ACHASOV	13	PR D88 054013	M.N. Achasov <i>et al.</i>	(SND Collab.)
BENAYOUN	13	EPJ C73 2453	M. Benayoun, P. David, L. DelBuono (PARIN, BERLIN+)	
DAVIER	13	EPJ C73 2597	M. Davier <i>et al.</i>	
LEES	12G	PR D86 032013	J.P. Lees <i>et al.</i>	(BABAR Collab.)
NIECKNIG	12	EPJ C72 2014	F. Niecknig, B. Kubis, S.P. Schneider	(BONN)
BENAYOUN	10	EPJ C65 211	M. Benayoun <i>et al.</i>	
ACHASOV	09A	JETP 109 379	M.N. Achasov <i>et al.</i>	(SND Collab.)
Translated from ZETF 136 442.				
ARNALDI	09	PL B677 260	R. Arnaldi <i>et al.</i>	(NA60 Collab.)
STAROSTIN	09	PR C79 065201	A. Starostin <i>et al.</i>	(Crystal Ball Collab. at MAMI)
ACHASOV	08	JETP 107 61	M.N. Achasov <i>et al.</i>	(SND Collab.)
Translated from ZETF 134 80.				
AMBROSINO	08G	PL B669 223	F. Ambrosino <i>et al.</i>	(KLOE Collab.)
ACHASOV	07B	PR D76 077101	M.N. Achasov <i>et al.</i>	(SND Collab.)
AKHMETSHIN	07	PL B648 28	R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)
ACHASOV	06	JETP 103 380	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)
Translated from ZETF 130 437.				
ACHASOV	06A	PR D74 014016	M.N. Achasov <i>et al.</i>	(SND Collab.)
AULCHENKO	06	JETPL 84 413	V.M. Aulchenko <i>et al.</i>	(Novosibirsk CMD-2 Collab.)
Translated from ZETFP 84 491.				
ACHASOV	05A	JETP 101 1053	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)
Translated from ZETF 128 1201.				
AKHMETSHIN	05	PL B605 26	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)
AKHMETSHIN	05A	PL B613 29	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)
AULCHENKO	05	JETPL 82 743	V.M. Aulchenko <i>et al.</i>	(Novosibirsk CMD-2 Collab.)
Translated from ZETFP 82 841.				
AKHMETSHIN	04	PL B578 285	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)
AKHMETSHIN	04B	PL B580 119	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.)
PDG	04	PL B592 1	S. Eidelman <i>et al.</i>	(PDG Collab.)
ACHASOV	03	PL B559 171	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)
ACHASOV	03D	PR D68 052006	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)
ALOISIO	03	PL B561 55	A. Aloisio <i>et al.</i>	(KLOE Collab.)
BENAYOUN	03	EPJ C29 397	M. Benayoun <i>et al.</i>	
ACHASOV	02E	PR D66 032001	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)
ACHASOV	02F	PL B537 201	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)
AKHMETSHIN	02	PL B527 161	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)
ALOISIO	02D	PL B537 21	A. Aloisio <i>et al.</i>	(KLOE Collab.)
HEISTER	02C	PL B528 19	A. Heister <i>et al.</i>	(ALEPH Collab.)
ACHASOV	01E	PR D63 072002	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)
AKHMETSHIN	01B	PL B509 217	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)
BARBERIS	01	PL B507 14	D. Barberis <i>et al.</i>	
ACHASOV	00	EPJ C12 25	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)
ACHASOV	00D	JETPL 72 282	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)
Translated from ZETFP 72 411.				
ACHASOV	00G	JETPL 71 355	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)
Translated from ZETFP 71 519.				
AKHMETSHIN	00C	PL B476 33	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)
AULCHENKO	00A	JETP 90 927	V.M. Aulchenko <i>et al.</i>	(Novosibirsk SND Collab.)
Translated from ZETF 117 1067.				

REFID=57513

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REFID=55499

REFID=54299

REFID=54305

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REFID=48324

REFID=47417

REFID=47882

REFID=47929

REFID=47423

REFID=47953

CASE	00	PR D61 032002	T. Case <i>et al.</i>	(Crystal Barrel Collab.)	REFID=47409
ACHASOV	99E	PL B462 365	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47391
GARDNER	99	PR D59 076002	S. Gardner, H.B. O'Connell		REFID=46919
BENAYOUN	98	EPJ C2 269	M. Benayoun <i>et al.</i>	(IPNP, NOVO, ADLD+)	REFID=45859
ABELE	97E	PL B411 361	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)	REFID=45755
BENAYOUN	96	ZPHY C72 221	M. Benayoun <i>et al.</i>	(IPNP, NOVO)	REFID=45753
PROKOSHKIN	95	PD 40 273	Y.D. Prokoshkin, V.D. Samoilenko	(SERP)	REFID=44616
		Translated from DANS 342 610.			
WURZINGER	95	PR C51 443	R. Wurzinger <i>et al.</i>	(BONN, ORSAY, SACL+)	REFID=45209
ALDE	94B	PL B340 122	D.M. Alde <i>et al.</i>	(SERP, BELG, LANL, LAPP+)	REFID=44100
AMSLER	94C	PL B327 425	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=44091
ALDE	93	PAN 56 1229	D.M. Alde <i>et al.</i>	(SERP, LAPP, LANL, BELG+)	REFID=43603
		Translated from YAF 56 137.			
Also		ZPHY C61 35	D.M. Alde <i>et al.</i>	(SERP, LAPP, LANL, BELG+)	REFID=43790
AMSLER	93B	PL B311 362	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=43602
WEIDENAUER	93	ZPHY C59 387	P. Weidenauer <i>et al.</i>	(ASTERIX Collab.)	REFID=43585
ANTONELLI	92	ZPHY C56 15	A. Antonelli <i>et al.</i>	(DM2 Collab.)	REFID=43168
DOLINSKY	91	PRPL 202 99	S.I. Dolinsky <i>et al.</i>	(NOVO)	REFID=41369
WEIDENAUER	90	ZPHY C47 353	P. Weidenauer <i>et al.</i>	(ASTERIX Collab.)	REFID=41368
DOLINSKY	89	ZPHY C42 511	S.I. Dolinsky <i>et al.</i>	(NOVO)	REFID=41003
BITYUKOV	88B	SJNP 47 800	S.I. Bitjukov <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)	REFID=20197
BIZZARRI	71	NP B27 140	R. Bizzarri <i>et al.</i>	(CERN, CDEF)	REFID=20198
COYNE	71	NP B32 333	D.G. Coyne <i>et al.</i>	(LRL)	REFID=20201
MOFFEIT	71	NP B29 349	K.C. Moffeit <i>et al.</i>	(LRL, UCB, SLAC+)	REFID=20204
ABRAMOVI...	70	NP B20 209	M. Abramovich <i>et al.</i>	(CERN)	REFID=20180
BIGGS	70B	PRL 24 1201	P.J. Biggs <i>et al.</i>	(DARE)	REFID=20184
BIZZARRI	70	PRL 25 1385	R. Bizzarri <i>et al.</i>	(ROMA, SYRA)	REFID=20181
ROOS	70	DNPL/R7 173	M. Roos	(CERN)	REFID=20191
Proc. Daresbury Study Weekend No. 1.					
AUGUSTIN	69D	PL 28B 513	J.E. Augustin <i>et al.</i>	(ORSAY)	REFID=20169
BIZZARRI	69	NP B14 169	R. Bizzarri <i>et al.</i>	(CERN, CDEF)	REFID=20171
DEINET	69B	PL 30B 426	W. Deinet <i>et al.</i>	(KARL, CERN)	REFID=20173
JACQUET	69B	NC 63A 743	F. Jacquet <i>et al.</i>	(EPOL, BERG)	REFID=20176
WILSON	69	Private Comm.	R. Wilson	(HARV)	REFID=20179
		Also			
		PR 178 2095	A.A. Wehmann <i>et al.</i>	(HARV, CASE, SLAC+)	REFID=20084
ASTVACAT...	68	PL 27B 45	R.G. Astvatsaturov <i>et al.</i>	(JINR, MOSU)	REFID=20055
BOLLINI	68C	NC 56A 531	D. Bollini <i>et al.</i>	(CERN, BGNA, STRB)	REFID=20164
BARASH	67B	PR 156 1399	N. Barash <i>et al.</i>	(COLU)	REFID=20160
FELDMAN	67C	PR 159 1219	M. Feldman <i>et al.</i>	(PENN)	REFID=20161
DIGIUGNO	66B	NC 44A 1272	G. Di Giugno <i>et al.</i>	(NAPL, FRAS, TRST)	REFID=20156
FLATTE	66	PR 145 1050	S.M. Flatte <i>et al.</i>	(LRL)	REFID=20157
JAMES	66	PR 142 896	F.E. James, H.L. Kraybill	(YALE, BNL)	REFID=10770
BARBARO...	65	PRL 14 279	A. Barbaro-Galtieri, R.D. Tripp	(LRL)	REFID=20152
BARMIN	64	JETP 18 1289	V.V. Barmin <i>et al.</i>	(ITEP)	REFID=20149
		Translated from ZETFP 45 1879.			
KRAEMER	64	PR 136 B496	R.W. Kraemer <i>et al.</i>	(JHU, NWES, WOOD)	REFID=10755
BUSCHBECK	63	Siena Conf. 1 166	B. Buschbeck <i>et al.</i>	(VIEN, CERN, ANIK)	REFID=20146

$\eta'(958)$

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

NODE=M002

 $\eta'(958)$ MASS

NODE=M002M

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

NODE=M002M

OCCUR=2

OCCUR=2

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

NODE=M002M;LINKAGE=BS

NODE=M002M;LINKAGE=NS

NODE=M002M;LINKAGE=BA

 $\eta'(958)$ WIDTH

NODE=M002W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
0.196±0.009 OUR FIT					
[0.197 ± 0.009 MeV OUR 2016 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 $\pi^+\pi^-\eta$	(42.6 ±0.7) %	DESIG=1
Γ_2 $\rho^0\gamma$ (including non-resonant $\pi^+\pi^-\gamma$)	(28.9 ±0.5) %	DESIG=9
Γ_3 $\pi^0\pi^0\eta$	(22.8 ±0.8) %	DESIG=2
Γ_4 $\omega\gamma$	(2.62±0.13) %	DESIG=7
Γ_5 ωe^+e^-	(2.0 ±0.4) × 10 ⁻⁴	DESIG=205
Γ_6 $\gamma\gamma$	(2.22±0.08) %	DESIG=6
Γ_7 $3\pi^0$	(2.54±0.18) × 10 ⁻³	DESIG=8
Γ_8 $\mu^+\mu^-\gamma$	(1.09±0.27) × 10 ⁻⁴	DESIG=20
Γ_9 $\pi^+\pi^-\mu^+\mu^-$	< 2.9 × 10 ⁻⁵	DESIG=201
Γ_{10} $\pi^+\pi^-\pi^0$	(3.61±0.17) × 10 ⁻³	DESIG=121
Γ_{11} $(\pi^+\pi^-\pi^0)$ S-wave	(3.8 ±0.5) × 10 ⁻³	DESIG=211
Γ_{12} $\pi^\mp\rho^\pm$	(7.4 ±2.3) × 10 ⁻⁴	DESIG=210
Γ_{13} $\pi^0\rho^0$	< 4 %	DESIG=18
Γ_{14} $2(\pi^+\pi^-)$	(8.6 ±0.9) × 10 ⁻⁵	DESIG=131
Γ_{15} $\pi^+\pi^-2\pi^0$	(1.8 ±0.4) × 10 ⁻⁴	DESIG=202

DESIG=1

DESIG=9

DESIG=2

DESIG=7

DESIG=205

DESIG=6

DESIG=8

DESIG=20

DESIG=201

DESIG=121

DESIG=211

DESIG=210

DESIG=18

DESIG=131

DESIG=202

Γ_{16}	$2(\pi^+\pi^-)$ neutrals	< 1	%	95%	DESIG=132
Γ_{17}	$2(\pi^+\pi^-)\pi^0$	< 1.8	$\times 10^{-3}$	90%	DESIG=141
Γ_{18}	$2(\pi^+\pi^-)2\pi^0$	< 1	%	95%	DESIG=15
Γ_{19}	$3(\pi^+\pi^-)$	< 3.1	$\times 10^{-5}$	90%	DESIG=203
Γ_{20}	$K^\pm\pi^\mp$	< 4	$\times 10^{-5}$	90%	DESIG=207
Γ_{21}	$\pi^+\pi^-e^+e^-$	$(2.4^{+1.3}_{-1.0}) \times 10^{-3}$			DESIG=10
Γ_{22}	$\pi^+e^-\nu_e + \text{c.c.}$	< 2.1	$\times 10^{-4}$	90%	DESIG=204
Γ_{23}	γe^+e^-	$(4.73 \pm 0.30) \times 10^{-4}$			DESIG=28
Γ_{24}	$\pi^0\gamma\gamma$	< 8	$\times 10^{-4}$	90%	DESIG=24
Γ_{25}	$4\pi^0$	< 3.2	$\times 10^{-4}$	90%	DESIG=26
Γ_{26}	e^+e^-	< 5.6	$\times 10^{-9}$	90%	DESIG=150
Γ_{27}	invisible	< 5	$\times 10^{-4}$	90%	DESIG=200

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

NODE=M002;CLUMP=B

Γ_{28}	$\pi^+\pi^-$	P, CP	< 1.8	$\times 10^{-5}$	90%	DESIG=111
Γ_{29}	$\pi^0\pi^0$	P, CP	< 5	$\times 10^{-4}$	90%	DESIG=25
Γ_{30}	$\pi^0e^+e^-$	C	[a] < 1.4	$\times 10^{-3}$	90%	DESIG=16
Γ_{31}	ηe^+e^-	C	[a] < 2.4	$\times 10^{-3}$	90%	DESIG=17
Γ_{32}	3γ	C	< 1.1	$\times 10^{-4}$	90%	DESIG=23
Γ_{33}	$\mu^+\mu^-\pi^0$	C	[a] < 6.0	$\times 10^{-5}$	90%	DESIG=22
Γ_{34}	$\mu^+\mu^-\eta$	C	[a] < 1.5	$\times 10^{-5}$	90%	DESIG=21
Γ_{35}	$e\mu$	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 16 branching ratios uses 46 measurements and one constraint to determine 9 parameters. The overall fit has a $\chi^2 = 62.7$ for 38 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta p_i \delta p_j \rangle / (\delta p_i \cdot \delta p_j)$, 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	-3							
x_3	-76	-58						
x_4	-10	-13	1					
x_6	-27	-24	29	-1				
x_7	-23	-18	28	0	8			
x_{10}	0	-1	-1	0	-1	0		
x_{21}	-5	-6	-5	-1	-3	-2	0	
Γ	24	4	-17	3	-71	-4	1	3
	x_1	x_2	x_3	x_4	x_6	x_7	x_{10}	x_{21}

	Mode	Rate (MeV)	
Γ_1	$\pi^+\pi^-\eta$	0.084 ± 0.004	DESIG=1
Γ_2	$\rho^0\gamma$ (including non-resonant $\pi^+\pi^-\gamma$)	0.0567 ± 0.0027	DESIG=9
Γ_3	$\pi^0\pi^0\eta$	0.0448 ± 0.0023	DESIG=2
Γ_4	$\omega\gamma$	0.00514 ± 0.00035	DESIG=7
Γ_6	$\gamma\gamma$	0.00436 ± 0.00013	DESIG=6
Γ_7	$3\pi^0$	$(5.0 \pm 0.4) \times 10^{-4}$	DESIG=8
Γ_{10}	$\pi^+\pi^-\pi^0$	$(7.1 \pm 0.5) \times 10^{-4}$	DESIG=121
Γ_{21}	$\pi^+\pi^-e^+e^-$	$(4.6^{+2.5}_{-1.9}) \times 10^{-4}$	DESIG=10

$\eta'(958)$ PARTIAL WIDTHS

NODE=M002220

 $\Gamma(\gamma\gamma)$ Γ_6

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
4.36±0.14 OUR FIT				
[4.35 ± 0.14 keV OUR 2016 FIT]				
4.28±0.19 OUR AVERAGE				
4.17±0.10±0.27	2000	¹ ACCIARRI	98Q L3	$e^+e^- \rightarrow e^+e^-\pi^+\pi^-\gamma$
4.53±0.29±0.51	266	KARCH	92 CBAL	$e^+e^- \rightarrow e^+e^-\eta\pi^0\pi^0$
3.61±0.13±0.48		² BEHREND	91 CELL	$e^+e^- \rightarrow e^+e^-\eta'(958)$
4.6 ±1.1 ±0.6	23	BARU	90 MD1	$e^+e^- \rightarrow e^+e^-\pi^+\pi^-\gamma$
4.57±0.25±0.44		BUTLER	90 MRK2	$e^+e^- \rightarrow e^+e^-\eta'(958)$
5.08±0.24±0.71	547	³ ROE	90 ASP	$e^+e^- \rightarrow e^+e^-2\gamma$
3.8 ±0.7 ±0.6	34	AIHARA	88C TPC	$e^+e^- \rightarrow e^+e^-\eta\pi^+\pi^-$
4.9 ±0.5 ±0.5	136	⁴ WILLIAMS	88 CBAL	$e^+e^- \rightarrow e^+e^-2\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
4.7 ±0.6 ±0.9	143	⁵ GIDAL	87 MRK2	$e^+e^- \rightarrow e^+e^-\eta\pi^+\pi^-$
4.0 ±0.9		⁶ BARTEL	85E JADE	$e^+e^- \rightarrow e^+e^-2\gamma$

¹ No non-resonant $\pi^+\pi^-$ contribution found.² Reevaluated by us using $B(\eta' \rightarrow \rho(770)\gamma) = (30.2 \pm 1.3)\%$.³ Reevaluated by us using $B(\eta' \rightarrow \gamma\gamma) = (2.11 \pm 0.13)\%$.⁴ Reevaluated by us using $B(\eta' \rightarrow \gamma\gamma) = (2.11 \pm 0.13)\%$.⁵ Superseded by BUTLER 90.⁶ Systematic error not evaluated.

NODE=M002W4
 NODE=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

 $\Gamma(e^+e^-)$ Γ_{26}

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<1.1 × 10⁻³	90	^{1,2} ACHASOV	15 SND	0.958 $e^+e^- \rightarrow \pi\pi\eta$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<2.0 × 10 ⁻³	90	² ACHASOV	15 SND	0.958 $e^+e^- \rightarrow \pi\pi\eta$
<2.4 × 10 ⁻³	90	² AKHMETSHIN	15 CMD3	0.958 $e^+e^- \rightarrow \pi^+\pi^-\eta$
¹ Combining data of ACHASOV 15 and AKHMETSHIN 15.				
² Using η and η' branching fractions from PDG 14.				

NODE=M002W1
 NODE=M002W1

OCCUR=2

NODE=M002W1;LINKAGE=A
 NODE=M002W1;LINKAGE=B

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

NODE=M002223

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

NODE=M002223

 $\Gamma(\gamma\gamma) \times \Gamma(\rho^0\gamma(\text{including non-resonant } \pi^+\pi^-\gamma)) / \Gamma_{\text{total}}$ $\Gamma_6\Gamma_2/\Gamma$

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
1.26±0.04 OUR FIT				
[1.27 ± 0.04 keV OUR 2016 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
 NEW

 $\Gamma(\gamma\gamma) \times \Gamma(\pi^0\pi^0\eta) / \Gamma_{\text{total}}$ $\Gamma_6\Gamma_3/\Gamma$

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
1.00±0.05 OUR FIT			
[0.97 ± 0.05 keV OUR 2016 FIT]			
0.92±0.06±0.11	¹ KARCH	92 CBAL	$e^+e^- \rightarrow e^+e^-\eta\pi^0\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.95±0.05±0.08	² KARCH	90 CBAL	$e^+e^- \rightarrow e^+e^-\eta\pi^0\pi^0$
1.00±0.08±0.10	^{2,3} ANTREASYAN	87 CBAL	$e^+e^- \rightarrow e^+e^-\eta\pi^0\pi^0$
¹ Reevaluated by us using $B(\eta \rightarrow \gamma\gamma) = (39.21 \pm 0.34)\%$. Supersedes ANTREASYAN 87 and KARCH 90.			
² Superseded by KARCH 92.			
³ Using $BR(\eta \rightarrow 2\gamma) = (38.9 \pm 0.5)\%$.			

NODE=M002G2
 NODE=M002G2
 NEW

NODE=M002G2;LINKAGE=K4

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

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

NODE=M002224

 $\Gamma(\pi^+ \pi^- \eta) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$ $\Gamma_1 \Gamma_{26} / \Gamma$

VALUE (10^{-3} eV)	CL%	DOCUMENT ID	TECN	COMMENT
<1.0	90	¹ AKHMETSHIN 15	CMD3	$0.958 e^+ e^- \rightarrow \pi^+ \pi^- \eta$
¹ AKHMETSHIN 15 reports $[\Gamma(\eta'(958) \rightarrow \pi^+ \pi^- \eta) \times \Gamma(\eta'(958) \rightarrow e^+ e^-) / \Gamma_{\text{total}}] \times [B(\eta \rightarrow 2\gamma)] < 4.1 \times 10^{-4}$ eV which we divide by our best value $B(\eta \rightarrow 2\gamma) = 39.41 \times 10^{-2}$.				

NODE=M002G01
NODE=M002G01

NODE=M002G01;LINKAGE=A

 $\eta'(958)$ BRANCHING RATIOS

NODE=M002230

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

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.426±0.007 OUR FIT				
[0.429 ± 0.007 OUR 2016 FIT]				

NODE=M002R47
NODE=M002R47
NEW

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

0.424 ± 0.011 ± 0.004 1.2k ¹ PEDLAR 09 CLEO $J/\psi \rightarrow \gamma \eta'$ ¹ Not independent of other η' branching fractions and ratios in PEDLAR 09.

NODE=M002R47;LINKAGE=PE

 $\Gamma(\pi^+ \pi^- \eta(\text{charged decay})) / \Gamma_{\text{total}}$ 0.286 Γ_1 / Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.1218±0.0019 OUR FIT				
[0.1228 ± 0.0020 OUR 2016 FIT]				

NODE=M002R3
NODE=M002R3
NEW

• • • 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 $3 K^- p$

 $\Gamma(\pi^+ \pi^- \eta(\text{neutral decay})) / \Gamma_{\text{total}}$ 0.714 Γ_1 / Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.304±0.005 OUR FIT				
[0.307 ± 0.005 OUR 2016 FIT]				

NODE=M002R1
NODE=M002R1
NEW

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

0.314 ± 0.026 281 RITTENBERG 69 HBC $1.7-2.7 K^- p$ $\Gamma(\rho^0 \gamma(\text{including non-resonant } \pi^+ \pi^- \gamma)) / \Gamma_{\text{total}}$ Γ_2 / Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.289±0.005 OUR FIT				
[0.291 ± 0.005 OUR 2016 FIT]				

NODE=M002R6
NODE=M002R6
NEW

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

0.287 ± 0.007 ± 0.004 0.2k ¹ 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 $3 K^- p$

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

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
0.679±0.017 OUR FIT			
[0.678 ± 0.017 OUR 2016 FIT]			

NODE=M002R43
NODE=M002R43
NEW**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 $J/\psi \rightarrow \eta' \gamma$

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

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.951±0.024 OUR FIT				
[0.950 ± 0.024 OUR 2016 FIT]				

NODE=M002R27
NODE=M002R27
NEW**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 $2.9 K^- p \rightarrow \Lambda X^0$

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

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT

0.228±0.008 OUR FIT

[0.223 ± 0.008 OUR 2016 FIT]

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

0.235±0.013±0.004 3.2k ¹ PEDLAR 09 CLEO $J/\psi \rightarrow \gamma\eta'$ ¹ Not independent of other η' branching fractions and ratios in PEDLAR 09.

NODE=M002R48
 NODE=M002R48
 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

0.0733±0.0026 OUR FIT

[0.0716 ± 0.0026 OUR 2016 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

0.536±0.026 OUR FIT

[0.519 ± 0.026 OUR 2016 FIT]

0.555±0.043±0.013PEDLAR 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

0.442±0.012 OUR FIT

[0.446 ± 0.012 OUR 2016 FIT]

0.43 ± 0.02 ± 0.02BARBERIS 98C OMEG 450 $pp \rightarrow p_f\eta'p_s$

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

2.62±0.13 OUR FIT**2.55±0.03±0.16**33.2k ¹ ABLIKIM 15AD BES3 $J/\psi \rightarrow \eta'\gamma$

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

2.34±0.30±0.04 70 ² PEDLAR 09 CLEO $J/\psi \rightarrow \gamma\eta'$ ¹ Using $B(J/\psi \rightarrow \eta'\gamma) = (5.15 \pm 0.16) \times 10^{-3}$ and $B(\omega \rightarrow \pi^+\pi^-\pi^0) = (89.2 \pm 0.7)\%$.² Not independent of other η' branching fractions and ratios in PEDLAR 09.

NODE=M002R49
 NODE=M002R49

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

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

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT

0.0615±0.0033 OUR FIT

[0.0610 ± 0.0033 OUR 2016 FIT]

0.055 ± 0.007 ± 0.001PEDLAR 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

0.115±0.007 OUR FIT

[0.117 ± 0.007 OUR 2016 FIT]

0.147±0.016ALDE 87B GAM2 38 $\pi^- p \rightarrow n4\gamma$

NODE=M002R33
 NODE=M002R33
 NEW

 $\Gamma(\omega e^+e^-)/\Gamma(\omega\gamma)$ Γ_5/Γ_4

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

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

7.71±1.34±0.54 ¹ ABLIKIM 15AD BES3 $J/\psi \rightarrow \eta'\gamma$ ¹ Obtained from other ABLIKIM 15AD measurements with common systematics taken into account.

NODE=M002R60
 NODE=M002R60

NODE=M002R60;LINKAGE=A

 $\Gamma(\omega e^+e^-)/\Gamma_{\text{total}}$ Γ_5/Γ

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

1.97±0.34±0.1766 ¹ ABLIKIM 15AD BES3 $J/\psi \rightarrow \eta'\gamma$ ¹ Using $B(J/\psi \rightarrow \eta'\gamma) = (5.15 \pm 0.16) \times 10^{-3}$ and $B(\omega \rightarrow \pi^+\pi^-\pi^0) = (89.2 \pm 0.7)\%$.

NODE=M002R59
 NODE=M002R59

NODE=M002R59;LINKAGE=A

$$\frac{\Gamma(\rho^0 \gamma (\text{including non-resonant } \pi^+ \pi^- \gamma))}{[\Gamma(\pi^+ \pi^- \eta) + \Gamma(\pi^0 \pi^0 \eta) + \Gamma(\omega \gamma)]} \Gamma_2 / (\Gamma_1 + \Gamma_3 + \Gamma_4)$$

VALUE DOCUMENT ID TECN COMMENT
0.425 ± 0.011 OUR FIT
 [0.429 ± 0.011 OUR 2016 FIT]

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

0.25 ± 0.14 DAUBER 64 HBC 1.95 $K^- p$

$$\frac{[\Gamma(\pi^0 \pi^0 \eta (\text{charged decay})) + \Gamma(\omega (\text{charged decay}) \gamma)]}{\Gamma_{\text{total}}} (0.286 \Gamma_3 + 0.89 \Gamma_4) / \Gamma$$

VALUE EVTS DOCUMENT ID TECN COMMENT
0.0886 ± 0.0026 OUR FIT
 [0.0871 ± 0.0026 OUR 2016 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 $K^- p$

$$\frac{\Gamma(\pi^+ \pi^- \text{ neutrals})}{\Gamma_{\text{total}}} (0.714 \Gamma_1 + 0.286 \Gamma_3 + 0.89 \Gamma_4) / \Gamma$$

VALUE EVTS DOCUMENT ID TECN COMMENT
0.3926 ± 0.0035 OUR FIT
 [0.394 ± 0.004 OUR 2016 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 $K^- p$

$$\Gamma(\gamma \gamma) / \Gamma_{\text{total}} \Gamma_6 / \Gamma$$

VALUE (units 10^{-2}) EVTS DOCUMENT ID TECN COMMENT
2.22 ± 0.08 OUR FIT
 [(2.21 ± 0.08) × 10^{-2} OUR 2016 FIT]
2.00 ± 0.15 OUR AVERAGE

1.98^{+0.31}_{−0.27} ± 0.07 114 ¹ WICHT 08 BELL $B^\pm \rightarrow K^\pm \gamma \gamma$
 2.00 ± 0.18 ² STANTON 80 SPEC 8.45 $\pi^- p \rightarrow n \pi^+ \pi^- 2\gamma$
 • • • We do not use the following data for averages, fits, limits, etc. • • •
 2.25 ± 0.16 ± 0.03 0.3k ³ PEDLAR 09 CLEO $J/\psi \rightarrow \gamma \eta'$
 1.8 ± 0.2 6000 ⁴ APEL 79 NICE 15–40 $\pi^- p \rightarrow n 2\gamma$
 2.5 ± 0.7 DUANE 74 MMS $\pi^- p \rightarrow n \text{MM}$
 1.71 ± 0.33 68 DALPIAZ 72 CNTR 1.6 $\pi^- p \rightarrow n X^0$
 2.0^{+0.8}_{−0.6} 31 HARVEY 71 OSPK 3.65 $\pi^- p \rightarrow n X^0$

¹ WICHT 08 reports $[\Gamma(\eta'(958) \rightarrow \gamma \gamma) / \Gamma_{\text{total}}] \times [B(B^+ \rightarrow \eta' K^+)] = (1.40^{+0.16+0.15}_{-0.15-0.12}) \times 10^{-6}$ which we divide by our best value $B(B^+ \rightarrow \eta' K^+) = (7.06 \pm 0.25) \times 10^{-5}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² Includes APEL 79 result.

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

⁴ Data is included in STANTON 80 evaluation.

$$\Gamma(\gamma \gamma) / \Gamma(\pi^+ \pi^- \eta) \Gamma_6 / \Gamma_1$$

VALUE DOCUMENT ID TECN COMMENT
0.0522 ± 0.0022 OUR FIT
 [0.0514 ± 0.0022 OUR 2016 FIT]

0.053 ± 0.004 ± 0.001 PEDLAR 09 CLE3 $J/\psi \rightarrow \eta' \gamma$

$$\Gamma(\gamma \gamma) / \Gamma(\rho^0 \gamma (\text{including non-resonant } \pi^+ \pi^- \gamma)) \Gamma_6 / \Gamma_2$$

VALUE DOCUMENT ID TECN COMMENT
0.0768 ± 0.0033 OUR FIT
 [0.0758 ± 0.0033 OUR 2016 FIT]

0.080 ± 0.008 ABLIKIM 06E BES2 $J/\psi \rightarrow \eta' \gamma$

$$\Gamma(\gamma \gamma) / \Gamma(\pi^0 \pi^0 \eta) \Gamma_6 / \Gamma_3$$

VALUE DOCUMENT ID TECN COMMENT
0.097 ± 0.004 OUR FIT
 [0.099 ± 0.004 OUR 2016 FIT]

0.105 ± 0.010 OUR AVERAGE Error includes scale factor of 1.9.

0.091 ± 0.009 AMSLER 93 CBAR 0.0 $\bar{p} p$
 0.112 ± 0.002 ± 0.006 ALDE 87B GAM2 38 $\pi^- p \rightarrow n 2\gamma$

NODE=M002R18
 NODE=M002R18
 NEW

NODE=M002R4
 NODE=M002R4
 NEW

NODE=M002R2
 NODE=M002R2
 NEW

NODE=M002R19
 NODE=M002R19
 NEW

NODE=M002R19;LINKAGE=WI

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

NODE=M002R46
 NODE=M002R46
 NEW

NODE=M002R42
 NODE=M002R42
 NEW

NODE=M002R38
 NODE=M002R38
 NEW

$\Gamma(\gamma\gamma)/\Gamma(\pi^0\pi^0\eta(\text{neutral decay}))$ $\Gamma_6/0.714\Gamma_3$

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT

0.136±0.006 OUR FIT

[0.139 ± 0.006 OUR 2016 FIT]

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

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

NODE=M002R28
 NODE=M002R28
 NEW

 $\Gamma(\text{neutrals})/\Gamma_{\text{total}}$ $(0.714\Gamma_3+0.09\Gamma_4+\Gamma_6)/\Gamma$

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT

0.188±0.006 OUR FIT

[0.184 ± 0.006 OUR 2016 FIT]

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

0.185±0.022	535	BASILE	71	CNTR	1.6 $\pi^- p \rightarrow n X^0$

0.189±0.026	123	RITTENBERG	69	HBC	1.7–2.7 $K^- p$

NODE=M002R5
 NODE=M002R5
 NEW

 $\Gamma(3\pi^0)/\Gamma_{\text{total}}$ Γ_7/Γ

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

2.54 ±0.18 OUR FIT[(2.20 ± 0.20) × 10^{-3} OUR 2016 FIT]**3.57 ±0.26 OUR AVERAGE**[(3.7 ± 0.4) × 10^{-3} OUR 2016 AVERAGE]

3.522±0.082±0.254	2015	ABLIKIM	17	BES3	$J/\psi \rightarrow \gamma(3\pi^0)$

4.79 ±0.59 ±1.14	183	¹ ABLIKIM	15P	BES3	$J/\psi \rightarrow K^+ K^- 3\pi$

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

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

¹ We have added all systematic uncertainties in quadrature to a single value.² Superseded by ABLIKIM 2017

NODE=M002R55
 NODE=M002R55
 NEW

NEW

 $\Gamma(3\pi^0)/\Gamma(\pi^0\pi^0\eta)$ Γ_7/Γ_3

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

111± 8 OUR FIT[(99 ± 9) × 10^{-4} OUR 2016 FIT]**78±10 OUR AVERAGE**

86±19	235	BLIK	08	GAMS	32 $\pi^- p \rightarrow \eta' n$

74±15		ALDE	87B	GAM2	38 $\pi^- p \rightarrow n 6\gamma$

75±18		BINON	84	GAM2	30–40 $\pi^- p \rightarrow n 6\gamma$

NODE=M002R32
 NODE=M002R32
 NEW

 $\Gamma(\mu^+\mu^-\gamma)/\Gamma(\gamma\gamma)$ Γ_8/Γ_6

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

4.9±1.2

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

NODE=M002R29
 NODE=M002R29

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

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

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

<0.29	90	¹ ABLIKIM	130	BES3	$J/\psi \rightarrow \gamma\eta'$

<2.4	90	² NAIK	09	CLEO	$J/\psi \rightarrow \gamma\eta'$

¹ Using $\Gamma_2/\Gamma = (29.3 \pm 0.6)\%$ from PDG 12.² Not independent of measured value of Γ_9/Γ_1 from NAIK 09.

NODE=M002R50
 NODE=M002R50

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

 $\Gamma(\pi^+\pi^-\mu^+\mu^-)/\Gamma(\pi^+\pi^-\eta)$ Γ_9/Γ_1

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

<0.5

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

¹ NAIK 09 reports $[\Gamma(\eta'(958) \rightarrow \pi^+\pi^-\mu^+\mu^-)/\Gamma(\eta'(958) \rightarrow \pi^+\pi^-\eta)] / [B(\eta \rightarrow 2\gamma)] < 1.3 \times 10^{-3}$ which we multiply by our best value $B(\eta \rightarrow 2\gamma) = 39.41 \times 10^{-2}$.

NODE=M002R03
 NODE=M002R03

NODE=M002R03;LINKAGE=NA

 $\Gamma(\pi^+\pi^-\mu^+\mu^-)/\Gamma(\rho^0\gamma(\text{including non-resonant } \pi^+\pi^-\gamma))$ Γ_9/Γ_2

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

<1.0

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

NODE=M002R57
 NODE=M002R57

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

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

3.61 $\pm$ 0.18 OUR FIT[(3.82 $\pm$ 0.35) $\times 10^{-3}$ OUR 2016 FIT]**3.61 $\pm$ 0.18 OUR AVERAGE**[(3.9 $\pm$ 0.4) $\times 10^{-3}$ OUR 2016 AVERAGE]3.591 $\pm$ 0.054 $\pm$ 0.174 6067 ABLIKIM 17 BES3 $J/\psi \rightarrow \gamma(\pi^+\pi^-\pi^0)$ 4.28 $\pm$ 0.49 $\pm$ 1.11 78 ¹ ABLIKIM 15P BES3 $J/\psi \rightarrow K^+K^-3\pi$ 3.7 $^{+1.1}_{-0.9}$ $\pm$ 0.4 ² NAIK 09 CLEO $J/\psi \rightarrow \gamma\eta'$

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

3.83 $\pm$ 0.15 $\pm$ 0.39 1014 ³ ABLIKIM 12E BES3 $J/\psi \rightarrow \gamma(\pi^+\pi^-\pi^0)$ ¹ We have added all systematic uncertainties in quadrature to a single value.² Not independent of measured value of Γ_{10}/Γ_1 from NAIK 09.³ Superseded by ABLIKIM 2017

NODE=M002R21

NODE=M002R21

NEW

NEW

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

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

37.63 $\pm$ 0.77 $\pm$ 5.00 6580 ¹ ABLIKIM 17 BES3 $J/\psi \rightarrow \gamma(\pi^+\pi^-\pi^0)$ ¹ We have added all systematic uncertainties in quadrature

NODE=M002R63

NODE=M002R63

NODE=M002R63;LINKAGE=A

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

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

7.44 $\pm$ 0.60 $\pm$ 2.23 1231 ¹ ABLIKIM 17 BES3 $J/\psi \rightarrow \gamma(\pi^\mp\rho^\pm)$ ¹ We have added all systematic uncertainties in quadrature

NODE=M002R62

NODE=M002R62

NODE=M002R62;LINKAGE=A

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

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

8.5 $\pm$ 0.4 OUR FIT[(8.9 $\pm$ 0.8) $\times 10^{-3}$ OUR 2016 FIT]**8.28 $^{+2.49}_{-2.12}$ $\pm$ 0.04** 20 ¹ NAIK 09 CLEO $J/\psi \rightarrow \gamma\eta'$

¹ NAIK 09 reports [$\Gamma(\eta'(958) \rightarrow \pi^+\pi^-\pi^0)/\Gamma(\eta'(958) \rightarrow \pi^+\pi^-\eta)$] / [$B(\eta \rightarrow 2\gamma)$] = (21 $^{+6}_{-5}$ $\pm$ 2) $\times 10^{-3}$ which we multiply by our best value $B(\eta \rightarrow 2\gamma) = (39.41 \pm 0.20) \times 10^{-2}$. 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

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

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<0.04 90 RITTENBERG 65 HBC 2.7 K^-p

NODE=M002R10

NODE=M002R10

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

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

8.6 $\pm$ 0.9 OUR AVERAGE [(8.5 $\pm$ 0.9) $\times 10^{-5}$ OUR 2016 AVERAGE]**8.6 $\pm$ 0.9 $\pm$ 0.3** 199 ¹ ABLIKIM 14M BES3 $J/\psi \rightarrow \gamma\eta'$

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

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

¹ ABLIKIM 14M reports [$\Gamma(\eta'(958) \rightarrow 2(\pi^+\pi^-))/\Gamma_{\text{total}}$] $\times$ [$B(J/\psi(1S) \rightarrow \gamma\eta'(958))$] = (4.40 $\pm$ 0.35 $\pm$ 0.30) $\times 10^{-7}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma\eta'(958)) = (5.13 \pm 0.17) \times 10^{-3}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

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

NODE=M002R24

NODE=M002R24

NEW

NODE=M002R24;LINKAGE=A

NODE=M002R24;LINKAGE=NA

 $\Gamma(2(\pi^+\pi^-))/\Gamma(\pi^+\pi^-\eta)$

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

<0.6 90 ¹ NAIK 09 CLEO $J/\psi \rightarrow \gamma\eta'$

¹ NAIK 09 reports [$\Gamma(\eta'(958) \rightarrow 2(\pi^+\pi^-))/\Gamma(\eta'(958) \rightarrow \pi^+\pi^-\eta)$] / [$B(\eta \rightarrow 2\gamma)$] < 1.4 $\times 10^{-3}$ 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_{15}/Γ

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

 $1.8 \pm 0.4 \pm 0.1$

84

¹

ABLIKIM

14M

BES3

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

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

<27

90

²

NAIK

09

CLEO

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

¹ ABLIKIM 14M reports $[\Gamma(\eta'(958) \rightarrow \pi^+\pi^-2\pi^0)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta'(958))]$
 $= (9.38 \pm 1.79 \pm 0.89) \times 10^{-7}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma\eta'(958))$
 $= (5.13 \pm 0.17) \times 10^{-3}$. Our first error is their experiment's error and our second error
 is the systematic error from using our best value.

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

NODE=M002R51
 NODE=M002R51

NODE=M002R51;LINKAGE=A

NODE=M002R51;LINKAGE=NA

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

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

<6

90

¹

NAIK

09

CLEO

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

¹ NAIK 09 reports $[\Gamma(\eta'(958) \rightarrow \pi^+\pi^-2\pi^0)/\Gamma(\eta'(958) \rightarrow \pi^+\pi^-\eta)] / [B(\eta \rightarrow 2\gamma)]$
 $< 15 \times 10^{-3}$ which we multiply by our best value $B(\eta \rightarrow 2\gamma) = 39.41 \times 10^{-2}$.

NODE=M002R05
 NODE=M002R05

NODE=M002R05;LINKAGE=NA

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

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<0.01

95

DANBURG

73

HBC

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

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

<0.01

90

RITTENBERG

69

HBC

 $1.7-2.7 K^- p$

NODE=M002R22
 NODE=M002R22

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

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<0.002

90

¹

NAIK

09

CLEO

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

<0.01

90

RITTENBERG

69

HBC

 $1.7-2.7 K^- p$

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

NODE=M002R23
 NODE=M002R23

NODE=M002R23;LINKAGE=NA

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

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

<4

90

¹

NAIK

09

CLEO

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

¹ NAIK 09 reports $[\Gamma(\eta'(958) \rightarrow 2(\pi^+\pi^-)\pi^0)/\Gamma(\eta'(958) \rightarrow \pi^+\pi^-\eta)] / [B(\eta \rightarrow 2\gamma)]$
 $< 11 \times 10^{-3}$ which we multiply by our best value $B(\eta \rightarrow 2\gamma) = 39.41 \times 10^{-2}$.

NODE=M002R06
 NODE=M002R06

NODE=M002R06;LINKAGE=NA

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

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<0.01

95

KALBFLEISCH

64B

HBC

 $K^- p \rightarrow \Lambda 2(\pi^+\pi^-)+MM$

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

<0.01

90

LONDON

66

HBC

Compilation

NODE=M002R16
 NODE=M002R16

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

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

< 3.1

90

¹

ABLIKIM

13U

BES3

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

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

< 53

90

²

NAIK

09

CLEO

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

<500

95

KALBFLEISCH

64B

HBC

 $K^- p \rightarrow \Lambda 2(\pi^+\pi^-)$

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

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

NODE=M002R07
 NODE=M002R07

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

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

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

<1.2

90

¹

NAIK

09

CLEO

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

¹ NAIK 09 reports $[\Gamma(\eta'(958) \rightarrow 3(\pi^+\pi^-))/\Gamma(\eta'(958) \rightarrow \pi^+\pi^-\eta)] / [B(\eta \rightarrow 2\gamma)]$
 $< 3.0 \times 10^{-3}$ which we multiply by our best value $B(\eta \rightarrow 2\gamma) = 39.41 \times 10^{-2}$.

NODE=M002R08
 NODE=M002R08

NODE=M002R08;LINKAGE=NA

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

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<1.3 $\times 10^{-4}$

90

ABLIKIM

16M

BES3

 $e^+e^- \rightarrow J/\psi \rightarrow \text{hadrons}$

NODE=M002R61
 NODE=M002R61

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

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

2.4 $^{+1.3}_{-1.0}$ OUR FIT

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

2.11 $\pm 0.12 \pm 0.14$ 429 ¹ ABLIKIM 130 BES3 $J/\psi \rightarrow \gamma\eta'$ 2.5 $^{+1.2}_{-0.9} \pm 0.5$ ² NAIK 09 CLEO $J/\psi \rightarrow \gamma\eta'$ <6 90 RITTENBERG 65 HBC 2.7 K^-p ¹ Using $\Gamma_{21}/\Gamma = (29.3 \pm 0.6)\%$ from PDG 12.² Not independent of measured value of Γ_{21}/Γ_1 from NAIK 09.NODE=M002R12
NODE=M002R12 $\Gamma(\pi^+\pi^-\pi^+\pi^-)/\Gamma(\pi^+\pi^-\eta)$ Γ_{21}/Γ_1

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

5.5 $^{+3.0}_{-2.2}$ OUR FIT $[(5.6^{+3.0}_{-2.2}) \times 10^{-3}]$ OUR 2016 FITNODE=M002R02
NODE=M002R02

NEW

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

¹ NAIK 09 reports $[\Gamma(\eta'(958) \rightarrow \pi^+\pi^-\pi^+\pi^-)/\Gamma(\eta'(958) \rightarrow \pi^+\pi^-\eta)] / [B(\eta \rightarrow 2\gamma)] = (14^{+7}_{-5} \pm 3) \times 10^{-3}$ 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;LINKAGE=NA

 $\Gamma(\pi^+\pi^-\pi^+\pi^-)/\Gamma(\rho^0\gamma(\text{including non-resonant } \pi^+\pi^-\gamma))$ Γ_{21}/Γ_2

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

7.2 $\pm 0.4 \pm 0.5$ 429 ABLIKIM 130 BES3 $J/\psi \rightarrow \gamma\eta'$ NODE=M002R56
NODE=M002R56 $\Gamma(\pi^+\pi^-\nu_e + \text{c.c.})/\Gamma(\pi^+\pi^-\eta)$ Γ_{22}/Γ_1

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

<5.0 90 ABLIKIM 13G BES3 $J/\psi \rightarrow \phi\eta'$ NODE=M002R54
NODE=M002R54 $\Gamma(\gamma e^+ e^-)/\Gamma_{\text{total}}$ Γ_{23}/Γ

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

• • • We do not use the following data for averages, fits, limits, etc. • • •
<0.9 90 BRIERE 00 CLEO 10.6 e^+e^- NODE=M002R40
NODE=M002R40 $\Gamma(\gamma e^+ e^-)/\Gamma(\gamma\gamma)$ Γ_{23}/Γ_6

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

2.13 $\pm 0.09 \pm 0.07$ 864 ABLIKIM 150 BES3 $J/\psi \rightarrow \gamma e^+ e^-$ NODE=M002R00
NODE=M002R00 $\Gamma(\pi^0\gamma\gamma)/\Gamma(\pi^0\pi^0\eta)$ Γ_{24}/Γ_3

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

<37 90 ALDE 87B GAM2 38 $\pi^-p \rightarrow n4\gamma$ NODE=M002R35
NODE=M002R35 $\Gamma(4\pi^0)/\Gamma_{\text{total}}$ Γ_{25}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<3.2 $\times 10^{-4}$ 90 DONSKOV 14 GAM4 32.5 $\pi^-p \rightarrow \eta' n$ NODE=M002R58
NODE=M002R58 $\Gamma(4\pi^0)/\Gamma(\pi^0\pi^0\eta)$ Γ_{25}/Γ_3

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

• • • We do not use the following data for averages, fits, limits, etc. • • •
<23 90 ALDE 87B GAM2 38 $\pi^-p \rightarrow n8\gamma$ NODE=M002R37
NODE=M002R37 $\Gamma(e^+e^-)/\Gamma_{\text{total}}$ Γ_{26}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

< 5.6 $\times 10^{-9}$ 90 ¹ ACHASOV 15 SND 0.958 $e^+e^- \rightarrow \pi\pi\eta$

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

<12 $\times 10^{-9}$ 90 ² AKHMETSHIN 15 CMD3 0.958 $e^+e^- \rightarrow \pi^+\pi^-\eta$ < 2.1 $\times 10^{-7}$ 90 VOROBYEV 88 ND $e^+e^- \rightarrow \pi^+\pi^-\eta$ ¹ Combining data of ACHASOV 15 and AKHMETSHIN 15 and using $\Gamma(\eta') = 0.198 \pm 0.009$ MeV.² Using $\Gamma_{\eta'(958)} = 198 \pm 9$ keV, $B(\eta'(958) \rightarrow \pi^+\pi^-\eta) = (42.9 \pm 0.7)\%$, and $B(\eta \rightarrow \gamma\gamma) = (39.41 \pm 0.20)\%$.NODE=M002R39
NODE=M002R39

NODE=M002R39;LINKAGE=B

NODE=M002R39;LINKAGE=A

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

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

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

<9.5	90	¹ NAIK	09 CLEO	$J/\psi \rightarrow \gamma \eta'$

¹ Not independent of measured value of Γ_{27}/Γ_1 from NAIK 09.

NODE=M002R52
NODE=M002R52

NODE=M002R52;LINKAGE=NA

 $\Gamma(\text{invisible})/\Gamma(\gamma\gamma)$ Γ_{27}/Γ_6

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

<2.4 90 ABLIKIM 13 BES3 $J/\psi \rightarrow \phi \eta'$

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

<6.69	90	ABLIKIM	06Q BES	$J/\psi \rightarrow \phi \eta'$

NODE=M002R44
NODE=M002R44

 $\Gamma(\text{invisible})/\Gamma(\pi^+\pi^-\eta)$ Γ_{27}/Γ_1

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

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

<2.1	90	¹ NAIK	09 CLEO	$J/\psi \rightarrow \gamma \eta'$

¹ NAIK 09 reports $[\Gamma(\eta'(958) \rightarrow \text{invisible})/\Gamma(\eta'(958) \rightarrow \pi^+\pi^-\eta)] / [B(\eta \rightarrow 2\gamma)]$
< 5.4×10^{-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_{28}/Γ

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

< 0.18 (CL = 90%) [$<0.6 \times 10^{-4}$ (CL = 90%) OUR 2016 BEST LIMIT]

< 0.18	90	¹ AAIJ	17D LHCB	$D_{(s)}^+ \rightarrow \pi^+\pi^-\pi^+$

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

< 0.6	90	² ABLIKIM	11G BES3	$J/\psi \rightarrow \gamma \pi^+\pi^-$

< 29	90	³ MORI	07A BELL	$\gamma\gamma \rightarrow \pi^+\pi^-$

< 3.3	90	⁴ MORI	07A BELL	$\gamma\gamma \rightarrow \pi^+\pi^-$

<800	95	DANBURG	73 HBC	$2.2 K^- p \rightarrow \Lambda X^0$

<200	90	RITTENBERG	69 HBC	$1.7\text{--}2.7 K^- p$

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

² ABLIKIM 11G reports $[\Gamma(\eta'(958) \rightarrow \pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma \eta'(958))] < 2.84 \times 10^{-7}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma \eta'(958)) = 5.13 \times 10^{-3}$.

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

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

NODE=M002R20
NODE=M002R20

OCCUR=2

NODE=M002R20;LINKAGE=A
NODE=M002R20;LINKAGE=AL

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

 $\Gamma(\pi^0\pi^0)/\Gamma_{\text{total}}$ Γ_{29}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

< 5×10^{-4} (CL = 90%) [$<4 \times 10^{-4}$ (CL = 90%) OUR 2016 BEST LIMIT]

< 5×10^{-4}	90	¹ ABLIKIM	11G BES3	$J/\psi \rightarrow \gamma \pi^0 \pi^0$

¹ ABLIKIM 11G reports $[\Gamma(\eta'(958) \rightarrow \pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma \eta'(958))] < 2.84 \times 10^{-7}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma \eta'(958)) = 5.13 \times 10^{-3}$.

NODE=M002R53
NODE=M002R53

NODE=M002R53;LINKAGE=AL

 $\Gamma(\pi^0\pi^0)/\Gamma(\pi^0\pi^0\eta)$ Γ_{29}/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_{30}/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_{31}/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_{32}/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_{33}/Γ
VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT	
<6.0	90	DZHELYADIN 81	CNTR	$30 \pi^- p \rightarrow \eta' n$	
$\Gamma(\mu^+\mu^-\eta)/\Gamma_{\text{total}}$					Γ_{34}/Γ
VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT	
<1.5	90	DZHELYADIN 81	CNTR	$30 \pi^- p \rightarrow \eta' n$	
$\Gamma(e\mu)/\Gamma_{\text{total}}$					Γ_{35}/Γ
VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT	
<4.7	90	BRIERE 00	CLEO	$10.6 e^+ e^-$	

NODE=M002R31
NODE=M002R31

NODE=M002R30
NODE=M002R30

NODE=M002R41
NODE=M002R41

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

NODE=M002225

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

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

NODE=M002225

Re(α) decay parameter

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

¹ See ABLIKIM 11 for the full correlation matrix.

² Superseded by DOROFEEV 07, which found this parameterization unacceptable. See below.

³ Assuming $\text{Im}(\alpha) = 0$, $C = 0$, and $D = 0$.

⁴ Assuming $C = 0$.

⁵ From the data of DAUBER 64, RITTENBERG 69, AGUILAR-BENITEZ 72B, JACOBS 73, and DANBURG 73.

NODE=M002A0
NODE=M002A0

NODE=M002A0;LINKAGE=AB
NODE=M002A0;LINKAGE=AM

NODE=M002A0;LINKAGE=BR
NODE=M002A0;LINKAGE=A
NODE=M002A0;LINKAGE=KA

Im(α) 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	¹ ABLIKIM	11 BES3	$J/\psi \rightarrow \gamma\eta\pi^+\pi^-$
$0.0 \pm 0.1 \pm 0.0$	7k	² AMELIN	05A VES	$28 \pi^- A \rightarrow \eta\pi^+\pi^-\pi^- A^*$
$-0.00 \pm 0.13 \pm 0.00$	5.4k	³ ALDE	86 GAM2	$38 \pi^- p \rightarrow n\eta\pi^0\pi^0$
0.0 ± 0.3		^{3,4} KALBFLEISCH	74 RVUE	$\eta' \rightarrow \eta\pi^+\pi^-$

¹ See ABLIKIM 11 for the full correlation matrix.

² Superseded by DOROFEEV 07, which found this parameterization unacceptable. See below.

³ Assuming $C = 0$.

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

NODE=M002IA0
NODE=M002IA0

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	¹ ABLIKIM	11 BES3	$J/\psi \rightarrow \gamma\eta\pi^+\pi^-$
$0.020 \pm 0.018 \pm 0.004$	7k	² AMELIN	05A VES	$28 \pi^- A \rightarrow \eta\pi^+\pi^-\pi^- A^*$

¹ See ABLIKIM 11 for the full correlation matrix.

² Superseded by DOROFEEV 07, which found this parameterization unacceptable. See below.

NODE=M002C0
NODE=M002C0

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

D decay parameter

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$-0.059 \pm 0.012 \pm 0.004$	44k	¹ ABLIKIM	11 BES3	$J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$
$-0.066 \pm 0.030 \pm 0.015$	7k	² AMELIN	05A VES	$28 \pi^- A \rightarrow \eta \pi^+ \pi^- \pi^- A^*$
$0.00 \pm 0.03 \pm 0.00$	5.4k	³ ALDE	86 GAM2	$38 \pi^- p \rightarrow n \eta \pi^0 \pi^0$
0		^{3,4} KALBFLEISCH	74 RVUE	$\eta' \rightarrow \eta \pi^+ \pi^-$
¹ See ABLIKIM 11 for the full correlation matrix.				
² Superseded by DOROFEEV 07, which found this parameterization unacceptable. See below.				
³ Assuming $C = 0$.				
⁴ From the data of DAUBER 64, RITTENBERG 69, AGUILAR-BENITEZ 72B, JACOBS 73, and DANBURG 73.				

NODE=M002D0
 NODE=M002D0

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

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

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

NODE=M002227

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

X and Y are Dalitz variables and a, b, c, and d are real-valued parameters. May be different for $\eta'(958) \rightarrow \eta \pi^+ \pi^-$ and $\eta'(958) \rightarrow \eta \pi^0 \pi^0$ decays. We do not average measurements in the section below because parameter values from each experiment are strongly correlated.

NODE=M002227

a decay parameter

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$-0.047 \pm 0.011 \pm 0.003$	44k	¹ ABLIKIM	11 BES3	$J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$
$-0.066 \pm 0.016 \pm 0.003$	15k	² BLIK	09 GAM4	$32.5 \pi^- p \rightarrow \eta' n$
$-0.127 \pm 0.016 \pm 0.008$	20k	³ DOROFEEV	07 VES	$27 \pi^- p \rightarrow \eta' n, \pi^- A \rightarrow \eta' \pi^- A^*$
¹ See ABLIKIM 11 for the full correlation matrix.				
² From $\eta' \rightarrow \eta \pi^0 \pi^0$ decay.				
³ From $\eta' \rightarrow \eta \pi^+ \pi^-$ decay.				

NODE=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	¹ ABLIKIM	11 BES3	$J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$
$-0.063 \pm 0.028 \pm 0.004$	15k	² BLIK	09 GAM4	$32.5 \pi^- p \rightarrow \eta' n$
$-0.106 \pm 0.028 \pm 0.014$	20k	³ DOROFEEV	07 VES	$27 \pi^- p \rightarrow \eta' n, \pi^- A \rightarrow \eta' \pi^- A^*$
¹ See ABLIKIM 11 for the full correlation matrix.				
² From $\eta' \rightarrow \eta \pi^0 \pi^0$ decay.				
³ From $\eta' \rightarrow \eta \pi^+ \pi^-$ decay.				

NODE=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	¹ ABLIKIM	11 BES3	$J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$
$-0.107 \pm 0.096 \pm 0.003$	15k	² BLIK	09 GAM4	$32.5 \pi^- p \rightarrow \eta' n$
$0.015 \pm 0.011 \pm 0.014$	20k	³ DOROFEEV	07 VES	$27 \pi^- p \rightarrow \eta' n, \pi^- A \rightarrow \eta' \pi^- A^*$
¹ See ABLIKIM 11 for the full correlation matrix.				
² From $\eta' \rightarrow \eta \pi^0 \pi^0$ decay.				
³ From $\eta' \rightarrow \eta \pi^+ \pi^-$ decay.				

NODE=M002DPC
 NODE=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	¹ ABLIKIM	11 BES3	$J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$
$0.018 \pm 0.078 \pm 0.006$	15k	² BLIK	09 GAM4	$32.5 \pi^- p \rightarrow \eta' n$
$-0.082 \pm 0.017 \pm 0.008$	20k	³ DOROFEEV	07 VES	$27 \pi^- p \rightarrow \eta' n, \pi^- A \rightarrow \eta' \pi^- A^*$
¹ See ABLIKIM 11 for the full correlation matrix.				
² From $\eta' \rightarrow \eta \pi^0 \pi^0$ decay. If $c \equiv 0$ from Bose-Einstein symmetry, $d = -0.067 \pm 0.020 \pm 0.003$.				
³ From $\eta' \rightarrow \eta \pi^+ \pi^-$ decay.				

NODE=M002DPD
 NODE=M002DPD

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

NODE=M002DPD;LINKAGE=DO

$\eta'(958)$ β PARAMETER

$|\text{MATRIX ELEMENT}|^2 = (1 + 2\beta Z)$

See the "Note on η Decay Parameters" in our 1994 edition Physical Review
D50 1173 (1994), p. 1454.

NODE=M002226

NODE=M002226

β decay parameter

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
-0.61 $\pm$ 0.08 OUR AVERAGE		Error includes scale factor of 1.2.		
-0.640 $\pm$ 0.046 $\pm$ 0.047	1.8k	ABLIKIM	15G BES3	$J/\psi \rightarrow \gamma(\pi^0 \pi^0 \pi^0)$
-0.59 $\pm$ 0.18	235	BLIK	08 GAMS	$32 \pi^- p \rightarrow \eta' n$
-0.1 $\pm$ 0.3		ALDE	87B GAM2	$38 \pi^- p \rightarrow n 3\pi^0$

NODE=M002B0
NODE=M002B0

$\eta'(958)$ C-NONCONSERVING DECAY PARAMETER

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

NODE=M002235

NODE=M002235

DECAY ASYMMETRY PARAMETER FOR $\pi^+ \pi^- \gamma$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
-0.03 $\pm$ 0.04 OUR AVERAGE				
-0.019 $\pm$ 0.056		AIHARA	87 TPC	$2\gamma \rightarrow \pi^+ \pi^- \gamma$
-0.069 $\pm$ 0.078	295	GRIGORIAN	75 STRC	$2.1 \pi^- p$
0.00 $\pm$ 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 $\pm$ 0.08	152	RITTENBERG	65 HBC	$2.1\text{--}2.7 K^- p$

NODE=M002A
NODE=M002A

$\eta'(958) \rightarrow \gamma \ell^+ \ell^-$ TRANSITION FORM FACTOR SLOPE

Related to the effective virtual meson mass Λ , via slope $\approx \Lambda^{-2}$. See e.g. LANDS-
BERG 85, eq. (3.8), for a detailed definition.

VALUE (GeV $^{-2}$)	EVTS	DOCUMENT ID	TECN	COMMENT
1.62 $\pm$ 0.17 OUR AVERAGE				
1.60 $\pm$ 0.17 $\pm$ 0.08	864	¹ ABLIKIM	150 BES3	$J/\psi \rightarrow \gamma e^+ e^-$
1.7 $\pm$ 0.4	33	¹ VIKTOROV	80	$25,33 \pi^- p \rightarrow 2\mu \gamma$

¹ In the single-pole Ansatz where slope = $1/(\Lambda^2 + \gamma^2)$ with Λ , γ being a Breit-Wigner
mass, width for the effective contributing vector meson.

NODE=M002FFL

NODE=M002FFL

NODE=M002FFL

NODE=M002FFL;LINKAGE=A

$\eta'(958)$ REFERENCES

AAIJ	17D	PL B764 233	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=57702
ABLIKIM	17	PRL 118 012001	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=57650
ABLIKIM	16M	PR D93 072008	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=57511
ABLIKIM	15AD	PR D92 051101	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=56983
ABLIKIM	15G	PR D92 012014	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=56602
ABLIKIM	15O	PR D92 012001	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=56780
ABLIKIM	15P	PR D92 012007	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=56781
ACHASOV	15	PR D91 092010	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=56788
AKHMETSHIN	15	PL B740 273	R.R. Akhmetshin <i>et al.</i>	(CMD-3 Collab.)	REFID=56386
PDG	15	RPP 2015 at pdg.lbl.gov		(PDG Collab.)	REFID=56977;ERROR=6
ABLIKIM	14M	PRL 112 251801	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=55904
DONSKOV	14	MPL A29 1450213	S. Donskov <i>et al.</i>	(GAMS-4 π Collab.)	REFID=56321
PDG	14	CP C38 070001	K. Olive <i>et al.</i>	(PDG Collab.)	REFID=55687
ABLIKIM	13	PR D87 012009	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=54829
ABLIKIM	13G	PR D87 032006	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=54952
ABLIKIM	13O	PR D87 092011	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=55388
ABLIKIM	13U	PR D88 091502	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=55582
ABLIKIM	12E	PRL 108 182001	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=54270
PDG	12	PR D86 010001	J. Beringer <i>et al.</i>	(PDG Collab.)	REFID=54066
ABLIKIM	11	PR D83 012003	M. Ablikim <i>et al.</i>	(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.			

NODE=M002

AMSLER	04B	EPJ C33 23	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=51079
BAI	04J	PL B594 47	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=50167
BRIERE	00	PRL 84 26	R. Briere <i>et al.</i>	(CLEO Collab.)	REFID=47410
ACCIARRI	98Q	PL B418 399	M. Acciarri <i>et al.</i>	(L3 Collab.)	REFID=46316
BARBERIS	98C	PL B440 225	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=46346
WURZINGER	96	PL B374 283	R. Wurzinger <i>et al.</i>	(BONN, ORSAY, SACL+)	REFID=44992
PDG	94	PR D50 1173	L. Montanet <i>et al.</i>	(CERN, LBL, BOST+)	REFID=43653
AMSLER	93	ZPHY C58 175	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=43311
BELADIDZE	92C	SJNP 55 1535	G.M. Beladidze, S.I. Bitukov, G.V. Borisov	(SERP+)	REFID=43175
		Translated from YAF 55 2748.			
KARCH	92	ZPHY C54 33	K. Karch <i>et al.</i>	(Crystal Ball Collab.)	REFID=42170
ARMSTRONG	91B	ZPHY C52 389	T.A. Armstrong <i>et al.</i>	(ATHU, BARI, BIRM+)	REFID=41862
BEHREND	91	ZPHY C49 401	H.J. Behrend <i>et al.</i>	(CELLO Collab.)	REFID=41497
AUGUSTIN	90	PR D42 10	J.E. Augustin <i>et al.</i>	(DM2 Collab.)	REFID=41352
BARU	90	ZPHY C48 581	S.E. Baru <i>et al.</i>	(MD-1 Collab.)	REFID=41366
BUTLER	90	PR D42 1368	F. Butler <i>et al.</i>	(Mark II Collab.)	REFID=41363
KARCH	90	PL B249 353	K. Karch <i>et al.</i>	(Crystal Ball Collab.)	REFID=41377
ROE	90	PR D41 17	N.A. Roe <i>et al.</i>	(ASP Collab.)	REFID=41014
AIHARA	88C	PR D38 1	H. Aihara <i>et al.</i>	(TPC-2 γ Collab.)	REFID=40564
VOROBYEV	88	SJNP 48 273	P.V. Vorobiev <i>et al.</i>	(NOVO)	REFID=41023
		Translated from YAF 48 436.			
WILLIAMS	88	PR D38 1365	D.A. Williams <i>et al.</i>	(Crystal Ball Collab.)	REFID=40567
AIHARA	87	PR D35 2650	H. Aihara <i>et al.</i>	(TPC-2 γ Collab.) JP	REFID=40009
ALBRECHT	87B	PL B199 457	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=40265
ALDE	87B	ZPHY C36 603	D.M. Alde <i>et al.</i>	(LANL, BELG, SERP, LAPP)	REFID=40236
ANTREASYAN	87	PR D36 2633	D. Antreasyan <i>et al.</i>	(Crystal Ball Collab.)	REFID=40008
GIDAL	87	PRL 59 2012	G. Gidal <i>et al.</i>	(LBL, SLAC, HARV)	REFID=40223
ALDE	86	PL B177 115	D.M. Alde <i>et al.</i>	(SERP, BELG, LANL, LAPP)	REFID=20310
BARTEL	85E	PL 160B 421	W. Bartel <i>et al.</i>	(JADE Collab.)	REFID=10843
LANDSBERG	85	PRPL 128 301	L.G. Landsberg	(SERP)	REFID=10844
ALTHOFF	84E	PL 147B 487	M. Althoff <i>et al.</i>	(TASSO Collab.)	REFID=20305
BERGER	84B	PL 142B 125	C. Berger	(PLUTO Collab.)	REFID=20306
BINON	84	PL 140B 264	F.G. Binon <i>et al.</i>	(SERP, BELG, LAPP+)	REFID=20307
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. Dzhelezhadine <i>et al.</i>	(SERP)	REFID=10836
STANTON	80	PL B92 353	N.R. Stanton <i>et al.</i>	(OSU, CARL, MCGI+)	REFID=40294
VIKTOROV	80	SJNP 32 520	V.A. Viktorov <i>et al.</i>	(SERP)	REFID=20298
		Translated from YAF 32 1005.			
APEL	79	PL 83B 131	W.D. Apel, K.H. Augenstein, E. Bertolucci	(KARLK+)	REFID=20295
BINNIE	79	PL 83B 141	D.M. Binnie <i>et al.</i>	(LOIC)	REFID=20296
ZANFINO	77	PRL 38 930	C. Zangino <i>et al.</i>	(CARL, MCGI, OHIO+)	REFID=20293
GRIGORIAN	75	NP B91 232	A. Grigorian <i>et al.</i>	(+)	REFID=20287
KALBFLEISCH	75	PR D11 987	G.R. Kalbfleisch, R.C. Strand, J.W. Chapman	(BNL+)	REFID=20223
DUANE	74	PRL 32 425	A. Duane <i>et al.</i>	(LOIC, SHMP)	REFID=20284
KALBFLEISCH	74	PR D10 916	G.R. Kalbfleisch	(BNL)	REFID=20286
DANBURG	73	PR D8 3744	J.S. Danburg <i>et al.</i>	(BNL, MICH) JP	REFID=20280
JACOBS	73	PR D8 18	S.M. Jacobs <i>et al.</i>	(BRAN, UMD, SYRA+)	REFID=20281
AGUILAR....	72B	PR D6 29	M. Aguilar-Benitez <i>et al.</i>	(BNL)	REFID=20205
APEL	72	PL 40B 680	W.D. Apel <i>et al.</i>	(KARLK, KARLE, PISA)	REFID=20275
DALPIAZ	72	PL 42B 377	P.F. Dalpiaz <i>et al.</i>	(CERN)	REFID=20278
BASILE	71	NC 3A 371	M. Basile <i>et al.</i>	(CERN, BGNA, STRB)	REFID=20270
HARVEY	71	PRL 27 885	E.H. Harvey <i>et al.</i>	(MINN, MICH)	REFID=20272
BENSINGER	70	PL 33B 505	J.R. Bensinger <i>et al.</i>	(WISC)	REFID=20268
RITTENBERG	69	Thesis UCRL 18863	A. Rittenberg	(LRL) I	REFID=20266
DAVIS	68	PL 27B 532	R. Davis <i>et al.</i>	(NWES, ANL)	REFID=20263
LONDON	66	PR 143 1034	G.W. London <i>et al.</i>	(BNL, SYRA) IJP	REFID=11774
BADIER	65B	PL 17 337	J. Badier <i>et al.</i>	(EPOL, SACL, AMST)	REFID=20253
RITTENBERG	65	PRL 15 556	A. Rittenberg, G.R. Kalbfleisch	(LRL, BNL)	REFID=10761
DAUBER	64	PRL 13 449	P.M. Dauber <i>et al.</i>	(UCLA) JP	REFID=20247
KALBFLEISCH	64B	PRL 13 349	G.R. Kalbfleisch, O.I. Dahl, A. Rittenberg	(LRL) JP	REFID=20252

$f_0(980)$

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

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

NODE=M003

NODE=M003

$f_0(980)$ MASS

NODE=M003M1

NODE=M003M1

→ UNCHECKED ←

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
990 ± 20 OUR ESTIMATE				
• • • We do not use the following data for averages, fits, limits, etc. • • •				
989.4 ± 1.3	424	ABLIKIM	15P BES3	$J/\psi \rightarrow K^+ K^- 3\pi$
989.9 ± 0.4	706	ABLIKIM	12E BES3	$J/\psi \rightarrow \gamma 3\pi$
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 $\pi^- \pi^0 \pi^0 \rightarrow K_S^0 K_S^0 K_L^0 X$
973 ± 1	2438	19 ALOISIO 02D	KLOE	$e^+e^- \rightarrow \pi^0 \pi^0 \gamma$
977 ± 3 ± 2	848	20 AITALA 01A	E791	$D^+ \rightarrow \pi^- \pi^+ \pi^+$
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	$e^+e^- \rightarrow \pi^0 \pi^0 \gamma$
975 ± 4 ± 6		25 AKHMETSHIN 99C	CMD2	$e^+e^- \rightarrow \pi^0 \pi^0 \gamma$
975 ± 4 ± 6		26 AKHMETSHIN 99C	CMD2	$e^+e^- \rightarrow \pi^+ \pi^- \gamma, \pi^0 \pi^0 \gamma$
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	$Z \rightarrow f_0 X$

OCCUR=2

OCCUR=2

OCCUR=2

OCCUR=2

OCCUR=2

OCCUR=2

OCCUR=3

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 $p\bar{p} \rightarrow p\bar{p}\pi^0\pi^0$
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 $\pi^-p \rightarrow \pi^0\pi^0n$
960 ± 10	10k	34 ALDE	95B	GAM2	38 $\pi^-p \rightarrow \pi^0\pi^0n$
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		JANSSEN	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 $p\bar{p}$
979 ± 4		41 ARMSTRONG	91	OMEG	300 $p\bar{p} \rightarrow p\bar{p}\pi\pi,$ $p\bar{p}K\bar{K}$
956 ± 12		BREAKSTONE	90	SFM	$p\bar{p} \rightarrow p\bar{p}\pi^+\pi^-$
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 ⁺ _{-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 $\pi^+p \rightarrow \pi^+p\pi^+\pi^-$

OCCUR=2

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 PROTOPOPESCU 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 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 (850–100i) 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.

¹² FLATTE 76 parameterization. $g_{f_0 \pi\pi} = 329 \pm 96$ MeV/c² assuming $g_{f_0 K\bar{K}}/g_{f_0 \pi\pi} = 2$.

¹³ Breit-Wigner mass. Using finite width corrections according to FLATTE 76 and ACHASOV 05, and the ratio $g_{f_0 K K}/g_{f_0 \pi\pi} = 4.21 \pm 0.25 \pm 0.21$ from ABLIKIM 05.

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, $g_{f_0 K\bar{K}}/g_{f_0 \pi\pi} = 4.21 \pm 0.25 \pm 0.21$.

¹⁸ K-matrix pole from combined analysis of $\pi^-p \rightarrow \pi^0\pi^0n$, $\pi^-p \rightarrow K\bar{K}n$, $\pi^+\pi^- \rightarrow \pi^+\pi^-$, $\bar{p}p \rightarrow \pi^0\pi^0\pi^0$, $\pi^0\eta\eta$, $\pi^0\pi^0\eta$, $\pi^+\pi^-\pi^0$, $K^+K^-\pi^0$, $K_S^0 K_S^0 \pi^0$, $K^+K_S^0 \pi^-$ at rest, $\bar{p}n \rightarrow \pi^-\pi^-\pi^+$, $K_S^0 K^- \pi^0$, $K_S^0 K_S^0 \pi^-$ at rest.

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.

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NODE=M003M1;LINKAGE=MU

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NODE=M003M;LINKAGE=TL

NODE=M003M;LINKAGE=V9

- 22 Supersedes ACHASOV 98i.
 23 In the “narrow resonance” approximation.
 24 Assuming $\Gamma(f_0) = 40$ 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) MeV.
 31 On sheet II in a 2 pole solution. The other pole is found on sheet III at (963–29i) 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) MeV and on sheet IV at (938–35i) 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) 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) 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) 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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 NODE=M003M;LINKAGE=SM
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 NODE=M003M1;LINKAGE=AA

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 NODE=M003M1;LINKAGE=KL

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 NODE=M003M1;LINKAGE=KM
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NODE=M003M1;LINKAGE=K
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 NODE=M003M;LINKAGE=R

$f_0(980)$ WIDTH

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

NODE=M003W1

NODE=M003W1

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
10 to 100 OUR ESTIMATE				
• • • We do not use the following data for averages, fits, limits, etc. • • •				
15.3 ± 4.7	424	ABLIKIM	15P	BES3 $J/\psi \rightarrow K^+ K^- 3\pi$
9.5 ± 1.1	706	ABLIKIM	12E	BES3 $J/\psi \rightarrow \gamma 3\pi$
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 $10.6 e^+e^- \rightarrow \phi\pi^+\pi^-\gamma$
81 ± 21	54 ± 9	9 AUBERT	07AK	BABR $10.6 e^+e^- \rightarrow \phi\pi^0\pi^0\gamma$
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 $40.0 \pi^- C \rightarrow K_S^0 K_S^0 K_L^0 X$
~ 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 $e^+e^- \rightarrow \pi^0\pi^0\gamma$

NODE=M003W1
 → UNCHECKED ←

OCCUR=2

OCCUR=2

122 ± 13	419	16,17	ACHASOV	00H	SND	$e^+e^- \rightarrow \pi^0\pi^0\gamma$	OCCUR=2
56 ± 20		18	AKHMETSHIN	99C	CMD2	$e^+e^- \rightarrow \pi^0\pi^0\gamma$	
65 ± 20			BARBERIS	99	OMEG	450 $pp \rightarrow p_s p_f K^+ K^-$	
80 ± 10			BARBERIS	99B	OMEG	450 $pp \rightarrow p_s p_f \pi^+ \pi^-$	
80 ± 10			BARBERIS	99C	OMEG	450 $pp \rightarrow p_s p_f \pi^0 \pi^0$	
48 ± 12 ± 8		19	BARBERIS	99D	OMEG	450 $pp \rightarrow K^+ K^-, \pi^+ \pi^-$	
65 ± 25			BELLAZZINI	99	GAM4	450 $pp \rightarrow pp\pi^0\pi^0$	
71 ± 14		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 $pp \rightarrow pp\pi^0\pi^0$	
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 pp	
72 ± 8		33	ARMSTRONG	91	OMEG	300 $pp \rightarrow pp\pi\pi, ppK\bar{K}$	
110 ± 30			BREAKSTONE	90	SFM	$pp \rightarrow pp\pi^+\pi^-$	
29 ± 13		22	ABACHI	86B	HRS	$e^+e^- \rightarrow \pi^+\pi^- X$	
120 ± 281 ± 20			ETKIN	82B	MPS	23 $\pi^- p \rightarrow n 2K_S^0$	
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	$\pi^- p \rightarrow nMM$	
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 (850–100i) 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 $g_{f_0} K K / g_{f_0} \pi\pi = 0$.

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 $g_{f_0} K K / g_{f_0} \pi\pi = 4.21 \pm 0.25 \pm 0.21$ from ABLIKIM 05.

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NODE=M003W1;LINKAGE=MU

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NODE=M003W1;LINKAGE=NS

NODE=M003W1;LINKAGE=MO

- 11 Breit-Wigner, solution 1, PWA ambiguous.
- 12 K-matrix pole from combined analysis of $\pi^- p \rightarrow \pi^0 \pi^0 n$, $\pi^- p \rightarrow K \bar{K} n$, $\pi^+ \pi^- \rightarrow \pi^+ \pi^-$, $\bar{p} p \rightarrow \pi^0 \pi^0 \pi^0$, $\pi^0 \eta \eta$, $\pi^0 \pi^0 \eta$, $\pi^+ \pi^- \pi^0$, $K^+ K^- \pi^0$, $K_S^0 K_S^0 \pi^0$, $K^+ K_S^0 \pi^-$ at rest, $\bar{p} n \rightarrow \pi^- \pi^- \pi^+$, $K_S^0 K^- \pi^0$, $K_S^0 K_S^0 \pi^-$ at rest.
- 13 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 PROTOPODESCU 73 data. With a simultaneous fit to the $\pi\pi$ phase-shifts, inelasticity and to the $K_S^0 K_S^0$ invariant mass.
- 36 Included in AGUILAR-BENITEZ 78 fit.

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 NODE=M003W1;LINKAGE=KL

NODE=M003W1;LINKAGE=CF
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 NODE=M003W1;LINKAGE=KM
 NODE=M003W1;LINKAGE=L

NODE=M003W1;LINKAGE=K
 NODE=M003W1;LINKAGE=B
 NODE=M003W;LINKAGE=B
 NODE=M003W;LINKAGE=C

NODE=M003W;LINKAGE=R

$f_0(980)$ 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 $e^+ e^-$	

NODE=M003215;NODE=M003

DESIG=2;OUR EVAL;→ UNCHECKED ←
 DESIG=1;OUR EVAL;→ UNCHECKED ←
 DESIG=5;OUR EVAL;→ UNCHECKED ←
 DESIG=4

$f_0(980)$ PARTIAL WIDTHS

$\Gamma(\gamma\gamma)$					Γ_3
VALUE (keV)	DOCUMENT ID	TECN	COMMENT		
0.31 $^{+0.05}_{-0.04}$ OUR AVERAGE					
0.32 ± 0.05	¹ DAI	14A	RVUE	Compilation	
0.286 ± 0.017 $^{+0.211}_{-0.070}$	² UEHARA	08A	BELL	10.6 $e^+ e^- \rightarrow e^+ e^- \pi^0 \pi^0$	
0.205 $^{+0.095}_{-0.083}$ $^{+0.147}_{-0.117}$	³ MORI	07	BELL	10.6 $e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^-$	
0.42 ± 0.06 ± 0.18	⁴ OEST	90	JADE	$e^+ e^- \rightarrow e^+ e^- \pi^0 \pi^0$	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.16 ± 0.01	⁵ MENNESSIER	11	RVUE		
0.29 ± 0.21 $^{+0.02}_{-0.07}$	⁶ MOUSSALLAM	11	RVUE	Compilation	
0.42	^{7,8} PENNINGTON	08	RVUE	Compilation	
0.10	^{8,9} PENNINGTON	08	RVUE	Compilation	
0.28 $^{+0.09}_{-0.13}$	¹⁰ BOGLIONE	99	RVUE	$\gamma\gamma \rightarrow \pi^+ \pi^-, \pi^0 \pi^0$	
0.29 ± 0.07 ± 0.12	^{11,12} BOYER	90	MRK2	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^-$	
0.31 ± 0.14 ± 0.09	^{11,12} MARSISKE	90	CBAL	$e^+ e^- \rightarrow e^+ e^- \pi^0 \pi^0$	
0.63 ± 0.14	¹³ MORGAN	90	RVUE	$\gamma\gamma \rightarrow \pi^+ \pi^-, \pi^0 \pi^0$	

NODE=M003220

NODE=M003W4
 NODE=M003W4

OCCUR=2

- ¹ Using dispersive analysis with phases from GARCIA-MARTIN 11A and BUETTIKER 04 as input.
- ² Using finite width corrections according to FLATTE 76 and ACHASOV 05, and the ratio $g_{f_0} K K / g_{f_0} \pi \pi = 0$.
- ³ Using finite width corrections according to FLATTE 76 and ACHASOV 05, and the ratio $g_{f_0} K K / g_{f_0} \pi \pi = 4.21 \pm 0.25 \pm 0.21$ from ABLIKIM 05.
- 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 Supersedes MORGAN 90.
- ¹¹ From analysis allowing arbitrary background unconstrained by unitarity.
- ¹² Data included in MORGAN 90, BOGLIONE 99 analyses.
- ¹³ 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	VOROBYEV	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
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
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.

 $f_0(980)$ REFERENCES

ABLIKIM	15P	PR D92 012007	M. Ablikim <i>et al.</i>	(BES III Collab.)
DAI	14A	PR D90 036004	L.-Y. Dai, M.R. Pennington	(CEBAF)
ABLIKIM	12E	PRL 108 182001	M. Ablikim <i>et al.</i>	(BES III Collab.)
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)
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.)
AMBROSINO	06B	PL B634 148	F. Ambrosino <i>et al.</i>	(KLOE Collab.)
AUBERT	06O	PR D74 032003	B. Aubert <i>et al.</i>	(BABAR Collab.)
GARMASH	06	PRL 96 251803	A. Garmash <i>et al.</i>	(BELLE Collab.)
ABLIKIM	05	PL B607 243	M. Ablikim <i>et al.</i>	(BES Collab.)
ABLIKIM	05Q	PR D72 092002	M. Ablikim <i>et al.</i>	(BES Collab.)
ACHASOV	05	PR D72 013006	N.N. Achasov, G.N. Shestakov	
GARMASH	05	PR D71 092003	A. Garmash <i>et al.</i>	(BELLE Collab.)
ABLIKIM	04G	PR D70 092002	M. Ablikim <i>et al.</i>	(BES Collab.)
BUETTIKER	04	EPJ C33 409	P. Buettiker, S. Descotes-Genon, B. Moussallam	
ANISOVICH	03	EPJ A16 229	V.V. Anisovich <i>et al.</i>	
TIKHOMIROV	03	PAN 66 828	G.D. Tikhomirov <i>et al.</i>	

Translated from YAF 66 860.

NODE=M003W4;LINKAGE=D

NODE=M003W4;LINKAGE=UE

NODE=M003W4;LINKAGE=MO

NODE=M003W4;LINKAGE=H

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NODE=M003R1;LINKAGE=B

NODE=M003

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REFID=50450

REFID=50958

REFID=50762

REFID=50641

REFID=50187

REFID=56428;ERROR=7

REFID=49401

REFID=49423

ALOISIO	02D	PL B537 21	A. Aloisio <i>et al.</i>	(KLOE Collab.)	REFID=48824
ANISOVICH	02D	PAN 65 1545	V.V. Anisovich <i>et al.</i>		REFID=48831
		Translated from YAF 65 1583.			
BRAMON	02	EPJ C26 253	A. Bramon <i>et al.</i>		REFID=49178
ACHASOV	01F	PR D63 094007	N.N. Achasov, V.V. Gubin	(Novosibirsk SND Collab.)	REFID=48312
AITALA	01A	PRL 86 765	E.M. Aitala <i>et al.</i>	(FNAL E791 Collab.)	REFID=48004
AITALA	01B	PRL 86 770	E.M. Aitala <i>et al.</i>	(FNAL E791 Collab.)	REFID=48005
ACHASOV	00H	PL B485 349	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47930
AKHMETSHIN	99B	PL B462 371	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=47392
AKHMETSHIN	99C	PL B462 380	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=47393
BARBERIS	99	PL B453 305	D. Barberis <i>et al.</i>	(Omega Expt.)	REFID=46921
BARBERIS	99B	PL B453 316	D. Barberis <i>et al.</i>	(Omega Expt.)	REFID=46922
BARBERIS	99C	PL B453 325	D. Barberis <i>et al.</i>	(Omega Expt.)	REFID=46923
BARBERIS	99D	PL B462 462	D. Barberis <i>et al.</i>	(Omega Expt.)	REFID=47395
BELLAZZINI	99	PL B467 296	R. Bellazzini <i>et al.</i>		REFID=47400
BOGLIONE	99	EPJ C9 11	M. Boglione, M.R. Pennington		REFID=46931
KAMINSKI	99	EPJ C9 141	R. Kaminski, L. Lesniak, B. Loiseau	(CRAC, PARIN)	REFID=46927
OLLER	99	PR D60 099906 (erratum)	J.A. Oller <i>et al.</i>		REFID=46899
OLLER	99B	NP A652 407 (erratum)	J.A. Oller, E. Oset		REFID=46924
OLLER	99C	PR D60 074023	J.A. Oller, E. Oset		REFID=47386
ACHASOV	98I	PL B440 442	M.N. Achasov <i>et al.</i>		REFID=46600
ACKERSTAFF	98Q	EPJ C4 19	K. Ackerstaff <i>et al.</i>	(OPAL Collab.)	REFID=46145
ALDE	98	EPJ A3 361	D. Alde <i>et al.</i>	(GAM4 Collab.)	REFID=46605
Also		PAN 62 405	D. Alde <i>et al.</i>	(GAMS Collab.)	REFID=46914
		Translated from YAF 62 446.			
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
ALDE	97	PL B397 350	D.M. Alde <i>et al.</i>	(GAMS Collab.)	REFID=45392
BERTIN	97C	PL B408 476	A. Bertin <i>et al.</i>	(OBELIX Collab.)	REFID=45701
ISHIDA	96	PTP 95 745	S. Ishida <i>et al.</i>	(TOKY, MIYA, KEK)	REFID=45770
TORNQVIST	96	PRL 76 1575	N.A. Tornqvist, M. Roos	(HELS)	REFID=44507
ALDE	95B	ZPHY C66 375	D.M. Alde <i>et al.</i>	(GAMS Collab.)	REFID=44375
AMSLER	95B	PL B342 433	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=44377
AMSLER	95D	PL B355 425	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=44441
ANISOVICH	95	PL B355 363	V.V. Anisovich <i>et al.</i>	(PNPI, SERP)	REFID=44442
JANSSEN	95	PR D52 2690	G. Janssen <i>et al.</i>	(STON, ADLD, JULI)	REFID=44508
AMSLER	94D	PL B333 277	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=44093
ANISOVICH	94	PL B323 233	V.V. Anisovich <i>et al.</i>	(Crystal Barrel Collab.)	REFID=43659
BUGG	94	PR D50 4412	D.V. Bugg <i>et al.</i>	(LOQM)	REFID=44078
KAMINSKI	94	PR D50 3145	R. Kaminski, L. Lesniak, J.P. Maillet	(CRAC+)	REFID=45771
ZOU	94B	PR D50 591	B.S. Zou, D.V. Bugg	(LOQM)	REFID=44072
MORGAN	93	PR D48 1185	D. Morgan, M.R. Pennington	(RAL, DURH)	REFID=43614
BEHREND	92	ZPHY C56 381	H.J. Behrend	(CELLO Collab.)	REFID=43172
AGUILAR-...	91	ZPHY C50 405	M. Aguilar-Benitez <i>et al.</i>	(LEBC-EHS Collab.)	REFID=41637
ARMSTRONG	91	ZPHY C51 351	T.A. Armstrong <i>et al.</i>	(ATHU, BARI, BIRM+)	REFID=41744
BOYER	90	PR D42 1350	J. Boyer <i>et al.</i>	(Mark II Collab.)	REFID=41362
BREAKSTONE	90	ZPHY C48 569	A.M. Breakstone <i>et al.</i>	(ISU, BGNA, CERN+)	REFID=41376
MARSISKE	90	PR D41 3324	H. Marsiske <i>et al.</i>	(Crystal Ball Collab.)	REFID=41351
MORGAN	90	ZPHY C48 623	D. Morgan, M.R. Pennington	(RAL, DURH)	REFID=41583
OEST	90	ZPHY C47 343	T. Oest <i>et al.</i>	(JADE Collab.)	REFID=41358
ACHASOV	89	NP B315 465	N.N. Achasov, V.N. Ivanchenko		REFID=48021
AUGUSTIN	89	NP B320 1	J.E. Augustin, G. Cosme	(DM2 Collab.)	REFID=41004
VOROBYEV	88	SJNP 48 273	P.V. Vorobiev <i>et al.</i>	(NOVO)	REFID=41023
		Translated from YAF 48 436.			
ABACHI	86B	PRL 57 1990	S. Abachi <i>et al.</i>	(PURD, ANL, IND, MICH+)	REFID=20394
ETKIN	82B	PR D25 1786	A. Etkin <i>et al.</i>	(BNL, CUNY, TUFTS, VAND)	REFID=20390
GIDAL	81	PL 107B 153	G. Gidal <i>et al.</i>	(SLAC, LBL)	REFID=20386
ACHASOV	80	SJNP 32 566	N.N. Achasov, S.A. Devyanin, G.N. Shestakov	(NOVM)	REFID=20458
		Translated from YAF 32 1098.			
COHEN	80	PR D22 2595	D. Cohen <i>et al.</i>	(ANL) IJP	REFID=20381
LOVERRE	80	ZPHY C6 187	P.F. Loverre <i>et al.</i>	(CERN, CDEF, MADR+) IJP	REFID=20382
AGUILAR-...	78	NP B140 73	M. Aguilar-Benitez <i>et al.</i>	(MADR, BOMB+)	REFID=20368
CASON	78	PRL 41 271	N.M. Cason <i>et al.</i>	(NDAM, ANL)	REFID=20370
LEEPER	77	PR D16 2054	R.J. Leeper <i>et al.</i>	(ISU)	REFID=20365
ROSSELET	77	PR D15 574	L. Rosselet <i>et al.</i>	(GEVA, SACL)	REFID=11004
FLATTE	76	PL 63B 224	S.M. Flatte	(CERN)	REFID=20446
WETZEL	76	NP B115 208	W. Wetzel <i>et al.</i>	(ETH, CERN, LOIC)	REFID=20362
SRINIVASAN	75	PR D12 681	V. Srinivasan <i>et al.</i>	(NDAM, ANL)	REFID=21062
GRAYER	74	NP B75 189	G. Grayer <i>et al.</i>	(CERN, MPIM)	REFID=20113
BINNIE	73	PRL 31 1534	D.M. Binnie <i>et al.</i>	(LOIC, SHMP)	REFID=20343
GRAYER	73	Tallahassee	G. Grayer <i>et al.</i>	(CERN, MPIM)	REFID=20347
HYAMS	73	NP B64 134	B.D. Hyams <i>et al.</i>	(CERN, MPIM)	REFID=20107
PROTOPOP...	73	PR D7 1279	S.D. Protopopescu <i>et al.</i>	(LBL)	REFID=20108

$a_0(980)$

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

See 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 ←

NODE=M036M1

NODE=M036M1

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
925 ± 9 OUR AVERAGE		[980.8 ± 2.7 MeV OUR 2008 AVERAGE]			
925 ± 5 ± 8	190k	¹ AAIJ	16N	LHCB	$D^0 \rightarrow K_S^0 K^\pm \pi^\mp$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
~ 1053		² OLLER	99C	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$
982 ± 3		³ ABELE	98	CBAR	$0.0 \bar{p}p \rightarrow K_L^0 K^\pm \pi^\mp$
975 ± 15		BERTIN	98B	OBLX ±	$0.0 \bar{p}p \rightarrow K^\pm K_S \pi^\mp$
976 ± 6	316	DEBILLY	80	HBC ±	$1.2\text{--}2 \bar{p}p \rightarrow f_1(1285)\omega$
1016 ± 10	100	⁴ ASTIER	67	HBC ±	$0.0 \bar{p}p$
1003.3 ± 7.0	143	⁵ ROSENFELD	65	RVUE ±	

¹ Using a two-channel resonance parametrization with couplings fixed to ABELE 98.

² T-matrix pole.

³ T-matrix pole on sheet II, the pole on sheet III is at 1006-i49 MeV.

⁴ ASTIER 67 includes data of BARLOW 67, CONFORTO 67, ARMENTEROS 65.

⁵ Plus systematic errors.

NODE=M036M2

NODE=M036M2

NEW

NODE=M036M2;LINKAGE=B
 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 $\begin{smallmatrix} +17.4 \\ -10.0 \end{smallmatrix}$		¹ UEHARA	09A	BELL	$\gamma\gamma \rightarrow \pi^0\eta$
80.2 $\pm$ 3.8 $\pm$ 5.4		² 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		$450 p\bar{p} \rightarrow \Delta_f^{++}\eta\pi^- p_s$
$\sim$ 42		³ OLLER	99	RVUE	$\eta\pi, K\bar{K}$
$\sim$ 112		³ 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		³ ANISOVICH	98B	RVUE	Compilation
65 $\pm$ 10		⁴ BERTIN	98B	OBLX $\pm$	$0.0 \bar{p}p \rightarrow K^\pm K_S \pi^\mp$
$\sim$ 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		⁵ AMSLER	92	CBAR	$0.0 \bar{p}p \rightarrow \eta\eta\pi^0$
95 $\pm$ 14	1040	⁵ ARMSTRONG	91B	OMEG $\pm$	$300 p\bar{p} \rightarrow p\bar{p}\eta\pi^+\pi^-$
62 $\pm$ 15	500	⁶ EVANGELIS...	81	OMEG $\pm$	$12 \pi^- p \rightarrow \eta\pi^+\pi^-\pi^- p$
60 $\pm$ 20	145	⁶ GURTU	79	HBC $\pm$	$4.2 K^- p \rightarrow \Lambda\eta 2\pi$
60 $\begin{smallmatrix} +50 \\ -30 \end{smallmatrix}$	47	CONFORTO	78	OSPK $-$	$4.5 \pi^- p \rightarrow pX^-$
86.0 $\begin{smallmatrix} +60.0 \\ -50.0 \end{smallmatrix}$	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		⁷ FLATTE	76	RVUE $-$	$4.2 K^- p \rightarrow \Lambda\eta 2\pi$
16.0 $\begin{smallmatrix} +25.0 \\ -16.0 \end{smallmatrix}$	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 $\pm$	$5.5 K^- p \rightarrow \Lambda\eta 2\pi$

¹ From a fit with the S-wave amplitude including two interfering Breit-Wigners plus a background term.

² From the T-matrix pole on sheet II, using AMSLER 94D and ABELE 98.

³ T-matrix pole.

⁴ The $\eta\pi$ width.

⁵ From a single Breit-Wigner fit.

⁶ From $f_1(1285)$ decay.

⁷ Using a two-channel resonance parametrization of GAY 76B data.

NODE=M036210

NODE=M036W1

→ UNCHECKED ←

OCCUR=2

NODE=M036W1;LINKAGE=UE

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 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		¹ ABELE 98	CBAR		$0.0 \bar{p}p \rightarrow K_L^0 K^\pm \pi^\mp$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
~ 24		² OLLER 99C	RVUE		$\pi\pi \rightarrow \pi\pi, K\bar{K}$
~ 25	100	³ ASTIER 67	HBC	$\pm$	
57 ± 13	143	⁴ ROSENFELD 65	RVUE	$\pm$	

¹ T-matrix pole on sheet II, the pole on sheet III is at 1006-i49 MeV.² T-matrix pole.³ ASTIER 67 includes data of BARLOW 67, CONFORTO 67, ARMENTEROS 65.⁴ Plus systematic errors.NODE=M036W2
NODE=M036W2NODE=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**

VALUE (keV)	DOCUMENT ID	TECN	Γ_4
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.30 ± 0.10	¹ AMSLER 98	RVUE	
¹ Using $\Gamma_{\gamma\gamma} B(a_0(980) \rightarrow \eta\pi) = 0.24 \pm 0.08$ keV.			

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	$\Gamma_1\Gamma_4/\Gamma$
$0.21^{+0.08}_{-0.04}$ OUR AVERAGE						
$0.128^{+0.003+0.502}_{-0.002-0.043}$			¹ UEHARA 09A	BELL	$\gamma\gamma \rightarrow \pi^0\eta$	
$0.28 \pm 0.04 \pm 0.10$	44		OEST 90	JADE	$e^+e^- \rightarrow e^+e^-\pi^0\eta$	
$0.19 \pm 0.07^{+0.10}_{-0.07}$			ANTREASYAN 86	CBAL	$e^+e^- \rightarrow e^+e^-\pi^0\eta$	

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	$\Gamma_1\Gamma_5/\Gamma$
<1.5	90		VOROBYEV 88	ND	$e^+e^- \rightarrow \pi^0\eta$	

NODE=M036G2
NODE=M036G2 **$a_0(980)$ BRANCHING RATIOS**

$\Gamma(K\bar{K})/\Gamma(\eta\pi)$	VALUE	DOCUMENT ID	TECN	CHG	COMMENT	Γ_2/Γ_1
0.183 ± 0.024 OUR AVERAGE	Error includes scale factor of 1.2.					
0.57 ± 0.16	¹ BARGIOTTI 03	OBLX			$\bar{p}p$	
0.23 ± 0.05	² ABELE 98	CBAR			$0.0 \bar{p}p \rightarrow K_L^0 K^\pm \pi^\mp$	
$0.166 \pm 0.01 \pm 0.02$	³ BARBERIS 98C	OMEG			$450 p\bar{p} \rightarrow p_f f_1(1285) p_s$	
• • • We do not use the following data for averages, fits, limits, etc. • • •						
1.20 ± 0.15	⁴ ANISOVICH 09	RVUE			$0.0 \bar{p}p, \pi N$	
$1.05 \pm 0.07 \pm 0.05$	⁵ BUGG 08A	RVUE	0		$\bar{p}p \rightarrow \pi^0\pi^0\eta$	
~ 0.60	OLLER 99B	RVUE			$\pi\pi \rightarrow \eta\pi, K\bar{K}$	
0.7 ± 0.3	³ CORDEN 78	OMEG			$12-15 \pi^- p \rightarrow n\eta 2\pi$	
0.25 ± 0.08	³ DEFOIX 72	HBC	$\pm$		$0.7 \bar{p} \rightarrow 7\pi$	

NODE=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 $K^- p \rightarrow \Lambda \eta 2\pi$

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

² Using $\pi^0 \pi^0 \eta$ from AMSLER 94D.

³ From the decay of $f_1(1285)$.

⁴ This is a ratio of couplings.

⁵ 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

AAIJ	16N	PR D93 052018	R. Aaij <i>et al.</i>	(LHCb Collab.)
AMBROSINO	09F	PL B681 5	F. Ambrosino <i>et al.</i>	(KLOE Collab.)
ANISOVICH	09	IJMP A24 2481	V.V. Anisovich, A.V. Sarantsev	
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	PR D57 3860	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
ACHASOV	98B	PL B438 441	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)
AMSLER	98	RMP 70 1293	C. Amsler	
ANISOVICH	98B	SPU 41 419	V.V. Anisovich <i>et al.</i>	
		Translated from UFN 168 481.		
BARBERIS	98C	PL B440 225	D. Barberis <i>et al.</i>	(WA 102 Collab.)
BERTIN	98B	PL B434 180	A. Bertin <i>et al.</i>	(OBELIX Collab.)
TORNQVIST	96	PRL 76 1575	N.A. Tornqvist, M. Roos	(HELS)
JANSSEN	95	PR D52 2690	G. Janssen <i>et al.</i>	(STON, ADLD, JULI)
AMSLER	94C	PL B327 425	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
AMSLER	94D	PL B333 277	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
BUGG	94	PR D50 4412	D.V. Bugg <i>et al.</i>	(LOQM)
AMSLER	92	PL B291 347	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
ARMSTRONG	91B	ZPHY C52 389	T.A. Armstrong <i>et al.</i>	(ATHU, BARI, BIRM+)
OEST	90	ZPHY C47 343	T. Oest <i>et al.</i>	(JADE Collab.)
ACHASOV	89	NP B315 465	N.N. Achasov, V.N. Ivanchenko	
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, TNT0, 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, LIVP)
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=57273

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$\phi(1020)$

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

NODE=M004

 $\phi(1020)$ MASS

NODE=M004M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1019.460±0.016 OUR AVERAGE				
[1019.461 ± 0.019 MeV OUR 2016 AVERAGE Scale factor = 1.1]				
1019.457±0.061	610k	KOZYREV	16	CMD3 $e^+e^- \rightarrow K_S^0 K_L^0$
1019.462±0.042±0.056	28k	¹ LEES	14H	BABR $e^+e^- \rightarrow K_S^0 K_L^0 \gamma$
1019.51 ±0.02 ±0.05		² LEES	13Q	BABR $e^+e^- \rightarrow K^+ K^- \gamma$
1019.30 ±0.02 ±0.10	105k	AKHMETSHIN	06	CMD2 $0.98-1.06 e^+e^- \rightarrow \pi^+ \pi^- \pi^0$
1019.52 ±0.05 ±0.05	17.4k	AKHMETSHIN	05	CMD2 $0.60-1.38 e^+e^- \rightarrow \pi^+ \pi^- \pi^0$
1019.483±0.011±0.025	272k	³ AKHMETSHIN	04	CMD2 $e^+e^- \rightarrow K_L^0 K_S^0$
1019.42 ±0.05	1900k	⁴ 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		⁵ ACHASOV	00B	SND $e^+e^- \rightarrow \eta \gamma$
1019.38 ±0.07 ±0.08	2200	⁶ AKHMETSHIN	99F	CMD2 $e^+e^- \rightarrow \pi^+ \pi^- \geq 2\gamma$
1019.51 ±0.07 ±0.10	11169	AKHMETSHIN	98	CMD2 $e^+e^- \rightarrow \pi^+ \pi^- \pi^0$
1019.5 ±0.4		BARBERIS	98	OMEG $450 p p \rightarrow p p 2K^+ 2K^-$
1019.42 ±0.06	55600	AKHMETSHIN	95	CMD2 $e^+e^- \rightarrow \text{hadrons}$
1019.7 ±0.3	2012	DAVENPORT	86	MPSF $400 p A \rightarrow 4 K X$
1019.7 ±0.1 ±0.1	5079	ALBRECHT	85D	ARG $10 e^+e^- \rightarrow K^+ K^- X$
1019.3 ±0.1	1500	ARENTON	82	AEMS $11.8 \text{ polar. } p p \rightarrow K K$
1019.67 ±0.17	25080	⁷ PELLINEN	82	RVUE $e^+e^- \rightarrow \text{hadrons}$
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. ● ● ●				
1019.48 ±0.01		LEES	13F	BABR $D^+ \rightarrow K^+ K^- \pi^+$
1019.441±0.008±0.080	542k	⁸ AKHMETSHIN	08	CMD2 $1.02 e^+e^- \rightarrow K^+ K^-$
1019.63 ±0.07	12540	⁹ AUBERT,B	05J	BABR $D^0 \rightarrow \bar{K}^0 K^+ K^-$
1019.8 ±0.7		ARMSTRONG	86	OMEG $85 \pi^+ / p p \rightarrow \pi^+ / p 4 K p$
1020.1 ±0.11	5526	⁹ ATKINSON	86	OMEG $20-70 \gamma p$
1019.7 ±1.0		BEBEK	86	CLEO $e^+e^- \rightarrow \gamma(4S)$
1019.411±0.008	642k	¹⁰ DIJKSTRA	86	SPEC $100-200 \pi^\pm, \bar{p}, p, K^\pm, \text{ on Be}$
1020.9 ±0.2		⁹ FRAME	86	OMEG $13 K^+ p \rightarrow \phi K^+ p$
1021.0 ±0.2		⁹ ARMSTRONG	83B	OMEG $18.5 K^- p \rightarrow K^- K^+ \Lambda$
1020.0 ±0.5		⁹ ARMSTRONG	83B	OMEG $18.5 K^- p \rightarrow K^- K^+ \Lambda$
1019.7 ±0.3		⁹ 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	⁹ 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 $2 \gamma p \rightarrow p K^+ K^-$
1020.3 ±0.4	100	BALLAM	73	HBC $2.8-9.3 \gamma p$
1019.4 ±0.7		BINNIE	73B	CNTR $\pi^- p \rightarrow \phi n$
1019.6 ±0.5	120	¹¹ AGUILAR-...	72B	HBC $3.9, 4.6 K^- p \rightarrow \Lambda K^+ K^-$
1019.9 ±0.5	100	¹¹ AGUILAR-...	72B	HBC $3.9, 4.6 K^- p \rightarrow K^- p K^+ K^-$
1020.4 ±0.5	131	COLLEY	72	HBC $10 K^+ p \rightarrow K^+ p \phi$
1019.9 ±0.3	410	STOTTLE...	71	HBC $2.9 K^- p \rightarrow \Sigma / \Lambda K \bar{K}$

NODE=M004M

NEW

OCCUR=2

OCCUR=2

OCCUR=2

- ¹ Using a vector meson dominance model with contribution from $\phi(1020)$ and higher mass excitations of $\rho(770)$, $\omega(782)$ and $\phi(1020)$.
- ² Using a phenomenological model based on KUHN 90 with a sum of Breit-Wigner resonances for $\rho(770)$, $\omega(782)$, $\phi(1020)$ and their higher mass excitations.
- ³ Update of AKHMETSHIN 99D
- ⁴ 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.
- ⁵ Using a total width of 4.43 ± 0.05 MeV. Systematic uncertainty included.
- ⁶ Using a total width of 4.43 ± 0.05 MeV.
- ⁷ PELLINEN 82 review includes AKERLOF 77, DAUM 81, BALDI 77, AYRES 74, DE-GROOT 74.
- ⁸ Strongly correlated with AKHMETSHIN 04.
- ⁹ Systematic errors not evaluated.
- ¹⁰ Weighted and scaled average of 12 measurements of DIJKSTRA 86.
- ¹¹ Mass errors enlarged by us to $\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.

NODE=M004M;LINKAGE=E

NODE=M004M;LINKAGE=C

NODE=M004M;LINKAGE=GS
 NODE=M004M;LINKAGE=AE

NODE=M004M;LINKAGE=G2
 NODE=M004M;LINKAGE=F2
 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

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
4.247$\pm$0.016 OUR AVERAGE Error includes scale factor of 1.2. [4.266 $\pm$ 0.031 MeV OUR 2016 AVERAGE Scale factor = 1.2]				
4.240 $\pm$ 0.017	610k	KOZYREV	16	CMD3 $e^+e^- \rightarrow K_S^0 K_L^0$
4.205 $\pm$ 0.103 $\pm$ 0.067	28k	¹ LEES	14H	BABR $e^+e^- \rightarrow K_S^0 K_L^0 \gamma$
4.29 $\pm$ 0.04 $\pm$ 0.07		² LEES	13Q	BABR $e^+e^- \rightarrow K^+ K^- \gamma$
4.30 $\pm$ 0.06 $\pm$ 0.17	105k	AKHMETSHIN 06	CMD2	0.98–1.06 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
4.280 $\pm$ 0.033 $\pm$ 0.025	272k	³ AKHMETSHIN 04	CMD2	$e^+e^- \rightarrow K_L^0 K_S^0$
4.21 $\pm$ 0.04	1900k	⁴ ACHASOV	01E	SND $e^+e^- \rightarrow K^+ K^-, K_S K_L, \pi^+\pi^-\pi^0$
4.44 $\pm$ 0.09	55600	AKHMETSHIN 95	CMD2	$e^+e^- \rightarrow$ hadrons
4.5 $\pm$ 0.7	1500	ARENTON	82	AEMS 11.8 polar. $pp \rightarrow KK$
4.2 $\pm$ 0.6	766	⁵ IVANOV	81	OLYA 1–1.4 $e^+e^- \rightarrow K^+ K^-$
4.3 $\pm$ 0.6		⁵ CORDIER	80	DM1 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
4.36 $\pm$ 0.29	3681	⁵ BUKIN	78C	OLYA $e^+e^- \rightarrow$ hadrons
4.4 $\pm$ 0.6	984	⁵ BESCH	74	CNTR $2\gamma p \rightarrow pK^+K^-$
4.67 $\pm$ 0.72	681	⁵ BALAKIN	71	OSPK $e^+e^- \rightarrow$ hadrons
4.09 $\pm$ 0.29		BIZOT	70	OSPK $e^+e^- \rightarrow$ hadrons
• • • We do not use the following data for averages, fits, limits, etc. • • •				
4.37 $\pm$ 0.02		LEES	13F	BABR $D^+ \rightarrow K^+ K^- \pi^+$
4.24 $\pm$ 0.02 $\pm$ 0.03	542k	⁶ AKHMETSHIN 08	CMD2	1.02 $e^+e^- \rightarrow K^+ K^-$
4.28 $\pm$ 0.13	12540	⁷ AUBERT,B	05J	BABR $D^0 \rightarrow \bar{K}^0 K^+ K^-$
4.45 $\pm$ 0.06	271k	DIJKSTRA	86	SPEC 100 π^- Be
3.6 $\pm$ 0.8	337	⁵ COOPER	78B	HBC 0.7–0.8 $\bar{p}p \rightarrow K_S^0 K_L^0 \pi^+\pi^-$
4.5 $\pm$ 0.50	1300	^{5,7} AKERLOF	77	SPEC 400 $pA \rightarrow K^+ K^- X$
4.5 $\pm$ 0.8	500	^{5,7} AYRES	74	ASPK 3–6 $\pi^- p \rightarrow K^+ K^- n, K^- p \rightarrow K^+ K^- \Lambda/\Sigma^0$
3.81 $\pm$ 0.37		COSME	74B	OSPK $e^+e^- \rightarrow K_L^0 K_S^0$
3.8 $\pm$ 0.7	454	⁵ BORENSTEIN	72	HBC 2.18 $K^- p \rightarrow K \bar{K} n$

NODE=M004W
 NEW

NODE=M004W;LINKAGE=E

NODE=M004W;LINKAGE=C

NODE=M004W;LINKAGE=GS
 NODE=M004W;LINKAGE=AE

NODE=M004W;LINKAGE=D
 NODE=M004W;LINKAGE=AH
 NODE=M004W;LINKAGE=A

- ¹ Using a vector meson dominance model with contribution from $\phi(1020)$ and higher mass excitations of $\rho(770)$, $\omega(782)$ and $\phi(1020)$.
- ² Using a phenomenological model based on KUHN 90 with a sum of Breit-Wigner resonances for $\rho(770)$, $\omega(782)$, $\phi(1020)$ and their higher mass excitations.
- ³ Update of AKHMETSHIN 99D
- ⁴ 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.
- ⁵ Width errors enlarged by us to $4\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.
- ⁶ Strongly correlated with AKHMETSHIN 04.
- ⁷ Systematic errors not evaluated.

$$\frac{\Gamma(\phi(1020) \rightarrow K_L^0 K_S^0)}{\Gamma_{\text{total}}(e^+e^-)} \times \frac{\Gamma(\phi(1020) \rightarrow \text{DESIG=2})}{\Gamma_{\text{DESIG=5}}}$$

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

¹ Using a vector meson dominance model with contribution from $\phi(1020)$ and higher mass excitations of $\rho(770)$, $\omega(782)$ and $\phi(1020)$.

NODE=M004GXX
NODE=M004GXX

NODE=M004GXX;LINKAGE=A

$\phi(1020)$ DECAY MODES

NODE=M004215;NODE=M004

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
$\Gamma_1 K^+ K^-$	(49.0 $\pm$ 0.5) %	S=1.2
$\Gamma_2 K_L^0 K_S^0$	(34.1 $\pm$ 0.4) %	S=1.1
$\Gamma_3 \rho\pi + \pi^+\pi^-\pi^0$	(15.33 $\pm$ 0.32) %	S=1.1
$\Gamma_4 \rho\pi$		
$\Gamma_5 \pi^+\pi^-\pi^0$		
$\Gamma_6 \eta\gamma$	(1.309 $\pm$ 0.024) %	S=1.2
$\Gamma_7 \pi^0\gamma$	(1.31 $\pm$ 0.05) $\times 10^{-3}$	
$\Gamma_8 \ell^+\ell^-$	—	
$\Gamma_9 e^+e^-$	(2.956 $\pm$ 0.030) $\times 10^{-4}$	S=1.1
$\Gamma_{10} \mu^+\mu^-$	(2.87 $\pm$ 0.19) $\times 10^{-4}$	
$\Gamma_{11} \eta e^+e^-$	(1.08 $\pm$ 0.04) $\times 10^{-4}$	
$\Gamma_{12} \pi^+\pi^-$	(7.3 $\pm$ 1.3) $\times 10^{-5}$	
$\Gamma_{13} \omega\pi^0$	(4.7 $\pm$ 0.5) $\times 10^{-5}$	
$\Gamma_{14} \omega\gamma$	< 5 %	CL=84%
$\Gamma_{15} \rho\gamma$	< 1.2 $\times 10^{-5}$	CL=90%
$\Gamma_{16} \pi^+\pi^-\gamma$	(4.1 $\pm$ 1.3) $\times 10^{-5}$	
$\Gamma_{17} f_0(980)\gamma$	(3.22 $\pm$ 0.19) $\times 10^{-4}$	S=1.1
$\Gamma_{18} \pi^0\pi^0\gamma$	(1.13 $\pm$ 0.06) $\times 10^{-4}$	
$\Gamma_{19} \pi^+\pi^-\pi^+\pi^-$	(4.0 $^{+2.8}_{-2.2}$) $\times 10^{-6}$	
$\Gamma_{20} \pi^+\pi^+\pi^-\pi^-\pi^0$	< 4.6 $\times 10^{-6}$	CL=90%
$\Gamma_{21} \pi^0 e^+e^-$	(1.33 $^{+0.07}_{-0.10}$) $\times 10^{-5}$	
$\Gamma_{22} \pi^0\eta\gamma$	(7.27 $\pm$ 0.30) $\times 10^{-5}$	S=1.5
$\Gamma_{23} a_0(980)\gamma$	(7.6 $\pm$ 0.6) $\times 10^{-5}$	
$\Gamma_{24} K^0 \bar{K}^0 \gamma$	< 1.9 $\times 10^{-8}$	CL=90%
$\Gamma_{25} \eta'(958)\gamma$	(6.25 $\pm$ 0.21) $\times 10^{-5}$	
$\Gamma_{26} \eta\pi^0\pi^0\gamma$	< 2 $\times 10^{-5}$	CL=90%
$\Gamma_{27} \mu^+\mu^-\gamma$	(1.4 $\pm$ 0.5) $\times 10^{-5}$	
$\Gamma_{28} \rho\gamma\gamma$	< 1.2 $\times 10^{-4}$	CL=90%
$\Gamma_{29} \eta\pi^+\pi^-$	< 1.8 $\times 10^{-5}$	CL=90%
$\Gamma_{30} \eta\mu^+\mu^-$	< 9.4 $\times 10^{-6}$	CL=90%
$\Gamma_{31} \eta U \rightarrow \eta e^+e^-$	< 1 $\times 10^{-6}$	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
DESIG=14
DESIG=21
DESIG=22
DESIG=23
DESIG=257
DESIG=194
DESIG=195
DESIG=196
DESIG=250
DESIG=255
DESIG=26
DESIG=259

Lepton Family number (LF) violating modes

$\Gamma_{32} e^\pm \mu^\mp$	LF	< 2	$\times 10^{-6}$	CL=90%

NODE=M004;CLUMP=A
DESIG=258

CONSTRAINED FIT INFORMATION

An overall fit to 30 branching ratios uses 82 measurements and one constraint to determine 14 parameters. The overall fit has a $\chi^2 = 59.0$ for 69 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta x_i \delta x_j \rangle / (\delta x_i \delta x_j)$, 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	-74										
x_3	-60	-10									
x_6	-17	13	3								
x_7	-11	10	3	8							
x_9	44	-43	-11	-32	-24						
x_{10}	-5	5	1	4	3	-11					
x_{12}	-3	2	1	2	1	-5	1				
x_{13}	-3	3	1	2	2	-7	1	0			
x_{17}	0	0	0	0	0	0	0	0	0		
x_{18}	-8	7	2	17	4	-17	2	1	1	0	
x_{19}	-1	1	0	0	0	-1	0	0	0	0	0
x_{23}	0	0	0	0	0	0	0	0	0	0	0
x_{25}	-6	4	1	32	2	-10	1	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

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

 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.
- 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 .
- ³ From forward-backward asymmetry and using $\Gamma_{\text{total}} = 4.26 \pm 0.05$ MeV from the 2004 edition of this Review.

NODE=M004W5;LINKAGE=AM

NODE=M004W8;LINKAGE=AK

NODE=M004W8;LINKAGE=AM

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

NODE=M004223

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

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

NODE=M004G01
NODE=M004G01

¹ Using a phenomenological model based on KUHN 90 with a sum of Breit-Wigner resonances for $\rho(770)$, $\omega(782)$, $\phi(1020)$ and their higher mass excitations. The first error combines statistical and systematic uncertainties. The second one is due to the parametrization of the charged kaon form factor and mass calibration.

NODE=M004G01;LINKAGE=A

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

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

14.49 ± 0.24 OUR FIT Error includes scale factor of 1.2. $[(14.46 \pm 0.23) \times 10^{-5}]$ OUR 2016 FIT Scale factor = 1.1]

NODE=M004G10
NODE=M004G10

NEW

14.24 ± 0.30 OUR AVERAGE

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

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

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

10.08 ± 0.11 OUR FIT

$[(10.10 \pm 0.13) \times 10^{-5}]$ OUR 2016 FIT]

10.07 ± 0.13 OUR AVERAGE

$[(10.06 \pm 0.16) \times 10^{-5}]$ OUR 2016 AVERAGE]

10.078 ± 0.223	610k	² KOZYREV	16 CMD3	$e^+ e^- \rightarrow K_S^0 K_L^0$
10.01 ± 0.04 ± 0.17	272k	³ AKHMETSHIN 04	CMD2	$e^+ e^- \rightarrow K_L^0 K_S^0$
10.27 ± 0.07 ± 0.34	500k	¹ ACHASOV	01E SND	$e^+ e^- \rightarrow K^+ K^-, K_S^0 K_L^0, \pi^+ \pi^- \pi^0$

NODE=M004G6
NODE=M004G6

NEW

NEW

ERROR=8

² Kozyrev 2016 also reports $\Gamma(\phi \rightarrow e^+ e^-) B(\phi \rightarrow K_S^0 K_L^0) = (0.428 \pm 0.001 \pm 0.009)$ keV.

NODE=M004G6;LINKAGE=A

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

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

4.53 ± 0.10 OUR FIT Error includes scale factor of 1.1.

4.46 ± 0.12 OUR AVERAGE

4.51 ± 0.16 ± 0.11	105k	AKHMETSHIN 06	CMD2	0.98–1.06 $e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
4.30 ± 0.08 ± 0.21		AUBERT, B	04N BABR	10.6 $e^+ e^- \rightarrow \pi^+ \pi^- \pi^0 \gamma$
4.665 ± 0.042 ± 0.261	400k	¹ ACHASOV	01E SND	$e^+ e^- \rightarrow K^+ K^-, K_S^0 K_L^0, \pi^+ \pi^- \pi^0$
4.35 ± 0.27 ± 0.08	11169	¹ 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 $\Gamma(\eta\gamma) / \Gamma_{\text{total}} \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$ $\Gamma_6 / \Gamma \times \Gamma_9 / \Gamma$

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

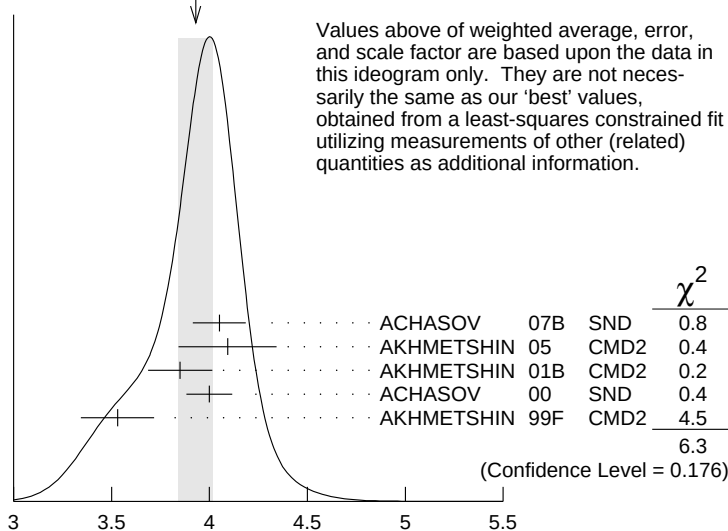
3.87 ± 0.07 OUR FIT Error includes scale factor of 1.2.

3.93 ± 0.09 OUR AVERAGE Error includes scale factor of 1.3. See the ideogram below.

4.050 ± 0.067 ± 0.118	33k	² ACHASOV	07B SND	0.6–1.38 $e^+ e^- \rightarrow \eta\gamma$
4.093 ^{+0.040} _{-0.043} ± 0.247	17.4k	³ AKHMETSHIN 05	CMD2	0.60–1.38 $e^+ e^- \rightarrow \eta\gamma$
3.850 ± 0.041 ± 0.159	23k	^{4,5} AKHMETSHIN 01B	CMD2	$e^+ e^- \rightarrow \eta\gamma$
4.00 ± 0.04 ± 0.11		⁶ ACHASOV	00 SND	$e^+ e^- \rightarrow \eta\gamma$
3.53 ± 0.08 ± 0.17	2200	^{7,8} AKHMETSHIN 99F	CMD2	$e^+ e^- \rightarrow \eta\gamma$

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

NODE=M004G2
NODE=M004G2

4.19 ± 0.06 ⁹ BENAYOUN 10 RVUE 0.4–1.05 e^+e^- WEIGHTED AVERAGE
3.93 $\pm$ 0.09 (Error scaled by 1.3)

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

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

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

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

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

3.87 $\pm$ 0.14 OUR FIT[(3.74 $\pm$ 0.18) $\times 10^{-7}$ OUR 2016 FIT]**3.87 $\pm$ 0.15 OUR AVERAGE**[(3.71 $\pm$ 0.21) $\times 10^{-7}$ OUR 2016 AVERAGE]4.04 $\pm$ 0.09 $\pm$ 0.19¹⁰ ACHASOV

16A

SND

0.60–1.38 $e^+e^- \rightarrow \pi^0\gamma$ 3.75 $\pm$ 0.11 $\pm$ 0.29

18680

AKHMETSHIN 05

CMD2

0.60–1.38 $e^+e^- \rightarrow \pi^0\gamma$ 3.67 $\pm$ 0.10 $^{+0.27}_{-0.25}$ ¹¹ ACHASOV

00

SND

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

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

4.29 $\pm$ 0.11⁹ BENAYOUN

10

RVUE

0.4–1.05 e^+e^-

¹⁰ From the VMD model with the interfering $\rho(770)$, $\omega(782)$, $\phi(1020)$ resonances, and an additional resonance describing the total contribution of the $\rho(1450)$ and $\omega(1420)$ states. Supersedes ACHASOV 2000.

NODE=M004G3

NODE=M004G3

NEW

NEW

NODE=M004G3;LINKAGE=B

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

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

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

8.5 $^{+0.5}_{-0.6}$ OUR FIT**8.8 $\pm$ 0.9 OUR AVERAGE**

Error includes scale factor of 1.5. See the ideogram below.

8.36 $\pm$ 0.59 $\pm$ 0.37

ACHASOV

01G

SND

 $e^+e^- \rightarrow \mu^+\mu^-$ 9.9 $\pm$ 1.4 $\pm$ 0.9⁷ ACHASOV

99C

SND

 $e^+e^- \rightarrow \mu^+\mu^-$ 14.4 $\pm$ 3.0¹ VASSERMAN

81

OLYA

 $e^+e^- \rightarrow \mu^+\mu^-$ 8.6 $\pm$ 5.9¹ AUGUSTIN

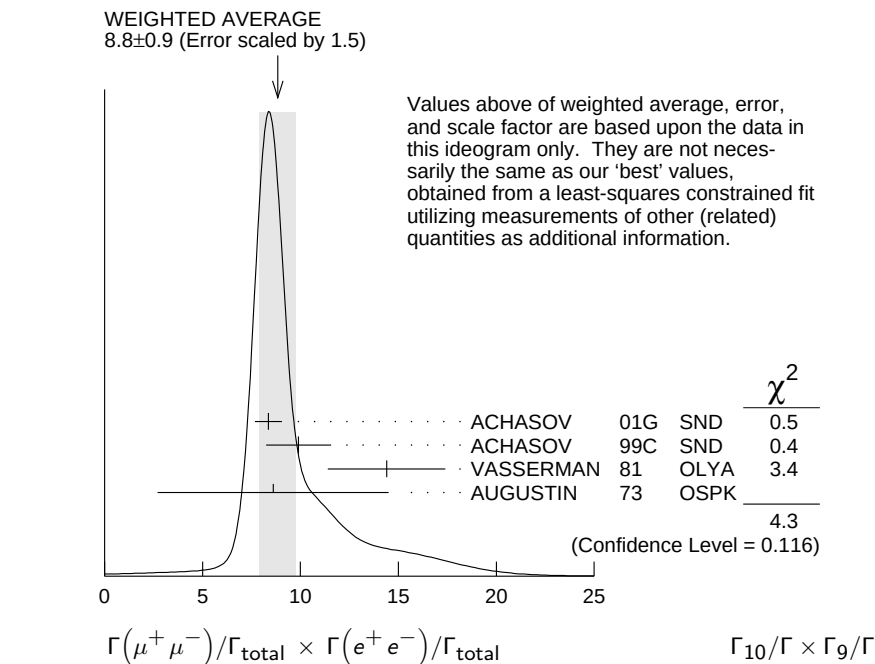
73

OSPK

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

NODE=M004G5

NODE=M004G5



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

VALUE (units 10 ⁻⁸)	DOCUMENT ID	TECN	COMMENT
2.2 ±0.4 OUR FIT			
2.2 ±0.4 OUR AVERAGE			
2.1 ±0.3 ±0.3	7 ACHASOV	00C	SND $e^+e^- \rightarrow \pi^+\pi^-$
1.95 ^{+1.15} _{-0.87}	1 GOLUBEV	86	ND $e^+e^- \rightarrow \pi^+\pi^-$
6.01 ^{+3.19} _{-2.51}	1 VASSERMAN	81	OLYA $e^+e^- \rightarrow \pi^+\pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
3.31±0.99	1 BENAYOUN	13	RVUE 0.4–1.05 e^+e^-

NODE=M004G4
NODE=M004G4

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

VALUE (units 10 ⁻⁸)	DOCUMENT ID	TECN	COMMENT
1.40±0.15 OUR FIT			
1.37±0.17±0.01	2,3 AMBROSINO	08G	KLOE $e^+e^- \rightarrow \pi^+\pi^-2\pi^0, 2\pi^0\gamma$

NODE=M004G11
NODE=M004G11

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

VALUE (units 10 ⁻⁸)	DOCUMENT ID	TECN	COMMENT
3.34±0.17 OUR FIT			
3.33^{+0.04+0.19}_{-0.09-0.20}	4 AMBROSINO	07	KLOE $e^+e^- \rightarrow \pi^0\pi^0\gamma$

NODE=M004G9
NODE=M004G9

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

VALUE (units 10 ⁻⁹)	EVTS	DOCUMENT ID	TECN	COMMENT
1.2^{+0.8}_{-0.7} OUR FIT				
1.17±0.52±0.64	3285	7 AKHMETSHIN	00E	CMD2 $e^+e^- \rightarrow \pi^+\pi^-\pi^+\pi^-$

NODE=M004G8
NODE=M004G8

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.

³ Update of AKHMETSHIN 99D

¹ Recalculated by us from the cross section in the peak.

² 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.

³ From the $\eta \rightarrow 2\gamma$ decay and using $B(\eta \rightarrow \gamma\gamma) = 39.43 \pm 0.26\%$.

⁴ From the $\eta \rightarrow 3\pi^0$ decay and using $B(\eta \rightarrow 3\pi^0) = (32.24 \pm 0.29) \times 10^{-2}$.

⁵ The combined fit from 600 to 1380 MeV taking into account $\rho(770)$, $\omega(782)$, $\phi(1020)$, and $\rho(1450)$ (mass and width fixed at 1450 MeV and 310 MeV respectively).

⁶ From the $\eta \rightarrow 2\gamma$ decay and using $B(\eta \rightarrow 2\gamma) = (39.21 \pm 0.34) \times 10^{-2}$.

⁷ Recalculated by the authors from the cross section in the peak.

⁸ From the $\eta \rightarrow \pi^+\pi^-\pi^0$ decay and using $B(\eta \rightarrow \pi^+\pi^-\pi^0) = (23.1 \pm 0.5) \times 10^{-2}$.

NODE=M004G;LINKAGE=AE

NODE=M004G;LINKAGE=GS

NODE=M004G;LINKAGE=B

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

- ⁹ A simultaneous fit of $e^+e^- \rightarrow \pi^+\pi^-, \pi^+\pi^-\pi^0, \pi^0\gamma, \eta\gamma$ data.
- ¹¹ From the $\pi^0 \rightarrow 2\gamma$ decay and using $B(\pi^0 \rightarrow 2\gamma) = (98.798 \pm 0.032) \times 10^{-2}$.
- ¹ A simultaneous fit to $e^+e^- \rightarrow \pi^+\pi^-, \pi^+\pi^-\pi^0, \pi^0\gamma, \eta\gamma, K\bar{K}$, and $\tau^- \rightarrow \pi^-\pi^0\nu_\tau$ data.
- ² Recalculated by the authors from the cross section at the peak.
- ³ 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.
- ⁴ Calculated by the authors from the cross section at the peak.

NODE=M004G7;LINKAGE=BE
 NODE=M004G3;LINKAGE=A
 NODE=M004G4;LINKAGE=A
 NODE=M004G11;LINKAGE=AB
 NODE=M004G11;LINKAGE=AM

NODE=M004G9;LINKAGE=AM

NODE=M004220

NODE=M004R1
 NODE=M004R1
 NEW

$\phi(1020)$ BRANCHING RATIOS

$\Gamma(K^+K^-)/\Gamma_{\text{total}}$					Γ_1/Γ
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
0.490±0.005 OUR FIT		Error includes scale factor of 1.2.			[0.489 ± 0.005 OUR 2016 FIT Scale factor = 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	$e^+e^- \rightarrow K^+K^-, K_S K_L,$ $\pi^+\pi^-\pi^0$	

$\Gamma(K_L^0 K_S^0)/\Gamma_{\text{total}}$					Γ_2/Γ
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
0.341±0.004 OUR FIT		Error includes scale factor of 1.1.			[0.342 ± 0.004 OUR 2016 FIT Scale factor = 1.1]
0.331±0.008 OUR AVERAGE					
[0.331 ± 0.009 OUR 2016 AVERAGE]					
0.331±0.010±0.010	28k	^{3,4} LEES 14H	BABR	$e^+e^- \rightarrow K_S^0 K_L^0 \gamma$	
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	$e^+e^- \rightarrow K^+K^-,$ $K_S K_L, \pi^+\pi^-\pi^0$	
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	$2.1-2.7 K^-p \rightarrow \Lambda K_L^0 K_S^0$	

³ Using a vector meson dominance model with contribution from $\phi(1020)$ and higher mass excitations of $\rho(770), \omega(782)$, and $\phi(1020)$.

⁴ LEES 14H reports $[\Gamma(\phi(1020) \rightarrow K_L^0 K_S^0)/\Gamma_{\text{total}}] \times [\Gamma(\phi(1020) \rightarrow e^+e^-)] = 0.4200 \pm 0.0033 \pm 0.0123$ keV which we divide by our best value $\Gamma(\phi(1020) \rightarrow e^+e^-) = 1.27 \pm 0.04$ keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M004R2
 NODE=M004R2
 NEW

NEW

ERROR=9

NODE=M004R2;LINKAGE=C

NODE=M004R2;LINKAGE=E

$\Gamma(K_L^0 K_S^0)/\Gamma(K^+K^-)$					Γ_2/Γ_1
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
0.696±0.014 OUR FIT		Error includes scale factor of 1.2.			[0.698 ± 0.014 OUR 2016 FIT Scale factor = 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	HBC	$3.9, 4.6 K^-p$	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.68 ± 0.03		¹ AKHMETSHIN 95	CMD2	$e^+e^- \rightarrow K_L^0 K_S^0, K^+K^-$	

NODE=M004R19
 NODE=M004R19
 NEW

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

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

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.410±0.005 OUR FIT	Error includes scale factor of 1.2. [0.411 ± 0.005 OUR 2016 FIT Scale factor = 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
NEW

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

$$\Gamma_3/\Gamma$$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.1533±0.0032 OUR FIT	Error includes scale factor of 1.1. [0.1532 ± 0.0032 OUR 2016 FIT Scale factor = 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	² AKHMETSHIN 98	CMD2	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
0.139 ±0.007		³ PARROUR	76B OSPK	e^+e^-

NODE=M004R3
NODE=M004R3
NEW

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

$$\Gamma_3/\Gamma_1$$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.313±0.009 OUR FIT	Error includes scale factor of 1.1. [0.313 ± 0.009 OUR 2016 FIT Scale factor = 1.1]			
0.28 ±0.09	34	AGUILAR-...	72B HBC	3.9,4.6 $K^- p$

NODE=M004R20
NODE=M004R20
NEW

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

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

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
0.450±0.011 OUR FIT	Error includes scale factor of 1.1. [0.448 ± 0.012 OUR 2016 FIT Scale factor = 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
NEW

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

$$\Gamma_5/\Gamma$$

VALUE	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
≈ 0.0087	1.98M	^{4,5} ALOISIO	03	KLOE	1.02 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
<0.0006	90	⁶ ACHASOV	02	SND	1.02 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
<0.23	90	⁶ CORDIER	80	DM1	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
<0.20	90	⁶ 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	⁷ ACHASOV	98F SND	$e^+e^- \rightarrow 7\gamma$
1.18 ±0.11	279	⁸ AKHMETSHIN 95	CMD2	$e^+e^- \rightarrow \pi^+\pi^-\pi^0 3\gamma$
1.30 ±0.06		⁹ DRUZHININ	84 ND	$e^+e^- \rightarrow 3\gamma$
1.4 ±0.2		¹⁰ 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	⁹ COSME	76 OSPK	e^+e^-

NODE=M004R11
NODE=M004R11

OCCUR=2

• • • 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 ⁻ → ηγ
1.37 ±0.05 ±0.01	33k	¹¹ ACHASOV 07B	SND	0.6–1.38 e ⁺ e ⁻ → ηγ
1.373±0.014±0.085	17.4k	^{12,13} AKHMETSHIN 05	CMD2	0.60-1.38 e ⁺ e ⁻ → ηγ
1.287±0.013±0.063		^{14,15} AKHMETSHIN 01B	CMD2	e ⁺ e ⁻ → ηγ
1.338±0.012±0.052		¹⁶ ACHASOV 00	SND	e ⁺ e ⁻ → ηγ
1.18 ±0.03 ±0.06	2200	¹⁷ AKHMETSHIN 99F	CMD2	e ⁺ e ⁻ → ηγ
1.21 ±0.07		¹⁸ BENAYOUN 96	RVUE	0.54-1.04 e ⁺ e ⁻ → ηγ

Γ(π⁰γ)/Γ_{total}

Γ₇/Γ

VALUE (units 10⁻³) EVTS DOCUMENT ID TECN COMMENT

1.31 ±0.05 OUR FIT
[(1.27 ± 0.06) × 10⁻³ OUR 2016 FIT]

1.31 ±0.13 OUR AVERAGE

1.30 ±0.13		DRUZHININ 84	ND	e ⁺ e ⁻ → 3γ
1.4 ±0.5	32	COSME 76	OSPK	e ⁺ e ⁻

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

1.367±0.072		¹⁹ ACHASOV 16A	SND	0.60–1.38 e ⁺ e ⁻ → π ⁰ γ
1.258±0.037±0.077	18680	^{20,21} AKHMETSHIN 05	CMD2	0.60-1.38 e ⁺ e ⁻ → π ⁰ γ
1.226±0.036 ^{+0.096} _{-0.089}		²² ACHASOV 00	SND	e ⁺ e ⁻ → π ⁰ γ
1.26 ±0.17		¹⁸ BENAYOUN 96	RVUE	0.54-1.04 e ⁺ e ⁻ → π ⁰ γ

¹⁹ Using B(φ → e⁺e⁻) from PDG15. Supersedes ACHASOV 2000.

Γ(ηγ)/Γ(π⁰γ)

Γ₆/Γ₇

VALUE DOCUMENT ID TECN COMMENT

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

10.9±0.3 ^{+0.7} _{-0.8}		ACHASOV 00	SND	e ⁺ e ⁻ → ηγ, π ⁰ γ

Γ(e⁺e⁻)/Γ_{total}

Γ₉/Γ

VALUE (units 10⁻⁴) EVTS DOCUMENT ID TECN COMMENT

2.956±0.030 OUR FIT Error includes scale factor of 1.1. [(2.954 ± 0.030) × 10⁻⁴ OUR 2016 FIT Scale factor = 1.1]

2.98 ±0.07 OUR AVERAGE

Error includes scale factor of 1.1.

2.93 ±0.14	1900k	¹ ACHASOV 01E	SND	e ⁺ e ⁻ → K ⁺ K ⁻ , K _S K _L , π ⁺ π ⁻ π ⁰
2.88 ±0.09	55600	AKHMETSHIN 95	CMD2	e ⁺ e ⁻ → hadrons
3.00 ±0.21	3681	BUKIN 78C	OLYA	e ⁺ e ⁻ → hadrons
3.10 ±0.14		² PARROUR 76	OSPK	e ⁺ e ⁻
3.3 ±0.3		COSME 74	OSPK	e ⁺ e ⁻ → hadrons
2.81 ±0.25	681	BALAKIN 71	OSPK	e ⁺ e ⁻ → hadrons
3.50 ±0.27		CHATELUS 71	OSPK	e ⁺ e ⁻

Γ(μ⁺μ⁻)/Γ_{total}

Γ₁₀/Γ

VALUE (units 10⁻⁴) DOCUMENT ID TECN COMMENT

2.87±0.19 OUR FIT

2.5 ±0.4 OUR AVERAGE

2.69±0.46		³ HAYES 71	CNTR	8.3,9.8 γC → μ ⁺ μ ⁻ X
2.17±0.60		³ EARLES 70	CNTR	6.0 γC → μ ⁺ μ ⁻ X
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2.87±0.20±0.14		⁴ ACHASOV 01G	SND	e ⁺ e ⁻ → μ ⁺ μ ⁻
3.30±0.45±0.32		² ACHASOV 99C	SND	e ⁺ e ⁻ → μ ⁺ μ ⁻
4.83±1.02		⁵ VASSERMAN 81	OLYA	e ⁺ e ⁻ → μ ⁺ μ ⁻
2.87±1.98		⁵ AUGUSTIN 73	OSPK	e ⁺ e ⁻ → μ ⁺ μ ⁻

Γ(ηe⁺e⁻)/Γ_{total}

Γ₁₁/Γ

VALUE (units 10⁻⁴) EVTS DOCUMENT ID TECN COMMENT

1.08 ±0.04 OUR AVERAGE

1.075±0.007±0.038	30k	⁶ BABUSCI 15	KLOE	1.02 e ⁺ e ⁻ → ηe ⁺ e ⁻
1.19 ±0.19 ±0.12	213	⁷ ACHASOV 01B	SND	e ⁺ e ⁻ → ηe ⁺ e ⁻
1.14 ±0.10 ±0.06	355	⁸ AKHMETSHIN 01	CMD2	e ⁺ e ⁻ → ηe ⁺ e ⁻
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1.13 ±0.14 ±0.07	183	⁹ AKHMETSHIN 01	CMD2	e ⁺ e ⁻ → ηe ⁺ e ⁻
1.21 ±0.14 ±0.09	130	¹⁰ AKHMETSHIN 01	CMD2	e ⁺ e ⁻ → ηe ⁺ e ⁻
1.04 ±0.20 ±0.08	42	¹¹ AKHMETSHIN 01	CMD2	e ⁺ e ⁻ → ηe ⁺ e ⁻
1.3 ^{+0.8} _{-0.6}	7	GOLUBEV 85	ND	e ⁺ e ⁻ → ηe ⁺ e ⁻

NODE=M004R17
NODE=M004R17

NEW

OCCUR=3

NODE=M004R17;LINKAGE=D

NODE=M004R42
NODE=M004R42

NODE=M004R16
NODE=M004R16

NEW

NODE=M004R10
NODE=M004R10

NODE=M004R24
NODE=M004R24

OCCUR=2

OCCUR=3

OCCUR=4

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

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$0.71 \pm 0.11 \pm 0.09$		² ACHASOV	00C SND	$e^+e^- \rightarrow \pi^+\pi^-$
$0.65^{+0.38}_{-0.29}$		² GOLUBEV	86 ND	$e^+e^- \rightarrow \pi^+\pi^-$
$2.01^{+1.07}_{-0.84}$		² 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=M004R18
 NODE=M004R18

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

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
4.7±0.5 OUR FIT			
5.2^{+1.3}_{-1.1}	12,13 AULCHENKO	00A SND	$e^+e^- \rightarrow \pi^+\pi^-\pi^0\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
4.4 ± 0.6	¹⁴ AMBROSINO	08G KLOE	$e^+e^- \rightarrow \pi^+\pi^-2\pi^0, 2\pi^0\gamma$
~ 5.4	¹⁵ ACHASOV	00E SND	$e^+e^- \rightarrow \pi^0\pi^0\gamma$
$5.5^{+1.6}_{-1.4} \pm 0.3$	^{13,16} AULCHENKO	00A SND	$e^+e^- \rightarrow \pi^+\pi^-\pi^0\pi^0$
$4.8^{+1.9}_{-1.7} \pm 0.8$	¹⁵ ACHASOV	99 SND	$e^+e^- \rightarrow \pi^+\pi^-\pi^0\pi^0$

NODE=M004R28
 NODE=M004R28

OCCUR=2

 $\Gamma(\omega\gamma)/\Gamma_{\text{total}}$ Γ_{14}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.05	84	LINDSEY	66 HBC	$2.1-2.7 K^-p \rightarrow \Lambda\pi^+\pi^- \text{ neutrals}$

NODE=M004R14
 NODE=M004R14

 $\Gamma(\rho\gamma)/\Gamma_{\text{total}}$ Γ_{15}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 0.12	90	¹⁷ AKHMETSHIN	99B CMD2	$e^+e^- \rightarrow \pi^+\pi^-\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
< 7	90	AKHMETSHIN	97C CMD2	$e^+e^- \rightarrow \pi^+\pi^-\gamma$
<200	84	LINDSEY	66 HBC	$2.1-2.7 K^-p \rightarrow \Lambda\pi^+\pi^- \text{ neutrals}$

NODE=M004R15
 NODE=M004R15

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

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
0.41±0.12±0.04		30175	¹⁸ AKHMETSHIN	99B CMD2	$e^+e^- \rightarrow \pi^+\pi^-\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 0.3	90		¹⁹ AKHMETSHIN	97C CMD2	$e^+e^- \rightarrow \pi^+\pi^-\gamma$
<600	90		KALBFLEISCH	75 HBC	$2.18 K^-p \rightarrow \Lambda\pi^+\pi^-\gamma$
< 70	90		COSME	74 OSPK	$e^+e^- \rightarrow \pi^+\pi^-\gamma$
<400	90		LINDSEY	65 HBC	$2.1-2.7 K^-p \rightarrow \Lambda\pi^+\pi^- \text{ neutrals}$

NODE=M004R12
 NODE=M004R12

 $\Gamma(f_0(980)\gamma)/\Gamma_{\text{total}}$ Γ_{17}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
3.22±0.19 OUR FIT Error includes scale factor of 1.1.					
3.21±0.19 OUR AVERAGE					
$3.21^{+0.03}_{-0.09} \pm 0.18$			²⁰ AMBROSINO	07 KLOE	$e^+e^- \rightarrow \pi^0\pi^0\gamma$
$2.90 \pm 0.21 \pm 1.54$			²¹ AKHMETSHIN	99C CMD2	$e^+e^- \rightarrow \pi^+\pi^-\gamma, \pi^0\pi^0\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
4.47 ± 0.21		2438	²² ALOISIO	02D KLOE	$e^+e^- \rightarrow \pi^0\pi^0\gamma$
$3.5 \pm 0.3^{+1.3}_{-0.5}$		419	^{23,24} ACHASOV	00H SND	$e^+e^- \rightarrow \pi^0\pi^0\gamma$
$1.93 \pm 0.46 \pm 0.50$		27188	²⁵ AKHMETSHIN	99B CMD2	$e^+e^- \rightarrow \pi^+\pi^-\gamma$
$3.05 \pm 0.25 \pm 0.72$		268	²⁶ AKHMETSHIN	99C CMD2	$e^+e^- \rightarrow \pi^0\pi^0\gamma$
1.5 ± 0.5		268	²⁷ AKHMETSHIN	99C CMD2	$e^+e^- \rightarrow \pi^0\pi^0\gamma$
$3.42 \pm 0.30 \pm 0.36$		164	²³ ACHASOV	98i SND	$e^+e^- \rightarrow 5\gamma$
< 1	90		²⁸ AKHMETSHIN	97C CMD2	$e^+e^- \rightarrow \pi^+\pi^-\gamma$
< 7	90		²⁹ AKHMETSHIN	97C CMD2	$e^+e^- \rightarrow \pi^+\pi^-\gamma$
< 20	90		DRUZHININ	87 ND	$e^+e^- \rightarrow \pi^0\pi^0\gamma$

NODE=M004R30
 NODE=M004R30

OCCUR=3

OCCUR=2

OCCUR=2

$\Gamma(f_0(980)\gamma)/\Gamma(\eta\gamma)$ Γ_{17}/Γ_6

VALUE (units 10^{-2})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
2.46 ± 0.15 OUR FIT					Error includes scale factor of 1.1.
2.6 ± 0.2 $^{+0.8}_{-0.3}$		419	²³ ACHASOV	00H SND	$e^+e^- \rightarrow \pi^0\pi^0\gamma$

NODE=M004R44
 NODE=M004R44

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

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
1.07 ± 0.06 OUR AVERAGE					
1.07 $^{+0.01}_{-0.03}$ $^{+0.06}_{-0.06}$			³⁰ AMBROSINO	07 KLOE	$e^+e^- \rightarrow \pi^0\pi^0\gamma$
1.08 $\pm 0.17 \pm 0.09$		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 $\pm 0.03 \pm 0.05$		2438	ALOISIO	02D KLOE	$e^+e^- \rightarrow \pi^0\pi^0\gamma$
1.158 $\pm 0.093 \pm 0.052$		419	^{24,31} 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					
$0.865 \pm 0.070 \pm 0.017$		419	³¹ 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 $\pm 0.08 \pm 0.07$		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 $\pm 1.74 \pm 2.14$		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

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

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

NODE=M004R27
 NODE=M004R27

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

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$1.33^{+0.07}_{-0.10}$ OUR AVERAGE					
[(1.12 $\pm$ 0.28) $\times 10^{-5}$ OUR 2016 AVERAGE]					
1.35 $\pm 0.05^{+0.05}_{-0.10}$		9500	³² ANASTASI	16B KLOE	$e^+e^- \rightarrow \pi^0 e^+ e^-$
1.01 $\pm 0.28 \pm 0.29$		52	³³ ACHASOV	02D SND	$e^+e^- \rightarrow \pi^0 e^+ e^-$
1.22 $\pm 0.34 \pm 0.21$		46	³⁴ AKHMETSHIN 01C	CMD2	$e^+e^- \rightarrow \pi^0 e^+ e^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<12		90	DOLINSKY	88 ND	$e^+e^- \rightarrow \pi^0 e^+ e^-$
³² Using $B(\pi^0 \rightarrow \gamma\gamma)$ from the 2014 Edition of this Review (PDG 14).					

NODE=M004R31
 NODE=M004R31

NEW

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

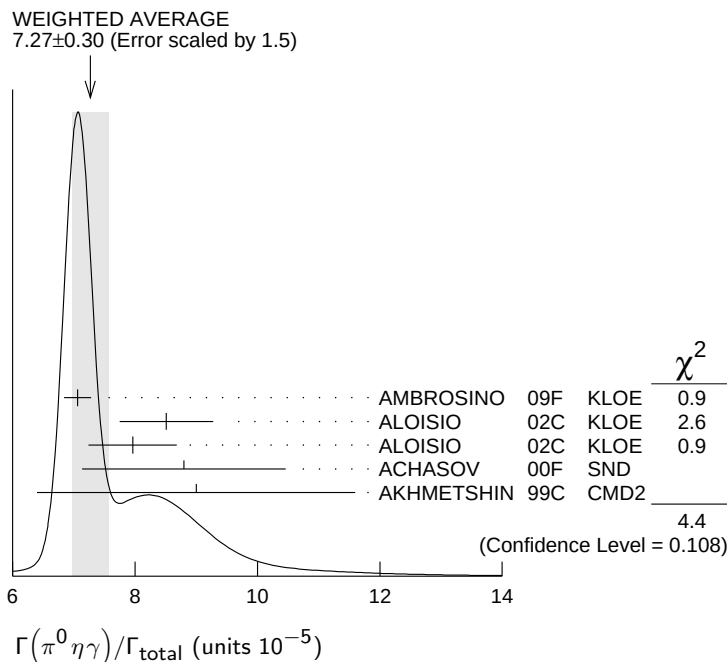
VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
7.27 ± 0.30 OUR AVERAGE					Error includes scale factor of 1.5. See the ideogram below.
7.06 ± 0.22		16.9k	¹ AMBROSINO	09F KLOE	1.02 $e^+e^- \rightarrow \eta\pi^0\gamma$
8.51 $\pm 0.51 \pm 0.57$		607	² ALOISIO	02C KLOE	$e^+e^- \rightarrow \eta\pi^0\gamma$
7.96 $\pm 0.60 \pm 0.40$		197	³ ALOISIO	02C KLOE	$e^+e^- \rightarrow \eta\pi^0\gamma$
8.8 $\pm 1.4 \pm 0.9$		36	⁴ ACHASOV	00F SND	$e^+e^- \rightarrow \eta\pi^0\gamma$
9.0 $\pm 2.4 \pm 1.0$		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 $\pm 0.10 \pm 0.20$		13.3k	^{2,5} AMBROSINO	09F KLOE	1.02 $e^+e^- \rightarrow \eta\pi^0\gamma$
7.12 $\pm 0.13 \pm 0.22$		3.6k	^{3,6} AMBROSINO	09F KLOE	1.02 $e^+e^- \rightarrow \eta\pi^0\gamma$
8.3 $\pm 2.3 \pm 1.2$		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



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

Γ_{23}/Γ

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			7 ALOISIO	02C	KLOE $e^+e^- \rightarrow \eta\pi^0\gamma$
8.8±1.7	36		8 ACHASOV	00F	SND $e^+e^- \rightarrow \eta\pi^0\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
11 ±2			9 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	10 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					
6.24±0.28±0.11	3407		11 AMBROSINO	07A	KLOE $1.02 e^+e^- \rightarrow \pi^+\pi^-\gamma$
6.7 $^{+2.8}_{-2.4}$ ±0.8	12		12 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		13 ALOISIO	02E	KLOE $1.02 e^+e^- \rightarrow \pi^+\pi^-3\gamma$
8.2 $^{+2.1}_{-1.9}$ ±1.1	21		14 AKHMETSHIN	00B	CMD2 $e^+e^- \rightarrow \pi^+\pi^-3\gamma$
4.9 $^{+2.2}_{-1.8}$ ±0.6	9		15 AKHMETSHIN	00F	CMD2 $e^+e^- \rightarrow \pi^+\pi^-\pi^+\pi^- \geq 2\gamma$
6.4 ±1.6	30		16 AKHMETSHIN	00F	CMD2 $e^+e^- \rightarrow \eta'(958)\gamma$
6.7 $^{+3.4}_{-2.9}$ ±1.0	5		17 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		14 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	18	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 $e^+e^- \rightarrow \pi^+\pi^-\gamma$
4.70±0.47±0.31	120	19	ALOISIO 02E	KLOE	1.02 $e^+e^- \rightarrow \pi^+\pi^-\gamma$
6.5 ^{+1.7} _{-1.5} ±0.8	21		AKHMETSHIN 00B	CMD2	$e^+e^- \rightarrow \pi^+\pi^-\gamma$

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

9.5 ^{+5.2} _{-4.0} ±1.4	6	20	AKHMETSHIN 97B	CMD2	$e^+e^- \rightarrow \pi^+\pi^-\gamma$

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	25	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	21	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

 $\Gamma(\eta U \rightarrow \eta e^+e^-)/\Gamma_{\text{total}}$ Γ_{31}/Γ

VALUE CL%

DOCUMENT ID TECN COMMENT

<1 × 10 ⁻⁶	90	22	BABUSCI 13B	KLOE	1.02 $e^+e^- \rightarrow \eta e^+e^-$

¹ Combined analysis of the CMD-2 data on $\phi \rightarrow K^+K^-, K_S^0 K_L^0, \pi^+\pi^-\pi^0, \eta\gamma$ assuming that the sum of their branching fractions is 0.99741 ± 0.00007 .

² Using $B(\phi \rightarrow e^+e^-) = (2.93 \pm 0.14) \times 10^{-4}$.

¹ 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.

² Using $B(\phi \rightarrow e^+e^-) = (2.99 \pm 0.08) \times 10^{-4}$.

³ 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.

⁴ From a fit without limitations on charged and neutral ρ masses and widths.

⁵ Adding the direct and $\omega\pi$ contributions and considering the interference between the $\rho\pi$ and $\pi^+\pi^-\pi^0$.

⁶ Neglecting the interference between the $\rho\pi$ and $\pi^+\pi^-\pi^0$.

⁷ Using $B(\phi \rightarrow e^+e^-) = (2.99 \pm 0.08) \times 10^{-4}$ and $B(\eta \rightarrow 3\pi^0) = (32.2 \pm 0.4) \times 10^{-2}$.

⁸ From $\pi^+\pi^-\pi^0$ decay mode of η .

NODE=M004R01
 NODE=M004R01

NODE=M004R1;LINKAGE=AK

NODE=M004R;LINKAGE=B2
 NODE=M004R19;LINKAGE=KH

NODE=M004R;LINKAGE=8D
 NODE=M004R3;LINKAGE=E

NODE=M004R;LINKAGE=L1
 NODE=M004R;LINKAGE=L2

NODE=M004R;LINKAGE=46
 NODE=M004R11;LINKAGE=AC
 NODE=M004R11;LINKAGE=Z3

- ⁹ From 2γ decay mode of η .
¹⁰ From $3\pi^0$ decay mode of η .
¹¹ 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 $B(\phi(1020) \rightarrow e^+e^-) = (2.956 \pm 0.030) \times 10^{-4}$. 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.
¹² Using $B(\phi \rightarrow e^+e^-) = (2.98 \pm 0.04) \times 10^{-4}$ and $B(\eta \rightarrow \gamma\gamma) = 39.43 \pm 0.26\%$.
¹³ Not independent of the corresponding $\Gamma(e^+e^-) \times \Gamma(\eta\gamma)/\Gamma_{\text{total}}^2$.
¹⁴ Using $B(\phi \rightarrow e^+e^-) = (2.99 \pm 0.08) \times 10^{-4}$ and $B(\eta \rightarrow 3\pi^0) = (32.24 \pm 0.29) \times 10^{-2}$.
¹⁵ 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).
¹⁶ From the $\eta \rightarrow 2\gamma$ decay and using $B(\phi \rightarrow e^+e^-) = (2.99 \pm 0.08) \times 10^{-4}$.
¹⁷ From $\pi^+\pi^-\pi^0$ decay mode of η and using $B(\phi \rightarrow e^+e^-) = (2.99 \pm 0.08) \times 10^{-4}$.
¹⁸ Reanalysis of DRUZHININ 84, DOLINSKY 89, and DOLINSKY 91 taking into account a triangle anomaly contribution.
²⁰ Using $B(\phi \rightarrow e^+e^-) = (2.98 \pm 0.04) \times 10^{-4}$.
²¹ Not independent of the corresponding $\Gamma(e^+e^-) \times \Gamma(\pi^0\gamma)/\Gamma_{\text{total}}^2$.
²² From the $\pi^0 \rightarrow 2\gamma$ decay and using $B(\phi \rightarrow e^+e^-) = (2.99 \pm 0.08) \times 10^{-4}$.
¹ From the combined fit assuming that the total $\phi(1020)$ production cross section is saturated by those of K^+K^- , $K_S K_L$, $\pi^+\pi^-\pi^0$, and $\eta\gamma$ decays modes and using ACHASOV 00B for the $\eta\gamma$ decay mode.
² 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.
³ Neglecting interference between resonance and continuum.
⁴ Using $B(\phi \rightarrow e^+e^-) = (2.91 \pm 0.07) \times 10^{-4}$.
⁵ Recalculated by us using $B(\phi \rightarrow e^+e^-) = (2.99 \pm 0.08) \times 10^{-4}$.
⁶ Using $B(\eta \rightarrow 3\pi^0) = (32.57 \pm 0.23)\%$ from PDG 12.
⁷ Using $B(\eta \rightarrow \gamma\gamma) = (39.25 \pm 0.32)\%$, $B(\phi \rightarrow \eta\gamma) = (1.26 \pm 0.06)\%$, and $B(\phi \rightarrow e^+e^-) = (3.00 \pm 0.06) \times 10^{-4}$.
⁸ The average of the branching ratios separately obtained from the $\eta \rightarrow \gamma\gamma$, $3\pi^0$, $\pi^+\pi^-\pi^0$ decays.
⁹ 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 $B(\phi \rightarrow \eta\gamma) = (1.297 \pm 0.033) \times 10^{-2}$.
¹⁰ 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 $B(\phi \rightarrow \eta\gamma) = (1.297 \pm 0.033) \times 10^{-2}$.
¹¹ 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 $B(\phi \rightarrow \eta\gamma) = (1.297 \pm 0.033) \times 10^{-2}$.
¹² Using the 1996 and 1998 data.
¹³ $(2.3 \pm 0.3)\%$ correction for other decay modes of the $\omega(782)$ applied.
¹⁴ Not independent of the corresponding $\Gamma(\omega\pi^0) \times \Gamma(e^+e^-) / \Gamma^2(\text{total})$.
¹⁵ Using the 1996 data.
¹⁶ Using the 1998 data.
¹⁷ Supersedes AKHMETSHIN 97C.
¹⁸ For $E_\gamma > 20$ MeV and assuming that $B(\phi(1020) \rightarrow f_0(980)\gamma)$ is negligible. Supersedes AKHMETSHIN 97C.
¹⁹ For $E_\gamma > 20$ MeV and assuming that $B(\phi(1020) \rightarrow f_0(980)\gamma)$ is negligible.
²⁰ 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.
²¹ From the combined fit of the photon spectra in the reactions $e^+e^- \rightarrow \pi^+\pi^-\gamma$, $\pi^0\pi^0\gamma$.
²² 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.
²³ 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 $B(f_0 \rightarrow \pi^+\pi^-) = 2B(f_0 \rightarrow \pi^0\pi^0)$.
²⁴ Using the value $B(\phi \rightarrow \eta\gamma) = (1.338 \pm 0.053) \times 10^{-2}$.
²⁵ For $E_\gamma > 20$ MeV. Supersedes AKHMETSHIN 97C.
²⁶ Neglecting other intermediate mechanisms ($\rho\pi$, $\sigma\gamma$).
²⁷ A narrow pole fit taking into account $f_0(980)$ and $f_0(1200)$ intermediate mechanisms.
²⁸ For destructive interference with the Bremsstrahlung process
²⁹ For constructive interference with the Bremsstrahlung process
³⁰ Supersedes ALOISIO 02D.
³¹ Supersedes ACHASOV 98I. Excluding $\omega\pi^0$.
³³ Using various branching ratios from the 2000 Edition of this Review (PDG 00).

NODE=M004R11;LINKAGE=A
 NODE=M004R11;LINKAGE=C
 NODE=M004R11;LINKAGE=AO

 NODE=M004R11;LINKAGE=AH
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 NODE=M004R;LINKAGE=BQ

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 NODE=M004R;LINKAGE=FF
 NODE=M004R;LINKAGE=TS

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 NODE=M004R;LINKAGE=3G
 NODE=M004R;LINKAGE=AE

 NODE=M004R16;LINKAGE=E

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 NODE=M004R;LINKAGE=2N

 NODE=M004R12;LINKAGE=Z3
 NODE=M004R30;LINKAGE=MB

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 NODE=M004R30;LINKAGE=B
 NODE=M004R26;LINKAGE=MB
 NODE=M004R;LINKAGE=V8
 NODE=M004R;LINKAGE=DS

- 34 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 $B(\eta \rightarrow \pi^+\pi^-\gamma) = (4.75 \pm 0.11) \times 10^{-2}$.
- 1 Combined results of $\eta \rightarrow \gamma\gamma$ and $\eta \rightarrow \pi^+\pi^-\pi^0$ decay modes measurements.
- 2 From the decay mode $\eta \rightarrow \gamma\gamma$.
- 3 From the decay mode $\eta \rightarrow \pi^+\pi^-\pi^0$.
- 4 Supersedes ACHASOV 98B.
- 5 Using $B(\phi \rightarrow \eta\gamma) = (1.304 \pm 0.025)\%$, $B(\eta \rightarrow 3\pi^0) = (32.56 \pm 0.23)\%$, and $B(\eta \rightarrow \gamma\gamma) = (39.31 \pm 0.20)\%$.
- 6 Using $B(\phi \rightarrow \eta\gamma) = (1.304 \pm 0.025)\%$, $B(\eta \rightarrow 3\pi^0) = (32.56 \pm 0.23)\%$, and $B(\eta \rightarrow \pi^+\pi^-\pi^0) = (22.73 \pm 0.28)\%$.
- 7 Using $M_{a_0(980)} = 984.8$ MeV and assuming $a_0(980)\gamma$ dominance.
- 8 Assuming $a_0(980)\gamma$ dominance in the $\eta\pi^0\gamma$ final state.
- 9 Using data of ACHASOV 00F.
- 10 Using results of ALOISIO 02D and assuming that $f_0(980)$ decays into $\pi\pi$ only and $a_0(980)$ into $\eta\pi$ only.
- 11 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.
- 12 Averaging AULCHENKO 03B with AULCHENKO 99.
- 13 Using $B(\phi \rightarrow \eta\gamma) = (1.297 \pm 0.033)\%$.
- 14 Using the value $B(\phi \rightarrow \eta\gamma) = (1.26 \pm 0.06) \times 10^{-2}$.
- 15 Using $B(\phi \rightarrow K_L^0 K_S^0) = (33.8 \pm 0.6)\%$.
- 16 Averaging AKHMETSHIN 00B with AKHMETSHIN 00F.
- 17 Using the value $B(\eta' \rightarrow \eta\pi^+\pi^-) = (43.7 \pm 1.5) \times 10^{-2}$ and $B(\eta \rightarrow \gamma\gamma) = (39.25 \pm 0.31) \times 10^{-2}$.
- 18 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.
- 19 From the decay mode $\eta' \rightarrow \eta\pi^+\pi^-$, $\eta \rightarrow \gamma\gamma$.
- 20 Superseded by AKHMETSHIN 00B.
- 21 For $E_\gamma > 20$ MeV.
- 22 For a narrow vector U with mass between 5 and 470 MeV, from the combined analysis of $\eta \rightarrow \pi^+\pi^-\pi^0$ and $\eta \rightarrow \pi^0\pi^0\pi^0$ from ARCHILLI 12. Measured 90% CL limits as a function of m_U range from 2.2×10^{-8} to 10^{-6} .

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 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=M004R01;LINKAGE=A

Lepton Family number (LF) violating modes

$\Gamma(e^\pm \mu^\mp)/\Gamma_{\text{total}}$					Γ_{32}/Γ
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
$<2 \times 10^{-6}$	90	ACHASOV	10A SND	$e^+e^- \rightarrow e^\pm \mu^\mp$	

NODE=M00422A

NODE=M004R29
 NODE=M004R29

$\pi^+\pi^-\pi^0 / \rho\pi$ AMPLITUDE RATIO a_1 IN DECAY OF $\phi \rightarrow \pi^+\pi^-\pi^0$

NODE=M004D1

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

NODE=M004D1

VALUE (units 10^{-2})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
9.1±1.2 OUR AVERAGE					
10.1±4.4±1.7	80k		¹ AKHMETSHIN 06	CMD2	1.017–1.021 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
9.0±1.1±0.6	1.98M		^{2,3} ALOISIO	03 KLOE	1.02 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
$-6 < a_1 < 6$	500k		³ ACHASOV	02 SND	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
$-16 < a_1 < 11$	90	9.8k	^{1,4} AKHMETSHIN 98	CMD2	$e^+e^- \rightarrow \pi^+\pi^-\gamma\gamma$

NODE=M004D1

¹ Dalitz plot analysis taking into account interference between the contact and $\rho\pi$ amplitudes.

NODE=M004D1;LINKAGE=AK

² From a fit without limitations on charged and neutral ρ masses and widths.

³ Recalculated by us to match the notations of AKHMETSHIN 98.

⁴ Assuming zero phase for the contact term.

NODE=M004D;LINKAGE=L1
 NODE=M004D;LINKAGE=L3
 NODE=M004D1;LINKAGE=KL

PARAMETER β IN $\phi \rightarrow P e^+ e^-$ DECAYS

In the one-pole approximation the electromagnetic transition form factor for $\phi \rightarrow P e^+ e^-$ ($P = \pi, \eta$) is given as a function of the $e^+ e^-$ invariant mass squared, q^2 , by the expression:

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

where vector meson dominance predicts parameter $\Lambda \approx 0.770 \text{ GeV}$ ($\Lambda^{-2} \approx 1.687 \text{ GeV}^{-2}$). The slope of this form factor, $\beta = dF/dq^2(q^2=0)$, equals Λ^{-2} in this approximation.

The measurements below obtain β in the one-pole approximation.

NODE=M004230

NODE=M004230

PARAMETER β IN $\phi \rightarrow \pi^0 e^+ e^-$ DECAY

VALUE (GeV^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
2.02$\pm$0.11	9500	¹ ANASTASI	16B KLOE	1.02 $e^+ e^- \rightarrow \pi^0 e^+ e^-$

¹ The error combines statistical and systematic uncertainties.

NODE=M004A00
NODE=M004A00

NODE=M004A00;LINKAGE=A

PARAMETER β IN $\phi \rightarrow \eta e^+ e^-$ DECAY

VALUE (GeV^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
1.29$\pm$0.13 OUR AVERAGE				
1.28 $\pm$ 0.10 ^{+0.09} _{-0.08}	30k	BABUSCI	15 KLOE	1.02 $e^+ e^- \rightarrow \eta e^+ e^-$
3.8 $\pm$ 1.8	213	¹ ACHASOV	01B SND	1.02 $e^+ e^- \rightarrow \eta e^+ e^-$

¹ The uncertainty is statistical only. The systematic one is negligible, in comparison.

NODE=M004BFP
NODE=M004BFP

NODE=M004BFP;LINKAGE=A

$\phi(1020)$ REFERENCES

ACHASOV	16A	PR D93 092001	M.N. Achasov <i>et al.</i>	(SND Collab.)
ANASTASI	16B	PL B757 362	A. Anastasi <i>et al.</i>	(KLOE-2 Collab.)
KOZYREV	16	PL B760 314	E.A.Kozyrev <i>et al.</i>	(CMD3 Collaboration)
BABUSCI	15	PL B742 1	D. Babusci <i>et al.</i>	(KLOE-2 Collab.)
LEES	14H	PR D89 092002	J.P. Lees <i>et al.</i>	(BABAR Collab)
PDG	14	CP C38 070001	K. Olive <i>et al.</i>	(PDG Collab.)
BABUSCI	13B	PL B720 111	D. Babusci <i>et al.</i>	(KLOE-2 Collab.)
BENAYOUN	13	EPJ C73 2453	M. Benayoun, P. David, L. DelBuono	(PARIN, BERLIN+)
LEES	13F	PR D87 052010	J.P. Lees <i>et al.</i>	(BABAR Collab.)
LEES	13Q	PR D88 032013	J.P. Lees <i>et al.</i>	(BABAR Collab.)
ARCHILLI	12	PL B706 251	F. Archilli <i>et al.</i>	(KLOE-2 Collab.)
BENAYOUN	12	EPJ C72 1848	M. Benayoun <i>et al.</i>	
NIECKNIG	12	EPJ C72 2014	F. Niecknig, B. Kubis, S.P. Schneider	(BONN)
PDG	12	PR D86 010001	J. Beringer <i>et al.</i>	(PDG Collab.)
AKHMETSHIN	11	PL B695 412	R. 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.				
FLOREZ-BAEZ	08	PR D78 077301	F.V. Florez-Baez, G. Lopez Castro	
ACHASOV	07B	PR D76 077101	M.N. Achasov <i>et al.</i>	(SND Collab.)
AMBROSINO	07	EPJ C49 473	F. Ambrosino <i>et al.</i>	(KLOE Collab.)
AMBROSINO	07A	PL B648 267	F. Ambrosino <i>et al.</i>	(KLOE Collab.)
DUBYSNKIY	07	PR D75 113001	S. Dubynskiy <i>et al.</i>	
ACHASOV	06A	PR D74 014016	M.N. Achasov <i>et al.</i>	(SND Collab.)
AKHMETSHIN	06	PL B642 203	R.R. Akhmetshin <i>et al.</i>	(CMD-2 Collab.)
AKHMETSHIN	05	PL B605 26	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)
AMBROSINO	05	PL B608 199	F. Ambrosino <i>et al.</i>	(KLOE Collab.)
AUBERT,B	05J	PR D72 052008	B. Aubert <i>et al.</i>	(BABAR Collab.)
AKHMETSHIN	04N	PL B578 285	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.)
ALOISIO	03	PL B561 55	A. Aloisio <i>et al.</i>	(KLOE Collab.)
AULCHENKO	03B	JETP 97 24	V.M. Aulchenko <i>et al.</i>	(Novosibirsk SND Collab.)
Translated from ZETF 124 28.				
ACHASOV	02	PR D65 032002	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)
ACHASOV	02D	JETPL 75 449	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)
Translated from ZETFP 75 539.				
ALOISIO	02C	PL B536 209	A. Aloisio <i>et al.</i>	(KLOE Collab.)
ALOISIO	02D	PL B537 21	A. Aloisio <i>et al.</i>	(KLOE Collab.)
ALOISIO	02E	PL B541 45	A. Aloisio <i>et al.</i>	(KLOE Collab.)
FISCHBACH	02	PL B526 355	E. Fischbach, A.W. Overhauser, B. Woodahl	
GOKALP	02	JP G28 2783	A. Gokalp <i>et al.</i>	
ACHASOV	01B	PL B504 275	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)
ACHASOV	01E	PR D63 072002	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)
ACHASOV	01F	PR D63 094007	N.N. Achasov, V.V. Gubin	(Novosibirsk SND Collab.)
ACHASOV	01G	PRL 86 1698	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)
AITALA	01B	PRL 86 770	E.M. Aitala <i>et al.</i>	(FNAL E791 Collab.)
AKHMETSHIN	01	PL B501 191	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)
AKHMETSHIN	01B	PL B509 217	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)
AKHMETSHIN	01C	PL B503 237	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)
BENAYOUN	01	EPJ C22 503	M. Benayoun, H.B. O'Connell	
ACHASOV	00	EPJ C12 25	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)
ACHASOV	00B	JETP 90 17	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)
Translated from ZETF 117 22.				

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ACHASOV	00C	PL B474 188	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47431
ACHASOV	00D	JETPL 72 282 Translated from ZETFP 72 411.	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47882
ACHASOV	00E	NP B569 158	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47927
ACHASOV	00F	PL B479 53	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47928
ACHASOV	00H	PL B485 349	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47930
AKHMETSHIN	00B	PL B473 337	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=47422
AKHMETSHIN	00E	PL B491 81	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=47936
AKHMETSHIN	00F	PL B494 26	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=47937
AULCHENKO	00A	JETP 90 927 Translated from ZETF 117 1067.	V.M. Aulchenko <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47953
BRAMON	00	PL B486 406	A. Bramon <i>et al.</i>		REFID=47969
PDG	00	EPJ C15 1	D.E. Groom <i>et al.</i>	(PDG Collab.)	REFID=47469
ACHASOV	99	PL B449 122	M.N. Achasov <i>et al.</i>		REFID=46896
ACHASOV	99C	PL B456 304	M.N. Achasov <i>et al.</i>		REFID=46939
AKHMETSHIN	99B	PL B462 371	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=47392
AKHMETSHIN	99C	PL B462 380	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=47393
AKHMETSHIN	99D	PL B466 385	R.R. Akhmetshin <i>et al.</i>		REFID=47397
Also		PL B508 217 (errat.)	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=48328
AKHMETSHIN	99F	PL B460 242	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=47473
AULCHENKO	99	JETPL 69 97 Translated from ZETFP 69 87.	V.M. Aulchenko <i>et al.</i>		REFID=46920
ACHASOV	98B	PL B438 441	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=46317
ACHASOV	98F	JETPL 68 573	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=46321
ACHASOV	98I	PL B440 442	M.N. Achasov <i>et al.</i>		REFID=46600
AKHMETSHIN	98	PL B434 426	R.R. Akhmetshin <i>et al.</i>	(CMD-2 Collab.)	REFID=46325
AULCHENKO	98	PL B436 199	V.M. Aulchenko <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=46336
BARBERIS	98	PL B432 436	D. Barberis <i>et al.</i>	(Omega Expt.)	REFID=46344
AKHMETSHIN	97B	PL B415 445	R.R. Akhmetshin <i>et al.</i>	(NOVO, BOST, PITT+)	REFID=45801
AKHMETSHIN	97C	PL B415 452	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=45802
BENAYOUN	96	ZPHY C72 221	M. Benayoun <i>et al.</i>	(IPNP, NOVO)	REFID=45753
AKHMETSHIN	95	PL B364 199	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=44617
DOLINSKY	91	PRPL 202 99	S.I. Dolinsky <i>et al.</i>	(NOVO)	REFID=41369
KUHN	90	ZPHY C48 445	J.H. Kuhn <i>et al.</i>	(MPIM)	REFID=45862
ACHASOV	89	NP B315 465	N.N. Achasov, V.N. Ivanchenko		REFID=48021
DOLINSKY	89	ZPHY C42 511	S.I. Dolinsky <i>et al.</i>	(NOVO)	REFID=41003
BARKOV	88	SJNP 47 248	L.M. Barkov <i>et al.</i>	(NOVO)	REFID=41024
		Translated from YAF 47 393.			
DOLINSKY	88	SJNP 48 277	S.I. Dolinsky <i>et al.</i>	(NOVO)	REFID=41022
		Translated from YAF 48 442.			
DRUZHININ	87	ZPHY C37 1	V.P. Druzhinin <i>et al.</i>	(NOVO)	REFID=40448
ARMSTRONG	86	PL 166B 245	T.A. Armstrong <i>et al.</i>	(ATHU, BARI, BIRM+)	REFID=20563
ATKINSON	86	ZPHY C30 521	M. Atkinson <i>et al.</i>	(BONN, CERN, GLAS+)	REFID=20564
BEBEK	86	PRL 56 1893	C. Bebek <i>et al.</i>	(CLEO Collab.)	REFID=11540
DAVENPORT	86	PR D33 2519	T.F. Davenport (TUFTS, ARIZ, FNAL, FSU, NDAM+)		REFID=20567
DIJKSTRA	86	ZPHY C31 375	H. Dijkstra <i>et al.</i>	(ANIK, BRIS, CERN+)	REFID=20568
FRAME	86	NP B276 667	D. Frame <i>et al.</i>	(GLAS)	REFID=20569
GOLUBEV	86	SJNP 44 409	V.B. Golubev <i>et al.</i>	(NOVO)	REFID=40449
		Translated from YAF 44 633.			
ALBRECHT	85D	PL 153B 343	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=20562
GOLUBEV	85	SJNP 41 756	V.B. Golubev <i>et al.</i>	(NOVO)	REFID=40450
		Translated from YAF 41 1183.			
DRUZHININ	84B	PL 144B 136	V.P. Druzhinin <i>et al.</i>	(NOVO)	REFID=20561
ARMSTRONG	83B	NP B224 193	T.A. Armstrong <i>et al.</i>	(BARI, BIRM, CERN+)	REFID=20558
BARATE	83	PL 121B 449	R. Barate <i>et al.</i>	(SACL, LOIC, SHMP, IND)	REFID=12177
KURDADZE	83C	JETPL 38 366	L.M. Kurdadze <i>et al.</i>	(NOVO)	REFID=20560
		Translated from ZETFP 38 306.			
ARENTON	82	PR D25 2241	M.W. Arenton <i>et al.</i>	(ANL, ILL)	REFID=20556
PELLINEN	82	PS 25 599	A. Pellinen, M. Roos	(HELS)	REFID=20557
DAUM	81	PL 100B 439	C. Daum <i>et al.</i>	(AMST, BRIS, CERN, CRAC+)	REFID=20552
IVANOV	81	PL 107B 297	P.M. Ivanov <i>et al.</i>	(NOVO)	REFID=20553
Also		Private Comm.	S.I. Eidelman	(NOVO)	REFID=20554
VASSERMAN	81	PL 99B 62	I.B. Vasserman <i>et al.</i>	(NOVO)	REFID=20555
Also		SJNP 35 240	L.M. Kurdadze <i>et al.</i>		REFID=47475
		Translated from YAF 35 352.			
CORDIER	80	NP B172 13	A. Cordier <i>et al.</i>	(LALO)	REFID=20240
CORDIER	79	PL 81B 389	A. Cordier <i>et al.</i>	(LALO)	REFID=20549
BUKIN	78B	SJNP 27 521	A.D. Bukin <i>et al.</i>	(NOVO)	REFID=20545
		Translated from YAF 27 985.			
BUKIN	78C	SJNP 27 516	A.D. Bukin <i>et al.</i>	(NOVO)	REFID=20544
		Translated from YAF 27 976.			
COOPER	78B	NP B146 1	A.M. Cooper <i>et al.</i>	(TATA, CERN, CDEF+)	REFID=20235
LOSTY	78	NP B133 38	M.J. Losty <i>et al.</i>	(CERN, AMST, NIJM+)	REFID=20547
AKERLOF	77	PRL 39 861	C.W. Akerlof <i>et al.</i>	(FNAL, MICH, PURD)	REFID=20534
ANDREWS	77	PRL 38 198	D.E. Andrews <i>et al.</i>	(ROCH)	REFID=20120
BALDI	77	PL 68B 381	R. Baldi <i>et al.</i>	(GEVA)	REFID=20536
CERRADA	77B	NP B126 241	M. Cerrada <i>et al.</i>	(AMST, CERN, NIJM+)	REFID=20537
COHEN	77	PRL 38 269	D. Cohen <i>et al.</i>	(ANL)	REFID=20538
LAVEN	77	NP B127 43	H. Laven <i>et al.</i>	(AACH3, BERL, CERN, LOIC+)	REFID=20541
LYONS	77	NP B125 207	L. Lyons, A.M. Cooper, A.G. Clark	(OXF)	REFID=20232
COSME	76	PL 63B 352	G. Cosme <i>et al.</i>	(ORSAY)	REFID=20529
KALBFLEISCH	76	PR D13 22	G.R. Kalbfleisch, R.C. Strand, J.W. Chapman	(BNL+)	REFID=20531
PARROUR	76	PL 63B 357	G. Parrou <i>et al.</i>	(ORSAY)	REFID=20532
PARROUR	76B	PL 63B 362	G. Parrou <i>et al.</i>	(ORSAY)	REFID=20533
KALBFLEISCH	75	PR D11 987	G.R. Kalbfleisch, R.C. Strand, J.W. Chapman	(BNL+)	REFID=20223
AYRES	74	PRL 32 1463	D.S. Ayres <i>et al.</i>	(ANL)	REFID=20522
BESCH	74	NP B70 257	H.J. Besch <i>et al.</i>	(BONN)	REFID=20523
COSME	74	PL 48B 155	G. Cosme <i>et al.</i>	(ORSAY)	REFID=20525
COSME	74B	PL 48B 159	G. Cosme <i>et al.</i>	(ORSAY)	REFID=20526
DEGROOT	74	NP B74 77	A.J. de Groot <i>et al.</i>	(AMST, NIJM)	REFID=20527
AUGUSTIN	73	PRL 30 462	J.E. Augustin <i>et al.</i>	(ORSAY)	REFID=47515
BALLAM	73	PR D7 3150	J. Ballam <i>et al.</i>	(SLAC, LBL)	REFID=20520
BINNIE	73B	PR D8 2789	D.M. Binnie <i>et al.</i>	(LOIC, SHMP)	REFID=20216
AGUILAR....	72B	PR D6 29	M. Aguilar-Benitez <i>et al.</i>	(BNL)	REFID=20205
ALVENSLEB...	72	PRL 28 66	H. Alvensleben <i>et al.</i>	(MIT, DESY)	REFID=20514
BORENSTEIN	72	PR D5 1559	S.R. Borenstein <i>et al.</i>	(BNL, MICH)	REFID=20215
COLLEY	72	NP B50 1	D.C. Colley <i>et al.</i>	(BIRM, GLAS)	REFID=20519
BALAKIN	71	PL 34B 328	V.E. Balakin <i>et al.</i>	(NOVO)	REFID=20507
CHATELUS	71	Thesis LAL 1247	Y. Chatelus	(STRB)	REFID=20508
Also		PL 32B 416	J.C. Bizot <i>et al.</i>	(ORSAY)	REFID=20501
HAYES	71	PR D4 899	S. Hayes <i>et al.</i>	(CORN)	REFID=20511
STOTTLE...	71	Thesis ORO 2504 170	A.R. Stottley	(UMD)	REFID=20512
BIZOT	70	PL 32B 416	J.C. Bizot <i>et al.</i>	(ORSAY)	REFID=20501
Also		Liverpool Sym. 69	J.P. Perez-y-Jorba		REFID=20502
EARLES	70	PRL 25 1312	D.R. Earles <i>et al.</i>	(NEAS)	REFID=20504
LINDSEY	66	PR 147 913	J.S. Lindsey, G. Smith	(LRL)	REFID=20481
LONDON	66	PR 143 1034	G.W. London <i>et al.</i>	(BNL, SYRA) IGJPC	REFID=11774
BADIER	65B	PL 17 337	J. Badier <i>et al.</i>	(EPOL, SACL, AMST)	REFID=20253
LINDSEY	65	PRL 15 221	J.S. Lindsey, G.A. Smith	(LRL)	REFID=20478
LINDSEY 65 data		included in LINDSEY 66.			
SCHLEIN	63	PRL 10 368	P.E. Schlein <i>et al.</i>	(UCLA) IGJP	REFID=20474

$h_1(1170)$

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

NODE=M030

 $h_1(1170)$ MASS

NODE=M030M

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.				

NODE=M030M
→ UNCHECKED ←

OCCUR=2

NODE=M030M;LINKAGE=B
NODE=M030M;LINKAGE=C

 $h_1(1170)$ WIDTH

NODE=M030W

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.				

NODE=M030W
→ UNCHECKED ←

OCCUR=2

NODE=M030W;LINKAGE=B
NODE=M030W;LINKAGE=C

 $h_1(1170)$ DECAY MODES

NODE=M030215;NODE=M030

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

DESIG=1;OUR EST;→ UNCHECKED ←

 $h_1(1170)$ BRANCHING RATIOS

NODE=M030220

$\Gamma(\rho\pi)/\Gamma_{\text{total}}$	DOCUMENT ID	TECN	COMMENT	Γ_1/Γ
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
seen	ANDO	92	SPEC	$8 \pi^- p \rightarrow \pi^+ \pi^- \pi^0 n$
seen	ATKINSON	84	OMEG	$20-70 \gamma p \rightarrow \pi^+ \pi^- \pi^0 p$
seen	DANKOWY...	81	SPEC	$8 \pi p \rightarrow 3\pi n$

NODE=M030R1
NODE=M030R1

 $h_1(1170)$ REFERENCES

NODE=M030

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. Dankowych <i>et al.</i>	(TNT0, BNL, CARL+)
BOWLER	75	NP B97 227	M.G. Bowler <i>et al.</i>	(OXFTP, DARE)

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

$b_1(1235)$

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

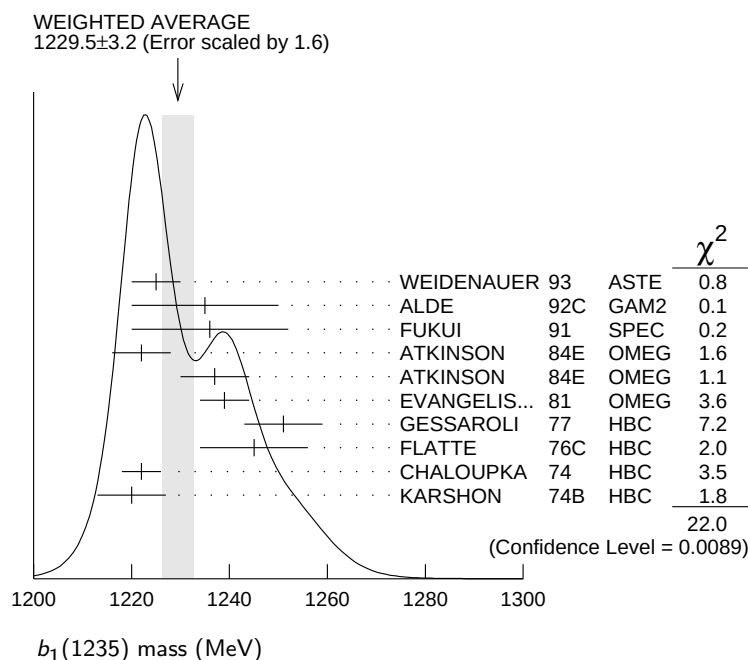
NODE=M011

 $b_1(1235)$ MASS

NODE=M011M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
1229.5 ± 3.2 OUR AVERAGE		Error includes scale factor of 1.6. See the ideogram below.			
1225 ± 5		WEIDENAUER 93	ASTE		$\bar{p}p \rightarrow 2\pi^+ 2\pi^- \pi^0$
1235 ± 15		ALDE 92C	GAM2		38,100 $\pi^- p \rightarrow \omega \pi^0 n$
1236 ± 16		FUKUI 91	SPEC		8.95 $\pi^- p \rightarrow \omega \pi^0 n$
1222 ± 6		ATKINSON 84E	OMEG ±		25-55 $\gamma p \rightarrow \omega \pi X$
1237 ± 7		ATKINSON 84E	OMEG 0		25-55 $\gamma p \rightarrow \omega \pi X$
1239 ± 5		EVANGELIS...	81	OMEG -	12 $\pi^- p \rightarrow \omega \pi p$
1251 ± 8	450	GESSAROLI 77	HBC	-	11 $\pi^- p \rightarrow \pi^- \omega p$
1245 ± 11	890	FLATTE 76C	HBC	-	4.2 $K^- p \rightarrow \pi^- \omega \Sigma^+$
1222 ± 4	1400	CHALOUPKA 74	HBC	-	3.9 $\pi^- p$
1220 ± 7	600	KARSHON 74B	HBC	+	4.9 $\pi^+ p$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1190 ± 10		AUGUSTIN 89	DM2	±	$e^+ e^- \rightarrow 5\pi$
1213 ± 5		ATKINSON 84C	OMEG 0		20-70 γp
1271 ± 11		COLLICK 84	SPEC	+	200 $\pi^+ Z \rightarrow Z \pi \omega$

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

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 $\omega\pi$ [D/S amplitude ratio = 0.277 ± 0.027]	dominant	
Γ_2 $\pi^\pm\gamma$	$(1.6 \pm 0.4) \times 10^{-3}$	
Γ_3 $\eta\rho$	seen	
Γ_4 $\pi^+\pi^+\pi^-\pi^0$	< 50 %	84%
Γ_5 $K^*(892)^\pm K^\mp$	seen	
Γ_6 $(K\bar{K})^\pm\pi^0$	< 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%

NODE=M011215;NODE=M011

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

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

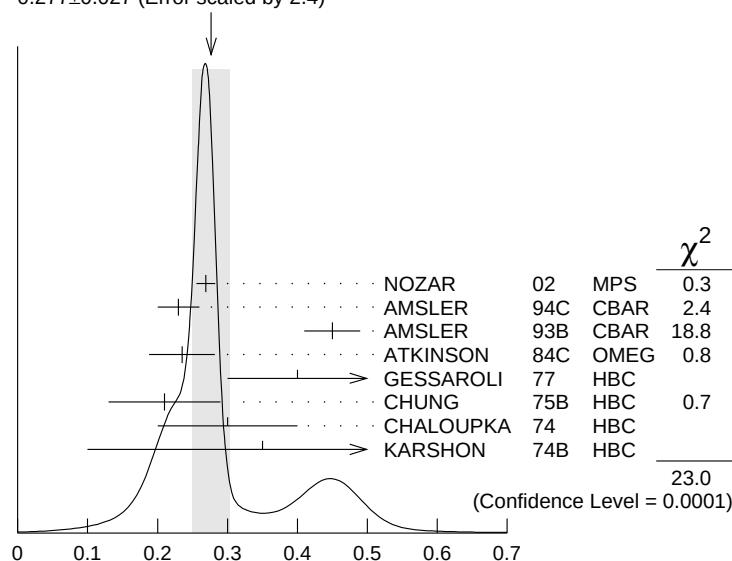
NODE=M011220

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 π [−] p → ω π [−] 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 γ p
0.4 $\begin{smallmatrix} +0.1 \\ -0.1 \end{smallmatrix}$		GESSAROLI	77	HBC	− 11 π [−] p → π [−] ω p
0.21 ±0.08		CHUNG	75B	HBC	+ 7.1 π ⁺ p
0.3 ±0.1		CHALOUPKA	74	HBC	− 3.9–7.5 π [−] p
0.35 ±0.25	600	KARSHON	74B	HBC	+ 4.9 π ⁺ p

NODE=M011DS

WEIGHTED AVERAGE
 0.277 ± 0.027 (Error scaled by 2.4) $b_1(1235)$ 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

<u>VALUE (°)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>CHG</u>	<u>COMMENT</u>
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	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	COMMENT
seen	¹ ABLIKIM	10E	BES2 $J/\psi \rightarrow K^\pm K_S^0 \pi^\mp \pi^0$

NODE=M011R10
NODE=M011R10¹ 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	$\pm$ 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	$\pm$ 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	$\pm$ 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	$\pm$ 0.0 $\bar{p} p$
<0.015		DAHL	67	HBC	1.6-4.2 $\pi^- p$

 $b_1(1235)$ REFERENCES

NODE=M011

ABLIKIM	10E	PL B693 88	M. Ablikim <i>et al.</i>	(BES II Collab.)	REFID=53361
NOZAR	02	PL B541 35	M. Nozar <i>et al.</i>		REFID=48850
VIKTOROV	96	PAN 59 1184	V.A. Viktorov <i>et al.</i>	(SERP)	REFID=45203
		Translated from YAF 59 1239.			
AMSLER	94C	PL B327 425	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=44091
AMSLER	93B	PL B311 362	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=43602
WEIDENAUER	93	ZPHY C59 387	P. Weidenauer <i>et al.</i>	(ASTERIX Collab.)	REFID=43585
ALDE	92C	ZPHY C54 553	D.M. Alde <i>et al.</i>	(BELG, SERP, KEK, LANL+)	REFID=41859
FUKUI	91	PL B257 241	S. Fukui <i>et al.</i>	(SUGI, NAGO, KEK, KYOT+)	REFID=41581
AUGUSTIN	89	NP B320 1	J.E. Augustin, G. Cosme	(DM2 Collab.)	REFID=41004
ATKINSON	84C	NP B243 1	M. Atkinson <i>et al.</i>	(BONN, CERN, GLAS+) JP	REFID=20625
ATKINSON	84D	NP B242 269	M. Atkinson <i>et al.</i>	(BONN, CERN, GLAS+)	REFID=20623
ATKINSON	84E	PL 138B 459	M. Atkinson <i>et al.</i>	(BONN, CERN, GLAS+)	REFID=20624
COLLICK	84	PRL 53 2374	B. Collick <i>et al.</i>	(MINN, ROCH, FNAL)	REFID=20626
EVANGELIS...	81	NP B178 197	C. Evangelista <i>et al.</i>	(BARI, BONN, CERN+)	REFID=20462
BALTAY	78B	PR D17 62	C. Baltay <i>et al.</i>	(COLU, BING)	REFID=21265
GESSAROLI	77	NP B126 382	R. Gessaroli <i>et al.</i>	(BGNA, FIRZ, GENO+) JP	REFID=20230
FLATTE	76C	PL 64B 225	S.M. Flatte <i>et al.</i>	(CERN, AMST, NIJM+) JP	REFID=20615
CHUNG	75B	PR D11 2426	S.U. Chung <i>et al.</i>	(BNL, LBL, UCSC) JP	REFID=20613
CHALOUPKA	74	PL 51B 407	V. Chaloupka <i>et al.</i>	(CERN) JP	REFID=20611
KARSHON	74B	PR D10 3608	U. Karshon <i>et al.</i>	(REHO) JP	REFID=20612
BIZZARRI	69	NP B14 169	R. Bizzarri <i>et al.</i>	(CERN, CDEF)	REFID=20171
BALTAY	67	PRL 18 93	C. Baltay <i>et al.</i>	(COLU)	REFID=20159
DAHL	67	PR 163 1377	O.I. Dahl <i>et al.</i>	(LRL)	REFID=20321
ABOLINS	63	PRL 11 381	M.A. Abolins <i>et al.</i>	(UCSD)	REFID=20006

$a_1(1260)$

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

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

NODE=M010

NODE=M010

NODE=M010M

NODE=M010M
→ UNCHECKED ←

 $a_1(1260)$ MASS

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 FOCS	$D^0 \rightarrow \pi^- \pi^+ \pi^- \pi^+$
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 $K^- p \rightarrow \Sigma 3\pi$

OCCUR=2

OCCUR=3

OCCUR=2

OCCUR=2

OCCUR=3

OCCUR=2

NODE=M010M;LINKAGE=AU

NODE=M010M;LINKAGE=LI

NODE=M010M;LINKAGE=GO

NODE=M010M;LINKAGE=B6

NODE=M010M;LINKAGE=KS

NODE=M010M;LINKAGE=IM

NODE=M010M;LINKAGE=A1

NODE=M010M;LINKAGE=F1

NODE=M010M;LINKAGE=X

NODE=M010M;LINKAGE=P

NODE=M010M;LINKAGE=I

NODE=M010M;LINKAGE=L

NODE=M010M;LINKAGE=M

NODE=M010M;LINKAGE=K

NODE=M010M;LINKAGE=G

NODE=M010M;LINKAGE=D

NODE=M010M;LINKAGE=F

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.

 $a_1(1260)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
250 to 600 OUR ESTIMATE				
367± 9⁺²⁸₋₂₅	420k	ALEKSEEV	10	COMP 190 $\pi^- Pb \rightarrow \pi^- \pi^- \pi^+ Pb'$

NODE=M010W

NODE=M010W
→ UNCHECKED ←

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

410± 31± 30		18	AUBERT	07AU	BABR	10.6 $e^+e^- \rightarrow \rho^0 \rho^\pm \pi^\mp \gamma$	
520–680	6360	19	LINK	07A	FOCS	$D^0 \rightarrow \pi^- \pi^+ \pi^- \pi^+$	
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± 36± 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± 27± 21	5904	25	ABREU	98G	DLPH	e^+e^-	OCCUR=2
478± 3± 15	5904	26	ABREU	98G	DLPH	e^+e^-	OCCUR=3
425± 14± 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± 32± 58		25,29	ACKERSTAFF	97R	OPAL	$E_{cm}^{ee} = 88-94, \tau \rightarrow 3\pi \nu$	
457± 15± 17		26,29	ACKERSTAFF	97R	OPAL	$E_{cm}^{ee} = 88-94, \tau \rightarrow 3\pi \nu$	OCCUR=2
446± 21 ⁺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± 13± 4		30	ANDO	92	SPEC	8 $\pi^- p \rightarrow \pi^+ \pi^- \pi^0 n$	OCCUR=3
465 ⁺²²⁸ ₋₁₄₃		31	IVANOV	91	RVUE	$\tau \rightarrow \pi^+ \pi^+ \pi^- \nu$	
298 ⁺⁴⁰ ₋₃₄		32	IVANOV	91	RVUE	$\tau \rightarrow \pi^+ \pi^+ \pi^- \nu$	OCCUR=2
488± 32		33	IVANOV	91	RVUE	$\tau \rightarrow \pi^+ \pi^+ \pi^- \nu$	OCCUR=3
430± 50			ARMSTRONG	90	OMEG	300.0 $p p \rightarrow p p \pi^+ \pi^- \pi^0$	
420± 40		34	ISGUR	89	RVUE	$\tau^+ \rightarrow \pi^+ \pi^+ \pi^- \nu$	
396± 43		35	BOWLER	88	RVUE		
405± 75± 25			BAND	87	MAC	$\tau^+ \rightarrow \pi^+ \pi^+ \pi^- \nu$	
419± 108± 57			BAND	87	MAC	$\tau^+ \rightarrow \pi^+ \pi^0 \pi^0 \nu$	OCCUR=2
521± 27			ALBRECHT	86B	ARG	$\tau^+ \rightarrow \pi^+ \pi^+ \pi^- \nu$	
476 ⁺¹³² ₋₁₂₀ ± 54			RUCKSTUHL	86	DLCO	$\tau^+ \rightarrow \pi^+ \pi^+ \pi^- \nu$	
462± 56± 30			SCHMIDKE	86	MRK2	$\tau^+ \rightarrow \pi^+ \pi^+ \pi^- \nu$	
292± 40			BELLINI	85	SPEC	40 $\pi^- A \rightarrow \pi^- \pi^+ \pi^- A$	
380± 100		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 $K^- p \rightarrow \Sigma 3\pi$	

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

NODE=M010W;LINKAGE=LI

NODE=M010W;LINKAGE=GO

NODE=M010W;LINKAGE=DR

NODE=M010W;LINKAGE=B6

NODE=M010W;LINKAGE=WE

NODE=M010W;LINKAGE=WB

NODE=M010W;LINKAGE=KS

NODE=M010W;LINKAGE=IM

NODE=M010W;LINKAGE=A1

NODE=M010W;LINKAGE=F1

NODE=M010W;LINKAGE=X

NODE=M010W;LINKAGE=P

NODE=M010W;LINKAGE=I

NODE=M010W;LINKAGE=L

NODE=M010W;LINKAGE=M

NODE=M010W;LINKAGE=K

NODE=M010W;LINKAGE=G

NODE=M010W;LINKAGE=D

NODE=M010W;LINKAGE=F

a₁(1260) DECAY MODES

NODE=M010215;NODE=M010

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

DESIG=22
DESIG=23
DESIG=7;OUR EST;→ UNCHECKED ←
DESIG=8;OUR EST;→ UNCHECKED ←
DESIG=9;OUR EST;→ UNCHECKED ←
DESIG=10;OUR EST;→ UNCHECKED ←
DESIG=16;OUR EST;→ UNCHECKED ←
DESIG=11;OUR EST;→ UNCHECKED ←
DESIG=12;OUR EST;→ UNCHECKED ←
DESIG=13;OUR EST;→ UNCHECKED ←
DESIG=14;OUR EST;→ UNCHECKED ←
DESIG=4;OUR EST;→ UNCHECKED ←

a₁(1260) PARTIAL WIDTHS

NODE=M010220

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

NODE=M010W4
NODE=M010W4

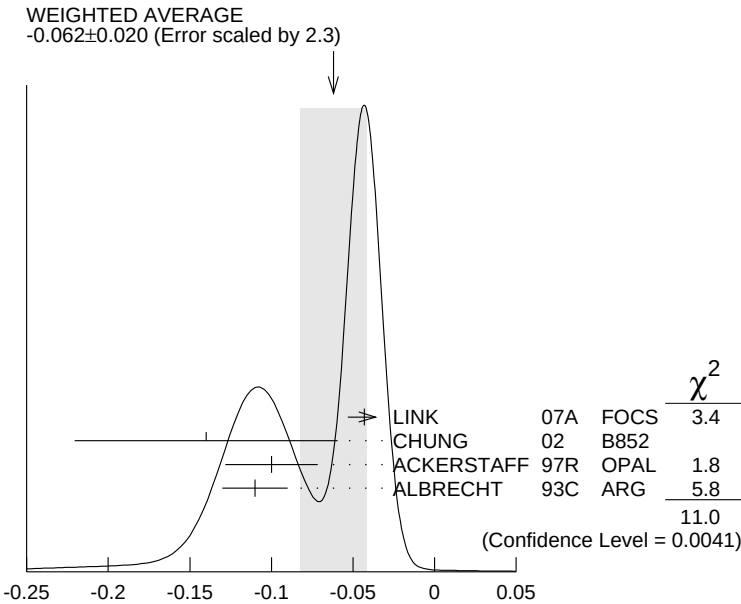
D-wave/S-wave AMPLITUDE RATIO IN DECAY OF a₁(1260) → ρπ

NODE=M010DS

VALUE	DOCUMENT ID	TECN	COMMENT
−0.062±0.020 OUR AVERAGE	Error includes scale factor of 2.3. See the ideogram below.		
−0.043±0.009±0.005	LINK	07A FOCS	$D^0 \rightarrow \pi^- \pi^+ \pi^- \pi^+$
−0.14 ±0.04 ±0.07	³⁸ CHUNG	02 B852	$18.3 \pi^- p \rightarrow \pi^+ \pi^- \pi^- p$
−0.10 ±0.02 ±0.02	^{39,40} ACKERSTAFF	97R OPAL	$E_{\text{cm}}^{\text{e}} = 88\text{--}94, \tau \rightarrow 3\pi \nu$
−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;LINKAGE=C
NODE=M010DS;LINKAGE=IM
NODE=M010DS;LINKAGE=X



D-wave/S-wave AMPLITUDE RATIO IN DECAY OF a₁(1260) → ρπ

a₁(1260) BRANCHING RATIOS

NODE=M010225

$\Gamma((\rho\pi)_{S\text{-wave}})/\Gamma_{\text{total}}$ Γ_3/Γ NODE=M010R5
NODE=M010R5

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 $e^+e^- \rightarrow \tau^+\tau^-$, $\tau^- \rightarrow \pi^-\pi^0\pi^0\nu_\tau$

 $\Gamma((\rho\pi)_{D\text{-wave}})/\Gamma_{\text{total}}$ Γ_4/Γ NODE=M010R6
NODE=M010R6

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 $e^+e^- \rightarrow \tau^+\tau^-$, $\tau^- \rightarrow \pi^-\pi^0\pi^0\nu_\tau$

 $\Gamma((\rho(1450)\pi)_{S\text{-wave}})/\Gamma_{\text{total}}$ Γ_5/Γ NODE=M010R7
NODE=M010R7

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 $e^+e^- \rightarrow \tau^+\tau^-$, $\tau^- \rightarrow \pi^-\pi^0\pi^0\nu_\tau$

 $\Gamma((\rho(1450)\pi)_{D\text{-wave}})/\Gamma_{\text{total}}$ Γ_6/Γ NODE=M010R8
NODE=M010R8

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 $e^+e^- \rightarrow \tau^+\tau^-$, $\tau^- \rightarrow \pi^-\pi^0\pi^0\nu_\tau$

 $\Gamma(\sigma\pi)/\Gamma_{\text{total}}$ Γ_7/Γ NODE=M010R9
NODE=M010R9

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 $e^+e^- \rightarrow \tau^+\tau^-$, $\tau^- \rightarrow \pi^-\pi^0\pi^0\nu_\tau$

 $\Gamma(f_0(980)\pi)/\Gamma_{\text{total}}$ Γ_8/Γ NODE=M010R10
NODE=M010R10

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 $e^+e^- \rightarrow \tau^+\tau^-$, $\tau^- \rightarrow \pi^-\pi^0\pi^0\nu_\tau$

 $\Gamma(f_0(1370)\pi)/\Gamma_{\text{total}}$ Γ_9/Γ NODE=M010R11
NODE=M010R11

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 $e^+e^- \rightarrow \tau^+\tau^-$, $\tau^- \rightarrow \pi^-\pi^0\pi^0\nu_\tau$

 $\Gamma(f_2(1270)\pi)/\Gamma_{\text{total}}$ Γ_{10}/Γ NODE=M010R12
NODE=M010R12

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 $e^+e^- \rightarrow \tau^+\tau^-$, $\tau^- \rightarrow \pi^-\pi^0\pi^0\nu_\tau$

 $\Gamma(K\bar{K}^*(892) + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{11}/Γ NODE=M010R13
NODE=M010R13

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 $\tau \rightarrow K\bar{K}\pi\nu_\tau$

$\Gamma(\sigma\pi)/\Gamma((\rho\pi)_{S\text{-wave}})$ 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 $1.05\text{--}1.38 \text{ e}^+ \text{e}^- \rightarrow \pi^+ \pi^- \pi^+ \pi^-$
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 GAVILLET 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=M010R13;LINKAGE=CO

NODE=M010R;LINKAGE=DR

NODE=M010R;LINKAGE=B6
 NODE=M010R13;LINKAGE=BA
 NODE=M010R4;LINKAGE=E

NODE=M010R;LINKAGE=RB

 $a_1(1260)$ REFERENCES

ALEKSEEV	10	PRL 104 241803	M.G. Alekseev <i>et al.</i>	(COMPASS Collab.)
AUBERT	07AU	PR D76 092005	B. Aubert <i>et al.</i>	(BABAR Collab.)
LINK	07A	PR D75 052003	J.M. Link <i>et al.</i>	(FNAL FOCUS Collab.)
PDG	06	JP G33 1	W.-M. Yao <i>et al.</i>	(PDG Collab.)
COAN	04	PRL 92 232001	T.E. Coan <i>et al.</i>	(CLEO Collab.)
GOMEZ-DUM...	04	PR D69 073002	D. Gomez Dumm, A. Pich, J. Portoles	
SALVINI	04	EPJ C35 21	P. Salvini <i>et al.</i>	(OBELIX Collab.)
BRIERE	03	PRL 90 181802	R. A. Briere <i>et al.</i>	(CLEO Collab.)
CHUNG	02	PR D65 072001	S.U. Chung <i>et al.</i>	(BNL E852 Collab.)
DRUTSKOY	02	PL B542 171	A. Drutskoy <i>et al.</i>	(BELLE Collab.)
BARBERIS	01	PL B507 14	D. Barberis <i>et al.</i>	
ASNER	00	PR D61 012002	D.M. Asner <i>et al.</i>	(CLEO Collab.)
AKHMETSHIN	99E	PL B466 392	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)
BARATE	99R	EPJ C11 599	R. Barate <i>et al.</i>	(ALEPH Collab.)
BONDAR	99	PL B466 403	A.E. Bondar <i>et al.</i>	(Novosibirsk CMD-2 Collab.)
ABREU	98G	PL B426 411	P. Abreu <i>et al.</i>	(DELPHI Collab.)
BARATE	98R	EPJ C4 409	R. Barate <i>et al.</i>	(ALEPH Collab.)
BARBERIS	98B	PL B422 399	D. Barberis <i>et al.</i>	(WA 102 Collab.)
ACKERSTAFF	97R	ZPHY C75 593	K. Akerstaff <i>et al.</i>	(OPAL Collab.)
BUSKULIC	96	ZPHY C70 579	D. Buskulic <i>et al.</i>	(ALEPH Collab.)
AKERS	95P	ZPHY C67 45	R. Akers <i>et al.</i>	(OPAL Collab.)
ALAM	94	PR D50 43	M.S. Alam <i>et al.</i>	(CLEO Collab.)
ALBRECHT	93C	ZPHY C58 61	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
DECKER	93A	ZPHY C58 445	R. Decker <i>et al.</i>	
ANDO	92	PL B291 496	A. Ando <i>et al.</i>	(KEK, KYOT, NIRS, SAGA+)
KUHN	92	ZPHY C56 661	J.H. Kuhn, E. Mirkes	
IVANOV	91	ZPHY C49 563	Y.P. Ivanov, A.A. Osipov, M.K. Volkov	(JINR)
ARMSTRONG	90	ZPHY C48 213	T.A. Armstrong, M. Benayoun, W. Beusch	(WA76 Coll.)
FEINDT	90	ZPHY C48 681	M. Feindt	(HAMB)
KUHN	90	ZPHY C48 445	J.H. Kuhn <i>et al.</i>	(MPIM)
ISGUR	89	PR D39 1357	N. Isgur, C. Morningstar, C. Reader	(TNTO)
BOWLER	88	PL B209 99	M.G. Bowler	(OXF)
BAND	87	PL B198 297	H.R. Band <i>et al.</i>	(MAC Collab.)
TORNQVIST	87	ZPHY C36 695	N.A. Tornqvist	(HELS)
ALBRECHT	86B	ZPHY C33 7	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
RUCKSTUHL	86	PRL 56 2132	W. Ruckstuhl <i>et al.</i>	(DELCO Collab.)
SCHMIDKE	86	PRL 57 527	W.B. Schmidke <i>et al.</i>	(Mark II Collab.)
BELLINI	85	SJNP 41 781	D. Bellini <i>et al.</i>	
Translated from YAF 41 1223.				
ZIELINSKI	84C	PRL 52 1195	M. Zielinski <i>et al.</i>	(ROCH, MINN, FNAL)
LONGACRE	82	PR D26 82	R.S. Longacre	(BNL)
DANKOWY...	81	PRL 46 580	J.A. Dankowych <i>et al.</i>	(TNTO, BNL, CARL+)
DAUM	81B	NP B182 269	C. Daum <i>et al.</i>	(AMST, CERN, CRAC, MPIM+)
DAUM	80	PL 89B 281	C. Daum <i>et al.</i>	(AMST, CERN, CRAC, MPIM+)
GAVILLET	77	PL 69B 119	P. Gavillet <i>et al.</i>	(AMST, CERN, NIJ+)
BOWLER	75	NP B97 227	M.G. Bowler <i>et al.</i>	(OXFTP, DARE)

NODE=M010

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 REFID=20852
 REFID=20571

$f_2(1270)$

$$I^G(J^{PC}) = 0^+(2^{++})$$

NODE=M005

 $f_2(1270)$ MASS

NODE=M005M

NODE=M005M

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
1275.5 ± 0.8 OUR AVERAGE				
1275.8 ± 1.0 ± 0.4		¹ BOGOLYUB...	13 SPEC	$7\pi^+(K^+,p)A \rightarrow n\gamma + X$
1262 $\pm \frac{1}{2} \pm 8$		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		² 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	³ ALDE	87 GAM4	$100\pi^-p \rightarrow 4\pi^0n$
1274 ± 5		³ AUGUSTIN	87 DM2	$J/\psi \rightarrow \gamma\pi^+\pi^-$
1283 ± 6		⁴ LONGACRE	86 MPS	$22\pi^-p \rightarrow n2K_S^0$
1276 ± 7		COURAU	84 DLCO	$e^+e^- \rightarrow e^+e^-\pi^+\pi^-$
1273.3 ± 2.3		⁵ CHABAUD	83 ASPK	$17\pi^-p$ polarized
1280 ± 4		⁶ CASON	82 STRC	$8\pi^+p \rightarrow \Delta^{++}\pi^0\pi^0$
1281 ± 7	11600	GIDAL	81 MRK2	J/ψ decay
1282 ± 5		⁷ CORDEN	79 OMEG	$12-15\pi^-p \rightarrow n2\pi$
1269 ± 4	10k	APEL	75 NICE	$40\pi^-p \rightarrow n2\pi^0$
1272 ± 4	4600	ENGLER	74 DBC	$6\pi^+n \rightarrow \pi^+\pi^-p$
1277 ± 4	5300	FLATTE	71 HBC	$7.0\pi^+p$
1273 ± 8		³ STUNTEBECK	70 HBC	$8\pi^-p, 5.4\pi^+d$
1265 ± 8		BOESEBECK	68 HBC	$8\pi^+p$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1259 ± 4 ± 4	1.7k	^{8,9} DOBBS	15	$J/\psi \rightarrow \gamma\pi^+\pi^-$
1267 ± 4 ± 3	1.5k	^{8,9} DOBBS	15	$\psi(2S) \rightarrow \gamma\pi^+\pi^-$
1270 ± 8		¹⁰ ANISOVICH	09 RVUE	$0.0\bar{p}p, \pi N$
1277 ± 6	870	¹¹ SCHEGELSKY	06A RVUE	$\gamma\gamma \rightarrow K_S^0 K_S^0$
1251 ± 10		TIKHOMIROV	03 SPEC	$40.0\pi^-C \rightarrow K_S^0 K_S^0 K_L^0 X$
1260 ± 10		¹² ALDE	97 GAM2	$450pp \rightarrow pp\pi^0\pi^0$
1278 ± 6		¹² GRYGOREV	96 SPEC	$40\pi^-N \rightarrow K_S^0 K_S^0 X$
1262 ± 11		AGUILAR-...	91 EHS	$400pp$
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	$e^+e^- \rightarrow \pi^+\pi^-\pi^0 X$
1284 ± 30	3k	BINON	83 GAM2	$38\pi^-p \rightarrow n2\eta$
1280 ± 20	3k	APEL	82 CNTR	$25\pi^-p \rightarrow n2\pi^0$
1284 ± 10	16000	DEUTSCH...	76 HBC	$16\pi^+p$
1258 ± 10	600	TAKAHASHI	72 HBC	$8\pi^-p \rightarrow n2\pi$
1275 ± 13		ARMENISE	70 HBC	$9\pi^+n \rightarrow p\pi^+\pi^-$
1261 ± 5	1960	³ ARMENISE	68 DBC	$5.1\pi^+n \rightarrow p\pi^+MM^-$
1270 ± 10	360	³ ARMENISE	68 DBC	$5.1\pi^+n \rightarrow p\pi^0MM$
1268 ± 6		¹³ JOHNSON	68 HBC	$3.7-4.2\pi^-p$

OCCUR=2

OCCUR=2

OCCUR=2

NODE=M005M;LINKAGE=B

NODE=M005M;LINKAGE=A
 NODE=M005M;LINKAGE=T
 NODE=M005M;LINKAGE=L
 NODE=M005M;LINKAGE=O
 NODE=M005M;LINKAGE=P
 NODE=M005M;LINKAGE=S
 NODE=M005M;LINKAGE=C
 NODE=M005M;LINKAGE=D
 NODE=M005M;LINKAGE=AN
 NODE=M005M;LINKAGE=SC
 NODE=M005M;LINKAGE=QQ
 NODE=M005M;LINKAGE=J

¹ Averaged over six nuclear targets, no statistically significant dependence on target nucleus observed.

² T-matrix pole.

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

⁴ From a partial-wave analysis of data using a K-matrix formalism with 5 poles.

⁵ From an energy-independent partial-wave analysis.

⁶ From an amplitude analysis of the reaction $\pi^+\pi^- \rightarrow 2\pi^0$.

⁷ From an amplitude analysis of $\pi^+\pi^- \rightarrow \pi^+\pi^-$ scattering data.

⁸ Using CLEO-c data but not authored by the CLEO Collaboration.

⁹ From a fit to a Breit-Wigner line shape with fixed $\Gamma = 185$ MeV.

¹⁰ 4-poles, 5-channel K matrix fit.

¹¹ From analysis of L3 data at 91 and 183–209 GeV.

¹² Systematic uncertainties not estimated.

¹³ JOHNSON 68 includes BONDAR 63, LEE 64, DERADO 65, EISNER 67.

$f_2(1270)$ WIDTH

NODE=M005W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

NODE=M005W

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

190.3 $\pm$ 1.9 $\pm$ 1.8		¹ BOGOLYUB...	13	SPEC	$7\pi^+(K^+,p)A \rightarrow n\gamma + X$	
175 $\pm$ ⁺⁶ ₋₄ $\pm$ 10		ABLIKIM	06v	BES2	$e^+e^- \rightarrow J/\psi \rightarrow \gamma\pi^+\pi^-$	
190 $\pm$ 20		ABLIKIM	05	BES2	$J/\psi \rightarrow \phi\pi^+\pi^-$	
171 $\pm$ 10		ALDE	98	GAM4	$100\pi^-p \rightarrow \pi^0\pi^0n$	
204 $\pm$ 20		² BERTIN	97c	OBLX	$0.0\bar{p}p \rightarrow \pi^+\pi^-\pi^0$	
192 $\pm$ 5	200k	PROKOSHKIN	94	GAM2	$38\pi^-p \rightarrow \pi^0\pi^0n$	
180 $\pm$ 24		AGUILAR-...	91	EHS	$400pp$	
169 $\pm$ 9	5730	³ AUGUSTIN	89	DM2	$e^+e^- \rightarrow 5\pi$	
150 $\pm$ 30	400	³ ALDE	87	GAM4	$100\pi^-p \rightarrow 4\pi^0n$	
186 $\pm$ ⁺⁹ ₋₂		⁴ LONGACRE	86	MPS	$22\pi^-p \rightarrow n2K_S^0$	
179.2 $\pm$ ^{+6.9} _{-6.6}		⁵ CHABAUD	83	ASPK	$17\pi^-p$ polarized	
160 $\pm$ 11		DENNEY	83	LASS	$10\pi^+N$	
196 $\pm$ 10	3k	APEL	82	CNTR	$25\pi^-p \rightarrow n2\pi^0$	
152 $\pm$ 9		⁶ CASON	82	STRC	$8\pi^+p \rightarrow \Delta^{++}\pi^0\pi^0$	
186 $\pm$ 27	11600	GIDAL	81	MRK2	J/ψ decay	
216 $\pm$ 13		⁷ CORDEN	79	OMEG	$12-15\pi^-p \rightarrow n2\pi$	
190 $\pm$ 10	10k	APEL	75	NICE	$40\pi^-p \rightarrow n2\pi^0$	
192 $\pm$ 16	4600	ENGLER	74	DBC	$6\pi^+n \rightarrow \pi^+\pi^-p$	
183 $\pm$ 15	5300	FLATTE	71	HBC	$7\pi^+p \rightarrow \Delta^{++}f_2$	
196 $\pm$ 30		³ STUNTEBECK	70	HBC	$8\pi^-p, 5.4\pi^+d$	
216 $\pm$ 20	1960	³ ARMENISE	68	DBC	$5.1\pi^+n \rightarrow p\pi^+MM^-$	
128 $\pm$ 27		³ BOESEBECK	68	HBC	$8\pi^+p$	
176 $\pm$ 21		^{3,8} JOHNSON	68	HBC	$3.7-4.2\pi^-p$	
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●						
194 $\pm$ 36		⁹ ANISOVICH	09	RVUE	$0.0\bar{p}p, \pi N$	
195 $\pm$ 15	870	¹⁰ SCHEGELSKY	06A	RVUE	$\gamma\gamma \rightarrow K_S^0K_S^0$	
121 $\pm$ 26		TIKHOMIROV	03	SPEC	$40.0\pi^-C \rightarrow K_S^0K_S^0K_L^0X$	
187 $\pm$ 20		¹¹ ALDE	97	GAM2	$450pp \rightarrow pp\pi^0\pi^0$	
184 $\pm$ 10		¹¹ GRYGOREV	96	SPEC	$40\pi^-N \rightarrow K_S^0K_S^0X$	
200 $\pm$ 10		AKER	91	CBAR	$0.0\bar{p}p \rightarrow 3\pi^0$	
240 $\pm$ 40	3k	BINON	83	GAM2	$38\pi^-p \rightarrow n2\eta$	
187 $\pm$ 30	650	³ ANTIPOV	77	CIBS	$25\pi^-p \rightarrow p3\pi$	
225 $\pm$ 38	16000	DEUTSCH...	76	HBC	$16\pi^+p$	
166 $\pm$ 28	600	³ TAKAHASHI	72	HBC	$8\pi^-p \rightarrow n2\pi$	
173 $\pm$ 53		³ ARMENISE	70	HBC	$9\pi^+n \rightarrow p\pi^+\pi^-$	

OCCUR=2

OCCUR=2

¹ Averaged over six nuclear targets, no statistically significant dependence on target nucleus observed.² T-matrix pole.³ Width errors enlarged by us to $4\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.⁴ From a partial-wave analysis of data using a K-matrix formalism with 5 poles.⁵ From an energy-independent partial-wave analysis.⁶ From an amplitude analysis of the reaction $\pi^+\pi^- \rightarrow 2\pi^0$.⁷ From an amplitude analysis of $\pi^+\pi^- \rightarrow \pi^+\pi^-$ scattering data.⁸ JOHNSON 68 includes BONDAR 63, LEE 64, DERADO 65, EISNER 67.⁹ 4-poles, 5-channel K matrix fit.¹⁰ From analysis of L3 data at 91 and 183–209 GeV.¹¹ Systematic uncertainties not estimated.

NODE=M005W;LINKAGE=C

NODE=M005W;LINKAGE=QA

NODE=M005W;LINKAGE=T

NODE=M005W;LINKAGE=L

NODE=M005W;LINKAGE=R

NODE=M005W;LINKAGE=Q

NODE=M005W;LINKAGE=U

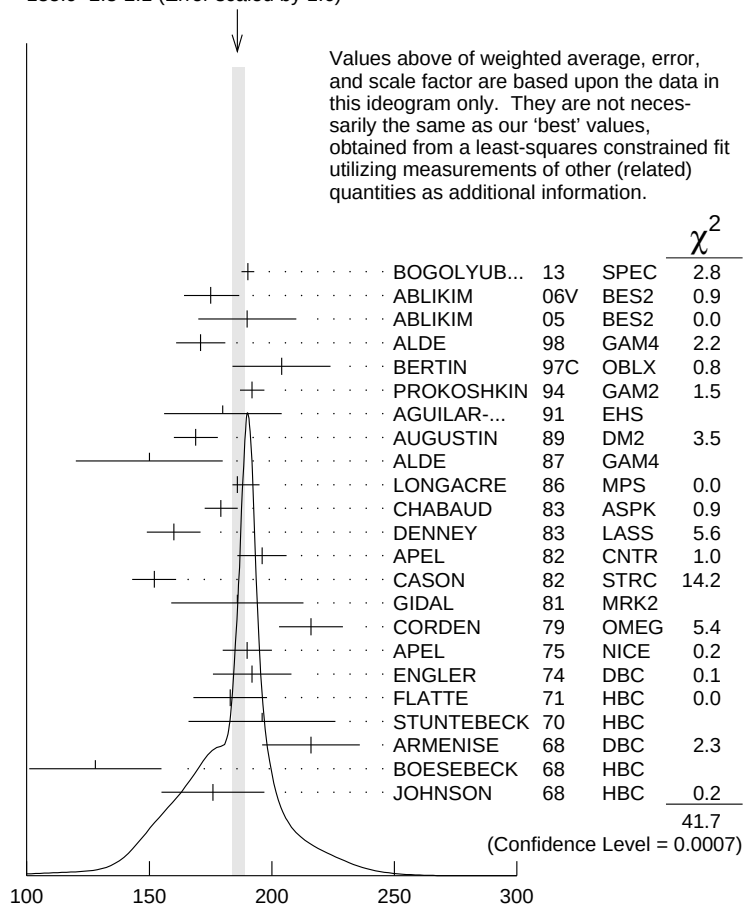
NODE=M005W;LINKAGE=J

NODE=M005W;LINKAGE=AN

NODE=M005W;LINKAGE=SC

NODE=M005W;LINKAGE=QQ

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



$f_2(1270)$ width (MeV)

$f_2(1270)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
$\Gamma_1 \quad \pi\pi$	$(84.2^{+2.9}_{-0.9})\%$	S=1.1
$\Gamma_2 \quad \pi^+\pi^-2\pi^0$	$(7.7^{+1.1}_{-3.2})\%$	S=1.2
$\Gamma_3 \quad K\bar{K}$	$(4.6^{+0.5}_{-0.4})\%$	S=2.7
$\Gamma_4 \quad 2\pi^+2\pi^-$	$(2.8 \pm 0.4)\%$	S=1.2
$\Gamma_5 \quad \eta\eta$	$(4.0 \pm 0.8) \times 10^{-3}$	S=2.1
$\Gamma_6 \quad 4\pi^0$	$(3.0 \pm 1.0) \times 10^{-3}$	
$\Gamma_7 \quad \gamma\gamma$	$(1.42 \pm 0.24) \times 10^{-5}$	S=1.4
$\Gamma_8 \quad \eta\pi\pi$	$< 8 \times 10^{-3}$	CL=95%
$\Gamma_9 \quad K^0K^-\pi^+ + \text{c.c.}$	$< 3.4 \times 10^{-3}$	CL=95%
$\Gamma_{10} \quad e^+e^-$	$< 6 \times 10^{-10}$	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 45 measurements and one constraint to determine 8 parameters. The overall fit has a $\chi^2 = 83.0$ for 38 degrees of freedom.

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

x_2	−90						
x_3	10	−39					
x_4	10	−38	1				
x_5	1	−6	0	0			
x_6	0	−7	0	0	0		
x_7	3	1	−15	0	0	0	
Γ	−71	65	−10	−7	−1	0	−6
	x_1	x_2	x_3	x_4	x_5	x_6	x_7

Mode	Rate (MeV)	Scale factor
$\Gamma_1 \quad \pi\pi$	157.2 $^{+4.0}_{-1.1}$	
$\Gamma_2 \quad \pi^+\pi^-2\pi^0$	14.4 $^{+2.1}_{-6.0}$	1.2
$\Gamma_3 \quad K\bar{K}$	8.5 ± 0.8	2.8
$\Gamma_4 \quad 2\pi^+2\pi^-$	5.2 ± 0.7	1.2
$\Gamma_5 \quad \eta\eta$	0.75 ± 0.14	2.1
$\Gamma_6 \quad 4\pi^0$	0.56 ± 0.19	
$\Gamma_7 \quad \gamma\gamma$	0.0026 ± 0.0005	1.4

$f_2(1270)$ PARTIAL WIDTHS

NODE=M005220

$\Gamma(\pi\pi)$

Γ_1

VALUE (MeV) EVTS DOCUMENT ID TECN COMMENT

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

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

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

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

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

Γ_3

VALUE (MeV) EVTS DOCUMENT ID TECN COMMENT

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

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

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

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

$\Gamma(\eta\eta)$

Γ_5

VALUE (MeV) EVTS DOCUMENT ID TECN COMMENT

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

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

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

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

$\Gamma(\gamma\gamma)$

Γ_7

The value of this width depends on the theoretical model used. Unitary approaches with scalars typically (with exception of PENNINGTON 08) give values clustering around 2.6 keV; without an S -wave contribution, values are systematically higher (typically around 3 keV).

VALUE (keV) EVTS DOCUMENT ID TECN COMMENT

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

2.93 ± 0.40 3 DAI 14A RVUE Compilation

NODE=M005W1
NODE=M005W1

NODE=M005W4
NODE=M005W4

NODE=M005W7
NODE=M005W7

NODE=M005W8
NODE=M005W8

NODE=M005W8

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

3.14±0.20		4,5	PENNINGTON 08	RVUE	Compilation
3.82±0.30		5,6	PENNINGTON 08	RVUE	Compilation
2.55±0.15	870	2	SCHEGELSKY 06A	RVUE	$\gamma\gamma \rightarrow K_S^0 K_S^0$
2.84±0.35			BOGLIONE 99	RVUE	$\gamma\gamma \rightarrow \pi^+\pi^-, \pi^0\pi^0$
2.93±0.23±0.32		7	YABUKI 95	VNS	
2.58±0.13 ^{+0.36} _{-0.27}		8	BEHREND 92	CELL	$e^+e^- \rightarrow e^+e^-\pi^+\pi^-$
3.10±0.35±0.35		9	BLINOV 92	MD1	$e^+e^- \rightarrow e^+e^-\pi^+\pi^-$
2.27±0.47±0.11			ADACHI 90D	TOPZ	$e^+e^- \rightarrow e^+e^-\pi^+\pi^-$
3.15±0.04±0.39			BOYER 90	MRK2	$e^+e^- \rightarrow e^+e^-\pi^+\pi^-$
3.19±0.16 ^{+0.29} _{-0.28}			MARSISKE 90	CBAL	$e^+e^- \rightarrow e^+e^-\pi^0\pi^0$
2.35±0.65		10	MORGAN 90	RVUE	$\gamma\gamma \rightarrow \pi^+\pi^-, \pi^0\pi^0$
3.19±0.09 ^{+0.22} _{-0.38}	2177		OEST 90	JADE	$e^+e^- \rightarrow e^+e^-\pi^0\pi^0$
3.2 ±0.1 ±0.4		11	AIHARA 86B	TPC	$e^+e^- \rightarrow e^+e^-\pi^+\pi^-$
2.5 ±0.1 ±0.5			BEHREND 84B	CELL	$e^+e^- \rightarrow e^+e^-\pi^+\pi^-$
2.85±0.25±0.5		12	BERGER 84	PLUT	$e^+e^- \rightarrow e^+e^-2\pi$
2.70±0.05±0.20			COURAU 84	DLCO	$e^+e^- \rightarrow e^+e^-\pi^+\pi^-$
2.52±0.13±0.38		13	SMITH 84C	MRK2	$e^+e^- \rightarrow e^+e^-\pi^+\pi^-$
2.7 ±0.2 ±0.6			EDWARDS 82F	CBAL	$e^+e^- \rightarrow e^+e^-2\pi^0$
2.9 ^{+0.6} _{-0.4} ±0.6		14	EDWARDS 82F	CBAL	$e^+e^- \rightarrow e^+e^-2\pi^0$
3.2 ±0.2 ±0.6			BRANDELIK 81B	TASS	$e^+e^- \rightarrow e^+e^-\pi^+\pi^-$
3.6 ±0.3 ±0.5			ROUSSARIE 81	MRK2	$e^+e^- \rightarrow e^+e^-\pi^+\pi^-$
2.3 ±0.8		15	BERGER 80B	PLUT	e^+e^-

OCCUR=2

OCCUR=3

OCCUR=2

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

Γ_{10}

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

NODE=M005W9

NODE=M005W9

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

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

¹ From a partial-wave analysis of data using a K-matrix formalism with 5 poles.

² From analysis of L3 data at 91 and 183–209 GeV and using SU(3) relations.

³ Based on a K-matrix analysis of BELLE data from MORI 07, UEHARA 08A, UEHARA 09 and UEHARA 13. The width is derived for the pole on the third sheet which is closest to the physical axis. Supersedes PENNINGTON 08.

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

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

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

⁷ With a narrow scalar state around 1220 MeV.

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

⁹ Using the unitarized model of LYTH 85.

¹⁰ Error includes spread of different solutions. Data of MARK2 and CRYSTAL BALL used in the analysis. Authors report strong correlations with $\gamma\gamma$ width of $f_0(1370)$: $\Gamma(f_2) + 1/4 \Gamma(f_0) = 3.6 \pm 0.3$ KeV.

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

¹² Using the MENNESSIER 83 model.

¹³ Superseded by BOYER 90.

¹⁴ If helicity = 2 assumption is not made.

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

NODE=M005PW;LINKAGE=L

NODE=M005W1;LINKAGE=SC

NODE=M005W8;LINKAGE=A

NODE=M005W8;LINKAGE=P1

NODE=M005W8;LINKAGE=P3

NODE=M005W8;LINKAGE=P2

NODE=M005W8;LINKAGE=YA

NODE=M005W;LINKAGE=B

NODE=M005W;LINKAGE=A

NODE=M005PW;LINKAGE=C

NODE=M005PW;LINKAGE=B

NODE=M005PW;LINKAGE=X

NODE=M005PW;LINKAGE=V

NODE=M005PW;LINKAGE=H

NODE=M005PW;LINKAGE=A

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

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

$\Gamma_3 \Gamma_7 / \Gamma$

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
0.121±0.020 OUR FIT			Error includes scale factor of 1.3.
0.091±0.007±0.027	¹ ALBRECHT 90G	ARG	$e^+e^- \rightarrow e^+e^-K^+K^-$

NODE=M005G1

NODE=M005G1

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

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

OCCUR=2

¹ Using an incoherent background.

² Using a coherent background.

NODE=M005G1;LINKAGE=A

NODE=M005G1;LINKAGE=K

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

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
$11.5^{+1.8+4.5}_{-2.0-3.7}$	¹ UEHARA	10A BELL	10.6 $e^+e^- \rightarrow e^+e^-\eta\eta$

¹ Including interference with the $f_2'(1525)$ (parameters fixed to the values from the 2008 edition of this review, PDG 08) and $f_0(Y)$.

NODE=M005G02
NODE=M005G02

NODE=M005G02;LINKAGE=UE

Helicity-0/Helicity-2 RATIO IN $\gamma\gamma \rightarrow f_2(1270) \rightarrow \pi\pi$

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
$3.7 \pm 0.3^{+15.9}_{-2.9}$	UEHARA	08A BELL	10.6 $e^+e^- \rightarrow e^+e^-\pi^0\pi^0$

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

9.5 ± 1.8	¹ DAI	14A RVUE	Compilation
13	^{2,3} PENNINGTON 08	RVUE	Compilation
26	^{3,4} PENNINGTON 08	RVUE	Compilation

¹ Based on a K -matrix analysis of BELLE data from MORI 07, UEHARA 08A, UEHARA 09 and UEHARA 13. The width is derived for the pole on the third sheet which is closest to the physical axis.

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

³ Dispersion theory based amplitude analysis of BOYER 90, MARSISKE 90, BEHREND 92, and MORI 07.

⁴ Solution B (worse than solution A; still acceptable when systematic uncertainties are included).

NODE=M005HR0
NODE=M005HR0

OCCUR=2
OCCUR=3

NODE=M005HR0;LINKAGE=A

NODE=M005HR0;LINKAGE=P1
NODE=M005HR0;LINKAGE=P3

NODE=M005HR0;LINKAGE=P2

$f_2(1270)$ BRANCHING RATIOS

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

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

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

0.837 ± 0.020 OUR AVERAGE

0.849 ± 0.025		CHABAUD	83 ASPK	17 $\pi^- p$ polarized
0.85 ± 0.05	250	BEAUPRE	71 HBC	8 $\pi^+ p \rightarrow \Delta^{++} f_2$
0.8 ± 0.04	600	OH	70 HBC	1.26 $\pi^- p \rightarrow \pi^+ \pi^- n$

 $\Gamma(\pi^+ \pi^- 2\pi^0)/\Gamma(\pi\pi)$
 Γ_2/Γ_1

Should be twice $\Gamma(2\pi^+ 2\pi^-)/\Gamma(\pi\pi)$ if decay is $\rho\rho$. (See ASCOLI 68D.)

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

$0.091^{+0.014}_{-0.040}$ OUR FIT Error includes scale factor of 1.2.

0.15 ± 0.06 600 EISENBERG 74 HBC 4.9 $\pi^+ p \rightarrow \Delta^{++} f_2$

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

0.07 EMMS 75D DBC 4 $\pi^+ n \rightarrow p f_2$

 $\Gamma(K\bar{K})/\Gamma(\pi\pi)$
 Γ_3/Γ_1

We average only experiments which either take into account $f_2(1270)$ - $a_2(1320)$ interference explicitly or demonstrate that $a_2(1320)$ production is negligible.

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

$0.054^{+0.005}_{-0.006}$ OUR FIT Error includes scale factor of 2.7.

$0.041^{+0.004}_{-0.005}$ OUR AVERAGE

0.045 ± 0.01		¹ BARGIOTTI	03	OBLX	$\bar{p}p$
$0.037^{+0.008}_{-0.021}$		ETKIN	82B	MPS	23 $\pi^- p \rightarrow n 2K_S^0$
0.045 ± 0.009		CHABAUD	81	ASPK	17 $\pi^- p$ polarized
0.039 ± 0.008		LOVERRE	80	HBC	4 $\pi^- p \rightarrow K \bar{K} N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
0.052 ± 0.025		ABLIKIM	04E	BES2	$J/\psi \rightarrow \omega K^+ K^-$
0.036 ± 0.005		² COSTA	80	OMEG	1-2.2 $\pi^- p \rightarrow K^+ K^- n$
0.030 ± 0.005		³ MARTIN	79	RVUE	
0.027 ± 0.009		⁴ POLYCHRO...	79	STRC	7 $\pi^- p \rightarrow n 2K_S^0$
0.025 ± 0.015		EMMS	75D	DBC	4 $\pi^+ n \rightarrow p f_2$
0.031 ± 0.012	20	ADERHOLZ	69	HBC	8 $\pi^+ p \rightarrow K^+ K^- \pi^+ p$

NODE=M005R10
NODE=M005R10

NODE=M005R2
NODE=M005R2
NODE=M005R2

NODE=M005R3
NODE=M005R3

NODE=M005R3

$\Gamma(2\pi^+ 2\pi^-)/\Gamma(\pi\pi)$ Γ_4/Γ_1

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.033±0.005 OUR FIT	Error includes scale factor of 1.2.			
0.033±0.004 OUR AVERAGE	Error includes scale factor of 1.1.			
0.024±0.006	160	EMMS	75D DBC	$4 \pi^+ n \rightarrow p f_2$
0.051±0.025	70	EISENBERG	74 HBC	$4.9 \pi^+ p \rightarrow \Delta^{++} f_2$
0.043 ^{+0.007} _{-0.011}	285	LOUIE	74 HBC	$3.9 \pi^- p \rightarrow n f_2$
0.037±0.007	154	ANDERSON	73 DBC	$6 \pi^+ n \rightarrow p f_2$
0.047±0.013		OH	70 HBC	$1.26 \pi^- p \rightarrow \pi^+ \pi^- n$

NODE=M005R1
 NODE=M005R1

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

VALUE (units 10 ⁻³)	DOCUMENT ID	TECN	COMMENT
4.0±0.8 OUR FIT	Error includes scale factor of 2.1.		
2.9±0.5 OUR AVERAGE			
2.7±0.7	BINON 05	GAMS	$33 \pi^- p \rightarrow \eta\eta n$
2.8±0.7	ALDE 86D	GAM4	$100 \pi^- p \rightarrow 2\eta n$
5.2±1.7	BINON 83	GAM2	$38 \pi^- p \rightarrow 2\eta n$

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

NODE=M005R12
 NODE=M005R12

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

² Re-evaluated by CHABAUD 83.

³ Includes PAWLICKI 77 data.

⁴ Takes into account the $f_2(1270)$ - $f_2'(1525)$ interference.

NODE=M005R;LINKAGE=BG
 NODE=M005R3;LINKAGE=D
 NODE=M005R3;LINKAGE=F
 NODE=M005R3;LINKAGE=M

 $f_2(1270)$ REFERENCES

NODE=M005

DOBBS 15	PR D91 052006	S. Dobbs <i>et al.</i>	(NWES)
DAI 14A	PR D90 036004	L.-Y. Dai, M.R. Pennington	(CEBAF)
BOGOLYUB... 13	PAN 76 1324	M.Yu. Bogolyubsky <i>et al.</i>	(HYPERON-M Collab.)
	Translated from YAF 76 1389.		
UEHARA 13	PTEP 2013 123C01	S. Uehara <i>et al.</i>	(BELLE Collab.)
UEHARA 10A	PR D82 114031	S. Uehara <i>et al.</i>	(BELLE Collab.)
ANISOVICH 09	IJMP A24 2481	V.V. Anisovich, A.V. Sarantsev	
UEHARA 09	PR D79 052009	S. Uehara <i>et al.</i>	(BELLE Collab.)
PDG 08	PL B667 1	C. Amsler <i>et al.</i>	(PDG Collab.)
PENNINGTON 08	EPJ C56 1	M.R. Pennington <i>et al.</i>	
UEHARA 08A	PR D78 052004	S. Uehara <i>et al.</i>	(BELLE Collab.)
MORI 07	PR D75 051101	T. Mori <i>et al.</i>	(BELLE Collab.)
ABLIKIM 06V	PL B642 441	M. Ablikim <i>et al.</i>	(BES Collab.)
SCHEGELSKY 06A	EPJ A27 207	V.A. Schegelsky <i>et al.</i>	
ABLIKIM 05	PL B607 243	M. Ablikim <i>et al.</i>	(BES Collab.)
BINON 05	PAN 68 960	F. Binon <i>et al.</i>	
	Translated from YAF 68 998.		

REFID=56805
 REFID=55923
 REFID=55585
 REFID=55592
 REFID=53641
 REFID=52719
 REFID=52761
 REFID=52166
 REFID=52303
 REFID=52309
 REFID=51652
 REFID=51507
 REFID=51185
 REFID=50450
 REFID=50780

ABLIKIM	04E	PL B603 138	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50174
BARGIOTTI	03	EPJ C26 371	M. Bargiotti <i>et al.</i>	(OBELIX Collab.)	REFID=49217
TIKHOMIROV	03	PAN 66 828	G.D. Tikhomirov <i>et al.</i>		REFID=49423
		Translated from YAF 66 860.			
ACHASOV	00K	PL B492 8	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47933
BARBERIS	00E	PL B479 59	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=47961
BOGLIONE	99	EPJ C9 11	M. Boglione, M.R. Pennington		REFID=46931
ALDE	98	EPJ A3 361	D. Alde <i>et al.</i>	(GAM4 Collab.)	REFID=46605
Also		PAN 62 405	D. Alde <i>et al.</i>	(GAMS Collab.)	REFID=46914
		Translated from YAF 62 446.			
ALDE	97	PL B397 350	D.M. Alde <i>et al.</i>	(GAMS Collab.)	REFID=45392
BERTIN	97C	PL B408 476	A. Bertin <i>et al.</i>	(OBELIX Collab.)	REFID=45701
GRYGOREV	96	PAN 59 2105	V.K. Grigoriev, O.N. Baloshin, B.P. Barkov	(ITEP)	REFID=45566
		Translated from YAF 59 2187.			
YABUKI	95	JPSJ 64 435	F. Yabuki <i>et al.</i>	(VENUS Collab.)	REFID=46384
PROKOSHKIN	94	PD 39 420	Y.D. Prokoshkin, A.A. Kondashov	(SERP)	REFID=44094
		Translated from DANS 336 613.			
BEHREND	92	ZPHY C56 381	H.J. Behrend	(CELLO Collab.)	REFID=43172
BLINOV	92	ZPHY C53 33	A.E. Blinov <i>et al.</i>	(NOVO)	REFID=41858
AGUILAR-...	91	ZPHY C50 405	M. Aguilar-Benitez <i>et al.</i>	(LEBC-EHS Collab.)	REFID=41637
AKER	91	PL B260 249	E. Aker <i>et al.</i>	(Crystal Barrel Collab.)	REFID=41587
ADACHI	90D	PL B234 185	I. Adachi <i>et al.</i>	(TOPAZ Collab.)	REFID=41345
ALBRECHT	90G	ZPHY C48 183	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=41374
BOYER	90	PR D42 1350	J. Boyer <i>et al.</i>	(Mark II Collab.)	REFID=41362
BREAKSTONE	90	ZPHY C48 569	A.M. Breakstone <i>et al.</i>	(ISU, BGNA, CERN+)	REFID=41376
MARSISKE	90	PR D41 3324	H. Marsiske <i>et al.</i>	(Crystal Ball Collab.)	REFID=41351
MORGAN	90	ZPHY C48 623	D. Morgan, M.R. Pennington	(RAL, DURH)	REFID=41583
OEST	90	ZPHY C47 343	T. Oest <i>et al.</i>	(JADE Collab.)	REFID=41358
AUGUSTIN	89	NP B320 1	J.E. Augustin, G. Cosme	(DM2 Collab.)	REFID=41004
VOROBYEV	88	SJNP 48 273	P.V. Vorobiev <i>et al.</i>	(NOVO)	REFID=41023
		Translated from YAF 48 436.			
ALDE	87	PL B198 286	D.M. Alde <i>et al.</i>	(LANL, BRUX, SERP, LAPP)	REFID=40221
AUGUSTIN	87	ZPHY C36 369	J.E. Augustin <i>et al.</i>	(LALO, CLER, FRAS+)	REFID=40268
ABACHI	86B	PRL 57 1990	S. Abachi <i>et al.</i>	(PURD, ANL, IND, MICH+)	REFID=20394
AIHARA	86B	PRL 57 404	H. Aihara <i>et al.</i>	(TPC-2 γ Collab.)	REFID=20764
ALDE	86D	NP B269 485	D.M. Alde <i>et al.</i>	(BELG, LAPP, SERP, CERN+)	REFID=20765
LANDRO	86	PL B172 445	M. Landro, K.J. Mork, H.A. Olsen	(UTRO)	REFID=20767
LONGACRE	86	PL B177 223	R.S. Longacre <i>et al.</i>	(BNL, BRAN, CUNY+)	REFID=20768
LYTH	85	JP G11 459	D.H. Lyth		REFID=42169
BEHREND	84B	ZPHY C23 223	H.J. Behrend <i>et al.</i>	(CELLO Collab.)	REFID=20757
BERGER	84	ZPHY C26 199	C. Berger <i>et al.</i>	(PLUTO Collab.)	REFID=20760
COURAU	84	PL 147B 227	A. Courau <i>et al.</i>	(CIT, SLAC)	REFID=20758
SMITH	84C	PR D30 851	J.R. Smith <i>et al.</i>	(SLAC, LBL, HARV)	REFID=20759
BINON	83	NC 78A 313	F.G. Binon <i>et al.</i>	(BELG, LAPP, SERP+)	REFID=20750
Also		SJNP 38 561	F.G. Binon <i>et al.</i>	(BELG, LAPP, SERP+)	REFID=20751
		Translated from YAF 38 934.			
CHABAUD	83	NP B223 1	V. Chabaud <i>et al.</i>	(CERN, CRAC, MPIM)	REFID=20131
DENNEY	83	PR D28 2726	D.L. Denney <i>et al.</i>	(IOWA, MICH)	REFID=20754
MENNESSIER	83	ZPHY C16 241	G. Mennessier	(MONP)	REFID=20393
APEL	82	NP B201 197	W.D. Apel <i>et al.</i>	(KARLK, KARLE, PISA, SERP+)	REFID=20745
CASON	82	PRL 48 1316	N.M. Cason <i>et al.</i>	(NDAM, ANL)	REFID=20746
EDWARDS	82F	PL 110B 82	C. Edwards <i>et al.</i>	(CIT, HARV, PRIN+)	REFID=20747
ETKIN	82B	PR D25 1786	A. Etkin <i>et al.</i>	(BNL, CUNY, TUFTS, VAND)	REFID=20390
BRANDELIK	81B	ZPHY C10 117	R. Brandelik <i>et al.</i>	(TASSO Collab.)	REFID=20741
CHABAUD	81	APP B12 575	V. Chabaud <i>et al.</i>	(CERN, CRAC, MPIM)	REFID=20742
GIDAL	81	PL 107B 153	G. Gidal <i>et al.</i>	(SLAC, LBL)	REFID=20386
ROUSSARIE	81	PL 105B 304	A. Roussarie <i>et al.</i>	(SLAC, LBL)	REFID=20388
BERGER	80B	PL 94B 254	C. Berger <i>et al.</i>	(PLUTO Collab.)	REFID=20736
COSTA	80	NP B175 402	G. Costa <i>et al.</i>	(BARI, BONN, CERN, GLAS+)	REFID=20737
LOVERRE	80	ZPHY C6 187	P.F. Loverre <i>et al.</i>	(CERN, CDEF, MADR+)	REFID=20382
CORDEN	79	NP B157 250	M.J. Corden <i>et al.</i>	(BIRM, RHEL, TELA+)	REFID=20374
MARTIN	79	NP B158 520	A.D. Martin, E.N. Ozmutlu	(DURH)	REFID=20377
POLYCHRO...	79	PR D19 1317	V.A. Polychronakos <i>et al.</i>	(NDAM, ANL)	REFID=20378
PDG	78	PL 75B 1	C. Bricman <i>et al.</i>		REFID=40124
ANTIPOV	77	NP B119 45	Y.M. Antipov <i>et al.</i>	(SERP, GEVA)	REFID=20728
PAWLIICKI	77	PR D15 3196	A.J. Pawlicki <i>et al.</i>	(ANL)	REFID=20367
DEUTSCH...	76	NP B103 426	M. Deutschmann <i>et al.</i>	(AACH3, BERL, BONN+)	REFID=20119
APEL	75	PL 57B 398	W.D. Apel <i>et al.</i>	(KARLK, KARLE, PISA, SERP+)	REFID=20720
EMMS	75D	NP B96 155	M.J. Emms <i>et al.</i>	(BIRM, DURH, RHEL)	REFID=20721
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, TNTO) 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. [1282.0 ± 0.5 MeV OUR 2016 AVERAGE Scale factor = 1.8]		
1281.0 ± 0.8		DICKSON	16 CLAS	2.55 $\gamma p \rightarrow \eta \pi^+ \pi^- p$
1287.4 ± 3.0	87	ABLIKIM	15P BES3	$J/\psi \rightarrow K^+ K^- 3\pi$
1281.16 ± 0.39 ± 0.45		¹ LEES	12X BABR	$\tau^- \rightarrow \pi^- f_1(1285) \nu_\tau$
1285.1 ± 1.0 $\pm \frac{1.6}{0.3}$		² ABLIKIM	11J BES3	$J/\psi \rightarrow \omega(\eta \pi^+ \pi^-)$
1281 ± 2 ± 1		AUBERT	07AU BABR	10.6 $e^+ e^- \rightarrow f_1(1285) \pi^+ \pi^- \gamma$
1276.1 ± 8.1 ± 8.0	203	BAI	04J BES2	$J/\psi \rightarrow \gamma \gamma \pi^+ \pi^-$
1274 ± 6	237	ABDALLAH	03H DLPH	91.2 $e^+ e^- \rightarrow K_S^0 K^\pm \pi^\mp + X$
1280 ± 4		ACCIARRI	01G L3	
1288 ± 4 ± 5	20k	ADAMS	01B B852	18 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 $p\bar{p} \rightarrow 2K4\pi$
1283 ± 5		DAHL	67 HBC	1.6-4.2 $\pi^- p$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
1284.2 ± 2.2		⁵ AAIJ	14Y LHCb	$\bar{B}_{(s)}^0 \rightarrow J/\psi 2(\pi^+ \pi^-)$
1281.9 ± 0.5		⁵ SOSA	99 SPEC	$pp \rightarrow p_{\text{slow}} (K_S^0 K^+ \pi^-) p_{\text{fast}}$
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 $\pi^- p \rightarrow K \bar{K} \pi X$

NODE=M008M

NEW

OCCUR=2

1288 ± 9	200	GURTU	79	HBC	4.2 $K^- p \rightarrow n\eta 2\pi$
~ 1275.0	46	⁷ STANTON	79	CNTR	8.5 $\pi^- p \rightarrow n2\gamma 2\pi$
1271 ± 10	34	CORDEN	78	OMEG	12-15 $\pi^- p \rightarrow$ $K^+ K^- \pi n$
1295 ± 12	85	CORDEN	78	OMEG	12-15 $\pi^- p \rightarrow n5\pi$
1292 ± 10	150	DEFOIX	72	HBC	0.7 $\bar{p} p \rightarrow 7\pi$
1280 ± 3	500	⁸ THUN	72	MMS	13.4 $\pi^- p$
1303 ± 8		BARDADIN...	71	HBC	8 $\pi^+ p \rightarrow p6\pi$
1283 ± 6		BOESEBECK	71	HBC	16.0 $\pi p \rightarrow p5\pi$
1270 ± 10		CAMPBELL	69	DBC	2.7 $\pi^+ d$
1285 ± 7		LORSTAD	69	HBC	0.7 $\bar{p} p$, 4,5-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.

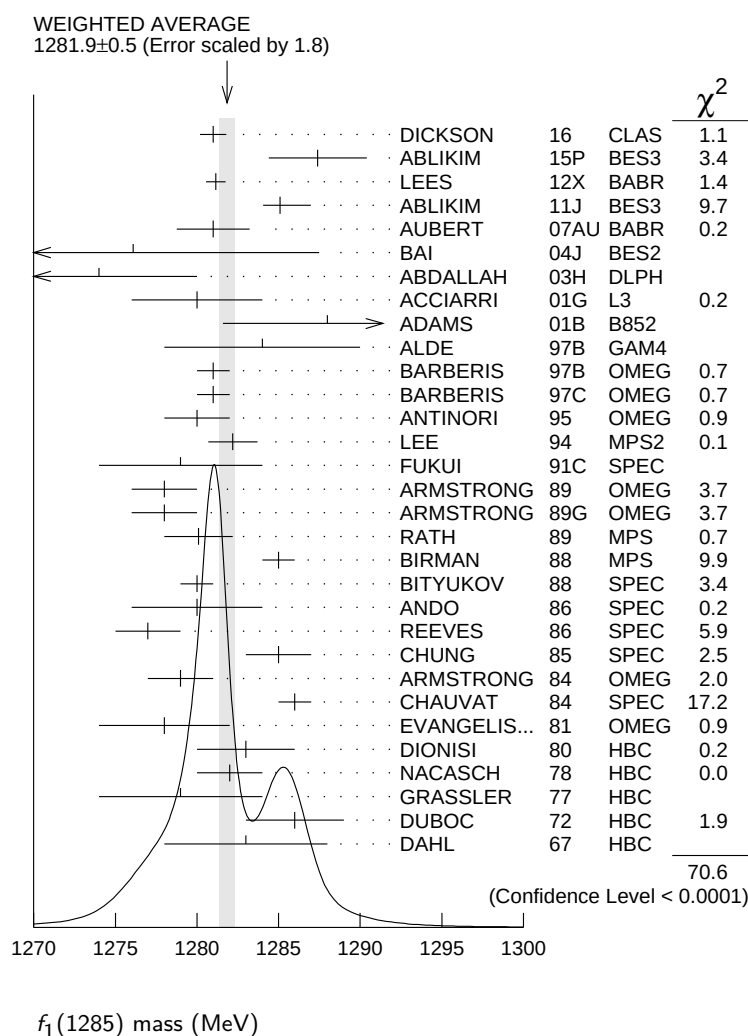
⁵ No systematic error given.

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
22.7 ± 1.1 OUR AVERAGE				Error includes scale factor of 1.5. See the ideogram below.
[24.1 ± 1.0 MeV OUR 2016 AVERAGE				Scale factor = 1.3]
18.4 ± 1.4		DICKSON	16 CLAS	2.55 $\gamma p \rightarrow \eta \pi^+ \pi^- p$

NODE=M008W

NEW

18.3± 6.3	87	ABLIKIM	15P	BES3	$J/\psi \rightarrow K^+ K^- 3\pi$
22.0± 3.1 ^{+2.0} _{-1.5}		¹ ABLIKIM	11J	BES3	$J/\psi \rightarrow \omega(\eta\pi^+\pi^-)$
35 ± 6 ± 4		AUBERT	07AU	BABR	10.6 $e^+e^- \rightarrow f_1(1285)\pi^+\pi^-\gamma$
40.0± 8.6± 9.3	203	BAI	04J	BES2	$J/\psi \rightarrow \gamma\gamma\pi^+\pi^-$
29 ±12	237	ABDALLAH	03H	DLPH	91.2 $e^+e^- \rightarrow K_S^0 K^\pm \pi^\mp + X$
45 ± 9 ± 7	20k	ADAMS	01B	B852	18 GeV $\pi^- p \rightarrow K^+ K^- \pi^0 n$
55 ±18	1400	ALDE	97B	GAM4	100 $\pi^- p \rightarrow \eta\pi^0\pi^0 n$
24 ± 3		BARBERIS	97B	OMEG	450 $pp \rightarrow pp2(\pi^+\pi^-)$
20 ± 2		BARBERIS	97C	OMEG	450 $pp \rightarrow ppK_S^0 K^\pm \pi^\mp$
36 ± 5		² ANTINORI	95	OMEG	300,450 $pp \rightarrow pp2(\pi^+\pi^-)$
29.0± 4.1		LEE	94	MPS2	18 $\pi^- p \rightarrow K^+ \bar{K}^0 2\pi^- p$
25 ± 4	140	ARMSTRONG	89	OMEG	300 $pp \rightarrow K \bar{K} \pi pp$
22 ± 2	4750	³ BIRMAN	88	MPS	8 $\pi^- p \rightarrow K^+ \bar{K}^0 \pi^- n$
25 ± 4	504	BITYUKOV	88	SPEC	32.5 $\pi^- p \rightarrow K^+ K^- \pi^0 n$
19 ± 5		ANDO	86	SPEC	8 $\pi^- p \rightarrow \eta\pi^+\pi^- n$
32 ± 8	420	REEVES	86	SPEC	6.6 $p\bar{p} \rightarrow KK\pi X$
22 ± 2		CHUNG	85	SPEC	8 $\pi^- p \rightarrow NK\bar{K}\pi$
32 ± 3	604	ARMSTRONG	84	OMEG	85 $\pi^+ p \rightarrow K\bar{K}\pi\pi p$, $pp \rightarrow K\bar{K}\pi pp$
24 ± 3		CHAUVAT	84	SPEC	ISR 31.5 pp
29 ±10	103	DIONISI	80	HBC	4 $\pi^- p \rightarrow K\bar{K}\pi n$
28.3± 6.7	320	NACASCH	78	HBC	0.7,0.76 $p\bar{p} \rightarrow K\bar{K}3\pi$

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

32.4± 5.8		⁴ AAIJ	14Y	LHCB	$\bar{B}^0(s) \rightarrow J/\psi 2(\pi^+\pi^-)$
18.2± 1.2		⁴ SOSA	99	SPEC	$pp \rightarrow p_{\text{slow}} (K_S^0 K^+ \pi^-)$
19.4± 1.5		⁴ SOSA	99	SPEC	$pp \xrightarrow{p_{\text{fast}}} p_{\text{slow}} (K_S^0 K^- \pi^+)$
40 ± 5		ABATZIS	94	OMEG	450 $pp \rightarrow pp2(\pi^+\pi^-)$
31 ± 5		ARMSTRONG	89E	OMEG	300 $pp \rightarrow pp2(\pi^+\pi^-)$
41 ±12		ARMSTRONG	89G	OMEG	85 $\pi^+ p \rightarrow 4\pi\pi p$, $pp \xrightarrow{4\pi pp}$
17.9±10.9	60	RATH	89	MPS	21.4 $\pi^- p \rightarrow K_S^0 K_S^0 \pi^0 n$
14 ⁺²⁰ ₋₁₄ ±10	16	BECKER	87	MRK3	$e^+e^- \rightarrow \phi K\bar{K}\pi$
26 ±12		EVANGELIS...	81	OMEG	12 $\pi^- p \rightarrow \eta\pi^+\pi^-\pi^- p$
25 ±15	200	GURTU	79	HBC	4.2 $K^- p \rightarrow n\eta 2\pi$
~ 10		⁵ STANTON	79	CNTR	8.5 $\pi^- p \rightarrow n2\gamma 2\pi$
24 ±18	210	GRASSLER	77	HBC	16 $\pi^\mp p$
28 ± 5	150	⁶ DEFOIX	72	HBC	0.7 $p\bar{p} \rightarrow 7\pi$
46 ± 9	180	⁶ DUBOC	72	HBC	1.2 $p\bar{p} \rightarrow 2K4\pi$
37 ± 5	500	⁷ THUN	72	MMS	13.4 $\pi^- p$
10 ±10		BOESEBECK	71	HBC	16.0 $\pi p \rightarrow p5\pi$
30 ±15		CAMPBELL	69	DBC	2.7 $\pi^+ d$
60 ±15		⁶ LORSTAD	69	HBC	0.7 $p\bar{p}$, 4,5-body
35 ±10		⁶ DAHL	67	HBC	1.6-4.2 $\pi^- p$

OCCUR=2

¹ The selected process is $J/\psi \rightarrow \omega a_0(980)\pi$.

² Supersedes ABATZIS 94, ARMSTRONG 89E.

³ From partial wave analysis of $K^+ \bar{K}^0 \pi^-$ system.

⁴ No systematic error given.

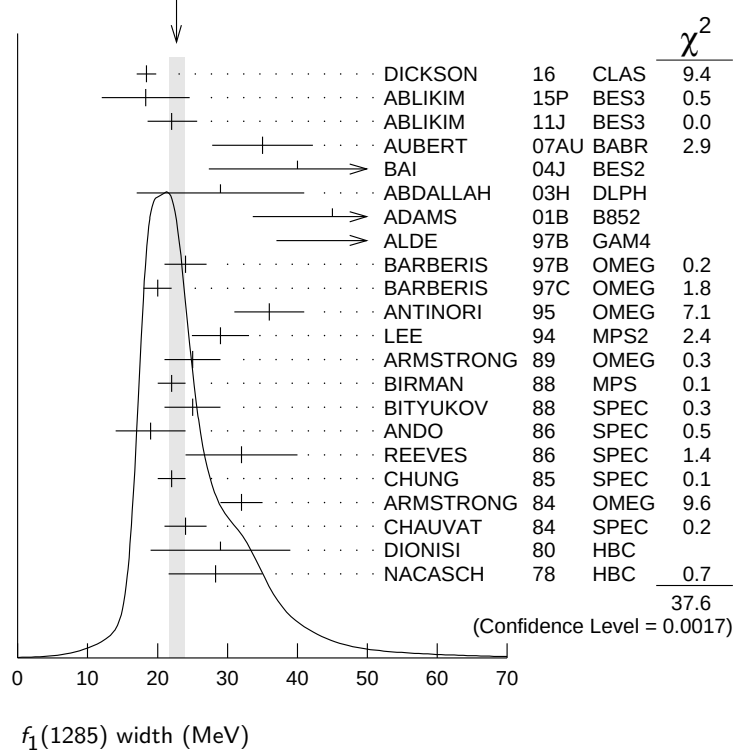
⁵ From phase shift analysis of $\eta\pi^+\pi^-$ system.

⁶ Resolution is not unfolded.

⁷ Seen in the missing mass spectrum.

NODE=M008W;LINKAGE=BL
 NODE=M008W;LINKAGE=B
 NODE=M008W;LINKAGE=A
 NODE=M008W;LINKAGE=N1
 NODE=M008W;LINKAGE=P
 NODE=M008W;LINKAGE=R
 NODE=M008W;LINKAGE=S

WEIGHTED AVERAGE
22.7±1.1 (Error scaled by 1.5)



$f_1(1285)$ DECAY MODES

NODE=M008215;NODE=M008

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	
Γ_1 4π	$(33.5^{+2.0}_{-1.8})\%$	S=1.3	DESIG=21
Γ_2 $\pi^0\pi^0\pi^+\pi^-$	$(22.3^{+1.3}_{-1.2})\%$	S=1.3	DESIG=22
Γ_3 $2\pi^+2\pi^-$	$(11.2^{+0.7}_{-0.6})\%$	S=1.3	DESIG=20
Γ_4 $\rho^0\pi^+\pi^-$	$(11.2^{+0.7}_{-0.6})\%$	S=1.3	DESIG=191
Γ_5 $\rho^0\rho^0$	seen		DESIG=23
Γ_6 $4\pi^0$	$< 7 \times 10^{-4}$	CL=90%	DESIG=7
Γ_7 $\eta\pi^+\pi^-$	$(35 \pm 15)\%$		DESIG=198
Γ_8 $\eta\pi\pi$	$(52.0^{+1.8}_{-2.1})\%$	S=1.2	DESIG=3
Γ_9 $a_0(980)\pi$ [ignoring $a_0(980) \rightarrow K\bar{K}$]	$(38 \pm 4)\%$		DESIG=4
Γ_{10} $\eta\pi\pi$ [excluding $a_0(980)\pi$]	$(14 \pm 4)\%$		DESIG=5
Γ_{11} $K\bar{K}\pi$	$(9.1 \pm 0.4)\%$	S=1.1	DESIG=1
Γ_{12} $K\bar{K}^*(892)$	not seen		DESIG=6
Γ_{13} $\pi^+\pi^-\pi^0$	$(3.0 \pm 0.9) \times 10^{-3}$		DESIG=197
Γ_{14} $\rho^\pm\pi^\mp$	$< 3.1 \times 10^{-3}$	CL=95%	DESIG=199
Γ_{15} $\gamma\rho^0$	$(5.3 \pm 1.2)\%$	S=2.9	DESIG=13
Γ_{16} $\phi\gamma$	$(7.5 \pm 2.7) \times 10^{-4}$		DESIG=10
Γ_{17} $\gamma\gamma^*$			DESIG=9
Γ_{18} $\gamma\gamma$			DESIG=8

CONSTRAINED FIT INFORMATION

An overall fit to 7 branching ratios uses 19 measurements and one constraint to determine 5 parameters. The overall fit has a $\chi^2 = 33.5$ for 15 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta x_i \delta x_j \rangle / (\delta x_i \delta x_j)$, 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	−28			
x_{10}	−11	−88		
x_{11}	34	−11	−5	
x_{15}	−36	−7	−3	−34
	x_1	x_9	x_{10}	x_{11}

$f_1(1285) \Gamma(i) \Gamma(\gamma\gamma) / \Gamma(\text{total})$

NODE=M008217

 $\Gamma(\eta\pi\pi) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$
 $\Gamma_8 \Gamma_{18} / \Gamma = (\Gamma_9 + \Gamma_{10}) \Gamma_{18} / \Gamma$
NODE=M008G2
NODE=M008G2

VALUE (keV)	CL%	DOCUMENT ID	TECN	COMMENT
<0.62	95	GIDAL	87	MRK2 $e^+ e^- \rightarrow e^+ e^- \eta \pi^+ \pi^-$

 $\Gamma(\eta\pi\pi) \times \Gamma(\gamma\gamma^*) / \Gamma_{\text{total}}$
 $\Gamma_8 \Gamma_{17} / \Gamma = (\Gamma_9 + \Gamma_{10}) \Gamma_{17} / \Gamma$
NODE=M008G3
NODE=M008G3

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
1.4 ± 0.4 OUR AVERAGE		Error includes scale factor of 1.4.		
1.18 ± 0.25 ± 0.20	26	^{1,2} AIHARA	88B	TPC $e^+ e^- \rightarrow e^+ e^- \eta \pi^+ \pi^-$
2.30 ± 0.61 ± 0.42		^{1,3} GIDAL	87	MRK2 $e^+ e^- \rightarrow e^+ e^- \eta \pi^+ \pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1.8 ± 0.3 ± 0.3	420	⁴ ACHARD	02B	L3 183–209 $e^+ e^- \rightarrow e^+ e^- \eta \pi^+ \pi^-$

¹ Assuming a ρ -pole form factor.² Published value multiplied by $\eta\pi\pi$ branching ratio 0.49.³ Published value divided by 2 and multiplied by the $\eta\pi\pi$ branching ratio 0.49.⁴ Published value multiplied by the $\eta\pi\pi$ branching ratio 0.52.NODE=M008G3;LINKAGE=A
NODE=M008G3;LINKAGE=F
NODE=M008G3;LINKAGE=B
NODE=M008G3;LINKAGE=AC

$f_1(1285) \text{ BRANCHING RATIOS}$

NODE=M008220

 $\Gamma(K\bar{K}\pi) / \Gamma(4\pi)$
 Γ_{11} / Γ_1
NODE=M008R1
NODE=M008R1
NEW

VALUE	DOCUMENT ID	TECN	COMMENT
0.272 ± 0.016 OUR FIT	Error includes scale factor of 1.3. [0.271 ± 0.016 OUR 2016 FIT Scale factor = 1.3]		
0.271 ± 0.016 OUR AVERAGE	Error includes scale factor of 1.2.		
0.265 ± 0.014	¹ BARBERIS	97C	OMEG 450 $p p \rightarrow p p K_S^0 K^\pm \pi^\mp$
0.28 ± 0.05	² ARMSTRONG	89E	OMEG 300 $p p \rightarrow p p f_1(1285)$
0.37 ± 0.03 ± 0.05	³ ARMSTRONG	89G	OMEG 85 $\pi p \rightarrow 4\pi X$

¹ Using $2(\pi^+ \pi^-)$ data from BARBERIS 97B.² Assuming $\rho\pi\pi$ and $a_0(980)\pi$ intermediate states.³ 4π consistent with being entirely $\rho\pi\pi$.NODE=M008R1;LINKAGE=B
NODE=M008R1;LINKAGE=M
NODE=M008R1;LINKAGE=A
 $\Gamma(\pi^0 \pi^0 \pi^+ \pi^-) / \Gamma_{\text{total}}$
 $\Gamma_2 / \Gamma = \frac{2}{3} \Gamma_1 / \Gamma$
NODE=M008R18
NODE=M008R18

VALUE	DOCUMENT ID
0.223^{+0.013}_{−0.012} OUR FIT	Error includes scale factor of 1.3. [0.220 ^{+0.014} _{−0.012} OUR 2016 FIT Scale factor = 1.3]

NEW

 $\Gamma(2\pi^+ 2\pi^-) / \Gamma_{\text{total}}$
 $\Gamma_3 / \Gamma = \frac{1}{3} \Gamma_1 / \Gamma$
NODE=M008R17
NODE=M008R17

VALUE	DOCUMENT ID
0.112^{+0.007}_{−0.006} OUR FIT	Error includes scale factor of 1.3. [0.110 ^{+0.007} _{−0.006} OUR 2016 FIT Scale factor = 1.3]

NEW

 $\Gamma(\rho^0 \pi^+ \pi^-) / \Gamma_{\text{total}}$
 $\Gamma_4 / \Gamma = \frac{1}{3} \Gamma_1 / \Gamma$
NODE=M008R19
NODE=M008R19

VALUE	DOCUMENT ID
0.112^{+0.007}_{−0.006} OUR FIT	Error includes scale factor of 1.3. [0.110 ^{+0.007} _{−0.006} OUR 2016 FIT Scale factor = 1.3]

NEW

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

VALUE	DOCUMENT ID	TECN	COMMENT

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

1.0 ± 0.4	GRASSLER	77	HBC 16 GeV $\pi^\pm p$

 Γ_4/Γ_3

NODE=M008R6
NODE=M008R6

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

VALUE	DOCUMENT ID	COMMENT

seen	BARBERIS	00C 450 $p p \rightarrow p_f 4\pi p_s$

 Γ_5/Γ

NODE=M008R21
NODE=M008R21

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

VALUE (units 10 ⁻⁴)	CL%	DOCUMENT ID	TECN	COMMENT

<7	90	ALDE	87	GAM4 100 $\pi^- p \rightarrow 4\pi^0 n$

 Γ_6/Γ

NODE=M008R8
NODE=M008R8

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

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT

0.86 ± 0.16 ± 0.20	2.3k	¹ DOROFEEV	11	VES $\pi^- N \rightarrow \pi^- f_1(1285) N$

 Γ_{13}/Γ_7

NODE=M008R02
NODE=M008R02

¹ Value obtained selecting the region corresponding to $f_0(980)$ in the $\pi^+ \pi^-$ mass spectrum.

NODE=M008R02;LINKAGE=DO

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

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

VALUE	DOCUMENT ID

0.520^{+0.018}_{-0.021} OUR FIT Error includes scale factor of 1.2. [0.524^{+0.019}_{-0.022} OUR 2016 FIT
Scale factor = 1.2]

NODE=M008R22
NODE=M008R22

NEW

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

 $\Gamma_1/\Gamma_8 = \Gamma_1/(\Gamma_9 + \Gamma_{10})$

VALUE	DOCUMENT ID	TECN	COMMENT

0.64^{+0.06}_{-0.05} OUR FIT Error includes scale factor of 1.2. [0.63 ± 0.06 OUR 2016 FIT
Scale factor = 1.2]

NODE=M008R4
NODE=M008R4

NEW

0.41 ± 0.14 OUR AVERAGE

0.37 ± 0.11 ± 0.11	BOLTON	92	MRK3 $J/\psi \rightarrow \gamma f_1(1285)$

0.64 ± 0.40	GURTU	79	HBC 4.2 $K^- p$

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

0.93 ± 0.30	¹ GRASSLER	77	HBC 16 $\pi^\mp p$

¹ Assuming $\rho \pi \pi$ and $a_0(980) \pi$ intermediate states.

NODE=M008R4;LINKAGE=M

$$\Gamma(2\pi^+ 2\pi^-) / \Gamma(\eta \pi \pi)$$

 Γ_3/Γ_8

VALUE	DOCUMENT ID	TECN	COMMENT

0.28 ± 0.02 ± 0.02	¹ LEES	12X	BABR $\tau^- \rightarrow \pi^- f_1(1285) \nu_\tau$

¹ Assuming $B(f_1(1285) \rightarrow \pi \pi \eta) = 3/2 B(f_1(1285) \rightarrow \pi^+ \pi^- \eta)$.

NODE=M008R04
NODE=M008R04

NODE=M008R04;LINKAGE=LE

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

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

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

0.72 ± 0.08 OUR FIT

[0.69 ± 0.13 OUR 2016 FIT]

0.72 ± 0.07 OUR AVERAGE

[0.69^{+0.13}_{-0.12} OUR 2016 AVERAGE]

NODE=M008R3
NODE=M008R3

NEW

NEW

0.74 ± 0.02 ± 0.09	DICKSON	16	CLAS $\gamma p \rightarrow f_1(1285) p$

0.72 ± 0.15	GURTU	79	HBC 4.2 $K^- p$

0.6 ^{+0.3} _{-0.2}	CORDEN	78	OMEG 12-15 $\pi^- p$

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

>0.69	95	ACHARD	02B L3 183-209 $e^+ e^- \rightarrow e^+ e^- \eta \pi^+ \pi^-$

0.28 ± 0.07	ALDE	97B	GAM4 100 $\pi^- p \rightarrow \eta \pi^0 \pi^0 n$

1.0 ± 0.3	GRASSLER	77	HBC 16 $\pi^\mp p$

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

VALUE	DOCUMENT ID	TECN	COMMENT
0.176±0.012 OUR FIT	Error includes scale factor of 1.1. [0.171 ± 0.013 OUR 2016 FIT Scale factor = 1.1]		
0.176±0.012 OUR AVERAGE	[0.170 ± 0.012 OUR 2016 AVERAGE]		

0.216±0.010±0.031	DICKSON	16	CLAS $\gamma p \rightarrow f_1(1285)p$
0.166±0.01 ±0.008	BARBERIS	98C	OMEG 450 $pp \rightarrow p_f f_1(1285)p_s$
0.42 ±0.15	GURTU	79	HBC 4.2 $K^- p$
0.5 ±0.2	¹ CORDEN	78	OMEG 12-15 $\pi^- p$
0.20 ±0.08	² DEFOIX	72	HBC 0.7 $\bar{p}p \rightarrow 7\pi$
0.16 ±0.08	CAMPBELL	69	DBC 2.7 $\pi^+ d$

¹ CORDEN 78 assumes low-mass $\eta\pi\pi$ region is dominantly 1^{++} . See BARBERIS 98C and MANAK 00A for discussion.

² $K\bar{K}$ system characterized by the $I = 1$ threshold enhancement. (See under $a_0(980)$).

NODE=M008R2
NODE=M008R2
NEW

NEW

OCCUR=2

NODE=M008R2;LINKAGE=CD

NODE=M008R2;LINKAGE=K

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

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	NACASCH	78	HBC 0.7,0.76 $\bar{p}p \rightarrow K\bar{K}3\pi$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
seen	¹ ACHARD	07	L3 183-209 $e^+e^- \rightarrow e^+e^- K_S^0 K^\pm \pi^\mp$

¹ A clear signal of 19.8 ± 4.4 events observed at high Q^2 .

NODE=M008R5
NODE=M008R5

NODE=M008R5;LINKAGE=CH

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

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.30±0.055±0.074	2.3k	¹ DOROFEEV	11	VES $\pi^- N \rightarrow \pi^- f_1(1285)N$

¹ Value obtained selecting the region corresponding to $f_0(980)$ in the $\pi^+\pi^-$ mass spectrum. The systematic error includes the uncertainty on the partial width $f_1 \rightarrow \eta\pi\pi$ obtained from PDG 10 data.

NODE=M008R01
NODE=M008R01

NODE=M008R01;LINKAGE=DO

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

VALUE (%)	CL%	DOCUMENT ID	TECN	COMMENT
<0.31	95	DOROFEEV	11	VES $\pi^- N \rightarrow \pi^- f_1(1285)N$

NODE=M008R03
NODE=M008R03

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

VALUE (units 10^{-2})	CL%	DOCUMENT ID	TECN	COMMENT
5.3±1.2 OUR FIT	Error includes scale factor of 2.9. [(5.5 ± 1.3) × 10 ⁻² OUR 2016 FIT Scale factor = 2.8]			

2.8±0.7±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

NEW

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

VALUE	DOCUMENT ID	TECN	COMMENT
0.48±0.13 OUR FIT	Error includes scale factor of 2.5. [0.50 ± 0.13 OUR 2016 FIT Scale factor = 2.5]		

0.45±0.18 ¹ COFFMAN 90 MRK3 $J/\psi \rightarrow \gamma\gamma\pi^+\pi^-$

¹ Using $B(J/\psi \rightarrow \gamma f_1(1285) \rightarrow \gamma\gamma\rho^0) = 0.25 \times 10^{-4}$ and $B(J/\psi \rightarrow \gamma f_1(1285) \rightarrow \gamma 2\pi^+ 2\pi^-) = 0.55 \times 10^{-4}$ given by MIR 88.

NODE=M008R13
NODE=M008R13
NEW

NODE=M008R13;LINKAGE=E

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

VALUE	DOCUMENT ID	TECN	COMMENT
9.7±1.9 OUR FIT	Error includes scale factor of 2.4. [9.5 ± 2.0 OUR 2016 FIT Scale factor = 2.5]		

8.5±2.0 OUR AVERAGE Error includes scale factor of 2.2. See the ideogram below. [7.9 ± 0.9 OUR 2016 AVERAGE]

21.3±4.4	DICKSON	16	CLAS $\gamma p \rightarrow f_1(1285)p$
10.0±1.0±2.0	BARBERIS	98C	OMEG 450 $pp \rightarrow p_f f_1(1285)p_s$
7.5±1.0	¹ ARMSTRONG	92C	OMEG 300 $pp \rightarrow p\rho\pi^+\pi^-\gamma, p\rho\eta\pi^+\pi^-$

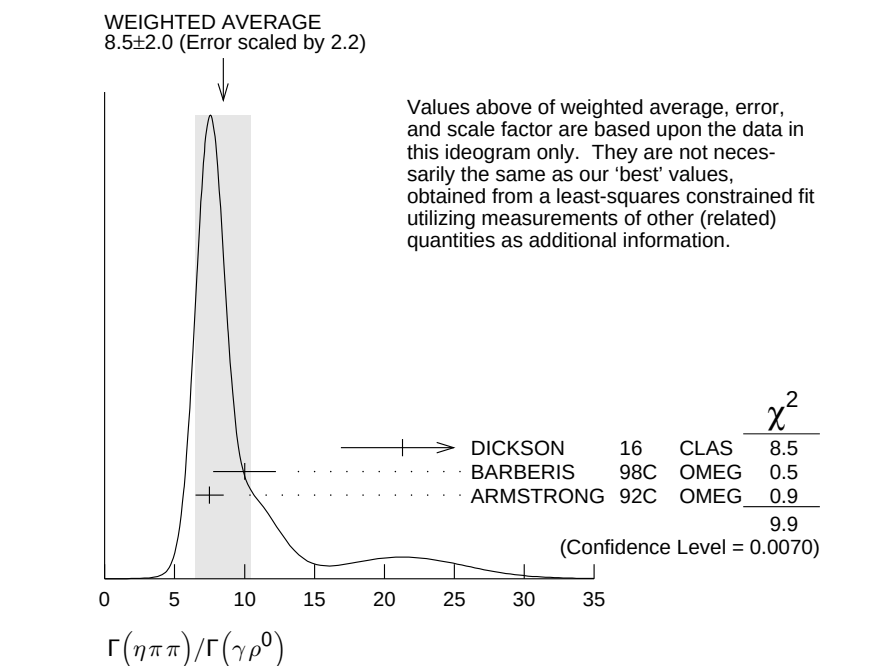
NODE=M008R16
NODE=M008R16

NEW

NEW

¹ Published value multiplied by 1.5.

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 ¹ COFFMAN 90 MRK3 $J/\psi \rightarrow \gamma\gamma\pi^+\pi^-$ ¹ Using $B(J/\psi \rightarrow \gamma f_1(1285) \rightarrow \gamma\gamma\rho^0) = 0.25 \times 10^{-4}$ and $B(J/\psi \rightarrow \gamma f_1(1285) \rightarrow \gamma K\bar{K}\pi) < 0.72 \times 10^{-3}$.

NODE=M008R12;LINKAGE=F

 $\Gamma(\phi\gamma)/\Gamma(K\bar{K}\pi)$ Γ_{16}/Γ_{11}

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

0.82±0.21±0.20 19 BITYUKOV 88 SPEC 32.5 $\pi^- p \rightarrow K^+ K^- \pi^0 n$

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

<0.50	95	BARBERIS	98C	OMEG	450 $pp \rightarrow p_f f_1(1285) p_s$
<0.93	95	AMELIN	95	VES	37 $\pi^- N \rightarrow \pi^- \pi^+ \pi^- \gamma N$

NODE=M008R9
NODE=M008R9

$f_1(1285)$ REFERENCES

NODE=M008

DICKSON	16	PR C93 065202	R. Dickson <i>et al.</i>	(JLab CLAS Collab.)	REFID=57487
ABLIKIM	15P	PR D92 012007	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=56781
AAIJ	14Y	PRL 112 091802	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=55837
LEES	12X	PR D86 092010	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=54714
ABLIKIM	11J	PRL 107 182001	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=53931
DOROFEEV	11	EPJ A47 68	V. Dorofeev <i>et al.</i>	(SERP, MIPT)	REFID=16755
PDG	10	JP G37 075021	K. Nakamura <i>et al.</i>	(PDG Collab.)	REFID=53229
ACHARD	07	JHEP 0703 018	P. Achard <i>et al.</i>	(L3 Collab.)	REFID=51698
AUBERT	07AU	PR D76 092005	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52049
BAI	04J	PL B594 47	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=50167
ABDALLAH	03H	PL B569 129	J. Abdallah <i>et al.</i>	(DELPHI Collab.)	REFID=49548
ACHARD	02B	PL B526 269	P. Achard <i>et al.</i>	(L3 Collab.)	REFID=48574
ACCIARRI	01G	PL B501 1	M. Acciarri <i>et al.</i>	(L3 Collab.)	REFID=48319
ADAMS	01B	PL B516 264	G.S. Adams <i>et al.</i>	(BNL E852 Collab.)	REFID=49649
BARBERIS	00C	PL B471 440	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=47959
MANAK	00A	PR D62 012003	J.J. Manak <i>et al.</i>	(BNL E852 Collab.)	REFID=47989
SOSA	99	PRL 83 913	M. Sosa <i>et al.</i>		REFID=46937
BARBERIS	98C	PL B440 225	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=46346
ALDE	97B	PAN 60 386	D. Alde <i>et al.</i>	(GAMS Collab.)	REFID=45396
Translated from YAF 60 458.					
BARBERIS	97B	PL B413 217	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=45758
BARBERIS	97C	PL B413 225	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=45759
AMELIN	95	ZPHY C66 71	D.V. Amelin <i>et al.</i>	(VES Collab.)	REFID=44376
ANTINORI	95	PL B353 589	F. Antinori <i>et al.</i>	(ATHU, BARI, BIRM+)	REFID=44437
ABATZIS	94	PL B324 509	S. Abatzis <i>et al.</i>	(ATHU, BARI, BIRM+)	REFID=44090
LEE	94	PL B323 227	J.H. Lee <i>et al.</i>	(BNL, IND, KYUN, MASD+)	REFID=44092
ARMSTRONG	93C	PL B307 394	T.A. Armstrong <i>et al.</i>	(FNAL, FERR, GENO+)	REFID=43587
ARMSTRONG	92C	ZPHY C54 371	T.A. Armstrong <i>et al.</i>	(ATHU, BARI, BIRM+)	REFID=42097
BOLTON	92	PL B278 495	T. Bolton <i>et al.</i>	(Mark III Collab.)	REFID=42175
BITYUKOV	91B	SJNP 54 318	S.I. Bitukov <i>et al.</i>	(SERP)	REFID=41864
Translated from YAF 54 529.					

FUKUI	91C	PL B267 293	S. Fukui <i>et al.</i>	(SUGI, NAGO, KEK, KYOT+)
COFFMAN	90	PR D41 1410	D.M. Coffman <i>et al.</i>	(Mark III Collab.)
ARMSTRONG	89	PL B221 216	T.A. Armstrong <i>et al.</i>	(CERN, CDEF, BIRM+)
ARMSTRONG	89E	PL B228 536	T.A. Armstrong, M. Benayoun	(ATHU, BARI, BIRM+)
ARMSTRONG	89G	ZPHY C43 55	T.A. Armstrong <i>et al.</i>	(CERN, BIRM, BARI+)
RATH	89	PR D40 693	M.G. Rath <i>et al.</i>	(NDAM, BRAN, BNL, CUNY+)
AIHARA	88B	PL B209 107	H. Aihara <i>et al.</i>	(TPC-2 γ Collab.)
BIRMAN	88	PRL 61 1557	A. Birman <i>et al.</i>	(BNL, FSU, IND, MASD)
BITYUKOV	88	PL B203 327	S.I. Bitukov <i>et al.</i>	(SERP)
MIR	88	Photon-Photon 88, 126	R. Mir	(Mark III Collab.)
Conference				
ALDE	87	PL B198 286	D.M. Alde <i>et al.</i>	(LANL, BRUX, SERP, LAPP)
BECKER	87	PRL 59 186	J.J. Becker <i>et al.</i>	(Mark III Collab.)
GIDAL	87	PRL 59 2012	G. Gidal <i>et al.</i>	(LBL, SLAC, HARV)
ANDO	86	PRL 57 1296	A. Ando <i>et al.</i>	(KEK, KYOT, NIRS, SAGA+)
REEVES	86	PR D34 1960	D.F. Reeves <i>et al.</i>	(FLOR, BNL, IND+)
CHUNG	85	PRL 55 779	S.U. Chung <i>et al.</i>	(BNL, FLOR, IND+)
ARMSTRONG	84	PL 146B 273	T.A. Armstrong <i>et al.</i>	(ATHU, BARI, BIRM+)
BITYUKOV	84B	PL 144B 133	S.I. Bitukov <i>et al.</i>	(SERP)
CHAUVAT	84	PL 148B 382	P. Chauvat <i>et al.</i>	(CERN, CLER, UCLA+)
TORNQVIST	82B	NP B203 268	N.A. Tornqvist	(HELS)
EVANGELIS...	81	NP B178 197	C. Evangelista <i>et al.</i>	(BARI, BONN, CERN+)
BROMBERG	80	PR D22 1513	C.M. Bromberg <i>et al.</i>	(CIT, FNAL, ILLC+)
DIONISI	80	NP B169 1	C. Dionisi <i>et al.</i>	(CERN, MADR, CDEF+)
GURTU	79	NP B151 181	A. Gurtu <i>et al.</i>	(CERN, ZEEM, NIJM, OXF)
STANTON	79	PRL 42 346	N.R. Stanton <i>et al.</i>	(OSU, CARL, MCGI+)
CORDEN	78	NP B144 253	M.J. Corden <i>et al.</i>	(BIRM, RHEL, TELA+)
NACASCH	78	NP B135 203	R. Nacasch <i>et al.</i>	(PARIS, MADR, CERN)
GRASSLER	77	NP B121 189	H. Grassler <i>et al.</i>	(AACH3, BERL, BONN+)
DEFOIX	72	NP B44 125	C. Defoix <i>et al.</i>	(CDEF, CERN)
DUBOC	72	NP B46 429	J. Duboc <i>et al.</i>	(PARIS, LIVP)
THUN	72	PRL 28 1733	R. Thun <i>et al.</i>	(STON, NEAS)
BARDADIN...	71	PR D4 2711	M. Bardadin-Otwinowska <i>et al.</i>	(WARS)
BOESEBECK	71	PL 34B 659	K. Boesebeck	(AACH, BERL, BONN, CERN, CRAC+)
CAMPBELL	69	PRL 22 1204	J.H. Campbell <i>et al.</i>	(PURD)
LORSTAD	69	NP B14 63	B. Lorstad <i>et al.</i>	(CDEF, CERN)
D'ANDLAU	68	NP B5 693	C. d'Andlau <i>et al.</i>	(CDEF, CERN, IRAD+)
DAHL	67	PR 163 1377	O.I. Dahl <i>et al.</i>	(LRL) IJP

REFID=41748
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REFID=20321

NODE=M037

$\eta(1295)$

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

See also the mini-review under $\eta(1405)$

NODE=M037

$\eta(1295)$ MASS

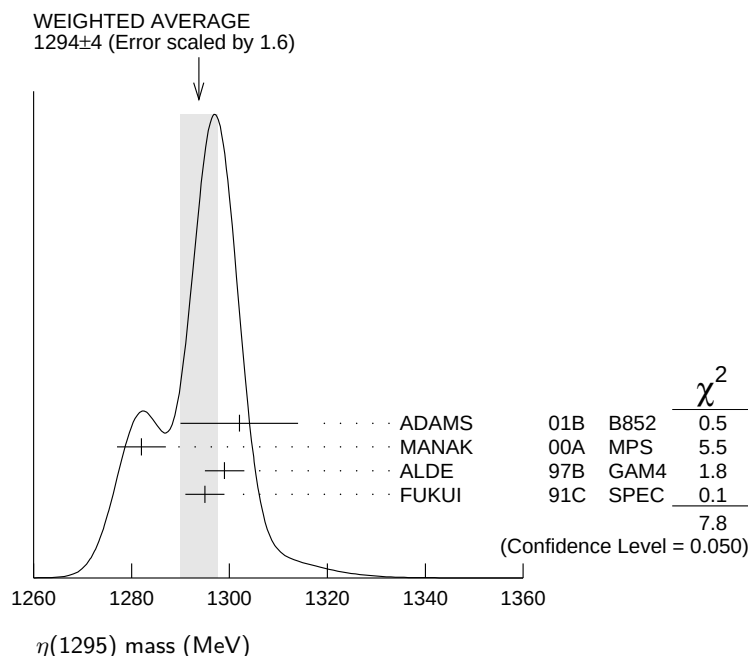
NODE=M037M

NODE=M037M

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
1294$\pm$4 OUR AVERAGE	Error includes scale factor of 1.6. See the ideogram below.			
1302 $\pm$ 9 $\pm$ 8	20k	ADAMS	01B B852	18 GeV $\pi^- p \rightarrow K^+ K^- \pi^0 n$
1282 $\pm$ 5	9082	MANAK	00A MPS	18 $\pi^- p \rightarrow \eta \pi^+ \pi^- n$
1299 $\pm$ 4	2100	ALDE	97B GAM4	100 $\pi^- p \rightarrow \eta \pi^0 \pi^0 n$
1295 $\pm$ 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 $\pm$ 8	¹ AUGUSTIN	90	DM2	$J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$
$\sim$ 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 $\pi^- p \rightarrow n \eta 2\pi$

NODE=M037W

NODE=M037W

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

NODE=M037W;LINKAGE=AG

$\eta(1295)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \eta \pi^+ \pi^-$	seen
$\Gamma_2 \quad a_0(980) \pi$	seen
$\Gamma_3 \quad \gamma \gamma$	
$\Gamma_4 \quad \eta \pi^0 \pi^0$	seen
$\Gamma_5 \quad \eta(\pi\pi)_S\text{-wave}$	seen
$\Gamma_6 \quad \sigma \eta$	
$\Gamma_7 \quad K \bar{K} \pi$	

NODE=M037215;NODE=M037

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

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

$\Gamma(\eta \pi^+ \pi^-) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$					$\Gamma_1 \Gamma_3 / \Gamma$
VALUE (keV)	CL%	DOCUMENT ID	TECN	COMMENT	
<0.066	95	ACCIARRI	01G L3	183-202 $e^+ e^- \rightarrow e^+ e^- \eta \pi^+ \pi^-$	
• • • 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=M037220

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 $e^+ e^- \rightarrow e^+ e^- K_S^0 K^\pm \pi^\mp$	

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 $K_S^0 K^\pm \pi^\mp$.

NODE=M037G3;LINKAGE=AH

NODE=M037G3;LINKAGE=B3

$\eta(1295)$ BRANCHING RATIOS

$\Gamma(a_0(980) \pi) / \Gamma_{\text{total}}$					Γ_2 / Γ
VALUE		DOCUMENT ID	TECN	COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
not seen		BERTIN	97 OBLX	0.0 $\bar{p} p \rightarrow K^\pm (K^0) \pi^\mp \pi^+ \pi^-$	
seen		BIRMAN	88 MPS	8 $\pi^- p \rightarrow K^+ \bar{K}^0 \pi^- n$	
large		ANDO	86 SPEC	8 $\pi^- p \rightarrow \eta \pi^+ \pi^- n$	
large		STANTON	79 CNTR	8.4 $\pi^- p \rightarrow n \eta 2\pi$	

NODE=M037225

NODE=M037R1
 NODE=M037R1

$\Gamma(a_0(980)\pi)/\Gamma(\eta\pi^0\pi^0)$

VALUE	DOCUMENT ID	TECN	COMMENT
0.65±0.10	⁵ ALDE	97B GAM4	100 $\pi^- p \rightarrow \eta\pi^0\pi^0 n$

⁵ Assuming that $a_0(980)$ decays only to $\eta\pi$.

 Γ_2/Γ_4

NODE=M037R2
NODE=M037R2

NODE=M037R2;LINKAGE=A

 $\Gamma(\eta(\pi\pi)_{S\text{-wave}})/\Gamma(\eta\pi^0\pi^0)$

VALUE	DOCUMENT ID	TECN	COMMENT
0.35±0.10	ALDE	97B GAM4	100 $\pi^- p \rightarrow \eta\pi^0\pi^0 n$

 Γ_5/Γ_4

NODE=M037R4
NODE=M037R4

 $\Gamma(a_0(980)\pi)/\Gamma(\sigma\eta)$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.48±0.22	9082	MANAK	00A MPS	18 $\pi^- p \rightarrow \eta\pi^+\pi^- n$

 Γ_2/Γ_6

NODE=M037R5
NODE=M037R5

 $\eta(1295)$ REFERENCES

AHOHE	05	PR D71 072001	R. Ahohe <i>et al.</i>	(CLEO Collab.)
ACCIARRI	01G	PL B501 1	M. Acciarri <i>et al.</i>	(L3 Collab.)
ADAMS	01B	PL B516 264	G.S. Adams <i>et al.</i>	(BNL E852 Collab.)
MANAK	00A	PR D62 012003	J.J. Manak <i>et al.</i>	(BNL E852 Collab.)
ALDE	97B	PAN 60 386	D. Alde <i>et al.</i>	(GAMS Collab.)
		Translated from YAF 60 458.		
BERTIN	97	PL B400 226	A. Bertin <i>et al.</i>	(OBELIX Collab.)
AUGUSTIN	92	PR D46 1951	J.E. Augustin, G. Cosme	(DM2 Collab.)
FUKUI	91C	PL B267 293	S. Fukui <i>et al.</i>	(SUGI, NAGO, KEK, KYOT+)
AUGUSTIN	90	PR D42 10	J.E. Augustin <i>et al.</i>	(DM2 Collab.)
AIHARA	88C	PR D38 1	H. Aihara <i>et al.</i>	(TPC-2 γ Collab.)
BIRMAN	88	PRL 61 1557	A. Birman <i>et al.</i>	(BNL, FSU, IND, MASD) JP
ANTREASYAN	87	PR D36 2633	D. Antreasyan <i>et al.</i>	(Crystal Ball Collab.)
ANDO	86	PRL 57 1296	A. Ando <i>et al.</i>	(KEK, KYOT, NIRS, SAGA+) IJP
STANTON	79	PRL 42 346	N.R. Stanton <i>et al.</i>	(OSU, CARL, MCGI+) JP

NODE=M037

REFID=50764
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REFID=49649
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REFID=45417
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REFID=41352
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REFID=40008
REFID=20891
REFID=20887

NODE=M058

 $\pi(1300)$

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

 $\pi(1300)$ 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 $\bar{p}d \rightarrow \pi^-4\pi^0 p$
1275± 15		BERTIN	97D	OBLX	0.05 $\bar{p}p \rightarrow 2\pi^+2\pi^-$
~ 1114		ABELE	96	CBAR	0.0 $\bar{p}p \rightarrow 5\pi^0$
1190± 30		ZIELINSKI	84	SPEC	200 $\pi^+Z \rightarrow Z3\pi$
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;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 $\bar{p}d \rightarrow \pi^-4\pi^0 p$
218±100		BERTIN	97D	OBLX	0.05 $\bar{p}p \rightarrow 2\pi^+2\pi^-$
~ 340		ABELE	96	CBAR	0.0 $\bar{p}p \rightarrow 5\pi^0$
440± 80		ZIELINSKI	84	SPEC	200 $\pi^+Z \rightarrow Z3\pi$
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 $\pi^- p$

NODE=M058W
→ UNCHECKED ←

³From analysis of L3 data at 183–209 GeV.

⁴Uses multichannel Aitchison-Bowler model (BOWLER 75). Uses data from DAUM 80 and DANKOWYCH 81.

NODE=M058W;LINKAGE=SC

NODE=M058W;LINKAGE=E

$\pi(1300)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $\rho\pi$	seen
Γ_2 $\pi(\pi\pi)_{S\text{-wave}}$	seen
Γ_3 $\gamma\gamma$	

NODE=M058215;NODE=M058

DESIG=1;OUR EST;→ UNCHECKED ←

DESIG=3;OUR EST;→ UNCHECKED ←

DESIG=4

$\pi(1300)$ $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

$\Gamma(\rho\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$					$\Gamma_1\Gamma_3/\Gamma$
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	$e^+e^- \rightarrow e^+e^-\pi^+\pi^-\pi^0$	

⁵From analysis of L3 data at 183–209 GeV.

NODE=M058218

NODE=M058G1

NODE=M058G1

NODE=M058G1;LINKAGE=SC

$\pi(1300)$ BRANCHING RATIOS

$\Gamma(\pi(\pi\pi)_{S\text{-wave}})/\Gamma(\rho\pi)$					Γ_2/Γ_1
VALUE	CL% EVTS	DOCUMENT ID	TECN	COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
2.2 ± 0.4	90k	SALVINI	04	OBLX $\bar{p}p \rightarrow 2\pi^+2\pi^-$	
seen		CHUNG	02	B852 $18.3\pi^-\pi^+ \rightarrow \pi^+2\pi^-\pi^0$	
<0.15	90	ABELE	01	CBAR $0.0\bar{p}d \rightarrow \pi^-\pi^+4\pi^0$	
2.12		⁶ AARON	81	RVUE	

NODE=M058220

NODE=M058R1

NODE=M058R1

⁶Uses multichannel Aitchison-Bowler model (BOWLER 75). Uses data from DAUM 80 and DANKOWYCH 81.

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, LIPV, 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

REFID=48837

REFID=48334

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REFID=45418

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REFID=20571

$a_2(1320)$

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

NODE=M012

 $a_2(1320)$ MASS

NODE=M012205

VALUE (MeV)

DOCUMENT ID

NODE=M012M0

$1318.3^{+0.5}_{-0.6}$ OUR AVERAGE Includes data from the 4 datablocks that follow this one.
Error includes scale factor of 1.2.

3 π MODE

VALUE (MeV)

EVTS

DOCUMENT ID

TECN

CHG

COMMENT

NODE=M012M1

NODE=M012M1

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

$1319.0^{+1.0}_{-1.3}$ OUR AVERAGE Error includes scale factor of 1.4. See the ideogram below.

1321	± 1	$^{+0}_{-7}$	420k	ALEKSEEV	10	COMP	190 $\pi^- Pb \rightarrow \pi^- \pi^- \pi^+ Pb'$
1326	± 2	± 2		CHUNG	02	B852	18.3 $\pi^- p \rightarrow \pi^+ \pi^- \pi^- p$
1317	± 3			BARBERIS	98B		450 $pp \rightarrow pf \pi^+ \pi^- \pi^0 p_s$
1323	± 4	± 3		ACCIARRI	97T	L3	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^- \pi^0$
1320	± 7			ALBRECHT	97B	ARG	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^- \pi^0$
1311.3	$\pm 1.6 \pm 3.0$	72.4k		AMELIN	96	VES	36 $\pi^- p \rightarrow \pi^+ \pi^- \pi^0 n$
1310	± 5			ARMSTRONG	90	OMEG 0	300.0 $pp \rightarrow pp \pi^+ \pi^- \pi^0$
1323.8	± 2.3	4022		AUGUSTIN	89	DM2 $\pm$	$J/\psi \rightarrow \rho^\pm a_2^\mp$
1320.6	± 3.1	3562		AUGUSTIN	89	DM2 0	$J/\psi \rightarrow \rho^0 a_2^0$
1317	± 2	25k	¹	DAUM	80C	SPEC -	63,94 $\pi^- p \rightarrow 3\pi p$
1320	± 10	1097	¹	BALTAY	78B	HBC +0	15 $\pi^+ p \rightarrow p 4\pi$
1306	± 8			FERRERSORIA	78	OMEG -	9 $\pi^- p \rightarrow p 3\pi$
1318	± 7	1.6k	¹	EMMS	75	DBC 0	4 $\pi^+ n \rightarrow p(3\pi)^0$
1315	± 5		¹	ANTIPOV	73C	CNTR -	25,40 $\pi^- p \rightarrow p \eta \pi^-$
1306	± 9	1580		CHALOUPKA	73	HBC -	3.9 $\pi^- p$
● ● ● 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 $\pi^+ p \rightarrow \Delta 3\pi$
1309	± 5	5k		BINNIE	71	MMS -	$\pi^- p$ near a_2 thresh- old
1299	± 6	28k		BOWEN	71	MMS -	5 $\pi^- p$
1300	± 6	24k		BOWEN	71	MMS +	5 $\pi^+ p$
1309	± 4	17k		BOWEN	71	MMS -	7 $\pi^- p$
1306	± 4	941		ALSTON-...	70	HBC +	7.0 $\pi^+ p \rightarrow 3\pi p$

OCCUR=2

OCCUR=2

OCCUR=2

OCCUR=2

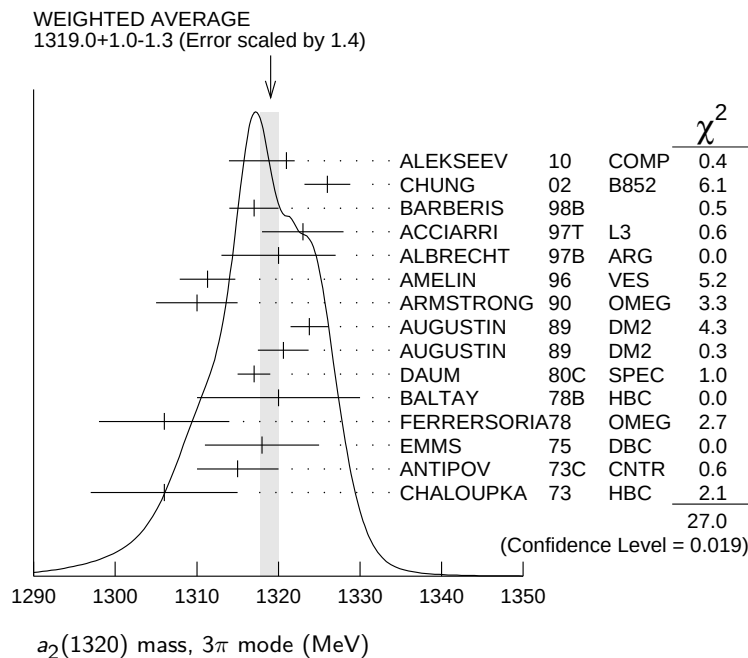
OCCUR=3

¹ From a fit to $J^P = 2^+ \rho\pi$ partial wave.

² From 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.

NODE=M012M2
NODE=M012M2

1318.1 $\pm$ 0.7 OUR AVERAGE

1319 $\pm$ 5	4700	^{1,2} CLELAND	82B	SPEC	+	50 $\pi^+ p \rightarrow K_S^0 K^+ p$	OCCUR=2
1324 $\pm$ 6	5200	^{1,2} CLELAND	82B	SPEC	-	50 $\pi^- p \rightarrow K_S^0 K^- p$	OCCUR=3
1320 $\pm$ 2	4000	CHABAUD	80	SPEC	-	17 $\pi^- A \rightarrow K_S^0 K^- A$	
1312 $\pm$ 4	11000	CHABAUD	78	SPEC	-	9.8 $\pi^- p \rightarrow K^- K_S^0 p$	
1316 $\pm$ 2	4730	CHABAUD	78	SPEC	-	18.8 $\pi^- p \rightarrow K^- K_S^0 p$	OCCUR=2
1318 $\pm$ 1		^{1,3} MARTIN	78D	SPEC	-	10 $\pi^- p \rightarrow K_S^0 K^- p$	
1320 $\pm$ 2	2724	MARGULIE	76	SPEC	-	23 $\pi^- p \rightarrow K^- K_S^0 p$	
1313 $\pm$ 4	730	FOLEY	72	CNTR	-	20.3 $\pi^- p \rightarrow K^- K_S^0 p$	
1319 $\pm$ 3	1500	³ GRAYER	71	ASPK	-	17.2 $\pi^- p \rightarrow K^- K_S^0 p$	

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

1304 $\pm$ 10	870	⁴ SCHEGELSKY	06A	RVUE	0	$\gamma\gamma \rightarrow K_S^0 K_S^0$	
1330 $\pm$ 11	1000	^{1,2} CLELAND	82B	SPEC	+	30 $\pi^+ p \rightarrow K_S^0 K^+ p$	
1324 $\pm$ 5	350	HYAMS	78	ASPK	+	12.7 $\pi^+ p \rightarrow K^+ K_S^0 p$	

¹ From a fit to $J^P = 2^+$ partial wave.

² Number of events evaluated by us.

³ Systematic error in mass scale subtracted.

⁴ From analysis of L3 data at 91 and 183–209 GeV.

NODE=M012M2;LINKAGE=P
NODE=M012M2;LINKAGE=W
NODE=M012M2;LINKAGE=S
NODE=M012M2;LINKAGE=SC

 $\eta\pi$ MODE

VALUE (MeV) EVTS DOCUMENT ID TECN CHG COMMENT

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

NODE=M012M3
NODE=M012M3

1317.7 $\pm$ 1.4 OUR AVERAGE

1308 $\pm$ 9		BARBERIS	00H			450 $pp \rightarrow p_f \eta \pi^0 p_s$	
1316 $\pm$ 9		BARBERIS	00H			450 $pp \rightarrow \Delta_f^{++} \eta \pi^- p_s$	
1317 $\pm$ 1 $\pm$ 2		THOMPSON	97	MPS		18 $\pi^- p \rightarrow \eta \pi^- p$	
1315 $\pm$ 5 $\pm$ 2		¹ AMSLER	94D	CBAR		0.0 $\bar{p} p \rightarrow \pi^0 \pi^0 \eta$	
1325.1 $\pm$ 5.1		AOYAGI	93	BKEI		$\pi^- p \rightarrow \eta \pi^- p$	
1317.7 $\pm$ 1.4 $\pm$ 2.0		BELADIDZE	93	VES		37 $\pi^- N \rightarrow \eta \pi^- N$	
1323 $\pm$ 8	1000	² KEY	73	OSPK	-	6 $\pi^- p \rightarrow p \pi^- \eta$	

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

1315 $\pm$ 12		³ ADOLPH	15	COMP		191 $\pi^- p \rightarrow \eta^{(\prime)} \pi^- p$	
1309 $\pm$ 4		ANISOVICH	09	RVUE		$\bar{p} p, \pi N$	
1324 $\pm$ 5		ARMSTRONG	93C	E760	0	$\bar{p} p \rightarrow \pi^0 \eta \eta \rightarrow 6\gamma$	
1336.2 $\pm$ 1.7	2561	DELFOSE	81	SPEC	+	$\pi^\pm p \rightarrow p \pi^\pm \eta$	
1330.7 $\pm$ 2.4	1653	DELFOSE	81	SPEC	-	$\pi^\pm p \rightarrow p \pi^\pm \eta$	OCCUR=2
1324 $\pm$ 8	6200	^{2,4} CONFORTO	73	OSPK	-	6 $\pi^- p \rightarrow p \pi^- \eta$	

- ¹ The systematic error of 2 MeV corresponds to the spread of solutions.
² Error includes 5 MeV systematic mass-scale error.
³ ADOLPH 15 value is derived from a Breit-Wigner fit with mass-dependent width taking the $\eta\pi$ and $\rho\pi$ channels into account.
⁴ Missing mass with enriched MMS = $\eta\pi^-$, $\eta = 2\gamma$.

NODE=M012M3;LINKAGE=DD

NODE=M012M3;LINKAGE=E

NODE=M012M3;LINKAGE=A

NODE=M012M3;LINKAGE=M

 $\eta'\pi$ MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

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

NODE=M012M4

NODE=M012M4

1322 $\pm$ 7 OUR AVERAGE

1318 $\pm$ 8 $^{+3}_{-5}$	IVANOV	01	B852	18 $\pi^- p \rightarrow \eta' \pi^- p$
1327.0 $\pm$ 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 $\pm$ 2 $^{+2}_{-15}$	420k	ALEKSEEV	10	COMP	190 $\pi^- Pb \rightarrow \pi^- \pi^- \pi^+ Pb'$
108 $\pm$ 3 $\pm$ 15		CHUNG	02	B852	18.3 $\pi^- p \rightarrow \pi^+ \pi^- \pi^- p$
120 $\pm$ 10		BARBERIS	98B		450 $p p \rightarrow p_f \pi^+ \pi^- \pi^0 p_s$
105 $\pm$ 10 $\pm$ 11		ACCIARRI	97T	L3	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^- \pi^0$
120 $\pm$ 10		ALBRECHT	97B	ARG	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^- \pi^0$
103.0 $\pm$ 6.0 $\pm$ 3.3	72.4k	AMELIN	96	VES	36 $\pi^- p \rightarrow \pi^+ \pi^- \pi^0 n$
120 $\pm$ 10		ARMSTRONG	90	OMEG 0	300.0 $p p \rightarrow p p \pi^+ \pi^- \pi^0$
107.0 $\pm$ 9.7	4022	AUGUSTIN	89	DM2 $\pm$	$J/\psi \rightarrow \rho^\pm a_2^\mp$
118.5 $\pm$ 12.5	3562	AUGUSTIN	89	DM2 0	$J/\psi \rightarrow \rho^0 a_2^0$
97 $\pm$ 5		¹ EVANGELIS...	81	OMEG -	12 $\pi^- p \rightarrow 3\pi p$
96 $\pm$ 9	25k	¹ DAUM	80C	SPEC -	63,94 $\pi^- p \rightarrow 3\pi p$
110 $\pm$ 15	1097	¹ BALTAY	78B	HBC +0	15 $\pi^+ p \rightarrow p 4\pi$
112 $\pm$ 18	1.6k	¹ EMMS	75	DBC 0	4 $\pi^+ n \rightarrow p(3\pi)^0$
122 $\pm$ 14	1.2k	^{1,2} WAGNER	75	HBC 0	7 $\pi^+ p \rightarrow \Delta^{++}(3\pi)^0$
115 $\pm$ 15		¹ ANTIPOV	73C	CNTR -	25,40 $\pi^- p \rightarrow p \eta \pi^-$
99 $\pm$ 15	1580	CHALOUPKA	73	HBC -	3.9 $\pi^- p$
105 $\pm$ 5	28k	BOWEN	71	MMS -	5 $\pi^- p$
99 $\pm$ 5	24k	BOWEN	71	MMS +	5 $\pi^+ p$
103 $\pm$ 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 $\pm$ 6 $\pm$ 20	18k	³ SCHEGELSKY	06	RVUE 0	$\gamma\gamma \rightarrow \pi^+ \pi^- \pi^0$
120 $\pm$ 40		CONDO	93	SHF	$\gamma p \rightarrow n \pi^+ \pi^+ \pi^-$
115 $\pm$ 14	490	BALTAY	78B	HBC 0	15 $\pi^+ p \rightarrow \Delta 3\pi$
72 $\pm$ 16	5k	BINNIE	71	MMS -	$\pi^- p$ near a_2 thresh- old
79 $\pm$ 12	941	ALSTON-...	70	HBC +	7.0 $\pi^+ p \rightarrow 3\pi p$

OCCUR=2

OCCUR=2

¹ From a fit to $J^P = 2^+ \rho\pi$ partial wave.² Width errors enlarged by us to $4\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.³ 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 $\pm$ 5 OUR ESTIMATE**110.4 $\pm$ 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	^{1,2} CLELAND	82B	SPEC	+	50 $\pi^+ p \rightarrow K_S^0 K^+ p$
120 ±25	5200	^{1,2} CLELAND	82B	SPEC	-	50 $\pi^- p \rightarrow K_S^0 K^- p$
106 ± 4	4000	CHABAUD	80	SPEC	-	17 $\pi^- A \rightarrow K_S^0 K^- A$
126 ±11	11000	CHABAUD	78	SPEC	-	9.8 $\pi^- p \rightarrow K^- K_S^0 p$
101 ± 8	4730	CHABAUD	78	SPEC	-	18.8 $\pi^- p \rightarrow K^- K_S^0 p$
113 ± 4		^{1,3} MARTIN	78D	SPEC	-	10 $\pi^- p \rightarrow K_S^0 K^- p$
105 ± 8	2724	³ MARGULIE	76	SPEC	-	23 $\pi^- p \rightarrow K^- K_S^0 p$
113 ±19	730	FOLEY	72	CNTR	-	20.3 $\pi^- p \rightarrow K^- K_S^0 p$
123 ±13	1500	³ GRAYER	71	ASPK	-	17.2 $\pi^- p \rightarrow K^- K_S^0 p$

OCCUR=2

OCCUR=3

OCCUR=2

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

120 ±15	870	⁴ SCHEGELSKY	06A	RVUE	0	$\gamma\gamma \rightarrow K_S^0 K_S^0$
121 ±51	1000	^{1,2} CLELAND	82B	SPEC	+	30 $\pi^+ p \rightarrow K_S^0 K^+ p$
110 ±18	350	HYAMS	78	ASPK	+	12.7 $\pi^+ p \rightarrow K^+ K_S^0 p$

¹ From a fit to $J^P = 2^+$ partial wave.² Number of events evaluated by us.³ Width errors enlarged by us to $4\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.⁴ From analysis of L3 data at 91 and 183–209 GeV.

NODE=M012W2;LINKAGE=P
 NODE=M012W2;LINKAGE=W
 NODE=M012W2;LINKAGE=S
 NODE=M012W2;LINKAGE=SC

 $\eta\pi$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

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

NODE=M012W3
 NODE=M012W3

111.1± 2.4 OUR AVERAGE

115 ±20		BARBERIS	00H			450 $p p \rightarrow p_f \eta \pi^0 p_s$
112 ±14		BARBERIS	00H			450 $p p \rightarrow \Delta_f^{++} \eta \pi^- p_s$
112 ± 3 ±2		¹ AMSLER	94D	CBAR		0.0 $\bar{p} p \rightarrow \pi^0 \pi^0 \eta$
103 ± 6 ±3		BELADIDZE	93	VES		37 $\pi^- N \rightarrow \eta \pi^- N$
112.2± 5.7	2561	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. • • •

119 ±14		² ADOLPH	15	COMP		191 $\pi^- p \rightarrow \eta^{(\prime)} \pi^- p$
110 ± 4		ANISOVICH	09	RVUE		$\bar{p} p, \pi N$
127 ± 2 ±2		³ 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	⁴ CONFORTO	73	OSPK	-	6 $\pi^- p \rightarrow p \pi^- \eta$

¹ The systematic error of 2 MeV corresponds to the spread of solutions.² ADOLPH 15 value is derived from a Breit-Wigner fit with mass-dependent width taking the $\eta\pi$ and $\rho\pi$ channels into account.³ Resolution is not unfolded.⁴ Missing mass with enriched MMS = $\eta\pi^-$, $\eta = 2\gamma$.

NODE=M012W3;LINKAGE=DD
 NODE=M012W3;LINKAGE=B

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 ±2.7) %	S=1.2
Γ_2 $\rho(770)\pi$		
Γ_3 $f_2(1270)\pi$		
Γ_4 $\rho(1450)\pi$		
Γ_5 $\eta\pi$	(14.5 ±1.2) %	

DESIG=1
 DESIG=11
 DESIG=12
 DESIG=13
 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	$\eta'(958)\pi$	$(5.5 \pm 0.9) \times 10^{-3}$		DESIG=8
Γ_9	$\pi^\pm\gamma$	$(2.91 \pm 0.27) \times 10^{-3}$		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 ± 3.0	870	¹ SCHEGELSKY 06A	RVUE	0	$\gamma\gamma \rightarrow K_S^0 K_S^0$

¹ From analysis of L3 data at 91 and 183–209 GeV, using $\Gamma(a_2(1320) \rightarrow \gamma\gamma) = 0.91$ keV and SU(3) relations.

NODE=M012W6
NODE=M012W6

NODE=M012W6;LINKAGE=SC

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

 Γ_7

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

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

7.0 ^{+2.0} _{-1.5}	870	¹ SCHEGELSKY 06A	RVUE	0	$\gamma\gamma \rightarrow K_S^0 K_S^0$

¹ From analysis of L3 data at 91 and 183–209 GeV, using $\Gamma(a_2(1320) \rightarrow \gamma\gamma) = 0.91$ keV and SU(3) relations.

NODE=M012W5
NODE=M012W5

NODE=M012W5;LINKAGE=SC

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

 Γ_9

VALUE (keV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

311 ± 25 OUR AVERAGE

358 ± 6 ± 42		¹ ADOLPH	14	COMP	–	190 $\pi^- \text{Pb} \rightarrow \pi^+ \pi^- \pi^- \text{Pb}'$
284 ± 25 ± 25	7.1k	MOLCHANOV 01	SELX			600 $\pi^- \text{A} \rightarrow \pi^+ \pi^- \pi^- \text{A}$
295 ± 60		CIHANGIR 82	SPEC	+		200 $\pi^+ \text{A}$

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

461 ± 110		² MAY	77	SPEC	±	9.7 γA

¹ Primakoff reaction using $a_2(1320) \rightarrow 3\pi$ branching ratio of 70.1%.

² Assuming one-pion exchange.

NODE=M012W7
NODE=M012W7NODE=M012W7;LINKAGE=AD
NODE=M012W;LINKAGE=M2

$\Gamma(\gamma\gamma)$

 Γ_{10}

VALUE (keV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

1.00 ± 0.06 OUR AVERAGE

0.98 ± 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	$e^+e^- \rightarrow e^+e^- \pi^+ \pi^- \pi^0$

NODE=M012W9
NODE=M012W9

$1.01 \pm 0.14 \pm 0.22$	85	OEST	90	JADE		$e^+e^- \rightarrow e^+e^-\pi^0\eta$
$0.90 \pm 0.27 \pm 0.15$	56	¹ ALTHOFF	86	TASS	0	$e^+e^- \rightarrow e^+e^-3\pi$
$1.14 \pm 0.20 \pm 0.26$		² ANTREASYAN	86	CBAL	0	$e^+e^- \rightarrow e^+e^-\pi^0\eta$
$1.06 \pm 0.18 \pm 0.19$		BERGER	84C	PLUT	0	$e^+e^- \rightarrow e^+e^-3\pi$

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

$0.81 \pm 0.19^{+0.42}_{-0.11}$	35	¹ BEHREND	83B	CELL	0	$e^+e^- \rightarrow e^+e^-3\pi$
$0.77 \pm 0.18 \pm 0.27$	22	² EDWARDS	82F	CBAL	0	$e^+e^- \rightarrow e^+e^-\pi^0\eta$

¹ From $\rho\pi$ decay mode.

² From $\eta\pi^0$ decay mode.

NODE=M012W;LINKAGE=F

NODE=M012W;LINKAGE=G

$\Gamma(e^+e^-)$ Γ_{11}

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
< 0.56	90	ACHASOV	00K	SND $e^+e^- \rightarrow \pi^0\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<25	90	VOROBYEV	88	ND $e^+e^- \rightarrow \pi^0\eta$

NODE=M012W10

NODE=M012W10

$a_2(1320) \Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

NODE=M012223

$\Gamma(3\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_1\Gamma_{10}/\Gamma$

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
$0.65 \pm 0.02 \pm 0.02$	18k	¹ SCHEGELSKY	06	RVUE $\gamma\gamma \rightarrow \pi^+\pi^-\pi^0$

¹ 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
$0.145^{+0.097}_{-0.034}$	¹ UEHARA	09A	BELL $e^+e^- \rightarrow e^+e^-\eta\pi^0$

¹ 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
$0.126 \pm 0.007 \pm 0.028$	¹ ALBRECHT	90G	ARG $e^+e^- \rightarrow e^+e^-K^+K^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$0.081 \pm 0.006 \pm 0.027$	² ALBRECHT	90G	ARG $e^+e^- \rightarrow e^+e^-K^+K^-$

¹ Using an incoherent background.

² Using a coherent background.

NODE=M012G1

NODE=M012G1

OCCUR=2

NODE=M012G1;LINKAGE=A

NODE=M012G1;LINKAGE=B

$a_2(1320)$ 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					

NODE=M012R3

NODE=M012R3

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	—	$11.0 \pi^- p$

$\Gamma(\omega\pi\pi)/\Gamma(3\pi)$

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		¹ KARSHON	74	HBC		Avg. of above two
0.10±0.05	279	² CHALOUPKA	73	HBC	—	3.9 $\pi^- p$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
0.29±0.08	140	¹ KARSHON	74	HBC	0	4.9 $\pi^+ p$
0.10±0.04	60	¹ KARSHON	74	HBC	+	4.9 $\pi^+ p$
0.19±0.08		DEFOIX	73	HBC	0	0.7 $\bar{p} p$

¹ 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.

² Decays to $b_1(1040)\pi$, $b_1 \rightarrow \omega\pi$. Error increased to account for possible systematic errors of complicated analysis.

 Γ_6/Γ_1

NODE=M012R12
NODE=M012R12

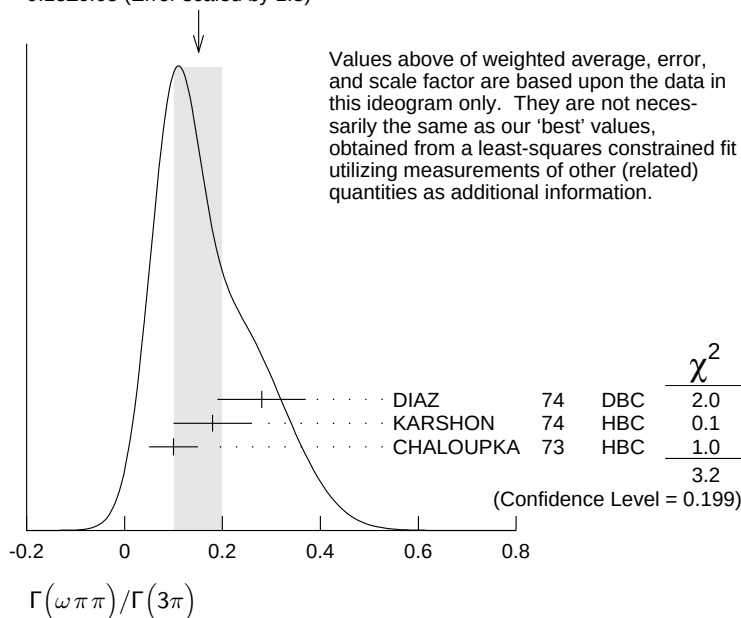
OCCUR=3

OCCUR=2

NODE=M012R12;LINKAGE=K

NODE=M012R12;LINKAGE=01

WEIGHTED AVERAGE
0.15±0.05 (Error scaled by 1.3)

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

VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

0.070±0.012 OUR FIT**0.078±0.017**

CHABAUD 78 RVUE

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

0.011±0.003		¹ BERTIN	98B	OBLX		0.0 $\bar{p} p \rightarrow K^\pm K_s \pi^\mp$
0.056±0.014	50	² CHALOUPKA	73	HBC	—	3.9 $\pi^- p$
0.097±0.018	113	² ALSTON-...	71	HBC	+	7.0 $\pi^+ p$
0.06 ±0.03		² ABRAMOVI...	70B	HBC	—	3.93 $\pi^- p$
0.054±0.022		² CHUNG	68	HBC	—	3.2 $\pi^- p$

¹ Using 4π data from BERTIN 97D.

² Included in CHABAUD 78 review.

 Γ_7/Γ_1

NODE=M012R1
NODE=M012R1

NODE=M012R1;LINKAGE=BE
NODE=M012R1;LINKAGE=C

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

VALUE	DOCUMENT ID	TECN	COMMENT

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

0.08±0.02	¹ BERTIN	98B	OBLX	0.0 $\bar{p} p \rightarrow K^\pm K_s \pi^\mp$

¹ Using $\eta\pi\pi$ data from AMSLER 94D.

 Γ_7/Γ_5

NODE=M012R14
NODE=M012R14

NODE=M012R14;LINKAGE=BE

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

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 $\pi^+ p$

 $\Gamma_5/(\Gamma_1+\Gamma_5+\Gamma_7)$

NODE=M012R2
NODE=M012R2

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

VALUE EVTS DOCUMENT ID TECN CHG COMMENT

0.054±0.009 OUR FIT

0.048±0.012 OUR AVERAGE

0.05 ±0.02		TOET	73	HBC	+	5 $\pi^+ p$
0.09 ±0.04		TOET	73	HBC	0	5 $\pi^+ p$
0.03 ±0.02	8	¹ DAMERI	72	HBC	−	11 $\pi^- p$
0.06 ±0.03	17	BARNHAM	71	HBC	+	3.7 $\pi^+ p$

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

0.020±0.004		² ESPIGAT	72	HBC	±	0.0 $\bar{p} p$

¹ Montanet agrees. Vlada.

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

NODE=M012R8
NODE=M012R8

OCCUR=2

NODE=M012R8;LINKAGE=01
NODE=M012R8;LINKAGE=A

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

VALUE CL% DOCUMENT ID TECN CHG COMMENT

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

<0.006	95	ALDE	92B	GAM2		38,100 $\pi^- p \rightarrow \eta' \pi^0 n$
<0.02	97	BARNHAM	71	HBC	+	3.7 $\pi^+ p$
0.004±0.004		¹ BOESEBECK	68	HBC	+	8 $\pi^+ p$

¹ No longer valid since $\Gamma(K\bar{K})/\Gamma(3\pi)$ value has changed (MORRISON 71).

NODE=M012R4
NODE=M012R4

NODE=M012R4;LINKAGE=B

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

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

$$\Gamma(\eta'(958)\pi)/\Gamma(\eta\pi)$$

VALUE DOCUMENT ID TECN COMMENT

0.038±0.005 OUR AVERAGE

0.05 ±0.02	ADOLPH	15	COMP	191 $\pi^- p \rightarrow \eta^{(\prime)} \pi^- p$
0.032±0.009	ABELE	97C	CBAR	0.0 $\bar{p} p \rightarrow \pi^0 \pi^0 \eta'$
0.047±0.010±0.004	¹ BELADIDZE	93	VES	37 $\pi^- N \rightarrow a_2^- N$
0.034±0.008±0.005	BELADIDZE	92	VES	36 $\pi^- C \rightarrow a_2^- C$

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

NODE=M012R13
NODE=M012R13

NODE=M012R13;LINKAGE=A

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

VALUE DOCUMENT ID TECN COMMENT

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

0.005 $\begin{smallmatrix} +0.005 \\ -0.003 \end{smallmatrix}$	¹ EISENBERG	72	HBC	4.3,5.25,7.5 γp

¹ Pion-exchange model used in this estimation.

NODE=M012R11
NODE=M012R11

NODE=M012R11;LINKAGE=R

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

VALUE (units 10⁻⁹) CL% DOCUMENT ID TECN COMMENT

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

<6	90	ACHASOV	00K	SND	$e^+ e^- \rightarrow \pi^0 \pi^0$

NODE=M012R15
NODE=M012R15

$a_2(1320)$ REFERENCES

ADOLPH	15	PL B740 303	M. Adolph <i>et al.</i>	(COMPASS Collab.)	REFID=56385
ADOLPH	14	EPJ A50 79	C. Adolph <i>et al.</i>	(COMPASS Collab.)	REFID=55911
ALEKSEEV	10	PRL 104 241803	M.G. Alekseev <i>et al.</i>	(COMPASS Collab.)	REFID=53356
ANISOVICH	09	IJMP A24 2481	V.V. Anisovich, A.V. Sarantsev		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

NODE=M012

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
ANTREASYAN	86	PR D33 1847	D. Antreasyan <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
DELFOSSSE	81	NP B183 349	A. Delfosse <i>et al.</i>	(GEVA, LAUS)	REFID=21277
EVANGELIS...	81	NP B178 197	C. Evangelista <i>et al.</i>	(BARI, BONN, CERN+)	REFID=20462
CHABAUD	80	NP B175 189	V. Chabaud <i>et al.</i>	(CERN, MPIM, AMST)	REFID=21274
DAUM	80C	PL 89B 276	C. Daum <i>et al.</i>	(AMST, CERN, CRAC, MPIM+) 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 **G33** 1 (2006).

NODE=M147

NODE=M147

 $f_0(1370)$ T-MATRIX POLE POSITION

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

NODE=M147PP

NODE=M147PP

NODE=M147PP

→ UNCHECKED ←

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
(1200–1500)–i(150–250) 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 – i 249	^{7,8} JANSSEN	95	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}$
1214 – i 168	^{8,9} TORNQVIST	95	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}, K\pi$, $\eta\pi$
1364 – i 139	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 – i 220	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		¹ AUBERT 09L	BABR	$B^\pm \rightarrow \pi^\pm \pi^\pm \pi^\mp$
1470^{+6+72}_{-7-255}		² UEHARA 08A	BELL	$10.6 e^+ e^- \rightarrow e^+ e^- \pi^0 \pi^0$
1259 ± 55	2.6k	BONVICINI 07	CLEO	$D^+ \rightarrow \pi^- \pi^+ \pi^+$
$1309 \pm 1 \pm 15$		³ BUGG 07A	RVUE	$0.0 p \bar{p} \rightarrow 3\pi^0$
1449 ± 13	4.3k	⁴ GARMASH 06	BELL	$B^+ \rightarrow K^+ \pi^+ \pi^-$
1350 ± 50		ABLIKIM 05	BES2	$J/\psi \rightarrow \phi \pi^+ \pi^-$
$1265 \pm 30^{+20}_{-35}$		ABLIKIM 05Q	BES2	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$
$1434 \pm 18 \pm 9$	848	AITALA 01A	E791	$D_s^+ \rightarrow \pi^- \pi^+ \pi^+$
1308 ± 10		BARBERIS 99B	OMEG 450	$pp \rightarrow p_s p_f \pi^+ \pi^-$
1315 ± 50		BELLAZZINI 99	GAM4 450	$pp \rightarrow pp \pi^0 \pi^0$
1315 ± 30		ALDE 98	GAM4 100	$\pi^- p \rightarrow \pi^0 \pi^0 n$
1280 ± 55		BERTIN 98	OBLX	$0.05-0.405 \bar{n} p \rightarrow \pi^+ \pi^+ \pi^-$
1186		^{5,6} TORNQVIST 95	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}, K\pi, \eta\pi$
1472 ± 12		ARMSTRONG 91	OMEG 300	$pp \rightarrow pp\pi\pi, ppK\bar{K}$
1275 ± 20		BREAKSTONE 90	SFM 62	$pp \rightarrow pp\pi^+ \pi^-$
1420 ± 20		AKESSON 86	SPEC 63	$pp \rightarrow pp\pi^+ \pi^-$
1256		FROGGATT 77	RVUE	$\pi^+ \pi^-$ channel

¹ Breit-Wigner mass.² Breit-Wigner mass. May also be the $f_0(1500)$.³ Reanalysis of ABELE 96C data.⁴ Also observed by GARMASH 07 in $B^0 \rightarrow K_S^0 \pi^+ \pi^-$ decays. Supersedes GARMASH 05.⁵ Uses data from BEIER 72B, OCHS 73, HYAMS 73, GRAYER 74, ROSSELET 77, CA-SON 83, ASTON 88, and ARMSTRONG 91B. Coupled channel analysis with flavor symmetry and all light two-pseudoscalars systems.⁶ Also observed by ASNER 00 in $\tau^- \rightarrow \pi^- \pi^0 \pi^0 \nu_\tau$ 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)	EVTS	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
$1360 \pm 31 \pm 28$	430	^{1,2} DOBBS 15		$J/\psi \rightarrow \gamma K^+ K^-$
$1350 \pm 48 \pm 15$	168	^{1,2} DOBBS 15		$\psi(2S) \rightarrow \gamma K^+ K^-$
1440 ± 6		VLADIMIRSK...06	SPEC	$40 \pi^- p \rightarrow K_S^0 K_S^0 n$
1391 ± 10		TIKHOMIROV 03	SPEC	$40.0 \pi^- C \rightarrow K_S^0 K_S^0 K_L^0 X$
1440 ± 50		BOLONKIN 88	SPEC	$40 \pi^- p \rightarrow K_S^0 K_S^0 n$
1463 ± 9		ETKIN 82B	MPS	$23 \pi^- p \rightarrow n 2 K_S^0$
1425 ± 15		WICKLUND 80	SPEC	$6 \pi N \rightarrow K^+ K^- N$
~ 1300		POLYCHRO... 79	STRC	$7 \pi^- p \rightarrow n 2 K_S^0$

¹ Using CLEO-c data but not authored by the CLEO Collaboration.² From a fit to a Breit-Wigner line shape with fixed $\Gamma = 346$ MeV.NODE=M147M2
NODE=M147M2

OCCUR=2

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

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
1395 ± 40		ABELE 01	CBAR	$0.0 \bar{p} d \rightarrow \pi^- 4\pi^0 p$
1374 ± 38		AMSLER 94	CBAR	$0.0 \bar{p} p \rightarrow \pi^+ \pi^- 3\pi^0$
1345 ± 12		ADAMO 93	OBLX	$\bar{n} p \rightarrow 3\pi^+ 2\pi^-$
1386 ± 30		GASPERO 93	DBC	$0.0 \bar{p} n \rightarrow 2\pi^+ 3\pi^-$
~ 1410	5751	¹ BETTINI 66	DBC	$0.0 \bar{p} n \rightarrow 2\pi^+ 3\pi^-$

¹ $\rho\rho$ dominant.NODE=M147M3
NODE=M147M3

NODE=M147M3;LINKAGE=BE

 $\eta\eta$ MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
$1262^{+51+82}_{-78-103}$	¹ UEHARA 10A	BELL	$10.6 e^+ e^- \rightarrow e^+ e^- \eta\eta$
1430	AMSLER 92	CBAR	$0.0 \bar{p} p \rightarrow \pi^0 \eta\eta$
1220 ± 40	ALDE 86D	GAM4 100	$\pi^- p \rightarrow n 2\eta$

¹ Breit-Wigner mass. May also be the $f_0(1500)$.NODE=M147M4
NODE=M147M4

NODE=M147M4;LINKAGE=UE

COUPLED CHANNEL MODE

<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

¹ ANISOVICH 03 RVUE

¹ K-matrix pole from combined analysis of $\pi^- p \rightarrow \pi^0 \pi^0 n$, $\pi^- p \rightarrow K \bar{K} n$,
 $\pi^+ \pi^- \rightarrow \pi^+ \pi^-$, $\bar{p} p \rightarrow \pi^0 \pi^0 \pi^0$, $\pi^0 \eta \eta$, $\pi^0 \pi^0 \eta$, $\pi^+ \pi^- \pi^0$, $K^+ K^- \pi^0$, $K_S^0 K_S^0 \pi^0$,
 $K^+ K_S^0 \pi^-$ at rest, $\bar{p} n \rightarrow \pi^- \pi^- \pi^+$, $K_S^0 K^- \pi^0$, $K_S^0 K_S^0 \pi^-$ at rest.

NODE=M147M5
 NODE=M147M5

NODE=M147M;LINKAGE=KM

 $f_0(1370)$ BREIT-WIGNER WIDTH

NODE=M147210

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>

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>

NODE=M147W1
 NODE=M147W1

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

300 ± 80		¹ AUBERT	09L	BABR	$B^\pm \rightarrow \pi^\pm \pi^\pm \pi^\mp$
90 ⁺ ₁₋ 2 ⁺ ₁₋ 50 ₂₂		² UEHARA	08A	BELL	10.6 $e^+ e^- \rightarrow e^+ e^- \pi^0 \pi^0$
298 ± 21	2.6k	BONVICINI	07	CLEO	$D^+ \rightarrow \pi^- \pi^+ \pi^+$
126 ± 25	4286	³ GARMASH	06	BELL	$B^+ \rightarrow K^+ \pi^+ \pi^-$
265 ± 40		ABLIKIM	05	BES2	$J/\psi \rightarrow \phi \pi^+ \pi^-$
350 ± 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		^{4,5} TORNQVIST	95	RVUE	$\pi\pi \rightarrow \pi\pi, K \bar{K}, K\pi, \eta\pi$
195 ± 33		ARMSTRONG	91	OMEG	300 $pp \rightarrow pp \pi\pi, pp K \bar{K}$
285 ± 60		BREAKSTONE	90	SFM	62 $pp \rightarrow pp \pi^+ \pi^-$
460 ± 50		AKESSON	86	SPEC	63 $pp \rightarrow pp \pi^+ \pi^-$
~ 400		⁶ FROGGATT	77	RVUE	$\pi^+ \pi^-$ channel

¹ The systematic errors are not reported.² Breit-Wigner width. May also be the $f_0(1500)$.³ Also observed by GARMASH 07 in $B^0 \rightarrow K_S^0 \pi^+ \pi^-$ decays. Supersedes GARMASH 05.⁴ Uses data from BEIER 72B, OCHS 73, HYAMS 73, GRAYER 74, ROSSELET 77, CA-SON 83, ASTON 88, and ARMSTRONG 91B. Coupled channel analysis with flavor symmetry and all light two-pseudoscalars systems.⁵ Also observed by ASNER 00 in $\tau^- \rightarrow \pi^- \pi^0 \pi^0 \nu_\tau$ decays⁶ 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>

NODE=M147W3
 NODE=M147W3

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

275 ± 55		ABELE	01	CBAR	0.0 $\bar{p} d \rightarrow \pi^- 4\pi^0 p$
375 ± 61		AMSLER	94	CBAR	0.0 $\bar{p} p \rightarrow \pi^+ \pi^- 3\pi^0$
398 ± 26		ADAMO	93	OBLX	$\bar{n} p \rightarrow 3\pi^+ 2\pi^-$
310 ± 50		GASPERO	93	DBC	0.0 $\bar{p} n \rightarrow 2\pi^+ 3\pi^-$
~ 90	5751	¹ BETTINI	66	DBC	0.0 $\bar{p} n \rightarrow 2\pi^+ 3\pi^-$

¹ $\rho\rho$ dominant.

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. • • •

$484^{+246+246}_{-170-263}$	¹ UEHARA	10A	BELL	$10.6 e^+ e^- \rightarrow e^+ e^- \eta\eta$
250	AMSLER	92	CBAR	$0.0 \bar{p} p \rightarrow \pi^0 \eta\eta$
320 ± 40	ALDE	86D	GAM4	$100 \pi^- p \rightarrow n 2\eta$

¹ Breit-Wigner width. May also be the $f_0(1500)$.

NODE=M147W4
NODE=M147W4

NODE=M147W4;LINKAGE=UE

COUPLED CHANNEL MODE

VALUE (MeV)	DOCUMENT ID	TECN

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

147^{+30}_{-50}	¹ ANISOVICH	03	RVUE

¹ K-matrix pole from combined analysis of $\pi^- p \rightarrow \pi^0 \pi^0 n$, $\pi^- p \rightarrow K \bar{K} n$, $\pi^+ \pi^- \rightarrow \pi^+ \pi^-$, $\bar{p} p \rightarrow \pi^0 \pi^0 \pi^0$, $\pi^0 \eta\eta$, $\pi^0 \pi^0 \eta$, $\pi^+ \pi^- \pi^0$, $K^+ K^- \pi^0$, $K_S^0 K_S^0 \pi^0$, $K^+ K_S^0 \pi^-$ at rest, $\bar{p} n \rightarrow \pi^- \pi^- \pi^+$, $K_S^0 K^- \pi^0$, $K_S^0 K_S^0 \pi^-$ at rest.

NODE=M147W5
NODE=M147W5

NODE=M147W;LINKAGE=KM

 $f_0(1370)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \pi\pi$	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 **$\Gamma(\gamma\gamma)$**

See $\gamma\gamma$ widths under $f_0(500)$ and MORGAN 90.

 Γ_{15}

NODE=M147217

NODE=M147W11

NODE=M147W11

NODE=M147W11

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

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

 Γ_{16}

NODE=M147W12
NODE=M147W12

 $f_0(1370) \Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$ **$\Gamma(\eta\eta) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$** **$\Gamma_{10}\Gamma_{15}/\Gamma$**

VALUE (eV)	DOCUMENT ID	TECN	COMMENT

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

$121^{+133+169}_{-53-106}$	¹ UEHARA	10A	BELL	$10.6 e^+ e^- \rightarrow e^+ e^- \eta\eta$

¹ Including interference with the $f_2'(1525)$ (parameters fixed to the values from the 2008 edition of this review, PDG 08) and $f_2(1270)$. May also be the $f_0(1500)$.

NODE=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	¹ AMSLER	94	CBAR $\bar{p}p \rightarrow \pi^+\pi^-3\pi^0$	
< 0.06	GASPERO	93	DBC 0.0 $\bar{p}n \rightarrow \text{hadrons}$	
¹ Using AMSLER 95B ($3\pi^0$).				

NODE=M147R3
NODE=M147R3

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	¹ GASPERO	93	DBC 0.0 $\bar{p}n \rightarrow \text{hadrons}$	
¹ 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	¹ GASPERO	93	DBC 0.0 $\bar{p}n \rightarrow 2\pi^+3\pi^-$	
¹ 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	¹ GASPERO	93	DBC 0.0 $\bar{p}n \rightarrow \text{hadrons}$	
¹ 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	¹ ABELE	01	CBAR 0.0 $\bar{p}d \rightarrow \pi^-4\pi^0 p$	
¹ From the combined data of ABELE 96 and ABELE 96C.				

NODE=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. • • •			
$(28 \pm 11) \times 10^{-3}$	¹ ANISOVICH	02D	SPEC Combined fit
$(4.7 \pm 2.0) \times 10^{-3}$	BARBERIS	00E	450 $pp \rightarrow p_f \eta \eta p_S$

NODE=M147R14
 NODE=M147R14

¹ From a combined K-matrix analysis of Crystal Barrel (0. $p\bar{p} \rightarrow \pi^0 \pi^0 \pi^0$, $\pi^0 \eta \eta$, $\pi^0 \pi^0 \eta$), GAMS ($\pi p \rightarrow \pi^0 \pi^0 n$, $\eta \eta n$, $\eta \eta' n$), and BNL ($\pi p \rightarrow K \bar{K} n$) data.

NODE=M147R14;LINKAGE=CH

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

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

NODE=M147R11
 NODE=M147R11

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

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.08±0.08	ABLIKIM	05	BES2 $J/\psi \rightarrow \phi \pi^+ \pi^-, \phi K^+ K^-$
0.91±0.20	¹ BARGIOTTI	03	OBLX $\bar{p}p$
0.12±0.06	² ANISOVICH	02D	SPEC Combined fit
0.46±0.15±0.11	BARBERIS	99D	OMEG 450 $pp \rightarrow K^+ K^-, \pi^+ \pi^-$

NODE=M147R13
 NODE=M147R13

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

² From a combined K-matrix analysis of Crystal Barrel (0. $p\bar{p} \rightarrow \pi^0 \pi^0 \pi^0$, $\pi^0 \eta \eta$, $\pi^0 \pi^0 \eta$), GAMS ($\pi p \rightarrow \pi^0 \pi^0 n$, $\eta \eta n$, $\eta \eta' n$), and BNL ($\pi p \rightarrow K \bar{K} n$) data.

NODE=M147R;LINKAGE=BG
 NODE=M147R;LINKAGE=CH

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

DOBBS	15	PR D91 052006	S. Dobbs <i>et al.</i>	(NWES)	REFID=56805
UEHARA	10A	PR D82 114031	S. Uehara <i>et al.</i>	(BELLE Collab.)	REFID=53641
ANISOVICH	09	IJMP A24 2481	V.V. Anisovich, A.V. Sarantsev		REFID=52719
AUBERT	09L	PR D79 072006	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52723
PDG	08	PL B667 1	C. Amsler <i>et al.</i>	(PDG Collab.)	REFID=52166
UEHARA	08A	PR D78 052004	S. Uehara <i>et al.</i>	(BELLE Collab.)	REFID=52309
BONVICINI	07	PR D76 012001	G. Bonvicini <i>et al.</i>	(CLEO Collab.)	REFID=51721
BUGG	07A	JP G34 151	D.V. Bugg <i>et al.</i>		REFID=53252
GARMASH	07	PR D75 012006	A. Garmash <i>et al.</i>	(BELLE Collab.)	REFID=51594
GARMASH	06	PRL 96 251803	A. Garmash <i>et al.</i>	(BELLE Collab.)	REFID=51162
PDG	06	JP G33 1	W.-M. Yao <i>et al.</i>	(PDG Collab.)	REFID=51004
VLADIMIRSK...	06	PAN 69 493	V.V. Vladimirovsky <i>et al.</i>	(ITEP, Moscow)	REFID=51191
		Translated from YAF 69 515.			
ABLIKIM	05	PL B607 243	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50450
ABLIKIM	05Q	PR D72 092002	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50958
GARMASH	05	PR D71 092003	A. Garmash <i>et al.</i>	(BELLE Collab.)	REFID=50641
ANISOVICH	03	EPJ A16 229	V.V. Anisovich <i>et al.</i>		REFID=49401
BARGIOTTI	03	EPJ C26 371	M. Bargiotti <i>et al.</i>	(OBELIX Collab.)	REFID=49217
TIKHOMIROV	03	PAN 66 828	G.D. Tikhomirov <i>et al.</i>		REFID=49423
		Translated from YAF 66 860.			
ANISOVICH	02D	PAN 65 1545	V.V. Anisovich <i>et al.</i>		REFID=48831
		Translated from YAF 65 1583.			

ABELE	01	EPJ C19 667	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)	REFID=48334
ABELE	01B	EPJ C21 261	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)	REFID=48356
AITALA	01A	PRL 86 765	E.M. Aitala <i>et al.</i>	(FNAL E791 Collab.)	REFID=48004
ASNER	00	PR D61 012002	D.M. Asner <i>et al.</i>	(CLEO Collab.)	REFID=47339
BARBERIS	00C	PL B471 440	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=47959
BARBERIS	00E	PL B479 59	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=47961
BARBERIS	99B	PL B453 316	D. Barberis <i>et al.</i>	(Omega Expt.)	REFID=46922
BARBERIS	99D	PL B462 462	D. Barberis <i>et al.</i>	(Omega Expt.)	REFID=47395
BELLAZZINI	99	PL B467 296	R. Bellazzini <i>et al.</i>		REFID=47400
KAMINSKI	99	EPJ C9 141	R. Kaminski, L. Lesniak, B. Loiseau	(CRAC, PARIN)	REFID=46927
ALDE	98	EPJ A3 361	D. Alde <i>et al.</i>	(GAM4 Collab.)	REFID=46605
Also		PAN 62 405	D. Alde <i>et al.</i>	(GAMS Collab.)	REFID=46914
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
JANSSSEN	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
1407±12 OUR AVERAGE	Error includes scale factor of 1.5.		
1412±4±8	ABLIKIM	15M BES3	$\psi(2S) \rightarrow \gamma \chi_{c1,2} \rightarrow \gamma K^* \bar{K}$
1440±60	ABELE	97H CBAR	$\bar{p}p \rightarrow K_L^0 K_S^0 \pi^0 \pi^0$
1380±20	ASTON	88C LASS	$11 K^- p \rightarrow K_S^0 K^\pm \pi^\mp \Lambda$

$h_1(1380)$ WIDTH

NODE=M109W

NODE=M109W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
89±23 OUR AVERAGE			
84±12±40	ABLIKIM	15M BES3	$\psi(2S) \rightarrow \gamma \chi_{c1,2} \rightarrow \gamma K^* \bar{K}$
170±80	ABELE	97H CBAR	$\bar{p}p \rightarrow K_L^0 K_S^0 \pi^0 \pi^0$
80±30	ASTON	88C LASS	$11 K^- p \rightarrow K_S^0 K^\pm \pi^\mp \Lambda$

$h_1(1380)$ 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=56778
REFID=45765
REFID=40282

ABLIKIM	15M	PR D91 112008	M. Ablikim <i>et al.</i>	(BES III Collab.)
ABELE	97H	PL B415 280	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
ASTON	88C	PL B201 573	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)

NODE=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 **G33** 1 (2006).

$\pi_1(1400)$ MASS

NODE=M111M

NODE=M111M

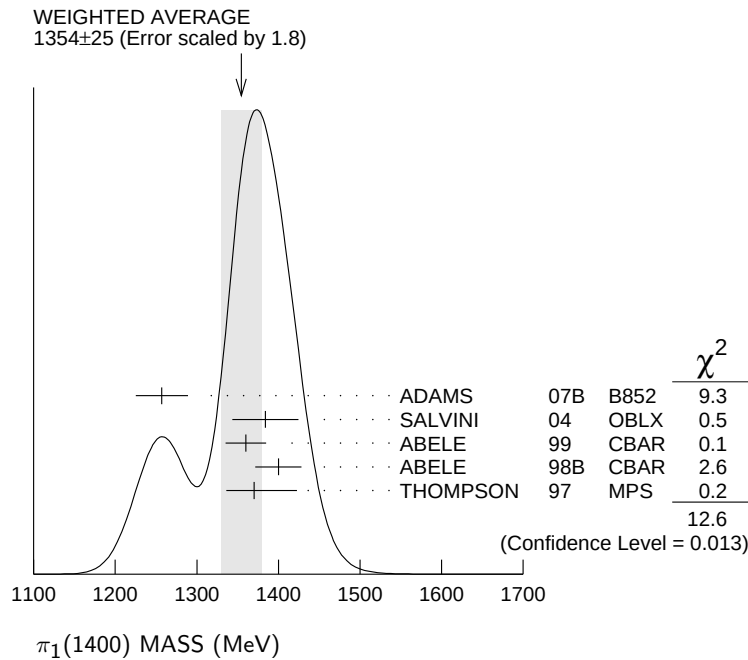
VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
1354 ±25 OUR AVERAGE	Error includes scale factor of 1.8. See the ideogram below.				
1257 ±20 ±25	23.5k	ADAMS	07B B852		$18 \pi^- p \rightarrow \eta \pi^0 n$
1384 ±20 ±35	90k	SALVINI	04 OBLX		$\bar{p}p \rightarrow 2\pi^+ 2\pi^-$
1360 ±25		ABELE	99 CBAR		$0.0 \bar{p}p \rightarrow \pi^0 \pi^0 \eta$
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

NODE=M111W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
330 ±35 OUR AVERAGE					
354 ±64 ± 58	23.5k	ADAMS	07B	B852	$18 \pi^- p \rightarrow \eta \pi^0 n$
378 ±50 ± 50	90k	SALVINI	04	OBLX	$\bar{p} p \rightarrow 2\pi^+ 2\pi^-$
220 ±90		ABELE	99	CBAR	$0.0 \bar{p} p \rightarrow \pi^0 \pi^0 \eta$
310 ±50 + 50 - 30		ABELE	98B	CBAR	$0.0 \bar{p} n \rightarrow \pi^- \pi^0 \eta$
385 ±40 + 65 - 105		⁴ THOMPSON	97	MPS	$18 \pi^- p \rightarrow \eta \pi^- p$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
143.2±12.5		⁵ AOYAGI	93	BKEI	$\pi^- p \rightarrow \eta \pi^- p$
180 ±20		⁶ ALDE	88B	GAM4 0	$100 \pi^- p \rightarrow \eta \pi^0 n$

NODE=M111W

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.

NODE=M111W;LINKAGE=QQ

NODE=M111W;LINKAGE=C

NODE=M111W;LINKAGE=A

$\pi_1(1400)$ DECAY MODES

NODE=M111215;NODE=M111

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \eta \pi^0$	seen
$\Gamma_2 \quad \eta \pi^-$	seen
$\Gamma_3 \quad \eta' \pi$	

DESIG=1;OUR EST;→ UNCHECKED ←

DESIG=4;OUR EST;→ UNCHECKED ←

DESIG=3

$\pi_1(1400)$ BRANCHING RATIOS

NODE=M111220

$\Gamma(\eta \pi^0)/\Gamma_{\text{total}}$				Γ_1/Γ
VALUE	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
not seen	PROKOSHKIN	95B	GAM4	$100 \pi^- p \rightarrow \eta \pi^0 n$
not seen	⁷ BUGG	94	RVUE	$\bar{p} p \rightarrow \eta 2\pi^0$
not seen	⁸ APEL	81	NICE 0	$40 \pi^- p \rightarrow \eta \pi^0 n$

NODE=M111R1

NODE=M111R1

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=M111R1;LINKAGE=C

NODE=M111R1;LINKAGE=B

$\Gamma(\eta\pi^-)/\Gamma_{\text{total}}$					Γ_2/Γ
VALUE		DOCUMENT ID	TECN	COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
possibly seen		BELADIDZE 93	VES	$37\pi^- N \rightarrow \eta\pi^- N$	
$\Gamma(\eta'\pi)/\Gamma(\eta\pi^0)$					Γ_3/Γ_1
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.80	95	BOUTEMEUR 90	GAM4	$100\pi^- p \rightarrow 4\gamma n$	

NODE=M111R4
NODE=M111R4

NODE=M111R3
NODE=M111R3

$\pi_1(1400)$ REFERENCES

NODE=M111

ADAMS	07B	PL B657 27	G.S. Adams <i>et al.</i>	(BNL E852 Collab.)
PDG	06	JP G33 1	W.-M. Yao <i>et al.</i>	(PDG Collab.)
SALVINI	04	EPJ C35 21	P. Salvini <i>et al.</i>	(OBELIX Collab.)
DZIERBA	03	PR D67 094015	A.R. Dzierba <i>et al.</i>	
ABELE	99	PL B446 349	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
ABELE	98B	PL B423 175	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
THOMPSON	97	PRL 79 1630	D.R. Thompson <i>et al.</i>	(BNL E852 Collab.)
PROKOSHKIN	95B	PAN 58 606	Y.D. Prokoshkin, S.A. Sadovsky	(SERP)
Translated from YAF 58 662.				
BUGG	94	PR D50 4412	D.V. Bugg <i>et al.</i>	(LOQM)
AOYAGI	93	PL B314 246	H. Aoyagi <i>et al.</i>	(BKEI Collab.)
BELADIDZE	93	PL B313 276	G.M. Beladidze <i>et al.</i>	(VES Collab.)
BOUTEMEUR	90	Hadron 89 Conf. p 119	M. Boutemeur, M. Poulet	(SERP, BELG, LANL+)
ALDE	88B	PL B205 397	D.M. Alde <i>et al.</i>	(SERP, BELG, LANL, LAPP) IGJPC
APEL	81	NP B193 269	W.D. Apel <i>et al.</i>	(SERP, CERN)

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

See also the $\eta(1475)$.
A REVIEW GOES HERE – Check our WWW List of Reviews

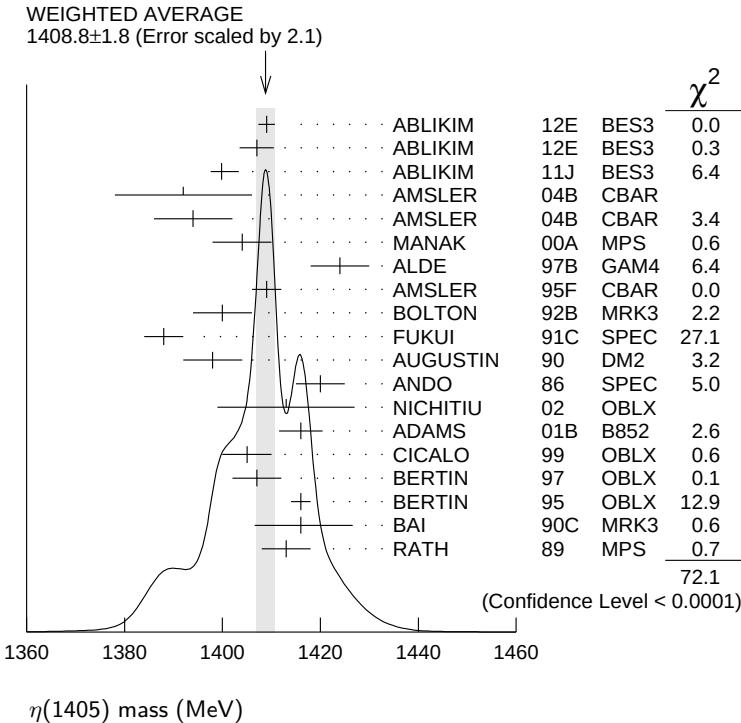
NODE=M027
NODE=M027

$\eta(1405)$ 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.

NODE=M027MX



$\eta\pi\pi$ MODE

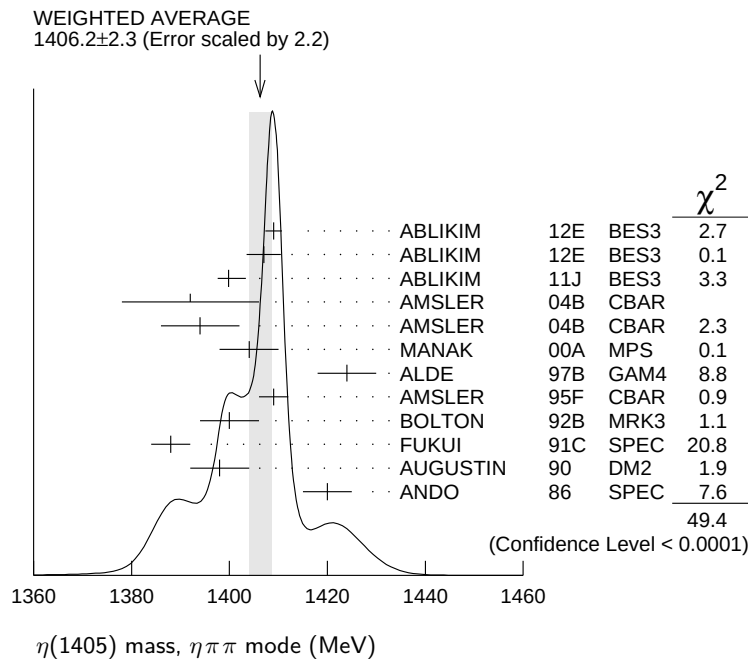
VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

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

NODE=M027M1
NODE=M027M1

1406.2 $\pm$ 2.3 OUR AVERAGE Error includes scale factor of 2.2. See the ideogram below.

1409.0 $\pm$ 1.7	743	ABLIKIM	12E BES3	$J/\psi \rightarrow \gamma(\pi^+\pi^-\pi^0)$	OCCUR=2
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	$J/\psi \rightarrow \omega(\eta\pi^+\pi^-)$	OCCUR=2
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	$18 \pi^-p \rightarrow \eta\pi^+\pi^-n$	
1424 $\pm$ 6	2200	ALDE	97B GAM4	$100 \pi^-p \rightarrow \eta\pi^0\pi^0n$	
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	$8.95 \pi^-p \rightarrow \eta\pi^+\pi^-n$	
1398 $\pm$ 6	261	³ AUGUSTIN	90 DM2	$J/\psi \rightarrow \gamma\eta\pi^+\pi^-$	
1420 $\pm$ 5		ANDO	86 SPEC	$8 \pi^-p \rightarrow \eta\pi^+\pi^-n$	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1385 $\pm$ 7		BAI	99 BES	$J/\psi \rightarrow \gamma\eta\pi^+\pi^-$	

 **$K\bar{K}\pi$ MODE ($a_0(980)\pi$ or direct $K\bar{K}\pi$)**

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

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

NODE=M027M4
NODE=M027M4

1413.9 $\pm$ 1.7 OUR AVERAGE Error includes scale factor of 1.1.

1413 $\pm$ 14	3651	⁴ NICHITIU	02 OBLX		OCCUR=2
1416 $\pm$ 4 $\pm$ 2	20k	ADAMS	01B B852	$18 \text{ GeV } \pi^-p \rightarrow K^+K^-\pi^0n$	
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	$21.4 \pi^-p \rightarrow n K_S^0 K_S^0 \pi^0$	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1459 $\pm$ 5		⁷ AUGUSTIN	92 DM2	$J/\psi \rightarrow \gamma K\bar{K}\pi$	

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	$J/\psi \rightarrow \gamma\gamma\pi^+\pi^-$	OCCUR=4
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. • • •				
1452.7 $\pm$ 3.3	191	^{11,12} ABLIKIM	13M BES3	$\psi(2S) \rightarrow \omega K K \pi$
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 $^{+20}_{-15}$	174	¹¹ EDWARDS	82E CBAL	$J/\psi \rightarrow \gamma K^+ K^- \pi^0$
1440 $^{+10}_{-15}$		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

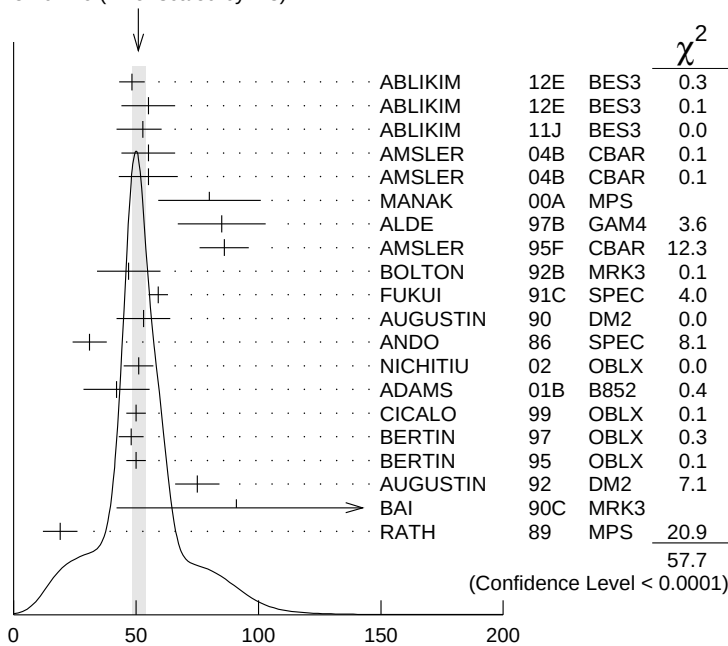
NODE=M027210

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.

NODE=M027WX

WEIGHTED AVERAGE
51.0±2.9 (Error scaled by 1.8)



$\eta(1405)$ width (MeV)

$\eta\pi\pi$ 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

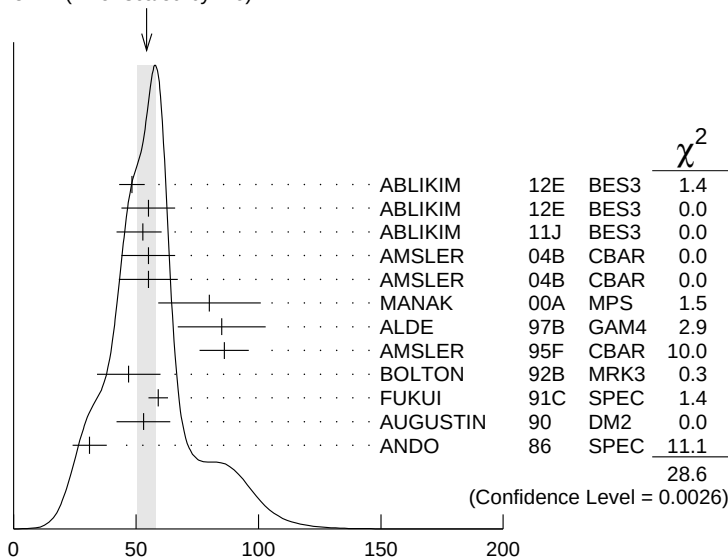
54 ± 4 OUR AVERAGE Error includes scale factor of 1.6. See the ideogram below.

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	$18 \pi^-\pi^+ \rightarrow \eta\pi^+\pi^-n$
85 ± 18	2200	ALDE	97B GAM4	$100 \pi^-\pi^+ \rightarrow \eta\pi^0\pi^0n$
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	$8.95 \pi^-\pi^+ \rightarrow \eta\pi^+\pi^-n$
53 ± 11	16	AUGUSTIN	90 DM2	$J/\psi \rightarrow \gamma\eta\pi^+\pi^-$
31 ± 7		ANDO	86 SPEC	$8 \pi^-\pi^+ \rightarrow \eta\pi^+\pi^-n$

OCCUR=2

OCCUR=2

WEIGHTED AVERAGE
54±4 (Error scaled by 1.6)



$\eta(1405)$ width $\eta\pi\pi$ mode (MeV)

$K\bar{K}\pi$ MODE ($a_0(980)\pi$ or direct $K\bar{K}\pi$)

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

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

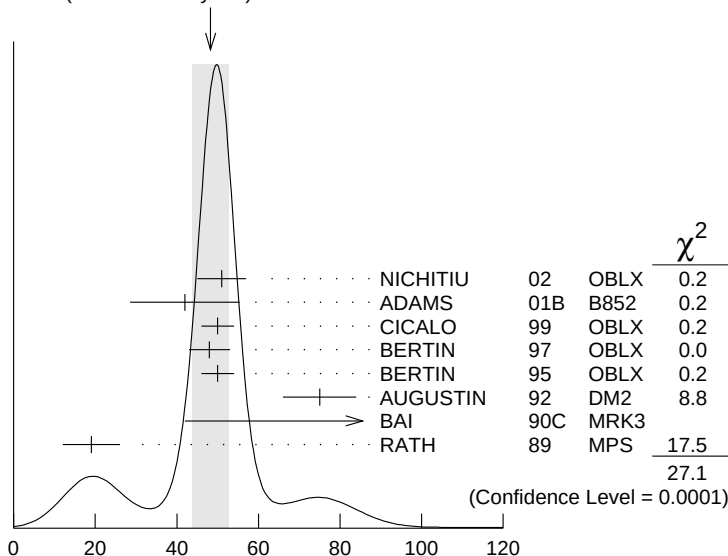
NODE=M027W4
 NODE=M027W4

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 ₋₃₁ ⁺¹⁵ ₋₃₈		19 BAI	90C MRK3	$J/\psi \rightarrow \gamma K_S^0 K^\pm \pi^\mp$
19 ± 7		19 RATH	89 MPS	21.4 $\pi^- p \rightarrow n K_S^0 K_S^0 \pi^0$

OCCUR=2

OCCUR=3

WEIGHTED AVERAGE
48 ± 4 (Error scaled by 2.1) $\eta(1405)$ width $K\bar{K}\pi$ mode ($a_0(980)\pi$ dominant) **$\pi\pi\gamma$ MODE**

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

64 ± 18 235 ± 91 AMSLER 04B CBAR 0 $\bar{p} p \rightarrow \pi^+ \pi^- \pi^+ \pi^- \gamma$

• • • 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	$J/\psi \rightarrow \pi^+ \pi^- 2\gamma$

NODE=M027W2
 NODE=M027W2

OCCUR=2

4 π MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

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

160 ± 30		BUGG	95 MRK3	$J/\psi \rightarrow \gamma \pi^+ \pi^- \pi^+ \pi^-$
144 ± 13	3270	21 BISELLO	89B DM2	$J/\psi \rightarrow 4\pi\gamma$

NODE=M027W3
 NODE=M027W3

 $K\bar{K}\pi$ MODE (unresolved)

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

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

45.9 ± 8.2	191	22,23 ABLIKIM	13M BES3	$\psi(2S) \rightarrow \omega K K \pi$
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	$\bar{p} p \rightarrow K\bar{K}\pi\pi\pi$

NODE=M027W6
 NODE=M027W6

OCCUR=2

OCCUR=2

OCCUR=3

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 $p \bar{p} \rightarrow K K \pi X$
60 ±10		22 CHUNG	85 SPEC	8 $\pi^- p \rightarrow K \bar{K} \pi n$
55 $\begin{smallmatrix} +20 \\ -30 \end{smallmatrix}$	174	22 EDWARDS	82E CBAL	$J/\psi \rightarrow \gamma K^+ K^- \pi^0$
50 $\begin{smallmatrix} +30 \\ -20 \end{smallmatrix}$		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 $\bar{p} p \rightarrow K \bar{K} \pi \pi \pi$
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% $a_0(980) \pi$.				

OCCUR=2

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

NODE=M027215;NODE=M027

 $\eta(1405)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 $K \bar{K} \pi$	seen	
Γ_2 $\eta \pi \pi$	seen	
Γ_3 $a_0(980) \pi$	seen	
Γ_4 $\eta(\pi \pi)_S$ -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 ←

 $\eta(1405) \Gamma(i) \Gamma(\gamma \gamma) / \Gamma(\text{total})$

$\Gamma(K \bar{K} \pi) \times \Gamma(\gamma \gamma) / \Gamma_{\text{total}}$	$\Gamma_1 \Gamma_8 / \Gamma$
VALUE (keV) CL% DOCUMENT ID TECN COMMENT	

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

<0.035 90 25,26 AHOHE 05 CLE2 10.6 $e^+ e^- \rightarrow e^+ e^- K_S^0 K^\pm \pi^\mp$

NODE=M027220

NODE=M027G3
 NODE=M027G3

$\Gamma(\eta \pi \pi) \times \Gamma(\gamma \gamma) / \Gamma_{\text{total}}$	$\Gamma_2 \Gamma_8 / \Gamma$
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

$\Gamma(\eta \pi \pi) / \Gamma(K \bar{K} \pi)$	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=M027225

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 $\bar{p}p \rightarrow K\bar{K}\pi\pi$
~ 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 $p\bar{p} \rightarrow K K\pi X$

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 $\pi^-p \rightarrow \eta\pi^0\pi^0n$
0.56±0.04±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±0.12±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 $\pi^-p \rightarrow \eta\pi^0\pi^0n$

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	0.9–1.2 $\bar{p}p \rightarrow \eta 3\pi^0$

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 $\pi^-p \rightarrow K^+K^-\pi^0n$

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

NODE=M027R14
 NODE=M027R14

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=M027R3;LINKAGE=AM
 NODE=M027R4;LINKAGE=C
 NODE=M027R2;LINKAGE=A
 NODE=M027R;LINKAGE=K3
 NODE=M027R9;LINKAGE=BK
 NODE=M027R7;LINKAGE=D

NODE=M027R10;LINKAGE=D
 NODE=M027R13;LINKAGE=AM
 NODE=M027R14;LINKAGE=BA

$\eta(1405)$ REFERENCES

NODE=M027

ABLIKIM	13M	PR D87 092006	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=55386
ABLIKIM	12E	PRL 108 182001	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=54270
ABLIKIM	11J	PRL 107 182001	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=53931
ABLIKIM	08E	PR D77 032005	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52143
AHOHE	05	PR D71 072001	R. Ahohe <i>et al.</i>	(CLEO Collab.)	REFID=50764
AMSLER	04B	EPJ C33 23	C. AMSler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=51079
BAI	04J	PL B594 47	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=50167
NICHITIU	02	PL B545 261	F. Nichitiu <i>et al.</i>	(OBELIX Collab.)	REFID=48848
ACCIARRI	01G	PL B501 1	M. Acciarri <i>et al.</i>	(L3 Collab.)	REFID=48319
ADAMS	01B	PL B516 264	G.S. Adams <i>et al.</i>	(BNL E852 Collab.)	REFID=49649
ANISOVICH	01	NP A690 567	A.V. Anisovich <i>et al.</i>		REFID=48308
ANISOVICH	00	PL B472 168	A.V. Anisovich <i>et al.</i>		REFID=47429
MANAK	00A	PR D62 012003	J.J. Manak <i>et al.</i>	(BNL E852 Collab.)	REFID=47989
BAI	99	PL B446 356	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=46606
CICALO	99	PL B462 453	C. Cicalo <i>et al.</i>	(OBELIX Collab.)	REFID=47394
ABELE	98E	NP B514 45	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)	REFID=46314
BAI	98C	PL B440 217	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=46337
ALDE	97B	PAN 60 386	D. Alde <i>et al.</i>	(GAMS Collab.)	REFID=45396
Translated from YAF 60 458.					
BERTIN	97	PL B400 226	A. Bertin <i>et al.</i>	(OBELIX Collab.)	REFID=45417
AMSLER	95F	PL B358 389	C. AMSler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=44613
BERTIN	95	PL B361 187	A. Bertin <i>et al.</i>	(OBELIX Collab.)	REFID=44614
BUGG	95	PL B353 378	D.V. Bugg <i>et al.</i>	(LOQM, PNPI, WASH)	REFID=44438
AUGUSTIN	92	PR D46 1951	J.E. Augustin, G. Cosme	(DM2 Collab.)	REFID=41584
BOLTON	92B	PRL 69 1328	T. Bolton <i>et al.</i>	(Mark III Collab.)	REFID=42176
FUKUI	91C	PL B267 293	S. Fukui <i>et al.</i>	(SUGI, NAGO, KEK, KYOT+)	REFID=41748
AUGUSTIN	90	PR D42 10	J.E. Augustin <i>et al.</i>	(DM2 Collab.)	REFID=41352
BAI	90C	PRL 65 2507	Z. Bai <i>et al.</i>	(Mark III Collab.)	REFID=41578
COFFMAN	90	PR D41 1410	D.M. Coffman <i>et al.</i>	(Mark III Collab.)	REFID=41350
BISELLO	89B	PR D39 701	G. Busetto <i>et al.</i>	(DM2 Collab.)	REFID=40575
DUCH	89	ZPHY C45 223	K.D. Duch <i>et al.</i>	(ASTERIX Collab.) JP	REFID=41016
RATH	89	PR D40 693	M.G. Rath <i>et al.</i>	(NDAM, BRAN, BNL, CUNY+)	REFID=40924
BIRMAN	88	PRL 61 1557	A. Birman <i>et al.</i>	(BNL, FSU, IND, MASD) JP	REFID=40568
ANDO	86	PRL 57 1296	A. Ando <i>et al.</i>	(KEK, KYOT, NIRS, SAGA+) IJP	REFID=20891
REEVES	86	PR D34 1960	D.F. Reeves <i>et al.</i>	(FLOR, BNL, IND+) JP	REFID=20936
CHUNG	85	PRL 55 779	S.U. Chung <i>et al.</i>	(BNL, FLOR, IND+) JP	REFID=20934
ALTHOFF	84E	PL 147B 487	M. Althoff <i>et al.</i>	(TASSO Collab.)	REFID=20305
EDWARDS	83B	PRL 51 859	C. Edwards <i>et al.</i>	(CIT, HARV, PRIN+)	REFID=21318
EDWARDS	82E	PRL 49 259	C. Edwards <i>et al.</i>	(CIT, HARV, PRIN+)	REFID=21314
Also		PRL 50 219	C. Edwards <i>et al.</i>	(CIT, HARV, PRIN+)	REFID=21315
SCHARRE	80	PL 97B 329	D.L. Scharre <i>et al.</i>	(SLAC, LBL)	REFID=21329
FOSTER	68B	NP B8 174	M. Foster <i>et al.</i>	(CERN, CDEF)	REFID=21179
BAILLON	67	NC 50A 393	P.H. Baillon <i>et al.</i>	(CERN, CDEF, IRAD)	REFID=20407

 $f_1(1420)$

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

See the minireview under $\eta(1405)$.

NODE=M006

NODE=M006

 $f_1(1420)$ MASS

NODE=M006M2

NODE=M006M2

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	$18 \text{ GeV } \pi^- p \rightarrow K^+ K^- \pi^0 n$
1426 ± 1		BARBERIS	97C OMEG	$450 p p \rightarrow p p K_S^0 K^\pm \pi^\mp$
1425 ± 8		BERTIN	97 OBLX	$0.0 \bar{p} p \rightarrow K^\pm (K^0) \pi^\mp \pi^+ \pi^-$
1435 ± 9		PROKOSHKIN	97B GAM4	$100 \pi^- p \rightarrow \eta \pi^0 \pi^0 n$
1430 ± 4		² ARMSTRONG	92E OMEG	$85,300 \pi^+ p, p p \rightarrow \pi^+ p, p p (K \bar{K} \pi)$
1462 ± 20		³ AUGUSTIN	92 DM2	$J/\psi \rightarrow \gamma K \bar{K} \pi$
1443 $\begin{smallmatrix} +7 \\ -6 \end{smallmatrix}$ $\begin{smallmatrix} +3 \\ -2 \end{smallmatrix}$	1100	BAI	90C MRK3	$J/\psi \rightarrow \gamma K_S^0 K^\pm \pi^\mp$
1425 ± 10	17	BEHREND	89 CELL	$\gamma \gamma \rightarrow K_S^0 K^\pm \pi^\mp$
1442 ± 5 $\begin{smallmatrix} +10 \\ -17 \end{smallmatrix}$	111	BECKER	87 MRK3	$e^+e^-, \omega K \bar{K} \pi$
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	$\text{ISR } 31.5 p p$
1440 ± 10		⁴ BROMBERG	80 SPEC	$100 \pi^- p \rightarrow K \bar{K} \pi X$
1426 ± 6	221	DIONISI	80 HBC	$4 \pi^- p \rightarrow K \bar{K} \pi n$
1420 ± 20		DAHL	67 HBC	$1.6-4.2 \pi^- p$

• • • 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 $K^- p \rightarrow K^+ K^- \pi^0 \gamma$

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 $\pi^+ p, pp \rightarrow \pi^+ p, pp(K \bar{K} \pi)$
129 ± 41		⁷ AUGUSTIN	92 DM2	$J/\psi \rightarrow \gamma K \bar{K} \pi$
68 $^{+29}_{-18}$ $^{+8}_{-9}$	1100	BAI	90C MRK3	$J/\psi \rightarrow \gamma K_S^0 K^\pm \pi^\mp$
42 ± 22	17	BEHREND	89 CELL	$\gamma \gamma \rightarrow K_S^0 K^\pm \pi^\mp$
40 $^{+17}_{-13}$ ± 5	111	BECKER	87 MRK3	$e^+ e^- \rightarrow \omega K \bar{K} \pi$
35 $^{+47}_{-20}$	13	AIHARA	86C TPC	$e^+ e^- \rightarrow e^+ e^- K \bar{K} \pi$
47 ± 10		CHAUVAT	84 SPEC	ISR 31.5 pp
62 ± 14		BROMBERG	80 SPEC	100 $\pi^- p \rightarrow K \bar{K} \pi X$
40 ± 15	221	DIONISI	80 HBC	4 $\pi^- p \rightarrow K \bar{K} \pi n$
60 ± 20		DAHL	67 HBC	1.6–4.2 $\pi^- p$

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

68.7 ± 2.9	⁸ SOSA	99	SPEC	$pp \rightarrow p_{\text{slow}} (K_S^0 K^+ \pi^-) p_{\text{fast}}$
58.8 ± 3.3	⁸ SOSA	99	SPEC	$pp \rightarrow p_{\text{slow}} (K_S^0 K^- \pi^+) p_{\text{fast}}$
58 ± 8	389	ARMSTRONG	89	OMEG 300 $pp \rightarrow K \bar{K} \pi pp$
62 ± 5	1520	ARMSTRONG	84	OMEG 85 $\pi^+ p, pp \rightarrow (\pi^+, p)(K \bar{K} \pi)p$
~ 50		BITYUKOV	84	SPEC 32 $K^- p \rightarrow K^+ K^- \pi^0 \gamma$

⁶ This result supersedes ARMSTRONG 84, ARMSTRONG 89.

⁷ From fit to the $K^*(892)K 1^{++}$ partial wave.

⁸ No systematic error given.

OCCUR=2

NODE=M006W;LINKAGE=C

NODE=M006W;LINKAGE=B

NODE=M006W;LINKAGE=N1

$f_1(1420)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $K \bar{K} \pi$	dominant
Γ_2 $K \bar{K}^*(892) + \text{c.c.}$	dominant
Γ_3 $\eta \pi \pi$	possibly seen
Γ_4 $a_0(980) \pi$	

NODE=M006215;NODE=M006

DESIG=2;OUR EST;→ UNCHECKED ←

DESIG=1;OUR EST;→ UNCHECKED ←

DESIG=5;OUR EST;→ UNCHECKED ←

DESIG=4

Γ_5 $\pi\pi\rho$
 Γ_6 4π
 Γ_7 $\rho^0\gamma$
 Γ_8 $\phi\gamma$

seen

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 $p\bar{p} \rightarrow p\eta\pi^+\pi^-$
• • • 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

$\Gamma(4\pi) / \Gamma(K\bar{K}^*(892) + \text{c.c.})$

 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

$$\Gamma(K\bar{K}\pi)/[\Gamma(K\bar{K}^*(892)+\text{c.c.})+\Gamma(a_0(980)\pi)] \quad \Gamma_1/(\Gamma_2+\Gamma_4)$$

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

$$\Gamma(a_0(980)\pi)/\Gamma(K\bar{K}^*(892)+\text{c.c.}) \quad \Gamma_4/\Gamma_2$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

0.04±0.01±0.01 BARBERIS 98C OMEG 450 $p p \rightarrow p_f \bar{f}_1(1420) p_S$

• • • 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

$$\Gamma(4\pi)/\Gamma(K\bar{K}\pi) \quad \Gamma_6/\Gamma_1$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<0.62 95 ARMSTRONG 89G OMEG 85 $\pi p \rightarrow 4\pi X$

NODE=M006R8
NODE=M006R8

$$\Gamma(\rho^0\gamma)/\Gamma_{\text{total}} \quad \Gamma_7/\Gamma$$

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

$$\Gamma(\rho^0\gamma)/\Gamma(K\bar{K}\pi) \quad \Gamma_7/\Gamma_1$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<0.02 95 BARBERIS 98C OMEG 450 $p p \rightarrow p_f \bar{f}_1(1420) p_S$

NODE=M006R10
NODE=M006R10

$$\Gamma(\phi\gamma)/\Gamma(K\bar{K}\pi) \quad \Gamma_8/\Gamma_1$$

VALUE	DOCUMENT ID	TECN	COMMENT

0.003±0.001±0.001 BARBERIS 98C OMEG 450 $p p \rightarrow p_f \bar{f}_1(1420) p_S$

NODE=M006R11
NODE=M006R11

$\bar{f}_1(1420)$ REFERENCES

NODE=M006

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.)
NICHITIU	02	PL B545 261	F. Nichitiu <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	PD 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. Bitjukov <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)

REFID=51698
REFID=49548
REFID=48848
REFID=49649
REFID=46937
REFID=46346
REFID=45759
REFID=45417
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REFID=21326
REFID=20891
REFID=20929
REFID=45856

REFID=20932
REFID=20304
REFID=20922
REFID=20924
REFID=20452
REFID=20435
REFID=20321
REFID=21291

$\omega(1420)$

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

NODE=M125

 $\omega(1420)$ 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. • • •

1470 ± 50	13.1k	¹ AULCHENKO	15A	SND	1.05–1.80 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
1382 ± 23 ± 70		AUBERT	07AU	BABR	10.6 $e^+e^- \rightarrow \omega\pi^+\pi^-\gamma$
1350 ± 20 ± 20		AUBERT,B	04N	BABR	10.6 $e^+e^- \rightarrow \pi^+\pi^-\pi^0\gamma$
1400 ± 50 ± 130	1.2M	² ACHASOV	03D	RVUE	0.44–2.00 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
1450 ± 10		³ HENNER	02	RVUE	1.2–2.0 $e^+e^- \rightarrow \rho\pi, \omega\pi\pi$
1373 ± 70	177	⁴ AKHMETSHIN	00D	CMD2	1.2–1.38 $e^+e^- \rightarrow \omega\pi^+\pi^-$
1370 ± 25	5095	ANISOVICH	00H	SPEC	0.0 $\rho\bar{p} \rightarrow \omega\pi^0\pi^0\pi^0$
1400 ⁺¹⁰⁰ _{–200}		⁵ ACHASOV	98H	RVUE	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
~ 1400		⁶ ACHASOV	98H	RVUE	$e^+e^- \rightarrow \omega\pi^+\pi^-$
~ 1460		⁷ ACHASOV	98H	RVUE	$e^+e^- \rightarrow K^+K^-$
1440 ± 70		⁸ CLEGG	94	RVUE	
1419 ± 31	315	⁹ ANTONELLI	92	DM2	1.34–2.4 $e^+e^- \rightarrow \rho\pi$

OCCUR=2

OCCUR=3

¹ From a fit with contributions from $\omega(782)$, $\phi(1020)$, $\omega(1420)$, and $\omega(1650)$.

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

³ Using results of CORDIER 81 and preliminary data of DOLINSKY 91 and ANTONELLI 92.

⁴ 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.

⁵ Using data from BARKOV 87, DOLINSKY 91, and ANTONELLI 92.

⁶ Using the data from ANTONELLI 92.

⁷ Using the data from IVANOV 81 and BISELLO 88B.

⁸ From a fit to two Breit-Wigner functions and using the data of DOLINSKY 91 and ANTONELLI 92.

⁹ From a fit to two Breit-Wigner functions interfering between them and with the ω, ϕ tails with fixed (+, −, +) phases.

NODE=M125M;LINKAGE=E

NODE=M125M;LINKAGE=VH

NODE=M125M;LINKAGE=AB

NODE=M125M;LINKAGE=KL

NODE=M125M;LINKAGE=L1

NODE=M125M;LINKAGE=L2

NODE=M125M;LINKAGE=L3

NODE=M125M;LINKAGE=AD

NODE=M125M;LINKAGE=B

 $\omega(1420)$ WIDTH

NODE=M125W

VALUE (MeV) EVTS DOCUMENT ID TECN COMMENT
(180–250) OUR ESTIMATE

NODE=M125W

→ UNCHECKED ←

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

880 ± 170	13.1k	¹⁰ AULCHENKO	15A	SND	1.05–1.80 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
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	¹¹ ACHASOV	03D	RVUE	0.44–2.00 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
199 ± 15		¹² HENNER	02	RVUE	1.2–2.0 $e^+e^- \rightarrow \rho\pi, \omega\pi\pi$
188 ± 45	177	¹³ 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		¹⁴ CLEGG	94	RVUE	
174 ± 59	315	¹⁵ ANTONELLI	92	DM2	1.34–2.4 $e^+e^- \rightarrow \rho\pi$

¹⁰ From a fit with contributions from $\omega(782)$, $\phi(1020)$, $\omega(1420)$, and $\omega(1650)$.

¹¹ 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.

¹² Using results of CORDIER 81 and preliminary data of DOLINSKY 91 and ANTONELLI 92.

¹³ 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.

¹⁴ From a fit to two Breit-Wigner functions and using the data of DOLINSKY 91 and ANTONELLI 92.

¹⁵ From a fit to two Breit-Wigner functions interfering between them and with the ω, ϕ tails with fixed (+, −, +) phases.

NODE=M125W;LINKAGE=E

NODE=M125W;LINKAGE=VH

NODE=M125W;LINKAGE=AB

NODE=M125W;LINKAGE=KL

NODE=M125W;LINKAGE=AD

NODE=M125W;LINKAGE=B

$\omega(1420)$ DECAY MODES

NODE=M125215;NODE=M125

Mode	Fraction (Γ_i/Γ)
Γ_1 $\rho\pi$	dominant
Γ_2 $\omega\pi\pi$	seen
Γ_3 $\omega\eta$	
Γ_4 $b_1(1235)\pi$	seen
Γ_5 e^+e^-	seen
Γ_6 $\pi^0\gamma$	

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

 $\omega(1420) \Gamma(i)\Gamma(e^+e^-)/\Gamma^2(\text{total})$

NODE=M125230

$\Gamma(\rho\pi)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ **$\Gamma_1/\Gamma \times \Gamma_5/\Gamma$**

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

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

0.73 ± 0.08	13.1k	¹⁶ AULCHENKO	15A	SND	1.05–1.80 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
0.82 $\pm 0.05 \pm 0.06$		AUBERT,B	04N	BABR	10.6 $e^+e^- \rightarrow \pi^+\pi^-\pi^0\gamma$
0.65 $\pm 0.13 \pm 0.21$	1.2M	^{17,18} ACHASOV	03D	RVUE	0.44–2.00 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
0.625 ± 0.160		^{19,20} CLEGG	94	RVUE	
0.466 ± 0.178		^{21,22} ANTONELLI	92	DM2	1.34–2.4 $e^+e^- \rightarrow \rho\pi$

¹⁶ From a fit with contributions from $\omega(782)$, $\phi(1020)$, $\omega(1420)$, and $\omega(1650)$.

¹⁷ Calculated by us from the cross section at the peak.

¹⁸ 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.

¹⁹ From a fit to two Breit-Wigner functions and using the data of DOLINSKY 91 and ANTONELLI 92.

²⁰ From the partial and leptonic width given by the authors.

²¹ From a fit to two Breit-Wigner functions interfering between them and with the ω, ϕ tails with fixed (+, −, +) phases.

²² From the product of the leptonic width and partial branching ratio given by the authors.

NODE=M125G3;LINKAGE=A
NODE=M125G;LINKAGE=AW
NODE=M125G;LINKAGE=VH

NODE=M125G;LINKAGE=AD

NODE=M125G;LINKAGE=SE
NODE=M125G;LINKAGE=A

NODE=M125G;LINKAGE=ES

$\Gamma(\omega\pi\pi)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ **$\Gamma_2/\Gamma \times \Gamma_5/\Gamma$**

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

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

19.7 ± 5.7		AUBERT	07AU	BABR	10.6 $e^+e^- \rightarrow \omega\pi^+\pi^-\gamma$
1.9 ± 1.9		²³ AKHMETSHIN 00D	CMD2	1.2–2.4 $e^+e^- \rightarrow \omega\pi^+\pi^-$	

²³ 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

$\Gamma(\omega\eta)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ **$\Gamma_3/\Gamma \times \Gamma_5/\Gamma$**

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

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

1.6 $^{+0.9}_{-0.7}$	898	²⁴ ACHASOV	16B	SND	1.34–2.00 $e^+e^- \rightarrow \omega\eta$

²⁴ From a fit with contributions from $\omega(1420)$, $\omega(1650)$ and $\phi(1680)$. The mass and the width of $\omega(1420)$ are fixed to the 2014 edition (PDG 14) of this review.

NODE=M125G6
NODE=M125G6

NODE=M125G6;LINKAGE=A

$\Gamma(\pi^0\gamma)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ **$\Gamma_6/\Gamma \times \Gamma_5/\Gamma$**

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

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

2.03 $^{+0.70}_{-0.75}$		²⁵ AKHMETSHIN 05	CMD2	0.60–1.38 $e^+e^- \rightarrow \pi^0\gamma$

²⁵ 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

$\Gamma(\omega\pi\pi)/\Gamma_{\text{total}}$ **Γ_2/Γ**

VALUE DOCUMENT ID TECN COMMENT

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

0.301 ± 0.029	²⁶ HENNER	02	RVUE	1.2–2.0 $e^+e^- \rightarrow \rho\pi, \omega\pi\pi$
possibly seen	AKHMETSHIN 00D	CMD2		$e^+e^- \rightarrow \omega\pi^+\pi^-$

NODE=M125R2
NODE=M125R2

$\Gamma(\omega\pi\pi)/\Gamma(b_1(1235)\pi)$ Γ_2/Γ_4

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT

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

0.60±0.16	5095	ANISOVICH	00H SPEC	0.0 $p\bar{p} \rightarrow \omega\pi^0\pi^0\pi^0$

NODE=M125R1
 NODE=M125R1

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

VALUE	DOCUMENT ID	TECN	COMMENT

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

0.699±0.029	26 HENNER	02	RVUE	1.2–2.0 $e^+e^- \rightarrow \rho\pi, \omega\pi\pi$

NODE=M125R3
 NODE=M125R3

 $\Gamma(e^+e^-)/\Gamma_{\text{total}}$ Γ_5/Γ

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

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

~ 6.6	1.2M	27,28	ACHASOV	03D RVUE	0.44–2.00 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
23 ±1	26	HENNER	02	RVUE	1.2–2.0 $e^+e^- \rightarrow \rho\pi, \omega\pi\pi$

NODE=M125R4
 NODE=M125R4

26 Assuming that the $\omega(1420)$ decays into $\rho\pi$ and $\omega\pi\pi$ only.

27 Calculated by us from the cross section at the peak.

28 Assuming that the $\omega(1420)$ decays into $\rho\pi$ only.

NODE=M125R;LINKAGE=AC
 NODE=M125R;LINKAGE=AW
 NODE=M125R;LINKAGE=GS

 $\omega(1420)$ REFERENCES

NODE=M125

ACHASOV	16B	PR D94 092002	M. N. Achasov <i>et al.</i>	(SND Collab.)
AULCHENKO	15A	JETP 121 27	V.M. Aulchenko <i>et al.</i>	(SND Collab.)
Translated from ZETF 148 34.				
PDG	14	CP C38 070001	K. Olive <i>et al.</i>	(PDG Collab.)
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=57537
 REFID=56843

REFID=55687
 REFID=52049
 REFID=50330
 REFID=50184
 REFID=49577
 REFID=48815
 REFID=49177
 REFID=48311
 REFID=47935
 REFID=47948
 REFID=47391
 REFID=46323
 REFID=44081
 REFID=43168
 REFID=41369
 REFID=40581
 REFID=40280

REFID=21586
 REFID=20553

$f_2(1430)$

$I^G(J^{PC}) = 0^+(2^{++})$

NODE=M066

OMITTED FROM SUMMARY TABLE

This entry lists nearby peaks observed in the D wave of the $K\bar{K}$ and $\pi^+\pi^-$ systems. Needs confirmation.

NODE=M066

$f_2(1430)$ MASS

NODE=M066M1

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
≈ 1430 OUR ESTIMATE			
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
1453 ± 4	¹ VLADIMIRSK...01	SPEC	$40 \pi^- p \rightarrow K_S^0 K_S^0 n$
1421 ± 5	AUGUSTIN 87	DM2	$J/\psi \rightarrow \gamma \pi^+ \pi^-$
1480 ± 50	AKESSON 86	SPEC	$pp \rightarrow pp \pi^+ \pi^-$
1436^{+26}_{-16}	DAUM 84	CNTR	$17-18 \pi^- p \rightarrow K^+ K^- n$
1412 ± 3	DAUM 84	CNTR	$63 \pi^- p \rightarrow K_S^0 K_S^0 n, K^+ K^- n$
1439^{+5}_{-6}	² BEUSCH 67	OSPK	$5,7,12 \pi^- p \rightarrow K_S^0 K_S^0 n$
¹ $J^{PC} = 0^{++}$ or 2^{++} .			
² Not seen by WETZEL 76.			

NODE=M066M1
→ UNCHECKED ←

OCCUR=2

NODE=M066M;LINKAGE=AC
NODE=M066M;LINKAGE=C

$f_2(1430)$ WIDTH

NODE=M066W1

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
13 ± 5	³ VLADIMIRSK...01	SPEC	$40 \pi^- p \rightarrow K_S^0 K_S^0 n$
30 ± 9	AUGUSTIN 87	DM2	$J/\psi \rightarrow \gamma \pi^+ \pi^-$
150 ± 50	AKESSON 86	SPEC	$pp \rightarrow pp \pi^+ \pi^-$
81^{+56}_{-29}	DAUM 84	CNTR	$17-18 \pi^- p \rightarrow K^+ K^- n$
14 ± 6	DAUM 84	CNTR	$63 \pi^- p \rightarrow K_S^0 K_S^0 n, K^+ K^- n$
43^{+17}_{-18}	⁴ BEUSCH 67	OSPK	$5,7,12 \pi^- p \rightarrow K_S^0 K_S^0 n$
³ $J^{PC} = 0^{++}$ or 2^{++} .			
⁴ Not seen by WETZEL 76.			

NODE=M066W1

OCCUR=2

NODE=M066W;LINKAGE=AC
NODE=M066W;LINKAGE=C

$f_2(1430)$ DECAY MODES

NODE=M066215;NODE=M066

Mode	
Γ_1	$K\bar{K}$
Γ_2	$\pi\pi$

DESIG=1
DESIG=2

$f_2(1430)$ REFERENCES

NODE=M066

VLADIMIRSK... 01	PAN 64 1895 Translated from YAF 64 1979.	V.V. Vladmirsky <i>et al.</i>
AUGUSTIN 87	ZPHY C36 369	J.E. Augustin <i>et al.</i>
AKESSON 86	NP B264 154	T. Akesson <i>et al.</i>
DAUM 84	ZPHY C23 339	C. Daum <i>et al.</i>
WETZEL 76	NP B115 208	W. Wetzels <i>et al.</i>
BEUSCH 67	PL 25B 357	W. Beusch <i>et al.</i>

REFID=48571
REFID=40268
REFID=21123
REFID=21372
REFID=20362
REFID=20320

$a_0(1450)$

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

See minireview on scalar mesons under $f_0(500)$.

NODE=M149

NODE=M149

NODE=M149M

NODE=M149M
NEW **$a_0(1450)$ MASS**

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1467 ±14 OUR AVERAGE				
[1474 ± 19 MeV OUR 2016 AVERAGE]				
1458 ±14 ±15	190k	AAIJ	16N LHCB	$D^0 \rightarrow K_S^0 K^\pm \pi^\mp$
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	$0.0 \bar{p}p, \pi N$
$1316.8^{+0.7+24.7}_{-1.0-4.6}$		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^{+40}_{-15}	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	$0.0 \bar{p}p \rightarrow K^\pm K_S^0 \pi^\mp$
1450 ±40		AMSLER	94D CBAR	$0.0 \bar{p}p \rightarrow \pi^0 \pi^0 \eta$
1410 ±25		ETKIN	82C MPS	$23 \pi^- p \rightarrow n 2 K_S^0$
~ 1300		MARTIN	78 SPEC	$10 K^\pm p \rightarrow K_S^0 \pi p$
1255 ± 5		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
271 ±11 OUR AVERAGE				
[265 ± 13 MeV OUR 2016 AVERAGE]				
282 ±12 ±13	190k	AAIJ	16N LHCB	$D^0 \rightarrow K_S^0 K^\pm \pi^\mp$
265 ±15		ABELE	98 CBAR	$0.0 \bar{p}p \rightarrow K_L^0 K^\pm \pi^\mp$
265 ±30		¹ AMSLER	95D CBAR	$0.0 \bar{p}p \rightarrow \pi^0 \pi^0 \pi^0, \pi^0 \eta \eta, \pi^0 \pi^0 \eta$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
230 ±36		² ANISOVICH	09 RVUE	$0.0 \bar{p}p, \pi N$
$65.0^{+2.1+99.1}_{-5.4-32.6}$		³ UEHARA	09A BELL	$\gamma\gamma \rightarrow \pi^0 \eta$
196 ±10 ±10		⁴ BUGG	08A RVUE	$\bar{p}p$
267 ±11	80k	⁵ UMAN	06 E835	$5.2 \bar{p}p \rightarrow \eta \eta \pi^0$
110 ±14	35280	² BAKER	03 SPEC	$\bar{p}p \rightarrow \omega \pi^+ \pi^- \pi^0$
92 ±16		⁶ BARGIOTTI	03 OBLX	$\bar{p}p$
81 ±21		⁷ AMSLER	02 CBAR	$0.9 \bar{p}p \rightarrow \pi^0 \pi^0 \eta$
292 ±40		⁷ ANISOVICH	98B RVUE	Compilation
80 ± 5		⁸ BERTIN	98B OBLX	$0.0 \bar{p}p \rightarrow K^\pm K_S^0 \pi^\mp$
270 ±40		AMSLER	94D CBAR	$0.0 \bar{p}p \rightarrow \pi^0 \pi^0 \eta$
230 ±30		ETKIN	82C MPS	$23 \pi^- p \rightarrow n 2 K_S^0$
~ 250		MARTIN	78 SPEC	$10 K^\pm p \rightarrow K_S^0 \pi p$
79 ±10		⁹ CASON	76	

NODE=M149W

NODE=M149W
NEW

- 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=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)
$\Gamma_1 \quad \pi\eta$	0.093 ± 0.020
$\Gamma_2 \quad \pi\eta'(958)$	0.033 ± 0.017
$\Gamma_3 \quad K\bar{K}$	0.082 ± 0.028
$\Gamma_4 \quad \omega\pi\pi$	DEFINED AS 1
$\Gamma_5 \quad a_0(980)\pi\pi$	seen
$\Gamma_6 \quad \gamma\gamma$	seen

NODE=M149215;NODE=M149

DESIG=1
 DESIG=2
 DESIG=3
 DESIG=4
 DESIG=5
 DESIG=6

$a_0(1450) \Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

$\Gamma(\pi\eta) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$	$\Gamma_1\Gamma_6/\Gamma$
VALUE (eV)	DOCUMENT ID TECN COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •	
$432 \pm 6^{+1073}_{-256}$	¹ UEHARA 09A BELL $\gamma\gamma \rightarrow \pi^0\eta$
¹ May be a different state.	

NODE=M149225

NODE=M149G01
 NODE=M149G01

NODE=M149G01;LINKAGE=UE

$a_0(1450)$ BRANCHING RATIOS

$\Gamma(\pi\eta'(958))/\Gamma(\pi\eta)$	Γ_2/Γ_1
VALUE	DOCUMENT ID TECN COMMENT
0.35±0.16	¹ ABELE 98 CBAR $0.0 \bar{p}p \rightarrow K_L^0 K^\pm \pi^\mp$
• • • We do not use the following data for averages, fits, limits, etc. • • •	
0.43 ± 0.19	ABELE 97C CBAR $0.0 \bar{p}p \rightarrow \pi^0 \pi^0 \eta'$
¹ Using $\pi^0\eta$ from AMSLER 94D.	

NODE=M149220

NODE=M149R1
 NODE=M149R1

NODE=M149R1;LINKAGE=A

$\Gamma(K\bar{K})/\Gamma(\pi\eta)$	Γ_3/Γ_1
VALUE	DOCUMENT ID TECN COMMENT
0.88±0.23	¹ ABELE 98 CBAR $0.0 \bar{p}p \rightarrow K_L^0 K^\pm \pi^\mp$
¹ 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 EVTS	DOCUMENT ID TECN COMMENT
10.7±2.3	35280 ¹ BAKER 03 SPEC $\bar{p}p \rightarrow \omega\pi^+\pi^-\pi^0$
¹ Using results on $\bar{p}p \rightarrow a_0(1450)^0\pi^0$, $a_0(1450) \rightarrow \eta\pi^0$ from ABELE 96C and assuming the $\omega\rho$ mechanism for the $\omega\pi\pi$ state.	

NODE=M149R3
 NODE=M149R3

NODE=M149R;LINKAGE=PP

$\Gamma(a_0(980)\pi\pi)/\Gamma_{\text{total}}$	Γ_5/Γ
VALUE	DOCUMENT ID TECN COMMENT
seen	BUGG 08A RVUE $\bar{p}p$

NODE=M149R01
 NODE=M149R01

$\Gamma(a_0(980)\pi\pi)/\Gamma(\pi\eta)$	Γ_5/Γ_1
VALUE	DOCUMENT ID TECN CHG COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •	
≤ 4.3	ANISOVICH 01 RVUE 0 $\bar{p}p \rightarrow \eta 2\pi^+ 2\pi^-$

NODE=M149R02
 NODE=M149R02

$\Gamma(\gamma\gamma)/\Gamma_{\text{total}}$	Γ_6/Γ
VALUE	DOCUMENT ID TECN COMMENT
seen	¹ UEHARA 09A BELL $\gamma\gamma \rightarrow \pi^0\eta$
¹ May be a different state.	

NODE=M149R03
 NODE=M149R03

NODE=M149R03;LINKAGE=UE

$\rho(1450)$ REFERENCES

AAIJ	16N	PR D93 052018	R. Aaij <i>et al.</i>	(LHCb Collab.)
ANISOVICH	09	IJMP A24 2481	V.V. Anisovich, A.V. Sarantsev	
UEHARA	09A	PR D80 032001	S. Uehara <i>et al.</i>	(BELLE Collab.)
BUGG	08A	PR D78 074023	D.V. Bugg	(LOQM)
UMAN	06	PR D73 052009	I. Uman <i>et al.</i>	(FNAL E835)
BAKER	03	PL B563 140	C.A. Baker <i>et al.</i>	
BARGIOTTI	03	EPJ C26 371	M. Bargiotti <i>et al.</i>	(OBELIX Collab.)
AMSLER	02	EPJ C23 29	C. Amsler <i>et al.</i>	
ANISOVICH	01	NP A690 567	A.V. Anisovich <i>et al.</i>	
ABELE	98	PR D57 3860	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
ANISOVICH	98B	SPU 41 419	V.V. Anisovich <i>et al.</i>	
		Translated from UFN 168 481.		
BERTIN	98B	PL B434 180	A. Bertin <i>et al.</i>	(OBELIX Collab.)
ABELE	97C	PL B404 179	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
ABELE	96C	NP A609 562	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
AMSLER	95B	PL B342 433	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
AMSLER	95C	PL B353 571	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
AMSLER	95D	PL B355 425	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
AMSLER	94D	PL B333 277	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.) IGJPC
BUGG	94	PR D50 4412	D.V. Bugg <i>et al.</i>	(LOQM)
ETKIN	82C	PR D25 2446	A. Etkin <i>et al.</i>	(BNL, CUNY, TUFTS, VAND)
MARTIN	78	NP B134 392	A.D. Martin <i>et al.</i>	(DURH, GEVA)
CASON	76	PRL 36 1485	N.M. Cason <i>et al.</i>	(NDAM, ANL)

NODE=M149

REFID=57273
REFID=52719
REFID=53002
REFID=52578
REFID=51063
REFID=49414
REFID=49217
REFID=48580
REFID=48308
REFID=45863
REFID=46331

REFID=46351
REFID=45531
REFID=45076
REFID=44377
REFID=44440
REFID=44441
REFID=44093
REFID=44078
REFID=20391
REFID=22446
REFID=21064

 $\rho(1450)$

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

See our mini-review under the $\rho(1700)$.

NODE=M105

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. • • •

1510 ± 7	10.2k	¹ ACHASOV	16D	SND	$1.05-2.00 e^+e^- \rightarrow \pi^0\pi^0\gamma$
1544 ± 22 ⁺¹¹ ₋₄₆	821	² MATVIENKO	15	BELL	$\bar{B}^0 \rightarrow D^{*+}\omega\pi^-$
1491 ± 19	7815	³ ACHASOV	13	SND	$1.05-2.00 e^+e^- \rightarrow \pi^0\pi^0\gamma$
1582 ± 17 ± 25	2382	⁴ AKHMETSHIN 03B	CMD2		$e^+e^- \rightarrow \pi^0\pi^0\gamma$
1349 ± 25 ⁺¹⁰ ₋₅	341	⁵ ALEXANDER 01B	CLE2		$B \rightarrow D^{(*)}\omega\pi^-$
1523 ± 10		⁶ EDWARDS	00A	CLE2	$\tau^- \rightarrow \omega\pi^- \nu_\tau$
1463 ± 25		⁷ CLEGG	94	RVUE	
1250		⁸ ASTON	80C	OMEG	$20-70 \gamma p \rightarrow \omega\pi^0 p$
1290 ± 40		⁸ BARBER	80C	SPEC	$3-5 \gamma p \rightarrow \omega\pi^0 p$

¹ From a phenomenological model based on vector meson dominance with interfering $\rho(770)$, $\rho(1450)$ and $\rho(1700)$. The $\rho(1700)$ mass and width are fixed at 1720 MeV and 250 MeV, respectively. Systematic uncertainties not estimated. Supersedes ACHASOV 2013.

² Using Breit-Wigner parameterization of the $\rho(1450)$ and assuming equal probabilities of the $\rho(1450) \rightarrow \pi\pi$ and $\rho(1450) \rightarrow \omega\pi$ decays.

³ From a phenomenological model based on vector meson dominance with the interfering $\rho(1450)$ and $\rho(1700)$ and their widths fixed at 400 and 250 MeV, respectively. Systematic uncertainty not estimated.

NODE=M105M3
NODE=M105M3

OCCUR=2

NODE=M105M3;LINKAGE=D

NODE=M105M3;LINKAGE=C

NODE=M105M3;LINKAGE=AC

⁴ Using the data of AKHMETSHIN 03B and BISELLO 91B assuming the $\omega\pi^0$ and $\pi^+\pi^-$ mass dependence of the total width. $\rho(1700)$ mass and width fixed at 1700 MeV and 240 MeV, respectively.

⁵ Using Breit-Wigner parameterization of the $\rho(1450)$ and assuming the $\omega\pi^-$ mass dependence for the total width.

⁶ Mass-independent width parameterization. $\rho(1700)$ mass and width fixed at 1700 MeV and 235 MeV respectively.

⁷ Using data from BISELLO 91B, DOLINSKY 86 and ALBRECHT 87L.

⁸ Not separated from $b_1(1235)$, not pure $J^P = 1^-$ effect.

4 π MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
1435 $\pm$ 40	ABELE	01B	CBAR $0.0 \bar{p}n \rightarrow 2\pi^- 2\pi^0 \pi^+$
1350 $\pm$ 50	ACHASOV	97	RVUE $e^+e^- \rightarrow 2(\pi^+\pi^-)$
1449 $\pm$ 4	¹ ARMSTRONG	89E	OMEG $300 p p \rightarrow p p 2(\pi^+\pi^-)$

¹ Not clear whether this observation has $I=1$ or 0.

$\pi\pi$ 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	1	ABRAMOWICZ12	ZEUS	$e p \rightarrow e \pi^+ \pi^- p$
1493 ±15	2	LEES	12G	BABR $e^+ e^- \rightarrow \pi^+ \pi^- \gamma$
1446 ± 7 ±28 5.4M	3,4	FUJIKAWA	08	BELL $\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$
1328 ±15	5	SCHAEEL	05C	ALEP $\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$
1406 ±15 87k	3,6	ANDERSON	00A	CLE2 $\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$
~ 1368	7	ABELE	99C	CBAR $0.0 \bar{p} d \rightarrow \pi^+ \pi^- \pi^- p$
1348 ±33		BERTIN	98	OBLX $0.05\text{--}0.405 \bar{n} p \rightarrow 2\pi^+ \pi^-$
1411 ±14	8	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	6	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	9	KURDADZE	83	OLYA $0.64\text{--}1.4 e^+ e^- \rightarrow \pi^+ \pi^-$

¹ Using the KUHN 90 parametrization of the pion form factor, neglecting $\rho-\omega$ interference.

² 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.

³ From the GOUNARIS 68 parametrization of the pion form factor.

⁴ $|F_\pi(0)|^2$ fixed to 1.

⁵ 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.

⁶ $\rho(1700)$ mass and width fixed at 1700 MeV and 235 MeV, respectively.

⁷ $\rho(1700)$ mass and width fixed at 1780 MeV and 275 MeV respectively.

⁸ T-matrix pole.

⁹ Using for $\rho(1700)$ mass and width 1600 ± 20 and 300 ± 10 MeV respectively.

$K\bar{K}$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
1208 $\pm$8 $\pm$9	190k	¹ AAIJ	16N	LHCB	$D^0 \rightarrow K_S^0 K^\pm \pi^\mp$

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

1422.8 $\pm$ 6.5	27k	² ABELE	99D	CBAR $\pm$	$0.0 \bar{p}p \rightarrow K^+ K^- \pi^0$

¹ Using the GOUNARIS 68 parameterization with fixed width.

² K-matrix pole. Isospin not determined, could be $\omega(1420)$.

$K\bar{K}^*(892) + \text{c.c.}$ MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
1505 $\pm$ 19 $\pm$ 7	AUBERT	08S	BABR $10.6 e^+e^- \rightarrow K\bar{K}^*(892)\gamma$

$\rho(1450)$ WIDTH

VALUE (MeV)	DOCUMENT ID
400$\pm$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=M105M3;LINKAGE=HK

NODE=M105M3;LINKAGE=3Z

NODE=M105M;LINKAGE=E1

NODE=M105M3;LINKAGE=B

NODE=M105M3;LINKAGE=A

NODE=M105M6

NODE=M105M6

NODE=M105M6;LINKAGE=A

NODE=M105M5

NODE=M105M5

NODE=M105M5;LINKAGE=AB

NODE=M105M5;LINKAGE=LE

NODE=M105M;LINKAGE=1K

NODE=M105M5;LINKAGE=FU

NODE=M105M5;LINKAGE=SC

NODE=M105M5;LINKAGE=A

NODE=M105M5;LINKAGE=C5

NODE=M105M5;LINKAGE=QQ

NODE=M105M5;LINKAGE=KD

NODE=M105M7

NODE=M105M7

NODE=M105M7;LINKAGE=A

NODE=M105M7;LINKAGE=AN

NODE=M105M8

NODE=M105M8

NODE=M105210

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	¹ AKHMETSHIN 01B	CMD2	$e^+e^- \rightarrow \eta\gamma$
211 ± 31	² AKHMETSHIN 00D	CMD2	$e^+e^- \rightarrow \eta\pi^+\pi^-$
230 ± 30	ANTONELLI 88	DM2	$e^+e^- \rightarrow \eta\pi^+\pi^-$
60 ± 15	FUKUI 88	SPEC	$8.95 \pi^- p \rightarrow \eta\pi^+\pi^- n$

¹ 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=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. • • •				
440 ± 40	10.2k	¹ ACHASOV	16D	SND $1.05-2.00 e^+e^- \rightarrow \pi^0\pi^0\gamma$
303^{+31}_{-52}	821	² MATVIENKO	15	BELL $\bar{B}^0 \rightarrow D^{*+}\omega\pi^-$
$429 \pm 42 \pm 10$	2382	³ AKHMETSHIN 03B	CMD2	$e^+e^- \rightarrow \pi^0\pi^0\gamma$
$547 \pm 86^{+46}_{-45}$	341	⁴ ALEXANDER	01B	CLE2 $B \rightarrow D^{(*)}\omega\pi^-$
400 ± 35		⁵ EDWARDS	00A	CLE2 $\tau^- \rightarrow \omega\pi^- \nu_\tau$
311 ± 62		⁶ CLEGG	94	RVUE
300		⁷ ASTON	80C	OMEG $20-70 \gamma p \rightarrow \omega\pi^0 p$
320 ± 100		⁷ BARBER	80C	SPEC $3-5 \gamma p \rightarrow \omega\pi^0 p$

¹ From a phenomenological model based on vector meson dominance with interfering $\rho(770)$, $\rho(1450)$ and $\rho(1700)$. The $\rho(1700)$ mass and width are fixed at 1720 MeV and 250 MeV, respectively. Systematic uncertainties not estimated. Supersedes ACHASOV 2013.

² Using Breit-Wigner parameterization of the $\rho(1450)$ and assuming equal probabilities of the $\rho(1450) \rightarrow \pi\pi$ and $\rho(1450) \rightarrow \omega\pi$ decays.

³ Using the data of AKHMETSHIN 03B and BISELLO 91B assuming the $\omega\pi^0$ and $\pi^+\pi^-$ mass dependence of the total width. $\rho(1700)$ mass and width fixed at 1700 MeV and 240 MeV, respectively.

⁴ Using Breit-Wigner parameterization of the $\rho(1450)$ and assuming the $\omega\pi^-$ mass dependence for the total width.

⁵ Mass-independent width parameterization. $\rho(1700)$ mass and width fixed at 1700 MeV and 235 MeV respectively.

⁶ Using data from BISELLO 91B, DOLINSKY 86 and ALBRECHT 87L.

⁷ Not separated from $b_1(1235)$, not pure $J^P = 1^-$ effect.

NODE=M105W3
NODE=M105W3

OCCUR=3

NODE=M105W3;LINKAGE=D

NODE=M105W3;LINKAGE=C

NODE=M105W3;LINKAGE=HK

NODE=M105W3;LINKAGE=3Z

NODE=M105W;LINKAGE=E1

NODE=M105W3;LINKAGE=B

NODE=M105W3;LINKAGE=A

 4π MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
325 ± 100	ABELE	01B	CBAR $0.0 \bar{p}n \rightarrow 2\pi^- 2\pi^0 \pi^+$

NODE=M105W66
NODE=M105W66

 $\pi\pi$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$460 \pm 30^{+40}_{-45}$	63.5k	¹ ABRAMOWICZ12	ZEUS	$ep \rightarrow e\pi^+\pi^- p$
427 ± 31		² LEES	12G	BABR $e^+e^- \rightarrow \pi^+\pi^-\gamma$
$434 \pm 16 \pm 60$	5.4M	^{3,4} FUJIKAWA	08	BELL $\tau^- \rightarrow \pi^-\pi^0\nu_\tau$
468 ± 41		⁵ SCHAEAL	05C	ALEP $\tau^- \rightarrow \pi^-\pi^0\nu_\tau$
455 ± 41	87k	^{3,6} ANDERSON	00A	CLE2 $\tau^- \rightarrow \pi^-\pi^0\nu_\tau$
~ 374		⁷ 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		⁸ ABELE	97	CBAR $\bar{p}n \rightarrow \pi^-\pi^0\pi^0$
310 ± 40		⁶ 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		⁹ KURDADZE	83	OLYA $0.64-1.4 e^+e^- \rightarrow \pi^+\pi^-$

NODE=M105W5
NODE=M105W5

- ¹ Using the KUHN 90 parametrization of the pion form factor, neglecting $\rho-\omega$ interference.
² 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.
³ From the GOUNARIS 68 parametrization of the pion form factor.
⁴ $|F_\pi(0)|^2$ fixed to 1.
⁵ 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.
⁶ $\rho(1700)$ mass and width fixed at 1700 MeV and 235 MeV, respectively.
⁷ $\rho(1700)$ mass and width fixed at 1780 MeV and 275 MeV respectively.
⁸ T-matrix pole.
⁹ Using for $\rho(1700)$ mass and width 1600 ± 20 and 300 ± 10 MeV respectively.

 $K\bar{K}$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
410 ±19 ±35	190k	¹ AAIJ	16N	LHCB	$D^0 \rightarrow K_S^0 K^\pm \pi^\mp$

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

146.5 ±10.5	27k	² ABELE	99D	CBAR ±	0.0 $\bar{p}p \rightarrow K^+ K^- \pi^0$

¹ Using the GOUNARIS 68 parameterization with fixed mass.

² K-matrix pole. Isospin not determined, could be $\omega(1420)$.

 $K\bar{K}^*(892) + \text{c.c.}$ MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
418 ±25 ±4	AUBERT	08S	BABR 10.6 $e^+e^- \rightarrow K\bar{K}^*(892)\gamma$

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

 $\rho(1450)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $\pi\pi$	seen
Γ_2 4π	seen
Γ_3 $\omega\pi$	
Γ_4 $a_1(1260)\pi$	
Γ_5 $h_1(1170)\pi$	
Γ_6 $\pi(1300)\pi$	
Γ_7 $\rho\rho$	
Γ_8 $\rho(\pi\pi)$ S-wave	
Γ_9 e^+e^-	seen
Γ_{10} $\eta\rho$	seen
Γ_{11} $a_2(1320)\pi$	not seen
Γ_{12} $K\bar{K}$	not seen
Γ_{13} $K\bar{K}^*(892) + \text{c.c.}$	possibly seen
Γ_{14} $\eta\gamma$	seen
Γ_{15} $f_0(500)\gamma$	not seen
Γ_{16} $f_0(980)\gamma$	not seen
Γ_{17} $f_0(1370)\gamma$	not seen
Γ_{18} $f_2(1270)\gamma$	not seen

 $\rho(1450)$ $\Gamma(i)\Gamma(e^+e^-)/\Gamma(\text{total})$ **$\Gamma(\pi\pi) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$**

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
0.12	¹ DIEKMAN	88	RVUE $e^+e^- \rightarrow \pi^+\pi^-$
0.027 ^{+0.015} _{-0.010}	² KURDADZE	83	OLYA 0.64–1.4 $e^+e^- \rightarrow \pi^+\pi^-$

¹ Using total width = 235 MeV.

² Using for $\rho(1700)$ mass and width 1600 ± 20 and 300 ± 10 MeV respectively.

NODE=M105W5;LINKAGE=AB
 NODE=M105W5;LINKAGE=LE

NODE=M105W5;LINKAGE=1K
 NODE=M105W5;LINKAGE=FU
 NODE=M105W5;LINKAGE=SC

NODE=M105W5;LINKAGE=A
 NODE=M105W5;LINKAGE=C5
 NODE=M105W5;LINKAGE=QQ
 NODE=M105W5;LINKAGE=KD

NODE=M105W7
 NODE=M105W7

NODE=M105W7;LINKAGE=A
 NODE=M105W7;LINKAGE=AN

NODE=M105W8
 NODE=M105W8

NODE=M105215;NODE=M105

DESIG=1;OUR EST;→ UNCHECKED ←
 DESIG=2;OUR EST;→ UNCHECKED ←
 DESIG=6
 DESIG=10
 DESIG=11
 DESIG=12
 DESIG=13
 DESIG=14
 DESIG=4;OUR EST;→ UNCHECKED ←
 DESIG=3
 DESIG=8;OUR EST;→ UNCHECKED ←
 DESIG=7;OUR EVAL;→ UNCHECKED ←
 DESIG=15;OUR EST;→ UNCHECKED ←
 DESIG=9
 DESIG=16;OUR EST;→ UNCHECKED ←
 DESIG=17;OUR EST;→ UNCHECKED ←
 DESIG=18;OUR EST;→ UNCHECKED ←
 DESIG=19;OUR EST;→ UNCHECKED ←

NODE=M105220

NODE=M105G3
 NODE=M105G3

NODE=M105G3;LINKAGE=B
 NODE=M105G3;LINKAGE=KD

$$\Gamma(\eta\rho) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{10}\Gamma_9/\Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT

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

74 ± 20	¹ AKHMETSHIN 00D	CMD2	$e^+e^- \rightarrow \eta\pi^+\pi^-$
91 ± 19	ANTONELLI 88	DM2	$e^+e^- \rightarrow \eta\pi^+\pi^-$

¹ Using the data of ANTONELLI 88, DOLINSKY 91, and AKHMETSHIN 00D. The energy-independent width of the $\rho(1450)$ and $\rho(1700)$ mesons assumed.

NODE=M105G4
NODE=M105G4

NODE=M105G4;LINKAGE=KL

$$\Gamma(\eta\gamma) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{14}\Gamma_9/\Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT

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

<16.4	¹ AKHMETSHIN 05	CMD2	$0.60-1.38 e^+e^- \rightarrow \eta\gamma$
$2.2 \pm 0.5 \pm 0.3$	² AKHMETSHIN 01B	CMD2	$e^+e^- \rightarrow \eta\gamma$

¹ From 2γ decay mode of η using 1465 MeV and 310 MeV for the $\rho(1450)$ mass and width. Recalculated by us.

² Using the data of AKHMETSHIN 01B on $e^+e^- \rightarrow \eta\gamma$, AKHMETSHIN 00D and ANTONELLI 88 on $e^+e^- \rightarrow \eta\pi^+\pi^-$. Recalculated by us using width of 226 MeV.

NODE=M105G6
NODE=M105G6

NODE=M105G6;LINKAGE=AK

NODE=M105G;LINKAGE=SW

$$\Gamma(K\bar{K}^*(892)+\text{c.c.}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{13}\Gamma_9/\Gamma$$

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

$$\rho(1450) \Gamma(i)/\Gamma(\text{total}) \times \Gamma(e^+e^-)/\Gamma(\text{total})$$

NODE=M105230

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

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

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

2.1 ± 0.4	10.2k	¹ ACHASOV	16D	SND $1.05-2.00 e^+e^- \rightarrow \pi^0\pi^0\gamma$
5.3 ± 0.4	7815	² ACHASOV	13	SND $1.05-2.00 e^+e^- \rightarrow \pi^0\pi^0\gamma$

¹ From a phenomenological model based on vector meson dominance with interfering $\rho(770)$, $\rho(1450)$ and $\rho(1700)$. The $\rho(1700)$ mass and width are fixed at 1720 MeV and 250 MeV, respectively. Systematic uncertainties not estimated. Supersedes ACHASOV 2013.

² From a phenomenological model based on vector meson dominance with the interfering $\rho(1450)$ and $\rho(1700)$ and their widths fixed at 400 and 250 MeV, respectively. Systematic uncertainty not estimated.

OCCUR=3

NODE=M105R05;LINKAGE=A

NODE=M105R05;LINKAGE=AC

$$\Gamma(\eta\rho)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{10}/\Gamma \times \Gamma_9/\Gamma$$

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

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

$4.3^{+1.1}_{-0.9} \pm 0.2$	4.9k	¹ AULCHENKO	15	SND $1.22-2.00 e^+e^- \rightarrow \eta\pi^+\pi^-$

¹ From a fit to the $e^+e^- \rightarrow \eta\pi^+\pi^-$ cross section with vector meson dominance model including $\rho(770)$, $\rho(1450)$, and $\rho(1700)$ decaying exclusively via $\eta\rho(770)$. Masses and widths of vector states are fixed to PDG 14. Coupling constants are assumed to be real.

NODE=M105R00
NODE=M105R00

NODE=M105R00;LINKAGE=A

$$\Gamma(f_0(500)\gamma)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{15}/\Gamma \times \Gamma_9/\Gamma$$

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	¹ ACHASOV	11	SND $e^+e^- \rightarrow \pi^0\pi^0\gamma$

NODE=M105R04
NODE=M105R04

¹ Using Breit-Wigner parametrization of the $\rho(1450)$ with mass and width of 1465 MeV and 400 MeV, respectively.

NODE=M105R01;LINKAGE=AC

$\rho(1450)$ BRANCHING RATIOS

NODE=M105225

 $\Gamma(\pi\pi)/\Gamma(4\pi)$ **Γ_1/Γ_2**

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.37 ± 0.10	^{1,2} ABELE	01B	CBAR $0.0 \bar{p} n \rightarrow 5\pi$
¹ $\omega\pi$ not included.			
² Using ABELE 97.			

NODE=M105R15
NODE=M105R15NODE=M105R;LINKAGE=BL
NODE=M105R;LINKAGE=LK **$\Gamma(\omega\pi)/\Gamma_{\text{total}}$** **$\Gamma_3/\Gamma$**

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
seen	821	¹ MATVIENKO	15	BELL $\bar{B}^0 \rightarrow D^{*+} \omega \pi^-$
seen	1.6k	ACHASOV	12	SND $e^+ e^- \rightarrow \pi^0 \pi^0 \gamma$
~ 0.21		CLEGG	94	RVUE

NODE=M105R5
NODE=M105R5¹ Using Breit-Wigner parameterization of the $\rho(1450)$ and assuming equal probabilities of the $\rho(1450) \rightarrow \pi\pi$ and $\rho(1450) \rightarrow \omega\pi$ decays.

NODE=M105R5;LINKAGE=A

 $\Gamma(\pi\pi)/\Gamma(\omega\pi)$ **Γ_1/Γ_3**

VALUE	DOCUMENT ID	TECN
• • • We do not use the following data for averages, fits, limits, etc. • • •		
~ 0.32	CLEGG	94 RVUE

NODE=M105R6
NODE=M105R6 **$\Gamma(\omega\pi)/\Gamma(4\pi)$** **$\Gamma_3/\Gamma_2$**

VALUE	DOCUMENT ID	TECN
• • • We do not use the following data for averages, fits, limits, etc. • • •		
< 0.14	CLEGG	88 RVUE

NODE=M105R3
NODE=M105R3 **$\Gamma(a_1(1260)\pi)/\Gamma(4\pi)$** **$\Gamma_4/\Gamma_2$**

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.27 ± 0.08	¹ ABELE	01B	CBAR $0.0 \bar{p} n \rightarrow 5\pi$
¹ $\omega\pi$ not included.			

NODE=M105R10
NODE=M105R10

NODE=M105R10;LINKAGE=BL

 $\Gamma(h_1(1170)\pi)/\Gamma(4\pi)$ **Γ_5/Γ_2**

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.08 ± 0.04	¹ ABELE	01B	CBAR $0.0 \bar{p} n \rightarrow 5\pi$
¹ $\omega\pi$ not included.			

NODE=M105R11
NODE=M105R11

NODE=M105R11;LINKAGE=BL

 $\Gamma(\pi(1300)\pi)/\Gamma(4\pi)$ **Γ_6/Γ_2**

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.37 ± 0.13	¹ ABELE	01B	CBAR $0.0 \bar{p} n \rightarrow 5\pi$
¹ $\omega\pi$ not included.			

NODE=M105R12
NODE=M105R12

NODE=M105R12;LINKAGE=BL

 $\Gamma(\rho\rho)/\Gamma(4\pi)$ **Γ_7/Γ_2**

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.11 ± 0.05	¹ ABELE	01B	CBAR $0.0 \bar{p} n \rightarrow 5\pi$
¹ $\omega\pi$ not included.			

NODE=M105R13
NODE=M105R13

NODE=M105R13;LINKAGE=BL

 $\Gamma(\rho(\pi\pi)_{\text{S-wave}})/\Gamma(4\pi)$ **Γ_8/Γ_2**

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.17 ± 0.09	¹ ABELE	01B	CBAR $0.0 \bar{p} n \rightarrow 5\pi$
¹ $\omega\pi$ not included.			

NODE=M105R14
NODE=M105R14

NODE=M105R14;LINKAGE=BL

 $\Gamma(\eta\rho)/\Gamma_{\text{total}}$ **Γ_{10}/Γ**

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
seen	35	¹ ACHASOV	14	SND $1.15-2.00 e^+ e^- \rightarrow \eta \gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
< 0.04		DONNACHIE	87B	RVUE

NODE=M105R2
NODE=M105R2¹ From a phenomenological model based on vector meson dominance with $\rho(1450)$ and $\phi(1680)$ masses and widths from the PDG 12.

NODE=M105R2;LINKAGE=A

$\Gamma(\eta\rho)/\Gamma(\omega\pi)$ Γ_{10}/Γ_3

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.081 ± 0.020	^{1,2} AULCHENKO 15	SND	$1.22-2.00 \text{ e}^+ \text{e}^- \rightarrow \eta \pi^+ \pi^-$
~ 0.24	³ DONNACHIE 91	RVUE	
>2	FUKUI 91	SPEC	$8.95 \pi^- p \rightarrow \omega \pi^0 n$

¹ From a fit to the $\text{e}^+ \text{e}^- \rightarrow \eta \pi^+ \pi^-$ cross section with vector meson dominance model including $\rho(770)$, $\rho(1450)$, and $\rho(1700)$ decaying exclusively via $\eta \rho(770)$. Masses and widths of vector states are fixed to PDG 14. Coupling constants are assumed to be real.

² Reports the inverse of the quoted value as 12.3 ± 3.1 .

³ Using data from BISELLO 91B, DOLINSKY 86 and ALBRECHT 87L.

NODE=M105R4
NODE=M105R4

NODE=M105R4;LINKAGE=A

NODE=M105R4;LINKAGE=B
NODE=M105R;LINKAGE=A

 $\Gamma(\pi\pi)/\Gamma(\eta\rho)$ Γ_1/Γ_{10}

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
1.3 ± 0.4	¹ AULCHENKO 15	SND	$1.22-2.00 \text{ e}^+ \text{e}^- \rightarrow \eta \pi^+ \pi^-$

¹ From a fit to the $\text{e}^+ \text{e}^- \rightarrow \eta \pi^+ \pi^-$ cross section with vector meson dominance model including $\rho(770)$, $\rho(1450)$, and $\rho(1700)$ decaying exclusively via $\eta \rho(770)$. Masses and widths of vector states are fixed to PDG 14. Coupling constants are assumed to be real.

NODE=M105R07
NODE=M105R07

NODE=M105R07;LINKAGE=A

 $\Gamma(a_2(1320)\pi)/\Gamma_{\text{total}}$ Γ_{11}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
not seen	AMELIN 00	VES	$37 \pi^- p \rightarrow \eta \pi^+ \pi^- n$

NODE=M105R9
NODE=M105R9

 $\Gamma(K\bar{K})/\Gamma(\omega\pi)$ Γ_{12}/Γ_3

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
<0.08	¹ DONNACHIE 91	RVUE	

¹ Using data from BISELLO 91B, DOLINSKY 86 and ALBRECHT 87L.

NODE=M105R8
NODE=M105R8

NODE=M105R8;LINKAGE=A

 $\Gamma(K\bar{K}^*(892) + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{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=M105R16
NODE=M105R16

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

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
seen	35	¹ ACHASOV 14	SND	$1.15-2.00 \text{ e}^+ \text{e}^- \rightarrow \eta \gamma$

¹ From a phenomenological model based on vector meson dominance with $\rho(1450)$ and $\phi(1680)$ masses and widths from the PDG 12.

NODE=M105R06
NODE=M105R06

NODE=M105R06;LINKAGE=A

 $\rho(1450)$ REFERENCES

NODE=M105

AAIJ 16N	PR D93 052018	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=57273
ACHASOV 16D	PR D94 112001	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=57618
AULCHENKO 15	PR D91 052013	V.M. Aulchenko <i>et al.</i>	(SND Collab.)	REFID=56793
MATVIENKO 15	PR D92 012013	D. Matvienko <i>et al.</i>	(BELLE Collab.)	REFID=56601
ACHASOV 14	PR D90 032002	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=55912
PDG 14	CP C38 070001	K. Olive <i>et al.</i>	(PDG Collab.)	REFID=55687
ACHASOV 13	PR D88 054013	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=55584
ABRAMOWICZ 12	EPJ C72 1869	H. Abramowicz <i>et al.</i>	(ZEUS Collab.)	REFID=54274
ACHASOV 12	JETPL 94 734	M.N. Achasov <i>et al.</i>		REFID=54275
Translated from ZETFP 94 796.				
LEES 12G	PR D86 032013	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=54299
PDG 12	PR D86 010001	J. Beringer <i>et al.</i>	(PDG Collab.)	REFID=54066
ACHASOV 11	JETP 113 75	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=16721
Translated from ZETF 140 87.				
AUBERT 08S	PR D77 092002	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52242
FUJIKAWA 08	PR D78 072006	M. Fujikawa <i>et al.</i>	(BELLE Collab.)	REFID=52536
AKHMETSHIN 05	PL B605 26	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=50330
ALOISIO 05	PL B606 12	A. Aloisio <i>et al.</i>	(KLOE Collab.)	REFID=51112
SCHAEEL 05C	PRPL 421 191	S. Schaeel <i>et al.</i>	(ALEPH Collab.)	REFID=50845
AKHMETSHIN 04	PL B578 285	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=49609
COAN 04	PRL 92 232001	T.E. Coan <i>et al.</i>	(CLEO Collab.)	REFID=49945
AKHMETSHIN 03B	PL B562 173	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=49406
ABELE 01B	EPJ C21 261	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)	REFID=48356
AKHMETSHIN 01B	PL B509 217	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=48167
ALEXANDER 01B	PR D64 092001	J.P. Alexander <i>et al.</i>	(CLEO Collab.)	REFID=48391
AKHMETSHIN 00D	PL B489 125	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=47935
AMELIN 00	NP A668 83	D. Amelin <i>et al.</i>	(VES Collab.)	REFID=47432
ANDERSON 00A	PR D61 112002	S. Anderson <i>et al.</i>	(CLEO Collab.)	REFID=47468
EDWARDS 00A	PR D61 072003	K.W. Edwards <i>et al.</i>	(CLEO Collab.)	REFID=47465
ABELE 99C	PL B450 275	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)	REFID=46916

ABELE	99D	PL B468 178	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
BERTIN	98	PR D57 55	A. Bertin <i>et al.</i>	(OBELIX Collab.)
ABELE	97	PL B391 191	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
ACHASOV	97	PR D55 2663	N.N. Achasov <i>et al.</i>	(NOVM)
BARATE	97M	ZPHY C76 15	R. Barate <i>et al.</i>	(ALEPH Collab.)
BERTIN	97C	PL B408 476	A. Bertin <i>et al.</i>	(OBELIX Collab.)
BERTIN	97D	PL B414 220	A. Bertin <i>et al.</i>	(OBELIX Collab.)
CLEGG	94	ZPHY C62 455	A.B. Clegg, A. Donnachie	(LANC, MCHS)
BISELLO	91B	NPBPS B21 111	D. Bisello	(DM2 Collab.)
DOLINSKY	91	PRPL 202 99	S.I. Dolinsky <i>et al.</i>	(NOVO)
DONNACHIE	91	ZPHY C51 689	A. Donnachie, A.B. Clegg	(MCHS, LANC)
FUKUI	91	PL B257 241	S. Fukui <i>et al.</i>	(SUGI, NAGO, KEK, KYOT+)
KUHN	90	ZPHY C48 445	J.H. Kuhn <i>et al.</i>	(MPIM)
ARMSTRONG	89E	PL B228 536	T.A. Armstrong, M. Benayoun	(ATHU, BARI, BIRM+)
BISELLO	89	PL B220 321	D. Bisello <i>et al.</i>	(DM2 Collab.)
DUBNICKA	89	JP G15 1349	S. Dubnicka <i>et al.</i>	(JINR, SLOV)
ANTONELLI	88	PL B212 133	A. Antonelli <i>et al.</i>	(DM2 Collab.)
CLEGG	88	ZPHY C40 313	A.B. Clegg, A. Donnachie	(MCHS, LANC)
DIEKMANN	88	PRPL 159 99	B. Diekmann	(BONN)
FUKUI	88	PL B202 441	S. Fukui <i>et al.</i>	(SUGI, NAGO, KEK, KYOT+)
ALBRECHT	87L	PL B185 223	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
DONNACHIE	87B	ZPHY C34 257	A. Donnachie, A.B. Clegg	(MCHS, LANC)
DOLINSKY	86	PL B174 453	S.I. Dolinsky <i>et al.</i>	(NOVO)
BARKOV	85	NP B256 365	L.M. Barkov <i>et al.</i>	(NOVO)
KURDADZE	83	JETPL 37 733	L.M. Kurdadze <i>et al.</i>	(NOVO)
ASTON	80C	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	

REFID=47401
 REFID=45782
 REFID=45415
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 REFID=20652
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NODE=M175

 $\eta(1475)$

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

See also the $\eta(1405)$.

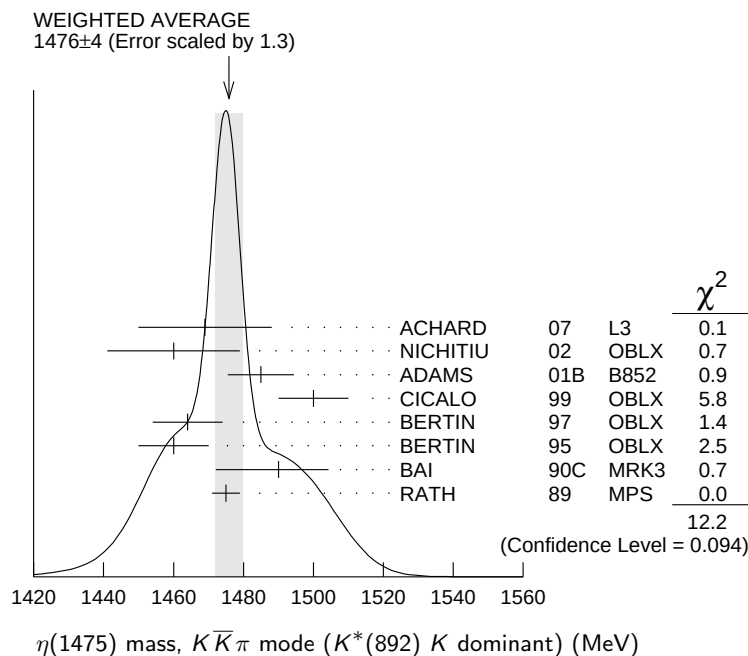
NODE=M175

 $\eta(1475)$ MASS

NODE=M175205

 $K\bar{K}\pi$ MODE ($K^*(892)$ K dominant)NODE=M175M5
NODE=M175M5

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 $e^+e^- \rightarrow e^+e^- K_S^0 K^\pm \pi^\mp$
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 $^{+14}_{-8} + \frac{3}{-16}$	1100	BAI	90C MRK3	$J/\psi \rightarrow \gamma K_S^0 K^\pm \pi^\mp$
1475 ± 4		RATH	89 MPS	21.4 $\pi^- p \rightarrow n K_S^0 K_S^0 \pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1565 ± 8 $^{+0}_{-63}$		¹ ABLIKIM	15T BES3	$J/\psi \rightarrow \gamma K_S^0 K_S^0 \eta$
1421 ± 14		AUGUSTIN	92 DM2	$J/\psi \rightarrow \gamma K\bar{K}\pi$

¹ Could also be the $\eta(1405)$.OCCUR=2
OCCUR=2OCCUR=2
NODE=M175M5;LINKAGE=A

$\eta(1475)$ 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⁺¹³ ₋₂₁₋₂₄		BAI	90C MRK3	$J/\psi \rightarrow \gamma K_S^0 K^\pm \pi^\mp$
51±13		RATH	89 MPS	21.4 $\pi^- p \rightarrow n K_S^0 K_S^0 \pi^0$
54 ⁺¹⁴⁺²¹ ₋₁₃₋₂₈		¹ ABLIKIM	15T BES3	$J/\psi \rightarrow \gamma K_S^0 K_S^0 \eta$

OCCUR=2

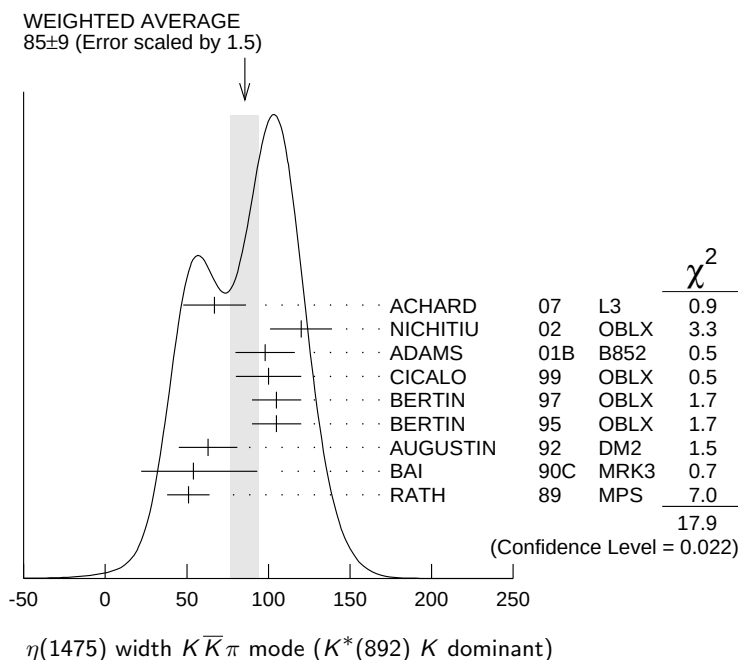
OCCUR=2

OCCUR=2

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

¹ Could also be the $\eta(1405)$.

NODE=M175W5;LINKAGE=A

 $\eta(1475)$ DECAY MODES

NODE=M175215;NODE=M175

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
Γ_5 $K_S^0 K_S^0 \eta$	possibly seen

DESIG=2;OUR EST;→ UNCHECKED ←
DESIG=1;OUR EST;→ UNCHECKED ←
DESIG=4;OUR EST;→ UNCHECKED ←
DESIG=7;OUR EST;→ UNCHECKED ←
DESIG=8;OUR EVAL;→ UNCHECKED ←
 $\eta(1475)$ $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

NODE=M175220

 $\Gamma(K\bar{K}\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_1\Gamma_4/\Gamma$

VALUE (keV)	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
0.23±0.05±0.05		74	¹ ACHARD	07 L3	183-209 $e^+e^- \rightarrow K_S^0 K^\pm \pi^\mp$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 0.089	90	2,3	AHOHE	05 CLE2	10.6 $e^+e^- \rightarrow K_S^0 K^\pm \pi^\mp$

NODE=M175G2
NODE=M175G2

- ¹Supersedes ACCIARRI 01G. Compatible with $K^* K$ decay. Using $B(K_S^0 \rightarrow \pi^+ \pi^-) = 0.6895$.
- ²Using $\eta(1475)$ 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.
- ³Assuming 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

$$\Gamma(K\bar{K}^*(892) + \text{c.c.}) / \Gamma(K\bar{K}\pi) \quad \Gamma_2 / \Gamma_1$$

VALUE	DOCUMENT ID	TECN	COMMENT

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

0.50 ± 0.10	¹ BAILLON	67	HBC	$0.0 \bar{p} p \rightarrow K\bar{K}\pi\pi\pi$

¹Data could also refer to $\eta(1405)$.

NODE=M175225

NODE=M175R1
NODE=M175R1

NODE=M175R;LINKAGE=BL

$$\Gamma(K\bar{K}^*(892) + \text{c.c.}) / [\Gamma(K\bar{K}^*(892) + \text{c.c.}) + \Gamma(a_0(980)\pi)] \quad \Gamma_2 / (\Gamma_2 + \Gamma_3)$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

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

< 0.25	90	EDWARDS	82E	CBAL $J/\psi \rightarrow K^+ K^- \pi^0 \gamma$

NODE=M175R6
NODE=M175R6 **$\eta(1475)$ REFERENCES**

ABLIKIM	15T	PRL 115 091803	M. Ablikim <i>et al.</i>	(BES III Collab.)
ACHARD	07	JHEP 0703 018	P. Achard <i>et al.</i>	(L3 Collab.)
AHOHE	05	PR D71 072001	R. Ahohe <i>et al.</i>	(CLEO Collab.)
NICHITIU	02	PL B545 261	F. Nichitiu <i>et al.</i>	(OBELIX Collab.)
ACCIARRI	01G	PL B501 1	M. Acciarri <i>et al.</i>	(L3 Collab.)
ADAMS	01B	PL B516 264	G.S. Adams <i>et al.</i>	(BNL E852 Collab.)
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)

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REFID=21314
REFID=20407

NODE=M152

 $f_0(1500)$

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

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 **G33** 1 (2006).

NODE=M152

 $f_0(1500)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

1504 ± 6 OUR AVERAGE Error includes scale factor of 1.3. See the ideogram below.

$1468^{+14}_{-15} \pm 23_{-74}$	5.5k	¹ ABLIKIM	13N	BES3 $e^+ e^- \rightarrow J/\psi \rightarrow \gamma \eta \eta$
$1466 \pm 6 \pm 20$		ABLIKIM	06v	BES2 $e^+ e^- \rightarrow J/\psi \rightarrow \gamma \pi^+ \pi^-$
1515 ± 12		² BARBERIS	00A	$450 \bar{p} p \rightarrow p_f \eta \eta p_s$
1511 ± 9		^{2,3} BARBERIS	00C	$450 \bar{p} p \rightarrow p_f 4\pi p_s$
1510 ± 8		² BARBERIS	00E	$450 \bar{p} p \rightarrow p_f \eta \eta p_s$
1522 ± 25		BERTIN	98	OBLX $0.05\text{--}0.405 \bar{n} p \rightarrow \pi^+ \pi^+ \pi^-$
1449 ± 20		² 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		⁴ AMSLER	95B	CBAR $0.0 \bar{p} p \rightarrow 3\pi^0$
1505 ± 15		⁵ 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. • • •

$1447 \pm 16 \pm 13$	163	^{6,7} DOBBS	15	$J/\psi \rightarrow \gamma \pi^+ \pi^-$
$1442 \pm 9 \pm 4$	261	^{6,7} DOBBS	15	$\psi(2S) \rightarrow \gamma \pi^+ \pi^-$
1486 ± 10		² ANISOVICH	09	RVUE $0.0 \bar{p} p, \pi N$
1470 ± 60	568	⁸ KLEMP	08	E791 $D_s^+ \rightarrow \pi^- \pi^+ \pi^+$
$1470^{+6}_{-7} \pm 25_{-255}$		⁹ 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	^{10,11} 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		¹⁰ BINON	05	GAMS $33 \pi^- p \rightarrow \eta \eta n$

NODE=M152M

NODE=M152M

OCCUR=2

OCCUR=2

1524±14	1400	12	GARMASH	05	BELL	$B^+ \rightarrow K^+ K^+ K^-$
1489 ⁺⁸ ₋₄		13	ANISOVICH	03	RVUE	
1490±30		10	ABELE	01	CBAR	0.0 $\bar{p}d \rightarrow \pi^- 4\pi^0 p$
1497±10		10	BARBERIS	99	OMEG	450 $pp \rightarrow p_S p_f K^+ K^-$
1502±10		10	BARBERIS	99B	OMEG	450 $pp \rightarrow p_S p_f \pi^+ \pi^-$
1502±12±10		14	BARBERIS	99D	OMEG	450 $pp \rightarrow K^+ K^-, \pi^+ \pi^-$
1530±45		10	BELLAZZINI	99	GAM4	450 $pp \rightarrow pp\pi^0\pi^0$
1505±18		10	FRENCH	99		300 $pp \rightarrow p_f(K^+ K^-) p_S$
1447±27		15	KAMINSKI	99	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}, \sigma\sigma$
1580±80		10	ALDE	98	GAM4	100 $\pi^- p \rightarrow \pi^0\pi^0 n$
1499±8		2	ANISOVICH	98B	RVUE	Compilation
~1520			REYES	98	SPEC	800 $pp \rightarrow p_S p_f K_S^0 K_S^0$
1510±20		2	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		2	ABELE	96C	RVUE	Compilation
1460±20	120	10	AMELIN	96B	VES	37 $\pi^- A \rightarrow \eta\eta\pi^- A$
1500±8			BUGG	96	RVUE	
1500±10		16	AMSLER	95D	CBAR	0.0 $\bar{p}p \rightarrow \pi^0\pi^0\pi^0, \pi^0\eta\eta, \pi^0\pi^0\eta$
1445±5		17	ANTINORI	95	OMEG	300,450 $pp \rightarrow pp2(\pi^+ \pi^-)$
1497±30		10	ANTINORI	95	OMEG	300,450 $pp \rightarrow pp\pi^+ \pi^-$
~1505			BUGG	95	MRK3	$J/\psi \rightarrow \gamma\pi^+ \pi^- \pi^+ \pi^-$
1446±5		10	ABATZIS	94	OMEG	450 $pp \rightarrow pp2(\pi^+ \pi^-)$
1545±25		10	AMSLER	94E	CBAR	0.0 $\bar{p}p \rightarrow \pi^0\eta\eta'$
1520±25		2,18	ANISOVICH	94	CBAR	0.0 $\bar{p}p \rightarrow 3\pi^0, \pi^0\eta\eta$
1505±20		2,19	BUGG	94	RVUE	$\bar{p}p \rightarrow 3\pi^0, \eta\eta\pi^0, \eta\pi^0\pi^0$
1560±25		10	AMSLER	92	CBAR	0.0 $\bar{p}p \rightarrow \pi^0\eta\eta$
1550±45±30		10	BELADIDZE	92C	VES	36 $\pi^- \text{Be} \rightarrow \pi^- \eta' \eta \text{Be}$
1449±4		10	ARMSTRONG	89E	OMEG	300 $pp \rightarrow pp2(\pi^+ \pi^-)$
1610±20		10	ALDE	88	GAM4	300 $\pi^- N \rightarrow \pi^- N 2\eta$
~1525			ASTON	88D	LASS	11 $K^- p \rightarrow K_S^0 K_S^0 \Lambda$
1570±20	600	10	ALDE	87	GAM4	100 $\pi^- p \rightarrow 4\pi^0 n$
1575±45		20	ALDE	86D	GAM4	100 $\pi^- p \rightarrow 2\eta n$
1568±33		10	BINON	84C	GAM2	38 $\pi^- p \rightarrow \eta\eta' n$
1592±25		10	BINON	83	GAM2	38 $\pi^- p \rightarrow 2\eta n$
1525±5		10	GRAY	83	DBC	0.0 $\bar{p}N \rightarrow 3\pi$

OCCUR=2

¹ From partial wave analysis including all possible combinations of 0^{++} , 2^{++} , and 4^{++} resonances.

² T-matrix pole.

³ Average between $\pi^+ \pi^- 2\pi^0$ and $2(\pi^+ \pi^-)$.

⁴ T-matrix pole, supersedes ANISOVICH 94.

⁵ T-matrix pole, supersedes ANISOVICH 94 and AMSLER 92.

⁶ Using CLEO-c data but not authored by the CLEO Collaboration.

⁷ From a fit to a Breit-Wigner line shape with fixed $\Gamma = 109$ MeV.

⁸ Reanalysis of AITALA 01A data. This state could also be $f_0(1370)$.

⁹ Breit-Wigner mass. May also be the $f_0(1370)$.

¹⁰ Breit-Wigner mass.

¹¹ Statistical error only.

¹² Breit-Wigner, solution 1, PWA ambiguous.

¹³ K-matrix pole from combined analysis of $\pi^- p \rightarrow \pi^0\pi^0 n$, $\pi^- p \rightarrow K\bar{K}n$, $\pi^+ \pi^- \rightarrow \pi^+ \pi^-$, $\bar{p}p \rightarrow \pi^0\pi^0\pi^0$, $\pi^0\eta\eta$, $\pi^0\pi^0\eta$, $\pi^+ \pi^- \pi^0$, $K^+ K^- \pi^0$, $K_S^0 K_S^0 \pi^0$, $K^+ K_S^0 \pi^-$ at rest, $\bar{p}n \rightarrow \pi^- \pi^- \pi^+$, $K_S^0 K^- \pi^0$, $K_S^0 K_S^0 \pi^-$ at rest.

¹⁴ Supersedes BARBERIS 99 and BARBERIS 99B.

¹⁵ T-matrix pole on sheet $--+$.

¹⁶ T-matrix pole. Coupled-channel analysis of AMSLER 95B, AMSLER 95C, and AMSLER 94D.

¹⁷ Supersedes ABATZIS 94, ARMSTRONG 89E. Breit-Wigner mass.

¹⁸ From a simultaneous analysis of the annihilations $\bar{p}p \rightarrow 3\pi^0, \pi^0\eta\eta$.

¹⁹ Reanalysis of ANISOVICH 94 data.

²⁰ From central value and spread of two solutions. Breit-Wigner mass.

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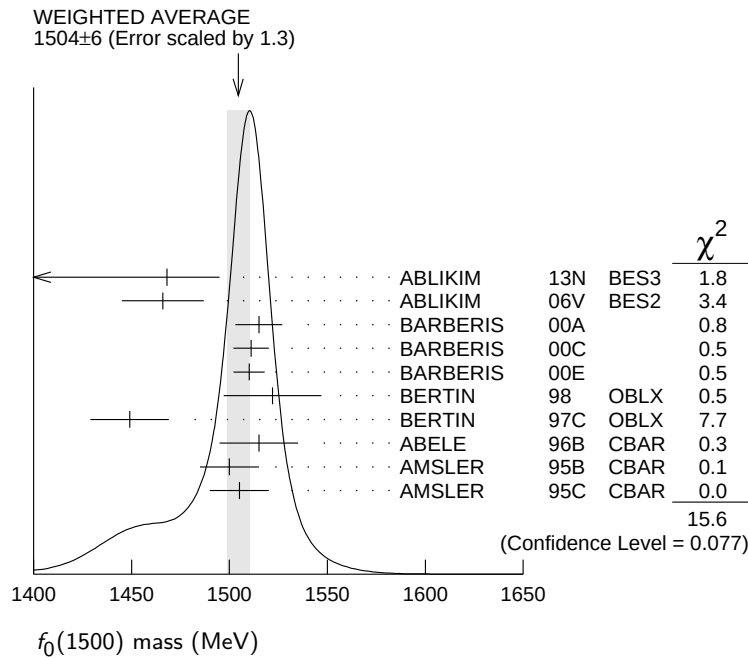
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$f_0(1500)$ WIDTH

NODE=M152W

NODE=M152W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
109± 7 OUR AVERAGE				
136 ⁺⁴¹⁺²⁸ ₋₂₆₋₁₀₀	5.5k	21 ABLIKIM 13N BES3		$e^+e^- \rightarrow J/\psi \rightarrow \gamma\eta\eta$
108 ⁺¹⁴ _{-11±25}		ABLIKIM 06V BES2		$e^+e^- \rightarrow J/\psi \rightarrow \gamma\pi^+\pi^-$
110± 24		22 BARBERIS 00A		450 $pp \rightarrow p_f\eta\eta p_s$
102± 18	22,23	BARBERIS 00C		450 $pp \rightarrow p_f4\pi p_s$
110± 16	22	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	22	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	24	AMSLER 95B CBAR		0.0 $\bar{p}p \rightarrow 3\pi^0$
120± 30	25	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		22 ANISOVICH 09 RVUE		0.0 $\bar{p}p, \pi N$
90 ⁺²⁺⁵⁰ ₋₁₋₂₂		26 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	27,28 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		27 BINON 05 GAMS		33 $\pi^-p \rightarrow \eta\eta n$
136± 23	1400	29 GARMASH 05 BELL		$B^+ \rightarrow K^+K^+K^-$
102± 10		30 ANISOVICH 03 RVUE		
140± 40		27 ABELE 01 CBAR		0.0 $\bar{p}d \rightarrow \pi^-4\pi^0 p$
104± 25		27 BARBERIS 99 OMEG		450 $pp \rightarrow p_s p_f K^+K^-$
131± 15		27 BARBERIS 99B OMEG		450 $pp \rightarrow p_s p_f \pi^+\pi^-$
98± 18± 16		31 BARBERIS 99D OMEG		450 $pp \rightarrow K^+K^-, \pi^+\pi^-$
160± 50		27 BELLAZZINI 99 GAM4		450 $pp \rightarrow pp\pi^0\pi^0$
100± 33		27 FRENCH 99		300 $pp \rightarrow p_f(K^+K^-)p_s$
108± 46		32 KAMINSKI 99 RVUE		$\pi\pi \rightarrow \pi\pi, K\bar{K}, \sigma\sigma$
280± 100		27 ALDE 98 GAM4		100 $\pi^-p \rightarrow \pi^0\pi^0 n$
130± 20		22 ANISOVICH 98B RVUE		Compilation
120± 35		22 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	27 AMELIN 96B VES		37 $\pi^-A \rightarrow \eta\eta\pi^-A$
132± 15		BUGG 96 RVUE		
154± 30		33 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		34 ANTINORI 95 OMEG		300,450 $pp \rightarrow pp2(\pi^+\pi^-)$

OCCUR=2

199± 30		27	ANTINORI	95	OMEG	300,450	$pp \rightarrow pp\pi^+\pi^-$
56± 12		27	ABATZIS	94	OMEG	450	$pp \rightarrow pp2(\pi^+\pi^-)$
100± 40		27	AMSLER	94E	CBAR	0.0	$\bar{p}p \rightarrow \pi^0\eta\eta'$
148 ⁺ ₋₂₅		22,35	ANISOVICH	94	CBAR	0.0	$\bar{p}p \rightarrow 3\pi^0, \pi^0\eta\eta$
150± 20		22,36	BUGG	94	RVUE	$\bar{p}p \rightarrow 3\pi^0, \eta\eta\pi^0, \eta\pi^0\pi^0$	
245± 50		27	AMSLER	92	CBAR	0.0	$\bar{p}p \rightarrow \pi^0\eta\eta$
153± 67± 50		27	BELADIDZE	92C	VES	36	$\pi^-\text{Be} \rightarrow \pi^-\eta'\eta\text{Be}$
78± 18		27	ARMSTRONG	89E	OMEG	300	$pp \rightarrow pp2(\pi^+\pi^-)$
170± 40		27	ALDE	88	GAM4	300	$\pi^-N \rightarrow \pi^-N2\eta$
150± 20	600	27	ALDE	87	GAM4	100	$\pi^-p \rightarrow 4\pi^0n$
265± 65		37	ALDE	86D	GAM4	100	$\pi^-p \rightarrow 2\eta n$
260± 60		27	BINON	84C	GAM2	38	$\pi^-p \rightarrow \eta\eta'n$
210± 40		27	BINON	83	GAM2	38	$\pi^-p \rightarrow 2\eta n$
101± 13		27	GRAY	83	DBC	0.0	$\bar{p}N \rightarrow 3\pi$

- 21 From partial wave analysis including all possible combinations of 0^{++} , 2^{++} , and 4^{++} resonances.
 22 T-matrix pole.
 23 Average between $\pi^+\pi^-2\pi^0$ and $2(\pi^+\pi^-)$.
 24 T-matrix pole, supersedes ANISOVICH 94.
 25 T-matrix pole, supersedes ANISOVICH 94 and AMSLER 92.
 26 Breit-Wigner width. May also be the $f_0(1370)$.
 27 Breit-Wigner width.
 28 Statistical error only.
 29 Breit-Wigner, solution 1, PWA ambiguous.
 30 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.
 31 Supersedes BARBERIS 99 and BARBERIS 99B.
 32 T-matrix pole on sheet $--+$.
 33 T-matrix pole. Coupled-channel analysis of AMSLER 95B, AMSLER 95C, and AMSLER 94D.
 34 Supersedes ABATZIS 94, ARMSTRONG 89E. Breit-Wigner mass.
 35 From a simultaneous analysis of the annihilations $\bar{p}p \rightarrow 3\pi^0, \pi^0\eta\eta$.
 36 Reanalysis of ANISOVICH 94 data.
 37 From central value and spread of two solutions. Breit-Wigner mass.

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 NODE=M152W;LINKAGE=ST
 NODE=M152W;LINKAGE=GA
 NODE=M152W;LINKAGE=KM

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
$\Gamma_1 \quad \pi\pi$	(34.9±2.3) %	1.2
$\Gamma_2 \quad \pi^+\pi^-$	seen	
$\Gamma_3 \quad 2\pi^0$	seen	
$\Gamma_4 \quad 4\pi$	(49.5±3.3) %	1.2
$\Gamma_5 \quad 4\pi^0$	seen	
$\Gamma_6 \quad 2\pi^+2\pi^-$	seen	
$\Gamma_7 \quad 2(\pi\pi)_{S\text{-wave}}$	seen	
$\Gamma_8 \quad \rho\rho$	seen	
$\Gamma_9 \quad \pi(1300)\pi$	seen	
$\Gamma_{10} \quad a_1(1260)\pi$	seen	
$\Gamma_{11} \quad \eta\eta$	(5.1±0.9) %	1.4
$\Gamma_{12} \quad \eta\eta'(958)$	(1.9±0.8) %	1.7
$\Gamma_{13} \quad K\bar{K}$	(8.6±1.0) %	1.1
$\Gamma_{14} \quad \gamma\gamma$	not seen	

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 DESIG=7
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 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 $\langle \delta x_i \delta x_j \rangle / (\delta x_i \cdot \delta x_j)$, 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	−83			
x_{11}	11	−52		
x_{12}	−5	−31	29	
x_{13}	39	−67	33	6
	x_1	x_4	x_{11}	x_{12}

$f_0(1500) \Gamma(i) \Gamma(\gamma\gamma) / \Gamma(\text{total})$

NODE=M152217

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

$\Gamma_1 \Gamma_{14} / \Gamma$

NODE=M152G1
NODE=M152G1

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$33^{+12}_{-6} + 1809_{21}$		38 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	$\gamma\gamma \rightarrow \pi^+ \pi^-$
38 May also be the $f_0(1370)$. Multiplied by us by 3 to obtain the $\pi\pi$ value.				

NODE=M152G1;LINKAGE=UE

$f_0(1500)$ BRANCHING RATIOS

NODE=M152220

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

Γ_1 / Γ

NODE=M152R8
NODE=M152R8

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.454 ± 0.104	BUGG	96 RVUE	

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

Γ_2 / Γ

NODE=M152R10
NODE=M152R10

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
seen	BERTIN	98 OBLX	$0.05\text{--}0.405 \bar{n} p \rightarrow \pi^+ \pi^+ \pi^-$
possibly seen	FRABETTI	97D E687	$D_S^\pm \rightarrow \pi^\mp \pi^\pm \pi^\pm$

$\Gamma(4\pi) / \Gamma(\pi\pi)$

Γ_4 / Γ_1

NODE=M152R6
NODE=M152R6

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
1.42 ± 0.18 OUR FIT	Error includes scale factor of 1.2.		
1.42 ± 0.18 OUR AVERAGE	Error includes scale factor of 1.2.		
1.37 ± 0.16	BARBERIS	00D	$450 p p \rightarrow p_f 4\pi p_s$
2.1 ± 0.6	39 AMSLER	98 RVUE	
• • • We do not use the following data for averages, fits, limits, etc. • • •			
2.1 ± 0.2	40 ANISOVICH	02D SPEC	Combined fit
3.4 ± 0.8	39 ABELE	96 CBAR	$0.0 \bar{p} p \rightarrow 5\pi^0$

$\Gamma(2(\pi\pi)_{\text{s-wave}}) / \Gamma(\pi\pi)$

Γ_7 / Γ_1

NODE=M152R14
NODE=M152R14

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.42 ± 0.26	41 ABELE	01 CBAR	$0.0 \bar{p} d \rightarrow \pi^- 4\pi^0 p$

$\Gamma(2(\pi\pi)_{\text{s-wave}}) / \Gamma(4\pi)$

Γ_7 / Γ_4

NODE=M152R15
NODE=M152R15

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.26 ± 0.07	ABELE	01B CBAR	$0.0 \bar{p} d \rightarrow 5\pi p$

$\Gamma(\rho\rho)/\Gamma(4\pi)$

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_8/Γ_4
• • • 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

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

VALUE	DOCUMENT ID	COMMENT	Γ_8/Γ_7
• • • 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

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

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_9/Γ_4
• • • 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

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

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_{10}/Γ_4
• • • 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

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

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_{11}/Γ
• • • 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 $\pi^- p \rightarrow 2\eta n$	

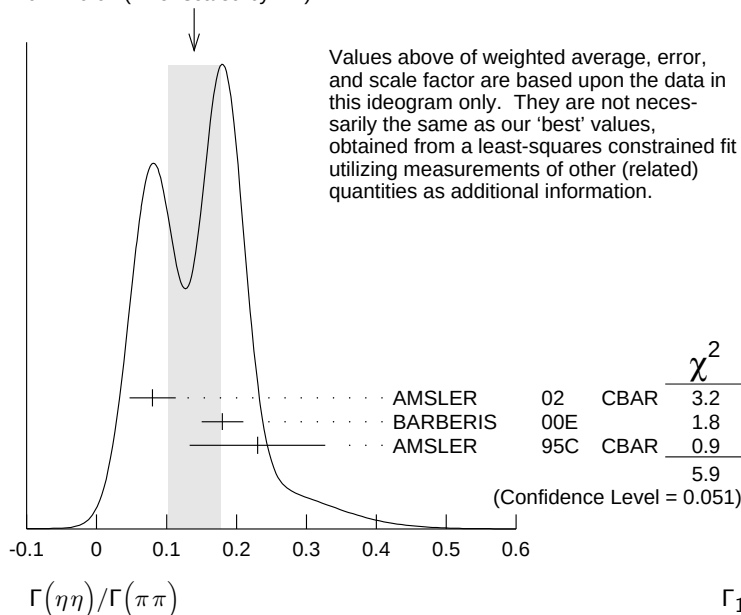
NODE=M152R1
 NODE=M152R1

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

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_{11}/Γ_1
• • • We do not use the following data for averages, fits, limits, etc. • • •				
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	42 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. • • •				
0.11 ± 0.03	40 ANISOVICH	02D	SPEC Combined fit	
0.078 ± 0.013	43 ABELE	96C	RVUE Compilation	
0.157 ± 0.060	44 AMSLER	95D	CBAR $0.0 \bar{p}p \rightarrow \pi^0 \pi^0 \pi^0, \pi^0 \eta\eta, \pi^0 \pi^0 \eta$	

NODE=M152R13
 NODE=M152R13

WEIGHTED AVERAGE
 0.14 ± 0.04 (Error scaled by 1.7)



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

VALUE	DOCUMENT ID	TECN	COMMENT
0.8 ± 0.3	ALDE	87	GAM4 100 $\pi^- p \rightarrow 4\pi^0 n$

 Γ_5/Γ_{11}

NODE=M152R5
 NODE=M152R5

 $\Gamma(\eta\eta'(958))/\Gamma(\pi\pi)$

VALUE	DOCUMENT ID	TECN	COMMENT
0.055 ± 0.024 OUR FIT	Error includes scale factor of 1.8.		
0.095 ± 0.026	BARBERIS	00A	450 $p p \rightarrow p_f \eta \eta p_s$
0.005 ± 0.003	⁴⁰ ANISOVICH	02D	SPEC Combined fit

 Γ_{12}/Γ_1

NODE=M152R12
 NODE=M152R12

 $\Gamma(\eta\eta'(958))/\Gamma(\eta\eta)$

VALUE	DOCUMENT ID	TECN	COMMENT
0.38 ± 0.16 OUR FIT	Error includes scale factor of 1.9.		
0.29 ± 0.10	⁴⁵ AMSLER	95C	CBAR 0.0 $\bar{p} p \rightarrow \eta \eta \pi^0$
0.05 ± 0.03	⁴⁰ ANISOVICH	02D	SPEC Combined fit
0.84 ± 0.23	ABELE	96C	RVUE Compilation
2.7 ± 0.8	BINON	84C	GAM2 38 $\pi^- p \rightarrow \eta \eta' n$

 Γ_{12}/Γ_{11}

NODE=M152R2
 NODE=M152R2

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

VALUE	DOCUMENT ID	TECN	COMMENT
0.044 ± 0.021	BUGG	96	RVUE

 Γ_{13}/Γ

NODE=M152R9
 NODE=M152R9

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

VALUE	DOCUMENT ID	TECN	COMMENT
0.246 ± 0.026 OUR FIT			
0.241 ± 0.028 OUR AVERAGE			
0.25 ± 0.03	⁴⁶ BARGIOTTI	03	OBLX $\bar{p} p$
0.19 ± 0.07	⁴⁷ ABELE	98	CBAR 0.0 $\bar{p} p \rightarrow K_L^0 K^\pm \pi^\mp$
0.16 ± 0.05	⁴⁰ ANISOVICH	02D	SPEC Combined fit
0.33 ± 0.03 ± 0.07	BARBERIS	99D	OMEG 450 $p p \rightarrow K^+ K^- \pi^+ \pi^-$
0.20 ± 0.08	⁴⁸ ABELE	96B	CBAR 0.0 $\bar{p} p \rightarrow \pi^0 K_L^0 K_L^0$

 Γ_{13}/Γ_1

NODE=M152R7
 NODE=M152R7

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

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 $p p \rightarrow p_f \eta \eta p_s$
1.5 ± 0.6		⁴⁰ ANISOVICH	02D	SPEC Combined fit
< 0.4	90	⁴⁹ PROKOSHKIN	91	GAM4 300 $\pi^- p \rightarrow \pi^- p \eta \eta$
< 0.6		⁵⁰ BINON	83	GAM2 38 $\pi^- p \rightarrow 2\eta n$

 Γ_{13}/Γ_{11}

NODE=M152R4
 NODE=M152R4

- ³⁹ Excluding $\rho\rho$ contribution to 4π .
- ⁴⁰ 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.
- ⁴¹ From the combined data of ABELE 96 and ABELE 96C.
- ⁴² Using AMSLER 95B ($3\pi^0$).
- ⁴³ 2π width determined to be 60 ± 12 MeV.
- ⁴⁴ Coupled-channel analysis of AMSLER 95B, AMSLER 95C, and AMSLER 94D.
- ⁴⁵ Using AMSLER 94E ($\eta\eta'\pi^0$).
- ⁴⁶ Coupled channel analysis of $\pi^+\pi^-\pi^0, K^+K^-\pi^0$, and $K^\pm K_S^0 \pi^\mp$.
- ⁴⁷ Using $\pi^0\pi^0$ from AMSLER 95B.
- ⁴⁸ Using AMSLER 95B ($3\pi^0$), AMSLER 94C ($2\pi^0\eta$) and SU(3).
- ⁴⁹ Combining results of GAM4 with those of WA76 on $K\bar{K}$ central production.
- ⁵⁰ Using ETKIN 82B and COHEN 80.

NODE=M152R6;LINKAGE=C
 NODE=M152R;LINKAGE=CH

NODE=M152R;LINKAGE=KZ
 NODE=M152R3;LINKAGE=A
 NODE=M152R3;LINKAGE=CM
 NODE=M152R3;LINKAGE=AB
 NODE=M152R2;LINKAGE=A
 NODE=M152R;LINKAGE=BG
 NODE=M152R7;LINKAGE=A
 NODE=M152R7;LINKAGE=D
 NODE=M152R4;LINKAGE=BZ
 NODE=M152R4;LINKAGE=A

f₀(1500) REFERENCES

NODE=M152

DOBBS	15	PR D91 052006	S. Dobbs <i>et al.</i>	(NWES)	REFID=56805
ABLIKIM	13N	PR D87 092009	Ablikim M. <i>et al.</i>	(BES III Collab.)	REFID=55387
ANISOVICH	09	IJMP A24 2481	V.V. Anisovich, A.V. Sarantsev		REFID=52719
KLEMP	08	EPJ C55 39	E. Klempt, M. Matveev, A.V. Sarantsev	(BONN+)	REFID=52286
UEHARA	08A	PR D78 052004	S. Uehara <i>et al.</i>	(BELLE Collab.)	REFID=52309
ABLIKIM	06V	PL B642 441	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51507
AMSLER	06	PL B639 165	C. Amsler <i>et al.</i>	(CBAR Collab.)	REFID=51136
AUBERT	06O	PR D74 032003	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51141
PDG	06	JP G33 1	W.-M. Yao <i>et al.</i>	(PDG Collab.)	REFID=51004
UMAN	06	PR D73 052009	I. Uman <i>et al.</i>	(FNAL E835)	REFID=51063
VLADIMIRSK...	06	PAN 69 493	V.V. Vladimirovsky <i>et al.</i>	(ITEP, Moscow)	REFID=51191
		Translated from YAF 69 515.			
BINON	05	PAN 68 960	F. Binon <i>et al.</i>		REFID=50780
		Translated from YAF 68 998.			
GARMASH	05	PR D71 092003	A. Garmash <i>et al.</i>	(BELLE Collab.)	REFID=50641
ANISOVICH	03	EPJ A16 229	V.V. Anisovich <i>et al.</i>		REFID=49401
BARGIOTTI	03	EPJ C26 371	M. Bargiotti <i>et al.</i>	(OBELIX Collab.)	REFID=49217
AMSLER	02	EPJ C23 29	C. Amsler <i>et al.</i>		REFID=48580
ANISOVICH	02D	PAN 65 1545	V.V. Anisovich <i>et al.</i>		REFID=48831
		Translated from YAF 65 1583.			
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
ACCIARRI	01H	PL B501 173	M. Acciarri <i>et al.</i>	(L3 Collab.)	REFID=48321
AITALA	01A	PRL 86 765	E.M. Aitala <i>et al.</i>	(FNAL E791 Collab.)	REFID=48004
BARATE	00E	PL B472 189	R. Barate <i>et al.</i>	(ALEPH Collab.)	REFID=47428
BARBERIS	00A	PL B471 429	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=47957
BARBERIS	00C	PL B471 440	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=47959
BARBERIS	00D	PL B474 423	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=47960
BARBERIS	00E	PL B479 59	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=47961
BARBERIS	99	PL B453 305	D. Barberis <i>et al.</i>	(Omega Expt.)	REFID=46921
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
FRENCH	99	PL B460 213	B. French <i>et al.</i>	(WA76 Collab.)	REFID=47491
KAMINSKI	99	EPJ C9 141	R. Kaminski, L. Lesniak, B. Loiseau	(CRAC, PARIN)	REFID=46927
ABELE	98	PR D57 3860	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)	REFID=45863
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.			
AMSLER	98	RMP 70 1293	C. Amsler		REFID=46601
ANISOVICH	98B	SPU 41 419	V.V. Anisovich <i>et al.</i>		REFID=46331
		Translated from UFN 168 481.			
BERTIN	98	PR D57 55	A. Bertin <i>et al.</i>	(OBELIX Collab.)	REFID=45782
REYES	98	PRL 81 4079	M.A. Reyes <i>et al.</i>		REFID=46378
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
FRABETTI	97D	PL B407 79	P.L. Frabetti <i>et al.</i>	(FNAL E687 Collab.)	REFID=45554
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
AMELIN	96B	PAN 59 976	D.V. Amelin <i>et al.</i>	(SERP, TBIL)	REFID=44725
		Translated from YAF 59 1021.			
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
ANTINORI	95	PL B353 589	F. Antinori <i>et al.</i>	(ATHU, BARI, BIRM+)	REFID=44437
BUGG	95	PL B353 378	D.V. Bugg <i>et al.</i>	(LOQM, PNPI, WASH)	REFID=44438
ABATZIS	94	PL B324 509	S. Abatzis <i>et al.</i>	(ATHU, BARI, BIRM+)	REFID=44090
AMSLER	94C	PL B327 425	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=44091
AMSLER	94D	PL B333 277	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=44093
AMSLER	94E	PL B340 259	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=44080
ANISOVICH	94	PL B323 233	V.V. Anisovich <i>et al.</i>	(Crystal Barrel Collab.)	REFID=43659
BUGG	94	PR D50 4412	D.V. Bugg <i>et al.</i>	(LOQM)	REFID=44078
AMSLER	92	PL B291 347	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=43169
BELADIDZE	92C	SJNP 55 1535	G.M. Beladidze, S.I. Bityukov, G.V. Borisov	(SERP+)	REFID=43175
		Translated from YAF 55 2748.			
PROKOSHKIN	91	SPD 36 155	Y.D. Prokoshkin	(GAM2, GAM4 Collab.)	REFID=41719
		Translated from DANS 316 900.			
ARMSTRONG	89E	PL B228 536	T.A. Armstrong, M. Benayoun	(ATHU, BARI, BIRM+)	REFID=41011
ALDE	88	PL B201 160	D.M. Alde <i>et al.</i>	(SERP, BELG, LANL, LAPP+)	REFID=40283
ASTON	88D	NP B301 525	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)	REFID=40330
ALDE	87	PL B198 286	D.M. Alde <i>et al.</i>	(LANL, BRUX, SERP, LAPP)	REFID=40221
ALDE	86D	NP B269 485	D.M. Alde <i>et al.</i>	(BELG, LAPP, SERP, CERN+)	REFID=20765
BINON	84C	NC 80A 363	F.G. Binon <i>et al.</i>	(BELG, LAPP, SERP+)	REFID=21418
BINON	83	NC 78A 313	F.G. Binon <i>et al.</i>	(BELG, LAPP, SERP+)	REFID=20750
Also		SJNP 38 561	F.G. Binon <i>et al.</i>	(BELG, LAPP, SERP+)	REFID=20751
		Translated from YAF 38 934.			
GRAY	83	PR D27 307	L. Gray <i>et al.</i>	(SYRA)	REFID=21370
ETKIN	82B	PR D25 1786	A. Etkin <i>et al.</i>	(BNL, CUNY, TUFTS, VAND)	REFID=20390
COHEN	80	PR D22 2595	D. Cohen <i>et al.</i>	(ANL)	REFID=20381

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

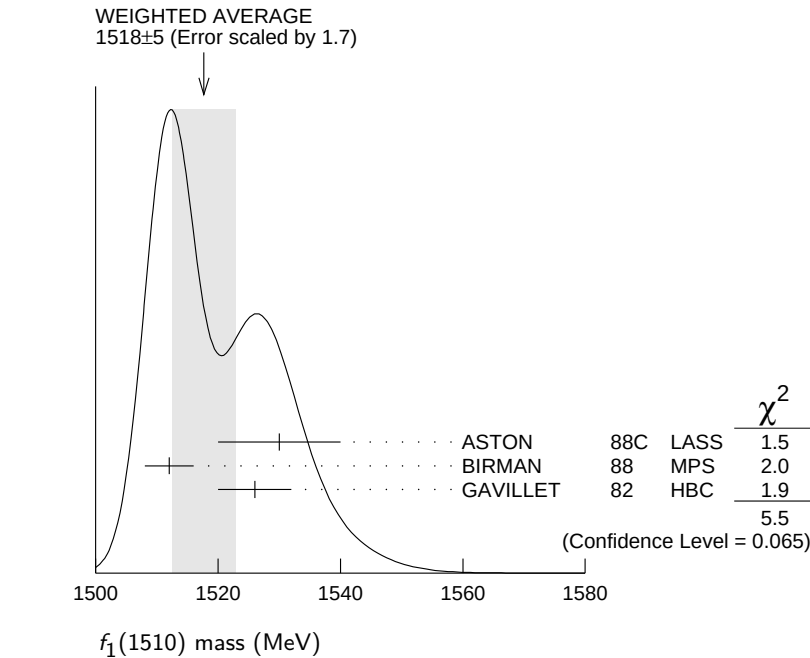
NODE=M084M

$f_1(1510)$ 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



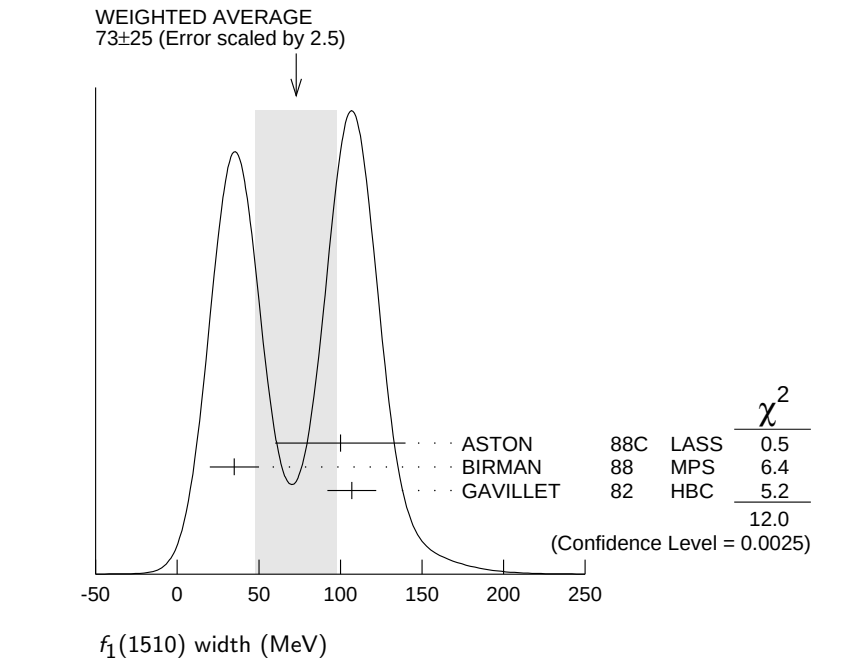
$f_1(1510)$ WIDTH

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	2	LONGACRE	86	MPS	22 $\pi^- p \rightarrow K_S^0 K_S^0 n$
1496 ⁺⁹ ₋₈	3	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	4	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

1523.3± 1.1 OUR AVERAGE Includes data from the datablock that follows this one. Error includes scale factor of 1.1.

NODE=M013M2

NODE=M013M2

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	5	BARKOV	99	SPEC	40 $K^- p \rightarrow K_S^0 K_S^0 Y$

PRODUCED IN e^+e^- ANNIHILATION AND PARTICLE DECAYS

VALUE (MeV)

EVTS

DOCUMENT ID

TECN

COMMENT

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

NODE=M013M3

NODE=M013M3

1521.9^{+1.8}_{-1.5} OUR AVERAGE Error includes scale factor of 1.1.

1522.2± 2.8 ^{+5.3} _{-2.0}		AAIJ	13AN	LHCB	$\bar{B}_s^0 \rightarrow J/\psi K^+ K^-$
1513 ± 5 ⁺⁴ ₋₁₀	5.5k	6	ABLIKIM	13N	BES3 $e^+ e^- \rightarrow J/\psi \rightarrow \gamma \eta \eta$
1525.3 ^{+1.2} _{-1.4} ^{+3.7} _{-2.1}		UEHARA	13	BELL	$\gamma \gamma \rightarrow K_S^0 K_S^0$
1521 ± 5		ABLIKIM	05	BES2	$J/\psi \rightarrow \phi K^+ K^-$
1518 ± 1 ± 3		ABE	04	BELL	10.6 $e^+ e^- \rightarrow e^+ e^- K^+ K^-$
1519 ± 2 ⁺¹⁵ ₋₅		BAI	03G	BES	$J/\psi \rightarrow \gamma K \bar{K}$
1523 ± 6	331	7	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		8	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. • • •

1532 ± 3 ± 6	644	^{9,10}	DOBBS	15	$J/\psi \rightarrow \gamma K^+ K^-$
1557 ± 9 ± 3	113	^{9,10}	DOBBS	15	$\psi(2S) \rightarrow \gamma K^+ K^-$
1526 ± 7	29	¹	LEES	14H BABR	$e^+ e^- \rightarrow K_S^0 K_S^0 K^+ K^- \gamma$
1523 ± 5	870	¹¹	SCHEGELSKY	06A RVUE	$\gamma\gamma \rightarrow K_S^0 K_S^0$
1496 ± 2		¹²	FALVARD	88 DM2	$J/\psi \rightarrow \phi K^+ K^-$

¹ From a fit to a Breit-Wigner line shape plus a second-order polynomial function. Systematic errors not evaluated.

OCCUR=2
ERROR=10

OCCUR=2

NODE=M013M3;LINKAGE=D

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	¹³	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	¹⁴	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 $e p$ COLLISIONS

VALUE (MeV)	EVS	DOCUMENT ID	TECN	COMMENT

1512 ± 3 ^{+1.4} _{-0.5}	¹⁵	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. • • •

1537 ⁺⁹ ₋₈	84	¹⁶	CHEKANOV	04	ZEUS	$e p \rightarrow K_S^0 K_S^0 X$

² From a partial-wave analysis of data using a K-matrix formalism with 5 poles.

³ CHABAUD 81 is a reanalysis of PAWLICKI 77 data.

⁴ 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.

⁵ Systematic errors not estimated.

⁶ From partial wave analysis including all possible combinations of 0^{++} , 2^{++} , and 4^{++} resonances.

⁷ Supersedes ACCIARRI 95J.

⁸ From an analysis ignoring interference with $f_0(1710)$.

⁹ Using CLEO-c data but not authored by the CLEO Collaboration.

¹⁰ From a fit to a Breit-Wigner line shape with fixed $\Gamma = 73$ MeV.

¹¹ From analysis of L3 data at 91 and 183–209 GeV.

¹² From an analysis including interference with $f_0(1710)$.

¹³ 4-poles, 5-channel K matrix fit.

¹⁴ T-matrix pole.

¹⁵ 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.

¹⁶ Systematic errors not estimated.

NODE=M013M;LINKAGE=L

NODE=M013M;LINKAGE=D

NODE=M013M;LINKAGE=N

NODE=M013M2;LINKAGE=SK

NODE=M013M3;LINKAGE=A

NODE=M013M;LINKAGE=HA

NODE=M013M;LINKAGE=F1

NODE=M013M3;LINKAGE=B

NODE=M013M3;LINKAGE=C

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

VALUE (MeV)	DOCUMENT ID	COMMENT

73⁺⁶₋₅ OUR FIT

76 ± 10	PDG	90	For fitting

NODE=M013210

NODE=M013WX

PRODUCED BY PION BEAM

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

• • • 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	¹⁸ LONGACRE	86	MPS	22	$\pi^- p \rightarrow K_S^0 K_S^0 n$
69 ⁺ _− ²² ₁₆	¹⁹ CHABAUD	81	ASPK	6	$\pi^- p \rightarrow K^+ K^- n$
137 ⁺ _− ²³ ₂₁	CHABAUD	81	ASPK	18.4	$\pi^- p \rightarrow K^+ K^- n$
150 ⁺ _− ⁸³ ₅₀	GORLICH	80	ASPK	17	$\pi^- p$ polarized $\rightarrow K^+ K^- n$
165±42	²⁰ CORDEN	79	OMEG	12–15	$\pi^- p \rightarrow \pi^+ \pi^- n$
92 ⁺ _− ³⁹ ₂₂	²¹ POLYCHRO...	79	STRC	7	$\pi^- p \rightarrow n K_S^0 K_S^0$

OCCUR=2

NODE=M013W1
NODE=M013W1

PRODUCED BY $K^\pm$ BEAM

VALUE (MeV)	EPTS	DOCUMENT ID	TECN	COMMENT

NODE=M013W2
NODE=M013W2

81.4 $^{+2.2}_{-1.9}$ 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	$K^- p \rightarrow K_S^0 K_S^0 \Upsilon$
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	22	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 AND PARTICLE DECAYS

VALUE (MeV)	EPTS	DOCUMENT ID	TECN	COMMENT

NODE=M013W3
NODE=M013W3

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

81.4 $^{+2.4}_{-2.0}$ OUR AVERAGE

84 ± 6 $^{+10}_{-5}$		AAIJ	13AN	LHCB	$\bar{B}_s^0 \rightarrow J/\psi K^+ K^-$
75 $^{+12}_{-10}$ $^{+16}_{-8}$	5.5k	23 ABLIKIM	13N	BES3	$e^+ e^- \rightarrow J/\psi \rightarrow \gamma \eta \eta$
82.9 $^{+2.1}_{-2.2}$ $^{+3.3}_{-2.0}$		UEHARA	13	BELL	$\gamma \gamma \rightarrow K_S^0 K_S^0$
77 ± 15		ABLIKIM	05	BES2	$J/\psi \rightarrow \phi K^+ K^-$
82 ± 2 ± 3		ABE	04	BELL	$10.6 e^+ e^- \rightarrow e^+ e^- K^+ K^-$
75 ± 4 $^{+15}_{-5}$		BAI	03G	BES	$J/\psi \rightarrow \gamma K \bar{K}$
100 ± 15	331	24 ACCIARRI	01H	L3	$91, 183-209 e^+ e^- \rightarrow e^+ e^- K_S^0 K_S^0$
60 ± 20 ± 19		ABREU	96C	DLPH	$Z^0 \rightarrow K^+ K^- + X$
60 ± 23 $^{+13}_{-20}$		BAI	96C	BES	$J/\psi \rightarrow \gamma K^+ K^-$
103 ± 30		AUGUSTIN	88	DM2	$J/\psi \rightarrow \gamma K^+ K^-$
62 ± 10	25	FALVARD	88	DM2	$J/\psi \rightarrow \phi K^+ K^-$
85 ± 35		BALTRUSAIT..87	MRK3		$J/\psi \rightarrow \gamma K^+ K^-$

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

37 ± 12	29	17 LEES	14H		$e^+ e^- \rightarrow K_S^0 K_S^0 K^+ K^- \gamma$
104 ± 10	870	26 SCHEGELSKY	06A	RVUE	$\gamma \gamma \rightarrow K_S^0 K_S^0$
100 ± 3		27 FALVARD	88	DM2	$J/\psi \rightarrow \phi K^+ K^-$

¹⁷ From a fit to a Breit-Wigner line shape plus a second-order polynomial function. Systematic errors not evaluated.

ERROR=11

OCCUR=2

NODE=M013W3;LINKAGE=B

PRODUCED IN $\bar{p}p$ ANNIHILATION

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

NODE=M013W9
NODE=M013W9

79 ± 8 28 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 ± 20	29	ANISOVICH	09	RVUE	0.0 $\bar{p}p, \pi N$
76 ± 6		AMSLER	06	CBAR	0.9 $\bar{p}p \rightarrow K^+ K^- \pi^0$

CENTRAL PRODUCTION

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

NODE=M013W4
NODE=M013W4

70 ± 25 BARBERIS 99 OMEG 450 $pp \rightarrow p_S p_f K^+ K^-$

PRODUCED IN $e p$ COLLISIONS

VALUE (MeV)	EPTS	DOCUMENT ID	TECN	COMMENT

NODE=M013W10
NODE=M013W10

83 ± 9 $^{+5}_{-4}$ 30 CHEKANOV 08 ZEUS $e p \rightarrow K_S^0 K_S^0 X$

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

50 $^{+34}_{-22}$	84	31 CHEKANOV	04	ZEUS	$e p \rightarrow K_S^0 K_S^0 X$

- 18 From a partial-wave analysis of data using a K-matrix formalism with 5 poles.
19 CHABAUD 81 is a reanalysis of PAWLICKI 77 data.
20 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.
21 From a fit to the D with $f_2(1270)$ - $f_2'(1525)$ interference. Mass fixed at 1516 MeV.
22 Systematic errors not estimated.
23 From partial wave analysis including all possible combinations of 0^{++} , 2^{++} , and 4^{++} resonances.
24 Supersedes ACCIARRI 95J.
25 From an analysis ignoring interference with $f_0(1710)$.
26 From analysis of L3 data at 91 and 183–209 GeV.
27 From an analysis including interference with $f_0(1710)$.
28 T-matrix pole.
29 4-poles, 5-channel K matrix fit.
30 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.
31 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=M013W3;LINKAGE=A

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

NODE=M013215;NODE=M013

$f_2'(1525)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad K\bar{K}$	(88.7 $\pm$ 2.2) %
$\Gamma_2 \quad \eta\eta$	(10.4 $\pm$ 2.2) %
$\Gamma_3 \quad \pi\pi$	(8.2 $\pm$ 1.5) $\times 10^{-3}$
$\Gamma_4 \quad K\bar{K}^*(892) + \text{c.c.}$	
$\Gamma_5 \quad \pi K\bar{K}$	
$\Gamma_6 \quad \pi\pi\eta$	
$\Gamma_7 \quad \pi^+\pi^+\pi^-\pi^-$	
$\Gamma_8 \quad \gamma\gamma$	(1.10 $\pm$ 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 17 measurements and one constraint to determine 5 parameters. The overall fit has a $\chi^2 = 14.3$ for 13 degrees of freedom.

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

x_2	−100			
x_3	−6	−1		
x_8	−6	6	1	
Γ	−23	23	−1	−56
	x_1	x_2	x_3	x_8

Mode	Rate (MeV)
$\Gamma_1 \quad K\bar{K}$	65 $\begin{smallmatrix} +5 \\ -4 \end{smallmatrix}$
$\Gamma_2 \quad \eta\eta$	7.6 $\pm$ 1.8
$\Gamma_3 \quad \pi\pi$	0.60 $\pm$ 0.12
$\Gamma_8 \quad \gamma\gamma$	(8.1 $\pm$ 0.9) $\times 10^{-5}$

DESIG=2
DESIG=4
DESIG=1
DESIG=8

$f_2'(1525)$ PARTIAL WIDTHS

NODE=M013220

$\Gamma(K\bar{K})$				Γ_1
VALUE (MeV)	DOCUMENT ID	TECN	COMMENT	

NODE=M013W6
NODE=M013W6

65^{+5}_{-4} OUR FIT

63^{+6}_{-5}

³² 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

7.6±1.8 OUR FIT

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

5.0±0.8	870	³³ SCHEGELSKY 06A	RVUE	$\gamma\gamma \rightarrow K_S^0 K_S^0$
24 $\begin{smallmatrix} +3 \\ -1 \end{smallmatrix}$		³² 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

0.60±0.12 OUR FIT

1.4 $\begin{smallmatrix} +1.0 \\ -0.5 \end{smallmatrix}$		³² LONGACRE 86	MPS	$22 \pi^- p \rightarrow K_S^0 K_S^0 n$

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

0.2 $\begin{smallmatrix} +1.0 \\ -0.2 \end{smallmatrix}$	870	³³ SCHEGELSKY 06A	RVUE	$\gamma\gamma \rightarrow K_S^0 K_S^0$

 $\Gamma(\gamma\gamma)$ Γ_8

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT

0.081±0.009 OUR FIT

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

0.13 ±0.03	870	³³ SCHEGELSKY 06A	RVUE	$\gamma\gamma \rightarrow K_S^0 K_S^0$

³² From a partial-wave analysis of data using a K-matrix formalism with 5 poles.³³ 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. $f_2'(1525) \Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

NODE=M013223

 $\Gamma(K\bar{K}) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_1\Gamma_8/\Gamma$

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT

0.072 ±0.007 OUR FIT**0.072 ±0.007 OUR AVERAGE**

0.048 $\begin{smallmatrix} +0.067 \\ -0.008 \end{smallmatrix}$ $\begin{smallmatrix} +0.108 \\ -0.012 \end{smallmatrix}$		UEHARA	13	BELL	$\gamma\gamma \rightarrow K_S^0 K_S^0$
0.0564±0.0048±0.0116		ABE	04	BELL	$10.6 e^+ e^- \rightarrow e^+ e^- K^+ K^-$
0.076 ±0.006 ±0.011	331	³⁴ ACCIARRI	01H	L3	$e^+ e^- \rightarrow e^+ e^- K_S^0 K_S^0$
0.067 ±0.008 ±0.015		³⁵ ALBRECHT	90G	ARG	$e^+ e^- \rightarrow e^+ e^- K^+ K^-$
0.11 $\begin{smallmatrix} +0.03 \\ -0.02 \end{smallmatrix}$ ±0.02		BEHREND	89c	CELL	$e^+ e^- \rightarrow e^+ e^- K_S^0 K_S^0$
0.10 $\begin{smallmatrix} +0.04 \\ -0.03 \end{smallmatrix}$ $\begin{smallmatrix} +0.03 \\ -0.02 \end{smallmatrix}$		BERGER	88	PLUT	$e^+ e^- \rightarrow e^+ e^- K_S^0 K_S^0$
0.12 ±0.07 ±0.04		³⁵ AIHARA	86B	TPC	$e^+ e^- \rightarrow e^+ e^- K^+ K^-$
0.11 ±0.02 ±0.04		³⁵ 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		³⁶ ALBRECHT	90G	ARG	$e^+ e^- \rightarrow e^+ e^- K^+ K^-$

³⁴ Supersedes ACCIARRI 95J. From analysis of L3 data at 91 and 183–209 GeV,³⁵ Using an incoherent background.³⁶ Using a coherent background. $f_2'(1525) \text{ BRANCHING RATIOS}$

NODE=M013225

 $\Gamma(\eta\eta)/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE	DOCUMENT ID	TECN	COMMENT

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

seen	UEHARA	10A	BELL	$10.6 e^+ e^- \rightarrow e^+ e^- \eta\eta$
0.10±0.03	³⁷ PROKOSHKIN	91	GAM4	$300 \pi^- p \rightarrow \pi^- p \eta\eta$

³⁷ Combining results of GAM4 with those of WA76 on $K\bar{K}$ central production and results of CBAL, MRK3 and DM2 on $J/\psi \rightarrow \gamma\eta\eta$.NODE=M013R8
NODE=M013R8

NODE=M013R8;LINKAGE=B

$\Gamma(\eta\eta)/\Gamma(K\bar{K})$ Γ_2/Γ_1

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	38	BINON	07	GAMS 32.5 $K^- p \rightarrow \eta\eta(\Lambda/\Sigma^0)$
0.11 ± 0.04		39	PROKOSHIN	91	GAM4 300 $\pi^- p \rightarrow \pi^- p \eta\eta$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
< 0.14	90		BARBERIS	00E	450 $pp \rightarrow p_f \eta\eta p_s$
< 0.50			BARNES	67	HBC 4.6,5.0 $K^- p$

³⁸ Using the compilation of the cross sections for $f'_2(1525)$ production in $K^- p$ collisions from ASTON 88D.

³⁹ 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
NODE=M013R3

NODE=M013R3;LINKAGE=BI

NODE=M013R3;LINKAGE=B

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

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 $^{+0.071}_{-0.013}$		40	GORLICH	80	ASPK 17,18 $\pi^- p$
0.0075±0.0025		40,41	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		40	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		40	BEUSCH	75B	OSPK 8.9 $\pi^- p \rightarrow K^0 \bar{K}^0 n$

⁴⁰ Assuming that the $f'_2(1525)$ is produced by an one-pion exchange production mechanism.

⁴¹ MARTIN 79 uses the PAWLICKI 77 data with different input value of the $f'_2(1525) \rightarrow K\bar{K}$ branching ratio.

NODE=M013R1
NODE=M013R1

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

 $[\Gamma(K\bar{K}^*(892) + \text{c.c.}) + \Gamma(\pi K\bar{K})]/\Gamma(K\bar{K})$ $(\Gamma_4 + \Gamma_5)/\Gamma_1$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

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

< 0.35	95		AGUILAR...	72B	HBC 3.9,4.6 $K^- p$
< 0.4	67		AMMAR	67	HBC

NODE=M013R5
NODE=M013R5

 $\Gamma(\pi\pi\eta)/\Gamma(K\bar{K})$ Γ_6/Γ_1

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

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

< 0.41	95		AGUILAR...	72B	HBC 3.9,4.6 $K^- p$
< 0.3	67		AMMAR	67	HBC

NODE=M013R4
NODE=M013R4

 $\Gamma(\pi^+ \pi^+ \pi^- \pi^-)/\Gamma(K\bar{K})$ Γ_7/Γ_1

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

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

< 0.32	95		AGUILAR...	72B	HBC 3.9,4.6 $K^- p$

NODE=M013R6
NODE=M013R6

$f_2'(1525)$ REFERENCES

NODE=M013

DOBBS	15	PR D91 052006	S. Dobbs <i>et al.</i>	(NWES)	REFID=56805
LEES	14H	PR D89 092002	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=55940
AAIJ	13AN	PR D87 072004	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=55137
ABLIKIM	13N	PR D87 092009	Ablikim M. <i>et al.</i>	(BES III Collab.)	REFID=55387
UEHARA	13	PTEP 2013 123C01	S. Uehara <i>et al.</i>	(BELLE Collab.)	REFID=55592
UEHARA	10A	PR D82 114031	S. Uehara <i>et al.</i>	(BELLE Collab.)	REFID=53641
ANISOVICH	09	IJMP A24 2481	V.V. Anisovich, A.V. Sarantsev		REFID=52719
CHEKANOV	08	PRL 101 112003	S. Chekanov <i>et al.</i>	(ZEUS Collab.)	REFID=52275
BINON	07	PAN 70 1713	F. Binon <i>et al.</i>	(GAMS Collab.)	REFID=52057
AMSLER	06	Translated from YAF 70 1758.	C. Amsler <i>et al.</i>	(CBAR Collab.)	REFID=51136
SCHEGELSKY	06A	EPJ A27 207	V.A. Schegelsky <i>et al.</i>		REFID=51185
ABLIKIM	05	PL B607 243	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50450
ABE	04	EPJ C32 323	K. Abe <i>et al.</i>	(BELLE Collab.)	REFID=49650
CHEKANOV	04	PL B578 33	S. Chekanov <i>et al.</i>	(ZEUS Collab.)	REFID=49672
BAI	03G	PR D68 052003	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49580
TIKHOMIROV	03	PAN 66 828	G.D. Tikhomirov <i>et al.</i>		REFID=49423
AMSLER	02	Translated from YAF 66 860.	C. Amsler <i>et al.</i>		REFID=48580
ACCIARRI	01H	EPJ C23 29	M. Acciarri <i>et al.</i>	(L3 Collab.)	REFID=48321
BARBERIS	00E	PL B501 173	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=47961
BARBERIS	99	PL B479 59	D. Barberis <i>et al.</i>	(Omega Expt.)	REFID=46921
BARKOV	99	PL B453 305	D. Barberis <i>et al.</i>		REFID=47379
ABREU	96C	JETPL 70 248	B.P. Barkov <i>et al.</i>		REFID=44671
BAI	96C	Translated from ZETFP 70 242.	P. Abreu <i>et al.</i>	(DELPHI Collab.)	REFID=45169
ACCIARRI	95J	PL B379 309	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=44615
PROKOSHIN	91	PRL 77 3959	M. Acciarri <i>et al.</i>	(L3 Collab.)	REFID=41719
ALBRECHT	90G	SPD 36 155	Y.D. Prokoshkin	(GAM2, GAM4 Collab.)	REFID=41374
PDG	90	Translated from DANS 316 900.	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=40744
BEHREND	89C	ZPHY C48 183	J.J. Hernandez <i>et al.</i>	(IFIC, BOST, CIT+)	REFID=40915
ASTON	88D	PL B239 1	H.J. Behrend <i>et al.</i>	(CELLO Collab.)	REFID=40330
AUGUSTIN	88	NP B301 525	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)	REFID=40574
BERGER	88	PRL 60 2238	J.E. Augustin <i>et al.</i>	(DM2 Collab.)	REFID=40566
FALVARD	88	ZPHY C37 329	C. Berger <i>et al.</i>	(PLUTO Collab.)	REFID=40576
AUGUSTIN	87	PR D38 2706	A. Falvard <i>et al.</i>	(CLER, FRAS, LALO+)	REFID=40268
BALTRUSAIT...	87	ZPHY C36 369	J.E. Augustin <i>et al.</i>	(LALO, CLER, FRAS+)	REFID=40010
AIHARA	86B	PR D35 2077	R.M. Baltrusaitis <i>et al.</i>	(Mark III Collab.)	REFID=20764
BOLONKIN	86	PRL 57 404	H. Aihara <i>et al.</i>	(TPC-2 γ Collab.)	REFID=44646
LONGACRE	86	SJNP 43 776	B.V. Bolonkin <i>et al.</i>	(ITEP) JP	REFID=20768
ALTHOFF	83	Translated from YAF 43 1211.	R.S. Longacre <i>et al.</i>	(BNL, BRAN, CUNY+)	REFID=21408
ARMSTRONG	83B	PL B177 223	M. Althoff <i>et al.</i>	(TASSO Collab.)	REFID=20558
AGUILAR-...	81B	PL 121B 216	T.A. Armstrong <i>et al.</i>	(BARI, BIRM, CERN+)	REFID=21104
ALHARRAN	81	NP B224 193	M. Aguilar-Benitez <i>et al.</i>	(CERN, CDEF+)	REFID=21403
CHABAUD	81	NP B191 26	S. Al-Harran <i>et al.</i>	(BIRM, CERN, GLAS+)	REFID=20742
COSTA	80	APP B12 575	V. Chabaud <i>et al.</i>	(CERN, CRAC, MPIM)	REFID=20737
GORLICH	80	NP B175 402	G. Costa <i>et al.</i>	(BARI, BONN, CERN, GLAS+)	REFID=20738
CORDEN	79	NP B174 16	L. Gorlich <i>et al.</i>	(CRAC, MPIM, CERN+)	REFID=20374
MARTIN	79	NP B157 250	M.J. Corden <i>et al.</i>	(BIRM, RHEL, TELA+) JP	REFID=20377
POLYCHRO...	79	NP B158 520	A.D. Martin, E.N. Ozmutlu	(DURH)	REFID=20378
BARREIRO	77	PR D19 1317	V.A. Polychronakos <i>et al.</i>	(NDAM, ANL)	REFID=21392
EVANGELIS...	77	NP B121 237	F. Barreiro <i>et al.</i>	(CERN, AMST, NIJ+)	REFID=20540
PAWLICKI	77	NP B127 384	C. Evangelista <i>et al.</i>	(BARI, BONN, CERN+)	REFID=20367
BRANDENB...	76C	PR D15 3196	A.J. Pawlicki <i>et al.</i>	(ANL) IJP	REFID=20225
BEUSCH	75B	NP B104 413	G.W. Brandenburg <i>et al.</i>	(SLAC)	REFID=21390
AGUILAR-...	72B	PL 60B 101	W. Beusch <i>et al.</i>	(CERN, ETH)	REFID=20205
AMMAR	67	PR D6 29	M. Aguilar-Benitez <i>et al.</i>	(BNL)	REFID=21382
BARNES	67	PRL 19 1071	R. Ammar <i>et al.</i>	(NWES, ANL) JP	REFID=21383
CRENNELL	66	PRL 19 964	V.E. Barnes <i>et al.</i>	(BNL, SYRA) IJPC	REFID=20317
		PRL 16 1025	D.J. Crennell <i>et al.</i>	(BNL) I	

$f_2(1565)$

$$I^G(J^{PC}) = 0^+(2^{++})$$

OMITTED FROM SUMMARY TABLE

Seen mostly in antinucleon-nucleon annihilation. Needs confirmation in other channels.

NODE=M123

NODE=M123

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 $f_0(1500)$.

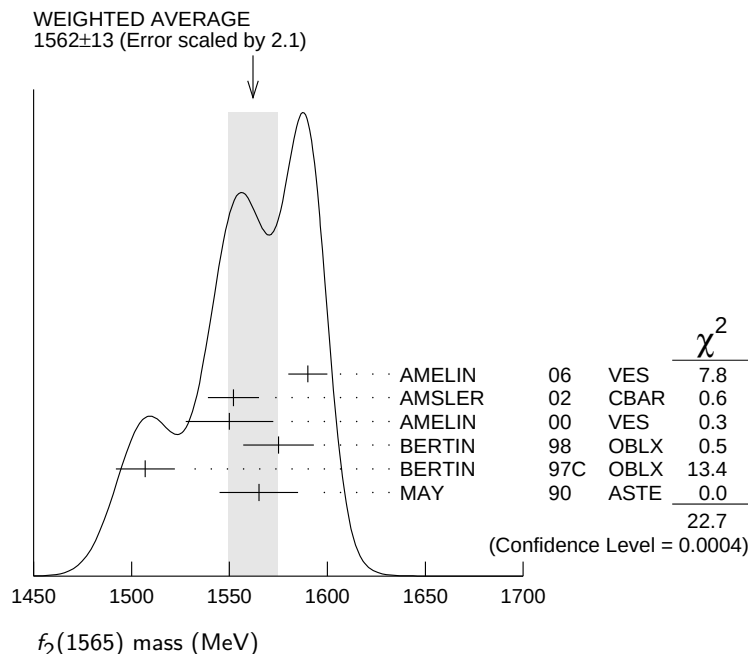
⁸ J^P not determined.

⁹ Superseded by AMSLER 95B.

OCCUR=2

NODE=M123M;LINKAGE=AM
 NODE=M123M;LINKAGE=G
 NODE=M123M;LINKAGE=AN
 NODE=M123M;LINKAGE=AA
 NODE=M123M;LINKAGE=AB
 NODE=M123M;LINKAGE=C

NODE=M123M;LINKAGE=E
 NODE=M123M;LINKAGE=F
 NODE=M123M;LINKAGE=BA



$f_2(1565)$ WIDTH

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
 NODE=M123W;LINKAGE=AN
 NODE=M123W;LINKAGE=CC
 NODE=M123W;LINKAGE=AB
 NODE=M123W;LINKAGE=D

NODE=M123W;LINKAGE=C
 NODE=M123W;LINKAGE=E
 NODE=M123W;LINKAGE=F
 NODE=M123W;LINKAGE=BA

 $f_2(1565)$ DECAY MODES

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 ←
 DESIG=5;OUR EST;→ UNCHECKED ←
 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)

REFID=52719
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REFID=41365
REFID=40921
REFID=21376
REFID=21377

$\rho(1570)$

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

OMITTED FROM SUMMARY TABLE

May be an OZI-violating decay mode of $\rho(1700)$. See our mini-review under the $\rho(1700)$.

NODE=M188

NODE=M188

NODE=M188M

NODE=M188M

NODE=M188M;LINKAGE=AU
NODE=M188M;LINKAGE=BI

NODE=M188W

NODE=M188W

NODE=M188W;LINKAGE=AU
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

REFID=52242
REFID=45765
REFID=41752
REFID=41632
REFID=40418
REFID=41373
REFID=40011
REFID=20246

 $\rho(1570)$ 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.				

NODE=M188R02
NODE=M188R02

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.)
ABELE	97H	PL B415 280	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
BISELLO	91B	NPBPS B21 111	D. Bisello	(DM2 Collab.)
DONNACHIE	91	ZPHY C51 689	A. Donnachie, A.B. Clegg	(MCHS, LANC)
ALBRECHT	87L	PL B185 223	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
AULCHENKO	87B	JETPL 45 145	V.M. Aulchenko <i>et al.</i>	(NOVO)
		Translated from ZETFP 45 118.		
BITYUKOV	87	PL B188 383	S.I. Bitjukov <i>et al.</i>	(SERP)
DOLINSKY	86	PL B174 453	S.I. Dolinsky <i>et al.</i>	(NOVO)

$h_1(1595)$

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

OMITTED FROM SUMMARY TABLE

Seen in a partial-wave analysis of the $\omega\eta$ system produced in the reaction $\pi^- p \rightarrow \omega\eta n$ at 18 GeV/c.

NODE=M166

NODE=M166

 $h_1(1595)$ MASS

NODE=M166M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$1594 \pm 15^{+10}_{-60}$	EUGENIO	01	SPEC 18 $\pi^- p \rightarrow \omega\eta n$

NODE=M166M

 $h_1(1595)$ WIDTH

NODE=M166W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$384 \pm 60^{+70}_{-100}$	EUGENIO	01	SPEC 18 $\pi^- p \rightarrow \omega\eta n$

NODE=M166W

 $h_1(1595)$ DECAY MODES

NODE=M166215;NODE=M166

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \omega\eta$	seen

DESIG=1;OUR EST;→ UNCHECKED ←

 $h_1(1595)$ REFERENCESEUGENIO 01 PL B497 190 P. Eugenio *et al.*

NODE=M166

REFID=48010

NODE=M164

 $\pi_1(1600)$

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

 $\pi_1(1600)$ MASS

NODE=M164M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$1662 \pm 8^{+8}_{-9}$ OUR AVERAGE				

NODE=M164M

$1660 \pm 10^{+0}_{-64}$	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.

NODE=M164M;LINKAGE=LU

NODE=M164M;LINKAGE=A

NODE=M164M;LINKAGE=DZ

 $\pi_1(1600)$ WIDTH

NODE=M164W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
241 ± 40 OUR AVERAGE				Error includes scale factor of 1.4. See the ideogram below.

NODE=M164W

$269 \pm 21^{+42}_{-64}$	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 $\pi^- p \rightarrow \pi^+ \pi^- \pi^- p$

⁴ May be a different state: natural and unnatural parity exchanges.

⁵ Natural parity exchange.

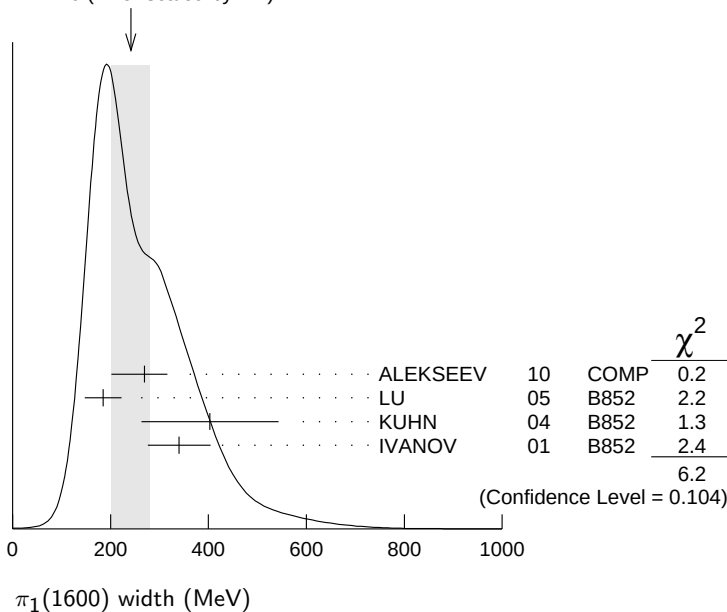
⁶ Superseded by DZIERBA 06 excluding this state in a more refined PWA analysis, with 2.6 M events of $\pi^- p \rightarrow \pi^- \pi^- \pi^+ p$ and 3 M events of $\pi^- p \rightarrow \pi^- \pi^0 \pi^0 p$ of E852 data.

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

$\Gamma(f_1(1285)\pi)/\Gamma(\eta'(958)\pi^-)$ Γ_6/Γ_5

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

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.

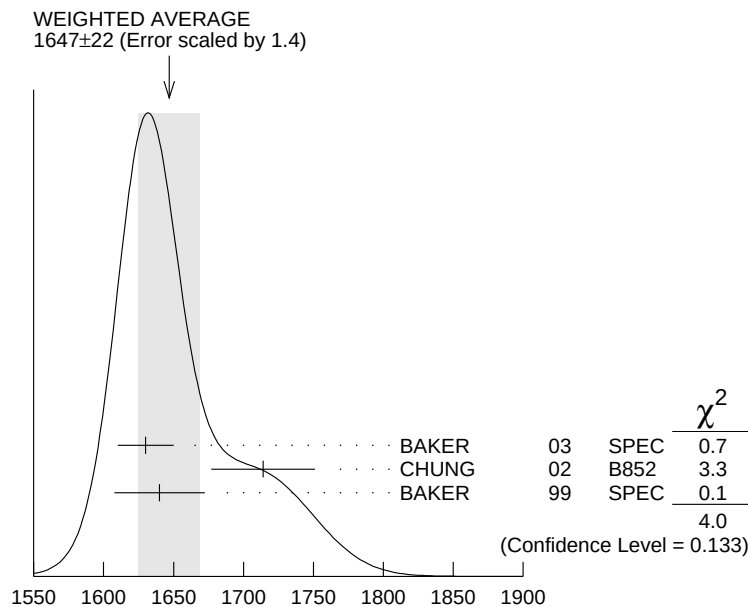
NODE=M161

 $a_1(1640)$ MASS

NODE=M161M

NODE=M161M

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 $\pi^- A \rightarrow \pi^- \pi^+ \pi^- A$

 $a_1(1640)$ mass (MeV)¹ Using the $a_1(1260)$ mass and width results of BOWLER 88.

NODE=M161M;LINKAGE=KB

 $a_1(1640)$ WIDTH

NODE=M161W

NODE=M161W

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 $\pi^- A \rightarrow \pi^- \pi^+ \pi^- A$

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

NODE=M117

$f_2(1640)$

$I^G(J^{PC}) = 0^+(2^{++})$

OMITTED FROM SUMMARY TABLE

$f_2(1640)$ MASS

NODE=M117M

NODE=M117M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
1639± 6 OUR AVERAGE	Error includes scale factor of 1.2.		
1620±16	BUGG	95	MRK3 $J/\psi \rightarrow \gamma \pi^+ \pi^- \pi^+ \pi^-$
1647± 7	ADAMO	92	OBLX $\bar{n} p \rightarrow 3 \pi^+ 2 \pi^-$
1635± 7	ALDE	90	GAM2 $38 \pi^- p \rightarrow \omega \omega n$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
1640± 5	AMSLER	06	CBAR $0.9 \bar{p} p \rightarrow K^+ K^- \pi^0$
1659± 6	VLADIMIRSK...	06	SPEC $40 \pi^- p \rightarrow K_S^0 K_S^0 n$
1643± 7	¹ ALDE	89B	GAM2 $38 \pi^- p \rightarrow \omega \omega n$
¹ Superseded by ALDE 90.			

NODE=M117M;LINKAGE=BB

$f_2(1640)$ WIDTH

NODE=M117W

NODE=M117W

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

$\omega(1650)$

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

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. • • •

1660± 10	898	¹ ACHASOV	16B	SND	1.34–2.00 $e^+e^- \rightarrow \omega\eta$
1680± 10	13.1k	² AULCHENKO	15A	SND	1.05–1.80 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
1667± 13± 6		AUBERT	07AU	BABR	10.6 $e^+e^- \rightarrow \omega\pi^+\pi^-\gamma$
1645± 8	13	AUBERT	06D	BABR	10.6 $e^+e^- \rightarrow \omega\eta\gamma$
1660± 10± 2		AUBERT,B	04N	BABR	10.6 $e^+e^- \rightarrow \pi^+\pi^-\pi^0\gamma$
1770± 50± 60	1.2M	³ ACHASOV	03D	RVUE	0.44–2.00 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
1619± 5		⁴ HENNER	02	RVUE	1.2–2.0 $e^+e^- \rightarrow \rho\pi, \omega\pi\pi$
1700± 20		EUGENIO	01	SPEC	18 $\pi^-p \rightarrow \omega\eta n$
1705± 26	612	⁵ AKHMETSHIN	00D	CMD2	$e^+e^- \rightarrow \omega\pi^+\pi^-$
1820 ⁺¹⁹⁰ _{–150}		⁶ ACHASOV	98H	RVUE	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
1840 ⁺¹⁰⁰ _{–70}		⁷ ACHASOV	98H	RVUE	$e^+e^- \rightarrow \omega\pi^+\pi^-$
1780 ⁺¹⁷⁰ _{–300}		⁸ ACHASOV	98H	RVUE	$e^+e^- \rightarrow K^+K^-$
~ 2100		⁹ ACHASOV	98H	RVUE	$e^+e^- \rightarrow K_S^0 K^\pm \pi^\mp$
1606± 9		¹⁰ CLEGG	94	RVUE	
1662± 13	750	¹¹ ANTONELLI	92	DM2	1.34–2.4 $e^+e^- \rightarrow \rho\pi, \omega\pi\pi$
1670± 20		ATKINSON	83B	OMEG	20–70 $\gamma p \rightarrow 3\pi X$
1657± 13		CORDIER	81	DM1	$e^+e^- \rightarrow \omega 2\pi$
1679± 34	21	ESPOSITO	80	FRAM	$e^+e^- \rightarrow 3\pi$
1652± 17		COSME	79	OSPK	$e^+e^- \rightarrow 3\pi$

OCCUR=2

OCCUR=2

OCCUR=3

OCCUR=4

OCCUR=5

OCCUR=4

¹ From a fit with contributions from $\omega(1420)$, $\omega(1650)$ and $\phi(1680)$.² From a fit with contributions from $\omega(782)$, $\phi(1020)$, $\omega(1420)$, and $\omega(1650)$.³ From the combined fit of ANTONELLI 92, ACHASOV 01E, ACHASOV 02E, and ACHASOV 03D data on the $\pi^+\pi^-\pi^0$ and ANTONELLI 92 on the $\omega\pi^+\pi^-$ final states. Supersedes ACHASOV 99E and ACHASOV 02E.⁴ Using results of CORDIER 81 and preliminary data of DOLINSKY 91 and ANTONELLI 92.⁵ Using the data of AKHMETSHIN 00D and ANTONELLI 92. The $\rho\pi$ dominance for the energy dependence of the $\omega(1420)$ and $\omega(1650)$ width assumed.⁶ Using data from BARKOV 87, DOLINSKY 91, and ANTONELLI 92.⁷ Using the data from ANTONELLI 92.⁸ Using the data from IVANOV 81 and BISELLO 88B.⁹ Using the data from BISELLO 91C.¹⁰ From a fit to two Breit-Wigner functions and using the data of DOLINSKY 91 and ANTONELLI 92.¹¹ From the combined fit of the $\rho\pi$ and $\omega\pi\pi$ final states.

NODE=M126M;LINKAGE=E
 NODE=M126M;LINKAGE=A
 NODE=M126M;LINKAGE=VH

NODE=M126M;LINKAGE=AB

NODE=M126M;LINKAGE=KI

NODE=M126M;LINKAGE=L1
 NODE=M126M;LINKAGE=L2
 NODE=M126M;LINKAGE=L3
 NODE=M126M;LINKAGE=L4
 NODE=M126M;LINKAGE=AD

NODE=M126M;LINKAGE=AE

 $\omega(1650)$ WIDTH

NODE=M126W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

315± 35 OUR ESTIMATE

NODE=M126W

→ UNCHECKED ←

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

110± 20	898	¹² ACHASOV	16B	SND	1.34–2.00 $e^+e^- \rightarrow \omega\eta$
310± 30	13.1k	¹³ AULCHENKO	15A	SND	1.05–1.80 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
222± 25± 20		AUBERT	07AU	BABR	10.6 $e^+e^- \rightarrow \omega\pi^+\pi^-\gamma$
114± 14	13	AUBERT	06D	BABR	10.6 $e^+e^- \rightarrow \omega\eta\gamma$
230± 30± 20		AUBERT,B	04N	BABR	10.6 $e^+e^- \rightarrow \pi^+\pi^-\pi^0\gamma$
490 ⁺²⁰⁰ _{–150} ± 130	1.2M	¹⁴ ACHASOV	03D	RVUE	0.44–2.00 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
250± 14		¹⁵ HENNER	02	RVUE	1.2–2.0 $e^+e^- \rightarrow \rho\pi, \omega\pi\pi$
250± 50		EUGENIO	01	SPEC	18 $\pi^-p \rightarrow \omega\eta n$
370± 25	612	¹⁶ AKHMETSHIN	00D	CMD2	$e^+e^- \rightarrow \omega\pi^+\pi^-$
113± 20		¹⁷ CLEGG	94	RVUE	

OCCUR=2

OCCUR=5

280 ± 24	750	18	ANTONELLI	92	DM2	1.34–2.4 e ⁺ e ⁻ → ρπ, ωππ
160 ± 20			ATKINSON	83B	OMEG	20–70 γ p → 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
12 From a fit with contributions from ω(1420), ω(1650) and φ(1680).						
13 From a fit with contributions from ω(782), φ(1020), ω(1420), and ω(1650).						
14 From the combined fit of ANTONELLI 92, ACHASOV 01E, ACHASOV 02E, and ACHASOV 03D data on the π ⁺ π ⁻ π ⁰ and ANTONELLI 92 on the ωπ ⁺ π ⁻ final states. Supersedes ACHASOV 99E and ACHASOV 02E.						
15 Using results of CORDIER 81 and preliminary data of DOLINSKY 91 and ANTONELLI 92.						
16 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.						
17 From a fit to two Breit-Wigner functions and using the data of DOLINSKY 91 and ANTONELLI 92.						
18 From the combined fit of the ρπ and ωππ final states.						

OCCUR=4

NODE=M126W;LINKAGE=E
 NODE=M126W;LINKAGE=A
 NODE=M126W;LINKAGE=VH

NODE=M126W;LINKAGE=AB

NODE=M126W;LINKAGE=KI

NODE=M126W;LINKAGE=AD

NODE=M126W;LINKAGE=AE

NODE=M126215;NODE=M126

ω(1650) DECAY MODES

Mode	Fraction (Γ _i /Γ)
Γ ₁ ρπ	seen
Γ ₂ ωππ	seen
Γ ₃ ωη	seen
Γ ₄ e ⁺ e ⁻	seen

DESIG=1;OUR EST;→ UNCHECKED ←

DESIG=2;OUR EST;→ UNCHECKED ←

DESIG=4;OUR EST;→ UNCHECKED ←

DESIG=3;OUR EST;→ UNCHECKED ←

ω(1650) Γ(i)Γ(e⁺e⁻)/Γ²(total)

NODE=M126230

Γ(ρπ)/Γ_{total} × Γ(e⁺e⁻)/Γ_{total} **Γ₁/Γ × Γ₄/Γ**

VALUE (units 10⁻⁶) EVTS DOCUMENT ID TECN COMMENT

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

1.56 ± 0.23	13.1k	20	AULCHENKO	15A	SND	1.05–1.80 e ⁺ e ⁻ → π ⁺ π ⁻ π ⁰
1.3 ± 0.1 ± 0.1			AUBERT,B	04N	BABR	10.6 e ⁺ e ⁻ → π ⁺ π ⁻ π ⁰ γ
1.2 ^{+0.4} _{-0.1} ± 0.8	1.2M	21,22	ACHASOV	03D	RVUE	0.44–2.00 e ⁺ e ⁻ → π ⁺ π ⁻ π ⁰
0.921 ± 0.230		23,24	CLEGG	94	RVUE	
0.479 ± 0.050	750	25,26	ANTONELLI	92	DM2	1.34–2.4 e ⁺ e ⁻ → ρπ, ωππ

NODE=M126G3
 NODE=M126G3

Γ(ωππ)/Γ_{total} × Γ(e⁺e⁻)/Γ_{total} **Γ₂/Γ × Γ₄/Γ**

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 ⁻ → ωπ ⁺ π ⁻ γ
4.1 ± 0.9 ± 1.3	1.2M	21,22	ACHASOV	03D	RVUE	0.44–2.00 e ⁺ e ⁻ → π ⁺ π ⁻ π ⁰
5.40 ± 0.95		27	AKHMETSHIN	00D	CMD2	1.2–1.38 e ⁺ e ⁻ → ωπ ⁺ π ⁻
3.18 ± 0.80		23,24	CLEGG	94	RVUE	
6.07 ± 0.61	750	25,26	ANTONELLI	92	DM2	1.34–2.4 e ⁺ e ⁻ → ρπ, ωππ

NODE=M126G4
 NODE=M126G4

Γ(ωη)/Γ_{total} × Γ(e⁺e⁻)/Γ_{total} **Γ₃/Γ × Γ₄/Γ**

VALUE (units 10⁻⁶) CL% EVTS DOCUMENT ID TECN COMMENT

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

0.44 ± 0.05		898	19	ACHASOV	16B	SND	1.34–2.00 e ⁺ e ⁻ → ωη
0.57 ± 0.06		13		AUBERT	06D	BABR	10.6 e ⁺ e ⁻ → ωηγ
<6	90		28	AKHMETSHIN	03B	CMD2	e ⁺ e ⁻ → ηπ ⁰ γ

19 From a fit with contributions from ω(1420), ω(1650) and φ(1680).

NODE=M126G5
 NODE=M126G5

ERROR=12

NODE=M126G5;LINKAGE=A

- 20 From a fit with contributions from $\omega(782)$, $\phi(1020)$, $\omega(1420)$, and $\omega(1650)$.
 21 Calculated by us from the cross section at the peak.
 22 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.
 23 From a fit to two Breit-Wigner functions and using the data of DOLINSKY 91 and ANTONELLI 92.
 24 From the partial and leptonic width given by the authors.
 25 From the combined fit of the $\rho\pi$ and $\omega\pi\pi$ final states.
 26 From the product of the leptonic width and partial branching ratio given by the authors.
 27 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.
 28 $\omega(1650)$ mass and width fixed at 1700 MeV and 250 MeV, respectively.

NODE=M126G3;LINKAGE=A
 NODE=M126G;LINKAGE=AW
 NODE=M126G;LINKAGE=VH

NODE=M126G;LINKAGE=AD

NODE=M126G;LINKAGE=SE
 NODE=M126G;LINKAGE=AE
 NODE=M126G;LINKAGE=ES
 NODE=M126G;LINKAGE=KL

NODE=M126G5;LINKAGE=KH

$\omega(1650)$ BRANCHING RATIOS

$\Gamma(\omega\pi\pi)/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT

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

~ 0.35	1.2M	29 ACHASOV	03D	RVUE	$0.44-2.00 e^+e^- \rightarrow \pi^+\pi^-\pi^0$
0.620 ± 0.014		30 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	29 ACHASOV	03D	RVUE	$0.44-2.00 e^+e^- \rightarrow \pi^+\pi^-\pi^0$
0.380 ± 0.014		30 HENNER	02	RVUE	$1.2-2.0 e^+e^- \rightarrow \rho\pi, \omega\pi\pi$

NODE=M126225

NODE=M126R2
 NODE=M126R2

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	30,31 ACHASOV	03D	RVUE	$0.44-2.00 e^+e^- \rightarrow \pi^+\pi^-\pi^0$
32 ± 1		30 HENNER	02	RVUE	$1.2-2.0 e^+e^- \rightarrow \rho\pi, \omega\pi\pi$

- 29 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.
 30 Assuming that the $\omega(1650)$ decays into $\rho\pi$ and $\omega\pi\pi$ only.
 31 Calculated by us from the cross section at the peak.

NODE=M126R4
 NODE=M126R4

NODE=M126R;LINKAGE=VH

NODE=M126R;LINKAGE=AC
 NODE=M126R;LINKAGE=AW

$\omega(1650)$ REFERENCES

ACHASOV	16B	PR D94 092002	M. N. Achasov <i>et al.</i>	(SND Collab.)
AULCHENKO	15A	JETP 121 27	V.M. Aulchenko <i>et al.</i>	(SND Collab.)
Translated from ZETF 148 34.				
AUBERT	07AU	PR D76 092005	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT	06D	PR D73 052003	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT,B	04N	PR D70 072004	B. Aubert <i>et al.</i>	(BABAR Collab.)
ACHASOV	03D	PR D68 052006	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)
AKHMETSHIN	03B	PL B562 173	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)
ACHASOV	02E	PR D66 032001	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)
HENNER	02	EPJ C26 3	V.K. Henner <i>et al.</i>	
ACHASOV	01E	PR D63 072002	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)
EUGENIO	01	PL B497 190	P. Eugenio <i>et al.</i>	
AKHMETSHIN	00D	PL B489 125	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)
ACHASOV	99E	PL B462 365	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)
ACHASOV	98H	PR D57 4334	N.N. Achasov, A.A. Kozhevnikov	
CLEGG	94	ZPHY C62 455	A.B. Clegg, A. Donnachie	(LANC, MCHS)
ANTONELLI	92	ZPHY C56 15	A. Antonelli <i>et al.</i>	(DM2 Collab.)
BISELLO	91C	ZPHY C52 227	D. Bisello <i>et al.</i>	(DM2 Collab.)
DOLINSKY	91	PRPL 202 99	S.I. Dolinsky <i>et al.</i>	(NOVO)
BISELLO	88B	ZPHY C39 13	D. Bisello <i>et al.</i>	(PADO, CLER, FRAS+)
BARKOV	87	JETPL 46 164	L.M. Barkov <i>et al.</i>	(NOVO)
Translated from ZETFP 46 132.				
ATKINSON	83B	PL 127B 132	M. Atkinson <i>et al.</i>	(BONN, CERN, GLAS+)
CORDIER	81	PL 106B 155	A. Cordier <i>et al.</i>	(ORSAY)
IVANOV	81	PL 107B 297	P.M. Ivanov <i>et al.</i>	(NOVO)
ESPOSITO	80	LNC 28 195	B. Esposito <i>et al.</i>	(FRAS, NAPL, PADO+)
COSME	79	NP B152 215	G. Cosme <i>et al.</i>	(IPN)

NODE=M126

REFID=57537
 REFID=56843

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

 $\pi_2(1670)$

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

NODE=M034

 $\pi_2(1670)$ 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 $\pi^- p \rightarrow p \pi_2$

NODE=M034M

NODE=M034M

OCCUR=2

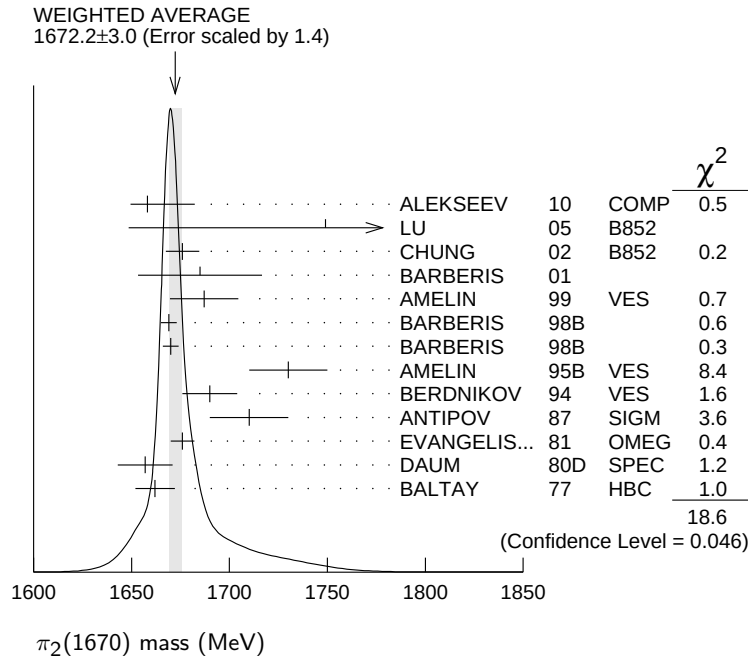
OCCUR=2

OCCUR=3

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;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

NODE=M034W

NODE=M034W

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 $\pi^- p \rightarrow p \pi_2$

OCCUR=2

OCCUR=2

OCCUR=3

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;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	$\pi(\pi\pi)_S\text{-wave}$	$(8.7 \pm 3.4) \%$	
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}	$\pi^\pm \gamma$	$(7.0 \pm 1.1) \times 10^{-4}$	
Γ_{11}	$\gamma\gamma$	$< 2.8 \times 10^{-7}$	90%
Γ_{12}	$\eta\pi$		
Γ_{13}	$\pi^\pm 2\pi^+ 2\pi^-$		
Γ_{14}	$\rho(1450)\pi$	$< 3.6 \times 10^{-3}$	97.7%
Γ_{15}	$b_1(1235)\pi$	$< 1.9 \times 10^{-3}$	97.7%
Γ_{16}	$\eta 3\pi$		
Γ_{17}	$f_1(1285)\pi$	possibly seen	
Γ_{18}	$a_2(1320)\pi$	not seen	

DESIG=20
DESIG=22
DESIG=23
DESIG=8
DESIG=2
DESIG=13
DESIG=11
DESIG=5
DESIG=14
DESIG=27
DESIG=12
DESIG=3
DESIG=4
DESIG=15
DESIG=16
DESIG=24
DESIG=25
DESIG=26

CONSTRAINED FIT INFORMATION

An overall fit to 4 branching ratios uses 6 measurements and one constraint to determine 4 parameters. The overall fit has a $\chi^2 = 1.9$ for 3 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta x_i \delta x_j \rangle / (\delta x_i \cdot \delta x_j)$, 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	-53		
x_7	-29	-59	
x_8	-8	-21	-9
	x_4	x_5	x_7

 $\pi_2(1670)$ PARTIAL WIDTHS

NODE=M034217

 $\Gamma(\pi^\pm \gamma)$ Γ_{10}

VALUE (keV)	DOCUMENT ID	TECN	CHG	COMMENT
$181 \pm 11 \pm 27$	17 ADOLPH	14	COMP	— 190 $\pi^- \text{Pb} \rightarrow \pi^+ \pi^- \pi^- \text{Pb}'$

¹⁷ Primakoff reaction. Assumes incoherent $f_2(1270)\pi$ contribution to 3π final state and uses $B(\pi_2(1670) \rightarrow f_2\pi) = 56\%$.

NODE=M034W2
NODE=M034W2

NODE=M034W2;LINKAGE=AD

 $\Gamma(\gamma\gamma)$ Γ_{11}

VALUE (keV)	CL%	DOCUMENT ID	TECN	CHG	COMMENT
<0.072	90	18 ACCIARRI	97T	L3	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^- \pi^0$

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

<0.19	90	18 ALBRECHT	97B	ARG	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^- \pi^0$
$1.41 \pm 0.23 \pm 0.28$		ANTREASYAN 90	CBAL	0	$e^+ e^- \rightarrow e^+ e^- \pi^0 \pi^0 \pi^0$
$0.8 \pm 0.3 \pm 0.12$		19 BEHREND	90C	CELL	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^- \pi^0$
$1.3 \pm 0.3 \pm 0.2$		20 BEHREND	90C	CELL	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^- \pi^0$

OCCUR=2

¹⁸ Decaying into $f_2(1270)\pi$ and $\rho\pi$.

¹⁹ Constructive interference between $f_2(1270)\pi, \rho\pi$ and background.

²⁰ Incoherent Ansatz.

NODE=M034W1
NODE=M034W1

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

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

$$\Gamma_2 \Gamma_{11} / \Gamma$$

VALUE (keV)	CL%	DOCUMENT ID	TECN	COMMENT
<0.1	95	²¹ SCHEGELSKY 06	RVUE	$\gamma\gamma \rightarrow \pi^+\pi^-\pi^0$

²¹ From analysis of L3 data at 183–209 GeV.NODE=M034G01
NODE=M034G01

NODE=M034G01;LINKAGE=SC

 $\pi_2(1670) \text{ BRANCHING RATIOS}$

NODE=M034220

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

$$\Gamma_1 / \Gamma = (\Gamma_4 + \Gamma_5 + \Gamma_7) / \Gamma$$

VALUE	DOCUMENT ID
0.958 ± 0.014 OUR FIT	

NODE=M034R20
NODE=M034R20

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

$$\Gamma_3 / \Gamma_2$$

VALUE	DOCUMENT ID	COMMENT
0.29 ± 0.03 ± 0.05	²² BARBERIS 01	450 $p p \rightarrow p_f 3\pi^0 p_s$

NODE=M034R21
NODE=M034R21

$$\Gamma(\rho\pi) / 0.565 \Gamma(f_2(1270)\pi)$$

$$\Gamma_5 / 0.565 \Gamma_4$$

(With $f_2(1270) \rightarrow \pi^+\pi^-$.)

VALUE	DOCUMENT ID	TECN	COMMENT
0.97 ± 0.09 OUR AVERAGE	Error includes scale factor of 1.9.		
0.76 ± 0.07 ± 0.10	CHUNG 02	B852	18.3 $\pi^- p \rightarrow \pi^+\pi^-\pi^- p$
1.01 ± 0.05	BARBERIS 98B		450 $p p \rightarrow p_f \pi^+\pi^-\pi^0 p_s$

NODE=M034R16
NODE=M034R16
NODE=M034R16

$$\Gamma(\sigma\pi) / \Gamma(f_2(1270)\pi)$$

$$\Gamma_6 / \Gamma_4$$

VALUE	DOCUMENT ID	TECN	COMMENT
0.19 ± 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	^{23,24} BAKER 99	SPEC	1.94 $\bar{p} p \rightarrow 4\pi^0$

NODE=M034R15
NODE=M034R15

$$\frac{1}{2} \Gamma(\rho\pi) / \Gamma(\pi^\pm\pi^+\pi^-)$$

$$\frac{1}{2} \Gamma_5 / (0.565 \Gamma_4 + \frac{1}{2} \Gamma_5 + 0.624 \Gamma_7)$$

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
0.29 ± 0.04 OUR FIT				
0.29 ± 0.05	²⁵ DAUM	81B	SPEC	63,94 $\pi^- p$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.3	BARTSCH 68	HBC	+	8 $\pi^+ p \rightarrow 3\pi p$

NODE=M034R2
NODE=M034R2

$$0.565 \Gamma(f_2(1270)\pi) / \Gamma(\pi^\pm\pi^+\pi^-)$$

$$0.565 \Gamma_4 / (0.565 \Gamma_4 + \frac{1}{2} \Gamma_5 + 0.624 \Gamma_7)$$

(With $f_2(1270) \rightarrow \pi^+\pi^-$.)

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
0.604 ± 0.035 OUR FIT				
0.60 ± 0.05 OUR AVERAGE	Error includes scale factor of 1.3.			
0.61 ± 0.04	²⁵ DAUM	81B	SPEC	63,94 $\pi^- p$
0.76 $^{+0.24}_{-0.34}$	ARMENISE 69	DBC	+	5.1 $\pi^+ d \rightarrow d 3\pi$
0.35 ± 0.20	BALTAY 68	HBC	+	7–8.5 $\pi^+ p$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.59	BARTSCH 68	HBC	+	8 $\pi^+ p \rightarrow 3\pi p$

NODE=M034R3
NODE=M034R3
NODE=M034R3

$$0.624 \Gamma(\pi(\pi\pi)_{S\text{-wave}}) / \Gamma(\pi^\pm\pi^+\pi^-)$$

$$0.624 \Gamma_7 / (0.565 \Gamma_4 + \frac{1}{2} \Gamma_5 + 0.624 \Gamma_7)$$

(With $(\pi\pi)_{S\text{-wave}} \rightarrow \pi^+\pi^-$.)

VALUE	DOCUMENT ID	TECN	COMMENT
0.10 ± 0.04 OUR FIT			
0.10 ± 0.05	²⁵ DAUM	81B	SPEC 63,94 $\pi^- p$

NODE=M034R11
NODE=M034R11
NODE=M034R11

$$\Gamma(K\bar{K}^*(892) + \text{c.c.}) / \Gamma(f_2(1270)\pi)$$

$$\Gamma_8 / \Gamma_4$$

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
0.075 ± 0.025 OUR FIT				
0.075 ± 0.025	²⁶ ARMSTRONG 82B	OMEG	—	16 $\pi^- p \rightarrow K^+ K^- \pi^- p$

NODE=M034R13
NODE=M034R13

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

$$\Gamma_9 / \Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
0.027 ± 0.004 ± 0.010	²⁷ AMELIN 99	VES	37 $\pi^- A \rightarrow \omega \pi^- \pi^0 A^*$

NODE=M034R17
NODE=M034R17

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

(All η decays.)

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
<0.09	BALTAY 68	HBC	+	$7-8.5 \pi^+ p$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.10	CRENNELL 70	HBC	-	$6 \pi^- p \rightarrow f_2 \pi^- N$

NODE=M034R5

NODE=M034R5

NODE=M034R5

$$\Gamma(\pi^\pm 2\pi^+ 2\pi^-)/\Gamma(\pi^\pm\pi^+\pi^-)$$

$$\Gamma_{13}/(0.565\Gamma_4+\frac{1}{2}\Gamma_5+0.624\Gamma_7)$$

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
<0.10	CRENNELL 70	HBC	-	$6 \pi^- p \rightarrow f_2 \pi^- N$
<0.1	BALTAY 68	HBC	+	$7,8.5 \pi^+ p$

NODE=M034R6

NODE=M034R6;CHECK LIMITS

$$\Gamma(\rho(1450)\pi)/\Gamma_{\text{total}}$$

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

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.0036	97.7	AMELIN 99	VES	$37 \pi^- A \rightarrow \omega \pi^- \pi^0 A^*$

NODE=M034R18

NODE=M034R18

$$\Gamma(b_1(1235)\pi)/\Gamma_{\text{total}}$$

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

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.0019	97.7	AMELIN 99	VES	$37 \pi^- A \rightarrow \omega \pi^- \pi^0 A^*$

NODE=M034R19

NODE=M034R19

$$\Gamma(f_1(1285)\pi)/\Gamma_{\text{total}}$$

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

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
possibly seen	69k	KUHN 04	B852	$18 \pi^- p \rightarrow \eta \pi^+ \pi^- \pi^- p$

NODE=M034R23

NODE=M034R23

$$\Gamma(a_2(1320)\pi)/\Gamma_{\text{total}}$$

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

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
not seen	69k	KUHN 04	B852	$18 \pi^- p \rightarrow \eta \pi^+ \pi^- \pi^- p$

NODE=M034R24

NODE=M034R24

$$D\text{-wave}/S\text{-wave RATIO FOR } \pi_2(1670) \rightarrow f_2(1270)\pi$$

VALUE	DOCUMENT ID	TECN	COMMENT
-0.18 ± 0.06	²³ 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	²⁵ 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

²² Using BARBERIS 98B.²³ Using preliminary CBAR data.²⁴ With the $\sigma\pi$ in $L=2$ and the $f_2(1270)\pi$ in $L=0$.²⁵ From a two-resonance fit to four 2^-0^+ waves.²⁶ From a partial-wave analysis of $K^+K^-\pi^-\pi^0$ system.²⁷ 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

ADOLPH 14	EPJ A50 79	C. Adolph <i>et al.</i>	(COMPASS Collab.)
ALEKSEEV 10	PRL 104 241803	M.G. Alekseev <i>et al.</i>	(COMPASS Collab.)
SCHEGELSKY 06	EPJ A27 199	V.A. Schegelsky <i>et al.</i>	
LU 05	PRL 94 032002	M. Lu <i>et al.</i>	(BNL E852 Collab.)
KUHN 04	PL B595 109	J. Kuhn <i>et al.</i>	(BNL E852 Collab.)
CHUNG 02	PR D65 072001	S.U. Chung <i>et al.</i>	(BNL E852 Collab.)
BARBERIS 01	PL B507 14	D. Barberis <i>et al.</i>	
AMELIN 99	PAN 62 445	D.V. Amelin <i>et al.</i>	(VES Collab.)
BAKER 99	PL B449 114	C.A. Baker <i>et al.</i>	
BARBERIS 98B	PL B422 399	D. Barberis <i>et al.</i>	(WA 102 Collab.)
ACCARI 97T	PL B413 147	M. Acciarri <i>et al.</i>	(L3 Collab.)
ALBRECHT 97B	ZPHY C74 469	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
AMELIN 95B	PL B356 595	D.V. Amelin <i>et al.</i>	(SERP, TBIL)
BERDNIKOV 94	PL B337 219	E.B. Berdnikov <i>et al.</i>	(SERP, TBIL)
ANTREASYAN 90	ZPHY C48 561	D. Antreasyan <i>et al.</i>	(Crystal Ball Collab.)
BEHREND 90C	ZPHY C46 583	H.J. Behrend <i>et al.</i>	(CELLO Collab.)
ANTIPOV 87	EPL 4 403	Y.M. Antipov <i>et al.</i>	(SERP, JINR, INRM+)
BELLINI 85	SJNP 41 781	D. Bellini <i>et al.</i>	
ARMSTRONG 82B	NP B202 1	T.A. Armstrong, B. Baccari	(AACH3, BARI, BONN+)
DAUM 81B	NP B182 269	C. Daum <i>et al.</i>	(AMST, CERN, CRAC, MPIM+)
EVANGELIS... 81	NP B178 197	C. Evangelista <i>et al.</i>	(BARI, BONN, CERN+)
Also	NP B186 594	C. Evangelista	
DAUM 80D	PL B9B 285	C. Daum <i>et al.</i>	(AMST, CERN, CRAC, MPIM+) JP
BALTAY 77	PRL 39 591	C. Baltay, C.V. Cautis, M. Kalekar	(COLU) JP
ASCOLI 73	PR D7 669	G. Ascoli	(ILL, TINTO, GENO, HAMB, MILA+) JP
CRENNELL 70	PRL 24 781	D.J. Crennell <i>et al.</i>	(BNL)
ARMENISE 69	LN C 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=55911

REFID=53356

REFID=51186

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REFID=20847

REFID=21553

REFID=20805

REFID=20689

REFID=21531

REFID=21532

$\phi(1680)$

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

NODE=M067

 $\phi(1680)$ MASS

NODE=M067205

 e^+e^- PRODUCTION

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
1680±20 OUR ESTIMATE				
1674±12±6	6264	¹ LEES	14H BABR	$e^+e^- \rightarrow K_S^0 K_L^0 \gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1733±10±10		² LEES	12F BABR	$10.6 e^+e^- \rightarrow \phi \pi^+ \pi^- \gamma$
1689±7±10	4.8k	³ SHEN	09 BELL	$10.6 e^+e^- \rightarrow K^+ K^- \pi^+ \pi^- \gamma$
1709±20±43		⁴ AUBERT	08S BABR	$10.6 e^+e^- \rightarrow \text{hadrons}$
1623±20	948	⁵ AKHMETSHIN	03 CMD2	$1.05\text{--}1.38 e^+e^- \rightarrow K_L^0 K_S^0$
~1500		⁶ ACHASOV	98H RVUE	$e^+e^- \rightarrow \pi^+ \pi^- \pi^0, \omega \pi^+ \pi^-,$ $K^+ K^-$
~1900		⁷ ACHASOV	98H RVUE	$e^+e^- \rightarrow K_S^0 K^\pm \pi^\mp$
1700±20		⁸ CLEGG	94 RVUE	$e^+e^- \rightarrow K^+ K^-, K_S^0 K \pi$
1657±27	367	BISELLO	91C DM2	$e^+e^- \rightarrow K_S^0 K^\pm \pi^\mp$
1655±17		⁹ BISELLO	88B DM2	$e^+e^- \rightarrow K^+ K^-$
1680±10		¹⁰ BUON	82 DM1	$e^+e^- \rightarrow \text{hadrons}$
1677±12		¹¹ MANE	82 DM1	$e^+e^- \rightarrow K_S^0 K \pi$

NODE=M067M1

NODE=M067M1

→ UNCHECKED ←

OCCUR=4

- ¹ Using a vector meson dominance model with contribution from $\phi(1020)$, $\phi(1680)$ and higher mass excitations of $\rho(770)$ and $\omega(782)$.
- ² Using events with $\pi\pi$ invariant mass less than 0.85 GeV.
- ³ From a fit with two incoherent Breit-Wigners.
- ⁴ 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.
- ⁵ From the combined fit of AKHMETSHIN 03 and MANE 81 also including ρ , ω , and ϕ . Neither isospin nor flavor structure known.
- ⁶ Using data from IVANOV 81, BARKOV 87, BISELLO 88B, DOLINSKY 91, and AN-TONELLI 92.
- ⁷ Using the data from BISELLO 91C.
- ⁸ Using BISELLO 88B and MANE 82 data.
- ⁹ From global fit including ρ , ω , ϕ and $\rho(1700)$ assume mass 1570 MeV and width 510 MeV for ρ radial excitation.
- ¹⁰ 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.
- ¹¹ Fit to one channel only, neglecting interference with ω , $\rho(1700)$.

NODE=M067M1;LINKAGE=B

NODE=M067M1;LINKAGE=A

NODE=M067M1;LINKAGE=SH

NODE=M067M1;LINKAGE=AU

NODE=M067M;LINKAGE=HK

NODE=M067M1;LINKAGE=L1

NODE=M067M1;LINKAGE=L4

NODE=M067M;LINKAGE=A

NODE=M067M;LINKAGE=E

NODE=M067M;LINKAGE=C

NODE=M067M;LINKAGE=D

PHOTOPRODUCTION

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
1753±3	¹² LINK	02K FOCS	$20\text{--}160 \gamma p \rightarrow K^+ K^- p$
1726±22	¹² BUSENITZ	89 TPS	$\gamma p \rightarrow K^+ K^- X$
1760±20	¹² ATKINSON	85C OMEG	$20\text{--}70 \gamma p \rightarrow K \bar{K} X$
1690±10	¹² ASTON	81F OMEG	$25\text{--}70 \gamma p \rightarrow K^+ K^- X$

- ¹² 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	¹³ AMSLER	06 CBAR	$0.9 \bar{p} p \rightarrow K^+ K^- \pi^0$

- ¹³ Could also be $\rho(1700)$.

NODE=M067M3

NODE=M067M3

NODE=M067M3;LINKAGE=AM

 $\phi(1680)$ WIDTH

NODE=M067210

 e^+e^- PRODUCTION

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
150±50 OUR ESTIMATE This is only an educated guess; the error given is larger than the error on the average of the published values.				
165±38±70	6264	¹⁴ LEES	14H BABR	$e^+e^- \rightarrow K_S^0 K_L^0 \gamma$

NODE=M067W1

NODE=M067W1

→ UNCHECKED ←

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

300±15± 37	15 LEES	12F BABR	10.6 $e^+e^- \rightarrow \phi\pi^+\pi^-\gamma$
211±14± 19 4.8k	16 SHEN	09 BELL	10.6 $e^+e^- \rightarrow K^+K^-\pi^+\pi^-\gamma$
322±77±160	17 AUBERT	08S BABR	10.6 $e^+e^- \rightarrow \text{hadrons}$
139±60 948	18 AKHMETSHIN	03 CMD2	1.05–1.38 $e^+e^- \rightarrow K_L^0 K_S^0$
300±60	19 CLEGG	94 RVUE	$e^+e^- \rightarrow K^+K^-, K_S^0 K\pi$
146±55 367	BISELLO	91C DM2	$e^+e^- \rightarrow K_S^0 K^\pm\pi^\mp$
207±45	20 BISELLO	88B DM2	$e^+e^- \rightarrow K^+K^-$
185±22	21 BUON	82 DM1	$e^+e^- \rightarrow \text{hadrons}$
102±36	22 MANE	82 DM1	$e^+e^- \rightarrow K_S^0 K\pi$

¹⁴ Using a vector meson dominance model with contribution from $\phi(1020)$, $\phi(1680)$ and higher mass excitations of $\rho(770)$ and $\omega(782)$.

¹⁵ Using events with $\pi\pi$ invariant mass less than 0.85 GeV.

¹⁶ From a fit with two incoherent Breit-Wigners.

¹⁷ 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.

¹⁸ From the combined fit of AKHMETSHIN 03 and MANE 81 also including ρ , ω , and ϕ . Neither isospin nor flavor structure known.

¹⁹ Using BISELLO 88B and MANE 82 data.

²⁰ From global fit including ρ , ω , ϕ and $\rho(1700)$.

²¹ 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.

²² Fit to one channel only, neglecting interference with ω , $\rho(1700)$.

NODE=M067W1;LINKAGE=B

NODE=M067W1;LINKAGE=A

NODE=M067W1;LINKAGE=SH

NODE=M067W1;LINKAGE=AU

NODE=M067W;LINKAGE=HK

NODE=M067W;LINKAGE=A

NODE=M067W;LINKAGE=E

NODE=M067W;LINKAGE=C

NODE=M067W;LINKAGE=D

$$\frac{\Gamma(\phi(1680) \rightarrow e^+e^-)}{\Gamma_{\text{total}}} \rightarrow \frac{K_L^0 K_S^0}{\Gamma_{\text{DESIG=9}} \Gamma_{\text{DESIG=6}}} \times \frac{\Gamma(\phi(1680) \rightarrow e^+e^-)}{\Gamma_{\text{DESIG=9}} \Gamma_{\text{DESIG=6}}}$$

NODE=M067A00

NODE=M067A00

NODE=M067A00

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
14.3+-2.4+-6.2	6264	²³ LEES	14H BABR	$e^+e^- \rightarrow K_S^0 K_L^0 \gamma$

²³ Using a vector meson dominance model with contribution from $\phi(1020)$, $\phi(1680)$ and higher mass excitations of $\rho(770)$ and $\omega(782)$.

NODE=M067A00;LINKAGE=A

PHOTOPRODUCTION

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

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

122±63	²⁴ LINK	02K FOCS	20–160 $\gamma p \rightarrow K^+K^-\rho$
121±47	²⁴ BUSENITZ	89 TPS	$\gamma p \rightarrow K^+K^-\chi$
80±40	²⁴ ATKINSON	85C OMEG	20–70 $\gamma p \rightarrow K\bar{K}\chi$
100±40	²⁴ ASTON	81F OMEG	25–70 $\gamma p \rightarrow K^+K^-\chi$

²⁴ We list here a state decaying into K^+K^- possibly different from $\phi(1680)$.

NODE=M067W2

NODE=M067W2

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	²⁵ AMSLER	06 CBAR	0.9 $\bar{p}p \rightarrow K^+K^-\pi^0$

²⁵ Could also be $\rho(1700)$.

NODE=M067W3

NODE=M067W3

NODE=M067W3;LINKAGE=AM

$\phi(1680)$ DECAY MODES

NODE=M067215;NODE=M067

Mode	Fraction (Γ_i/Γ)
Γ_1 $K\bar{K}^*(892) + \text{c.c.}$	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 $\eta\phi$	seen
Γ_{10} $\eta\gamma$	seen
Γ_{11} $K^+K^-\pi^0$	

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=13

DESIG=2

$\phi(1680) \Gamma(i) \Gamma(e^+ e^-) / \Gamma(\text{total})$

NODE=M067220

This combination of a partial width with the partial width into $e^+ e^-$ and with the total width is obtained from the integrated cross section into channel (I) in $e^+ e^-$ annihilation. We list only data that have not been used to determine the partial width $\Gamma(I)$ or the branching ratio $\Gamma(I)/\text{total}$.

NODE=M067220

$$\Gamma(\phi\pi\pi) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_7 \Gamma_5 / \Gamma$$

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
$(42 \pm 2 \pm 3) \times 10^{-3}$	LEES	12F BABR	$10.6 e^+ e^- \rightarrow \phi \pi^+ \pi^- \gamma$

NODE=M067G02
NODE=M067G02

 $\phi(1680) \Gamma(i) \Gamma(e^+ e^-) / \Gamma^2(\text{total})$

NODE=M067223

This combination of a branching ratio into channel (i) and branching ratio into $e^+ e^-$ is directly measured and obtained from the cross section at the peak. We list only data that have not been used to determine the branching ratio into (i) or $e^+ e^-$.

NODE=M067223

$$\Gamma(K_L^0 K_S^0) / \Gamma_{\text{total}} \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_4 / \Gamma \times \Gamma_5 / \Gamma$$

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 ²⁶ AKHMETSHIN 03 CMD2 1.05–1.38 $e^+ e^- \rightarrow K_L^0 K_S^0$

²⁶ 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 ²⁷ AUBERT 08S BABR 10.6 $e^+ e^- \rightarrow K \bar{K}^*(892) \gamma + \text{c.c.}$

3.29 ± 1.57 367 ²⁸ BISELLO 91C DM2 1.35–2.40 $e^+ e^- \rightarrow K_S^0 K^\pm \pi^\mp$

²⁷ 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.

²⁸ 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 ± 0.14 ± 0.21 4.8k ²⁹ SHEN 09 BELL 10.6 $e^+ e^- \rightarrow K^+ K^- \pi^+ \pi^- \gamma$

²⁹ Multiplied by 3/2 to take into account the $\phi \pi^0 \pi^0$ mode. Using $B(\phi \rightarrow K^+ K^-) = (49.2 \pm 0.6)\%$.

NODE=M067G01
NODE=M067G01

NODE=M067G01;LINKAGE=SH

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

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

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

0.43 ± 0.10 ± 0.09 ³⁰ AUBERT 08S BABR 10.6 $e^+ e^- \rightarrow \phi \eta \gamma$

³⁰ 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

 $\phi(1680) \text{ BRANCHING RATIOS}$

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

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

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT

seen	35	³¹ ACHASOV	14	SND 1.15–2.00 $e^+e^- \rightarrow \eta\gamma$

³¹ From a phenomenological model based on vector meson dominance with $\rho(1450)$ and $\phi(1680)$ masses and widths from the PDG 12.

NODE=M067R01
NODE=M067R01

NODE=M067R01;LINKAGE=A

 $\Gamma(\eta\phi)/\Gamma(K\bar{K}^*(892)+\text{c.c.})$ Γ_9/Γ_1

VALUE	DOCUMENT ID	TECN	COMMENT

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

≈ 0.37	³² AUBERT	08S	BABR 10.6 $e^+e^- \rightarrow \text{hadrons}$

³² From the fit including data from AUBERT 07AK.

NODE=M067R5
NODE=M067R5

NODE=M067R5;LINKAGE=AU

 $\Gamma(\eta\gamma)/\Gamma_{\text{total}}$ Γ_{10}/Γ

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT

seen	35	³³ ACHASOV	14	SND 1.15–2.00 $e^+e^- \rightarrow \eta\gamma$

³³ From a phenomenological model based on vector meson dominance with $\rho(1450)$ and $\phi(1680)$ masses and widths from the PDG 12.

NODE=M067R02
NODE=M067R02

NODE=M067R02;LINKAGE=A

$\phi(1680)$ REFERENCES

ACHASOV	14	PR D90 032002	M.N. Achasov <i>et al.</i>	(SND Collab.)
LEES	14H	PR D89 092002	J.P. Lees <i>et al.</i>	(BABAR Collab.)
LEES	12F	PR D86 012008	J.P. Lees <i>et al.</i>	(BABAR Collab.)
PDG	12	PR D86 010001	J. Beringer <i>et al.</i>	(PDG Collab.)
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)

NODE=M067

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REFID=21596
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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 $\pm$ 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 $\pm$ 4 OUR AVERAGE

1677 $\pm$ 14		EVANGELIS...	81	OMEG	—	12 $\pi^- p \rightarrow 2\pi p$
1679 $\pm$ 11	476	BALTAY	78B	HBC	0	15 $\pi^+ p \rightarrow$ $\pi^+ \pi^- n$
1678 $\pm$ 12	175	¹ ANTIPOV	77	CIBS	0	25 $\pi^- p \rightarrow p 3\pi$
1690 $\pm$ 7	600	¹ ENGLER	74	DBC	0	6 $\pi^+ n \rightarrow$ $\pi^+ \pi^- p$
1693 $\pm$ 8		² GRAYER	74	ASPK	0	17 $\pi^- p \rightarrow$ $\pi^+ \pi^- n$
1678 $\pm$ 12		MATTHEWS	71C	DBC	0	7 $\pi^+ N$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
1734 $\pm$ 10		³ CORDEN	79	OMEG		12–15 $\pi^- p \rightarrow$ $n 2\pi$
1692 $\pm$ 12		^{2,4} ESTABROOKS	75	RVUE		17 $\pi^- p \rightarrow$ $\pi^+ \pi^- n$
1737 $\pm$ 23		ARMENISE	70	DBC	0	9 $\pi^+ N$
1650 $\pm$ 35	122	BARTSCH	70B	HBC	+	8 $\pi^+ p \rightarrow N 2\pi$
1687 $\pm$ 21		STUNTEBECK	70	HDBC	0	8 $\pi^- p, 5.4 \pi^+ d$
1683 $\pm$ 13		ARMENISE	68	DBC	0	5.1 $\pi^+ d$
1670 $\pm$ 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 $\pm$ 4 OUR AVERAGE

1699 $\pm$ 5		ALPER	80	CNTR	0	62 $\pi^- p \rightarrow$ $K^+ K^- n$
1698 $\pm$ 12	6k	^{5,6} MARTIN	78D	SPEC		10 $\pi p \rightarrow$ $K_S^0 K^- p$
1692 $\pm$ 6		BLUM	75	ASPK	0	18.4 $\pi^- p \rightarrow$ $n K^+ K^-$
1690 $\pm$ 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 $\pm$ 8		⁷ COSTA	80	OMEG		10 $\pi^- p \rightarrow$ $K^+ K^- n$

⁵ From a fit to $J^P = 3^-$ partial wave.⁶ Systematic error on mass scale subtracted.⁷ They cannot distinguish between $\rho_3(1690)$ and $\omega_3(1670)$.

NODE=M015M2;LINKAGE=P

NODE=M015M2;LINKAGE=S

NODE=M015M2;LINKAGE=L

(4 π) $^\pm$ MODE

VALUE (MeV)

EVTS

DOCUMENT ID

TECN

CHG

COMMENT

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

NODE=M015M3

NODE=M015M3

1686 $\pm$ 5 OUR AVERAGE Error includes scale factor of 1.1.

1694 $\pm$ 6		⁸ EVANGELIS...	81	OMEG	—	12 $\pi^- p \rightarrow p 4\pi$
1665 $\pm$ 15	177	BALTAY	78B	HBC	+	15 $\pi^+ p \rightarrow p 4\pi$
1670 $\pm$ 10		THOMPSON	74	HBC	+	13 $\pi^+ p$
1687 $\pm$ 20		CASON	73	HBC	—	8,18.5 $\pi^- p$
1685 $\pm$ 14		⁹ CASON	73	HBC	—	8,18.5 $\pi^- p$
1680 $\pm$ 40	144	BARTSCH	70B	HBC	+	8 $\pi^+ p \rightarrow N 4\pi$
1689 $\pm$ 20	102	⁹ BARTSCH	70B	HBC	+	8 $\pi^+ p \rightarrow N 2\rho$
1705 $\pm$ 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 $\pi^- p$ back-ward
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

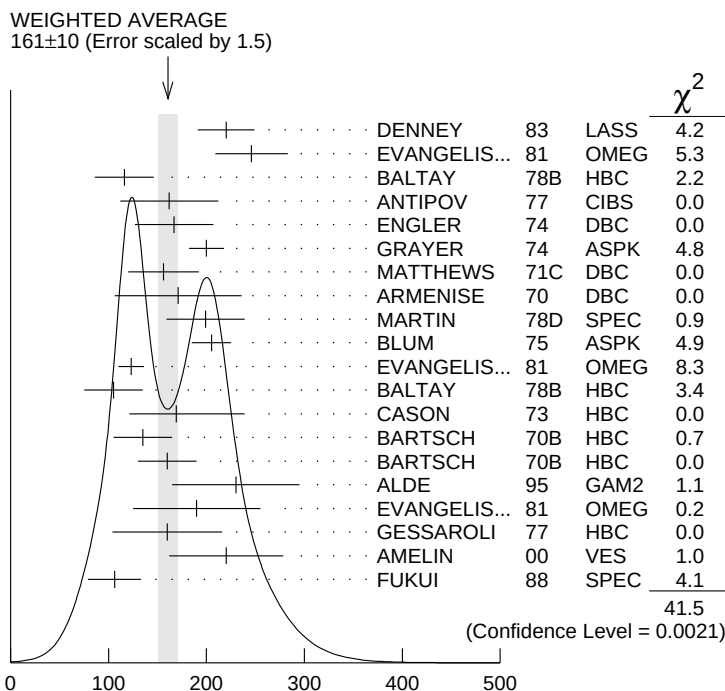
2 π , $K\bar{K}$, AND $K\bar{K}\pi$ MODES

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



$\rho_3(1690)$ 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 $\pi^+ d, 8 \pi^- p$

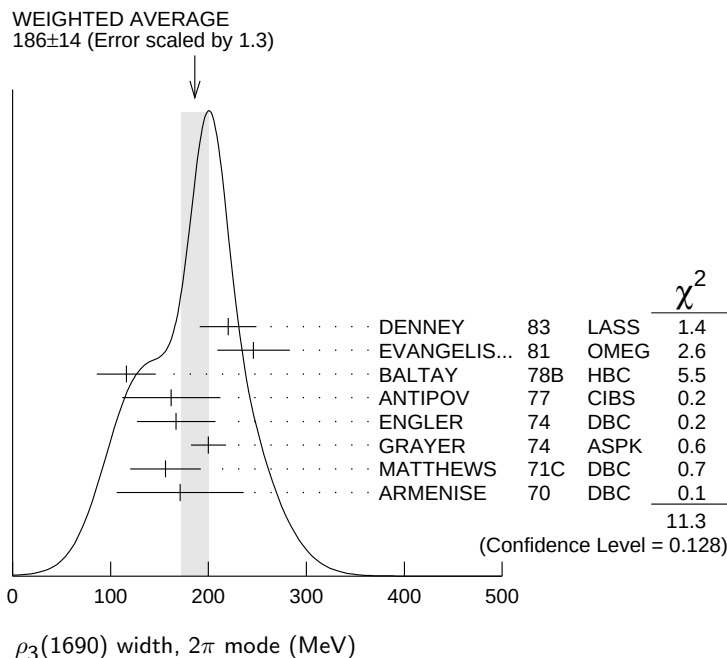
¹⁵ Width errors enlarged by us to $4\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.

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.

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 $\omega_3(1670)$.

$(4\pi)^\pm$ MODE

VALUE (MeV) EVTS DOCUMENT ID TECN CHG COMMENT

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

129±10 OUR AVERAGE

123±13		²¹ EVANGELIS...	81	OMEG -	12 $\pi^- p \rightarrow p 4\pi$
105±30	177	BALTAY	78B	HBC +	15 $\pi^+ p \rightarrow p 4\pi$
169+70 -48		CASON	73	HBC -	8,18.5 $\pi^- p$
135±30	144	BARTSCH	70B	HBC +	8 $\pi^+ p \rightarrow N 4\pi$
160±30	102	BARTSCH	70B	HBC +	8 $\pi^+ p \rightarrow N 2\rho$

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

230±28		²² EVANGELIS...	81	OMEG -	12 $\pi^- p \rightarrow p 4\pi$
184±33		²³ EVANGELIS...	81	OMEG -	12 $\pi^- p \rightarrow p 4\pi$
150	66	²⁴ KLIGER	74	HBC -	4.5 $\pi^- p \rightarrow p 4\pi$
106±25		THOMPSON	74	HBC +	13 $\pi^+ p$
125+83 -35		²⁴ CASON	73	HBC -	8,18.5 $\pi^- p$
130±30		HOLMES	72	HBC +	10-12 $K^+ p$
180±30	90	²⁴ BARTSCH	70B	HBC +	8 $\pi^+ p \rightarrow N a_2\pi$
100±35		BALTAY	68	HBC +	7, 8.5 $\pi^+ p$

²¹ From $\rho^- \rho^0$ mode, not independent of the other two EVANGELISTA 81 entries.

²² From $a_2(1320)^- \pi^0$ mode, not independent of the other two EVANGELISTA 81 entries.

²³ From $a_2(1320)^0 \pi^-$ mode, not independent of the other two EVANGELISTA 81 entries.

²⁴ From $\rho^\pm \rho^0$ mode.

NODE=M015W2

NODE=M015W2

NODE=M015W2;LINKAGE=P

NODE=M015W2;LINKAGE=L

NODE=M015W3

NODE=M015W3

OCCUR=3

OCCUR=2

OCCUR=3

OCCUR=2

OCCUR=2

NODE=M015W3;LINKAGE=A

NODE=M015W3;LINKAGE=B

NODE=M015W3;LINKAGE=C

NODE=M015W3;LINKAGE=F

$\omega\pi$ 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.

NODE=M015W5
NODE=M015W5

NODE=M015W5;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.

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=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±0.013 OUR FIT					
0.243±0.013 OUR AVERAGE					
0.259 ^{+0.018} _{−0.019}	BECKER	79	ASPK	0	17 $\pi^- p$ polarized
0.23 ±0.02	CORDEN	79	OMEG		12–15 $\pi^- p \rightarrow n^2\pi$
0.22 ±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±0.006	²⁹ ESTABROOKS	75	RVUE		17 $\pi^- p \rightarrow \pi^+ \pi^- n$

²⁸ One-pion-exchange model used in this estimation.

²⁹ From phase-shift analysis of HYAMS 75 data.

NODE=M015R1
NODE=M015R1

$\Gamma(\pi\pi)/\Gamma(\pi^\pm \pi^+ \pi^- \pi^0)$					Γ_4/Γ_2
VALUE	DOCUMENT ID	TECN	CHG	COMMENT	
0.35±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 $\pi^- p$

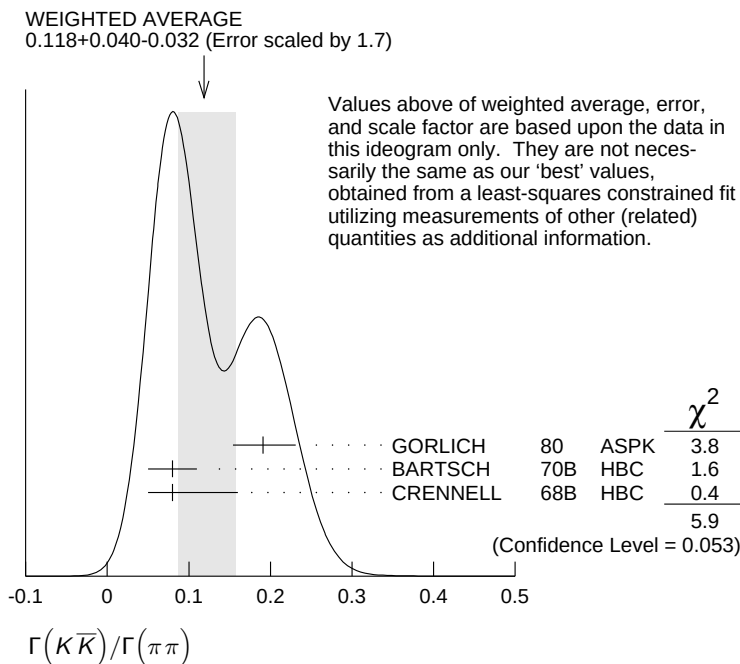
NODE=M015R2
NODE=M015R2

$\Gamma(\pi\pi)/\Gamma(4\pi)$					Γ_4/Γ_1
VALUE	DOCUMENT ID	TECN	CHG	COMMENT	
0.332±0.026 OUR FIT	Error includes scale factor of 1.1.				
0.30 ±0.10	BALTAY	78B	HBC	0	15 $\pi^+ p \rightarrow p4\pi$

NODE=M015R3
NODE=M015R3

$\Gamma(K\bar{K})/\Gamma(\pi\pi)$					Γ_6/Γ_4
VALUE	DOCUMENT ID	TECN	CHG	COMMENT	
0.067±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 ±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

 $[\Gamma(\pi\pi\rho) + \Gamma(a_2(1320)\pi) + \Gamma(\rho\rho)]/\Gamma(\pi^\pm\pi^+\pi^-\pi^0)$

VALUE	DOCUMENT ID	TECN	CHG	COMMENT	$(\Gamma_9+\Gamma_{10}+\Gamma_{11})/\Gamma_2$
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

 $\Gamma(\rho\rho)/[\Gamma(\pi\pi\rho) + \Gamma(a_2(1320)\pi) + \Gamma(\rho\rho)]$

VALUE	DOCUMENT ID	TECN	CHG	COMMENT	$\Gamma_{11}/(\Gamma_9+\Gamma_{10}+\Gamma_{11})$
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.)
ALDE	95	ZPHY C66 379	D.M. Alde <i>et al.</i>	(GAMS Collab.) JP
ALDE	92C	ZPHY C54 553	D.M. Alde <i>et al.</i>	(BELG, SERP, KEK, LANL+)
FUKUI	88	PL B202 441	S. Fukui <i>et al.</i>	(SUGI, NAGO, KEK, KYOT+)
DENNEY	83	PR D28 2726	D.L. Denney <i>et al.</i>	(IOWA, MICH)
EVANGELIS...	81	NP B178 197	C. Evangelista <i>et al.</i>	(BARI, BONN, CERN+)
ALPER	80	PL 94B 422	B. Alper <i>et al.</i>	(AMST, CERN, CRAC, MPIM+)
COSTA	80	NP B175 402	G. Costa <i>et al.</i>	(BARI, BONN, CERN, GLAS+)
GORLICH	80	NP B174 16	L. Gorlich <i>et al.</i>	(CRAC, MPIM, CERN+)
BECKER	79	NP B151 46	H. Becker <i>et al.</i>	(MPIM, CERN, ZEEM, CRAC)
CORDEN	79	NP B157 250	M.J. Corden <i>et al.</i>	(BIRM, RHEL, TELA+)
BALTAY	78B	PR D17 62	C. Baltay <i>et al.</i>	(COLU, BING)
MARTIN	78B	NP B140 158	A.D. Martin <i>et al.</i>	(DURH, GEVA)
MARTIN	78D	PL 74B 417	A.D. Martin <i>et al.</i>	(DURH, GEVA)
ANTIPOV	77	NP B119 45	Y.M. Antipov <i>et al.</i>	(SERP, GEVA)
GESSAROLI	77	NP B126 382	R. Gessaroli <i>et al.</i>	(BGNA, FIRZ, GENO+)
BLUM	75	PL 57B 403	W. Blum <i>et al.</i>	(CERN, MPIM) JP
ESTABROOKS	75	NP B95 322	P.G. Estabrooks, A.D. Martin	(DURH)
HYAMS	75	NP B100 205	B.D. Hyams <i>et al.</i>	(CERN, MPIM)
ENGLER	74	PR D10 2070	A. Engler <i>et al.</i>	(CMU, CASE)

REFID=47432
REFID=44371
REFID=41859
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REFID=20462
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REFID=20737
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REFID=21272
REFID=20728
REFID=20230
REFID=21651
REFID=20642
REFID=20355
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
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NODE=M065

 $\rho(1700)$

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

A REVIEW GOES HERE – Check our WWW List of Reviews

NODE=M065

 $\rho(1700)$ MASS

NODE=M065205

 $\eta\rho^0$ AND $\pi^+\pi^-$ MODES

VALUE (MeV)

DOCUMENT ID

1720 $\pm$ 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 $\pm$ 20	ANTONELLI	88	DM2	$e^+e^- \rightarrow \eta\pi^+\pi^-$
1701 $\pm$ 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 $\pm$ 20 $^{+15}_{-20}$	63.5k	¹ ABRAMOWICZ12	ZEUS	$ep \rightarrow e\pi^+\pi^- p$
1861 $\pm$ 17		² LEES	12G BABR	$e^+e^- \rightarrow \pi^+\pi^-\gamma$
1728 $\pm$ 17 $\pm$ 89	5.4M	^{3,4} FUJIKAWA	08 BELL	$\tau^- \rightarrow \pi^-\pi^0\nu_\tau$
1780 $^{+37}_{-29}$		⁵ ABELE	97 CBAR	$\bar{p}n \rightarrow \pi^-\pi^0\pi^0$
1719 $\pm$ 15		⁵ BERTIN	97C OBLX	0.0 $\bar{p}p \rightarrow \pi^+\pi^-\pi^0$
1730 $\pm$ 30		CLEGG	94 RVUE	$e^+e^- \rightarrow \pi^+\pi^-$
1768 $\pm$ 21		BISELLO	89 DM2	$e^+e^- \rightarrow \pi^+\pi^-$
1745.7 $\pm$ 91.9		DUBNICKA	89 RVUE	$e^+e^- \rightarrow \pi^+\pi^-$
1546 $\pm$ 26		GESHKEN...	89 RVUE	
1650		⁶ ERKAL	85 RVUE	20-70 $\gamma p \rightarrow \gamma\pi$
1550 $\pm$ 70		ABE	84B HYBR	20 $\gamma p \rightarrow \pi^+\pi^- p$
1590 $\pm$ 20		⁷ ASTON	80 OMEG	20-70 $\gamma p \rightarrow p2\pi$
1600 $\pm$ 10		⁸ ATIYA	79B SPEC	50 $\gamma C \rightarrow C2\pi$
1598 $^{+24}_{-22}$		BECKER	79 ASPK	17 $\pi^- p$ polarized
1659 $\pm$ 25		⁶ LANG	79 RVUE	
1575		⁶ MARTIN	78C RVUE	17 $\pi^- p \rightarrow \pi^+\pi^- n$
1610 $\pm$ 30		⁶ FROGGATT	77 RVUE	17 $\pi^- p \rightarrow \pi^+\pi^- n$
1590 $\pm$ 20		⁹ HYAMS	73 ASPK	17 $\pi^- p \rightarrow \pi^+\pi^- n$

- ¹ Using the KUHN 90 parametrization of the pion form factor, neglecting $\rho-\omega$ interference.
- ² 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.
- ³ $|F_\pi(0)|^2$ fixed to 1.
- ⁴ From the GOUNARIS 68 parametrization of the pion form factor.
- ⁵ T-matrix pole.
- ⁶ From phase shift analysis of HYAMS 73 data.
- ⁷ Simple relativistic Breit-Wigner fit with constant width.
- ⁸ An additional 40 MeV uncertainty in both the mass and width is present due to the choice of the background shape.
- ⁹ Included in BECKER 79 analysis.

 $\pi\omega$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

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

1708±41	7815	¹ ACHASOV	13	SND	1.05–2.00 $e^+e^- \rightarrow \pi^0\pi^0\gamma$
1550 to 1620		² ACHASOV	00i	SND	$e^+e^- \rightarrow \pi^0\pi^0\gamma$
1580 to 1710		³ ACHASOV	00i	SND	$e^+e^- \rightarrow \pi^0\pi^0\gamma$
1710±90		ACHASOV	97	RVUE	$e^+e^- \rightarrow \omega\pi^0$

- ¹ From a phenomenological model based on vector meson dominance with the interfering $\rho(1450)$ and $\rho(1700)$ and their widths fixed at 400 and 250 MeV, respectively. Systematic uncertainty not estimated.
- ² Taking into account both $\rho(1450)$ and $\rho(1700)$ contributions. Using the data of ACHASOV 00i on $e^+e^- \rightarrow \omega\pi^0$ and of EDWARDS 00A on $\tau^- \rightarrow \omega\pi^- \nu_\tau$. $\rho(1450)$ mass and width fixed at 1400 MeV and 500 MeV respectively.
- ³ Taking into account the $\rho(1700)$ contribution only. Using the data of ACHASOV 00i on $e^+e^- \rightarrow \omega\pi^0$ and of EDWARDS 00A on $\tau^- \rightarrow \omega\pi^- \nu_\tau$.

 $K\bar{K}$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

1541 ±12 ±33	190k	¹ AAIJ	16N	LHCB	$D^0 \rightarrow K_S^0 K^\pm \pi^\mp$

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

1740.8±22.2	27k	² ABELE	99D	CBAR ±	0.0 $\bar{p}p \rightarrow K^+ K^- \pi^0$
1582 ±36	1600	CLELAND	82B	SPEC ±	50 $\pi p \rightarrow K_S^0 K^\pm p$

- ¹ Using the GOUNARIS 68 parameterization with a fixed width. Value is average using different $K\pi$ S-wave parametrizations in fit.
- ² K-matrix pole. Isospin not determined, could be $\omega(1650)$ or $\phi(1680)$.

 $2(\pi^+\pi^-)$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

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

1851 ⁺²⁷ ₋₂₄		ACHASOV	97	RVUE	$e^+e^- \rightarrow 2(\pi^+\pi^-)$
1570±20		¹ CORDIER	82	DM1	$e^+e^- \rightarrow 2(\pi^+\pi^-)$
1520±30		² ASTON	81E	OMEG	20–70 $\gamma p \rightarrow p4\pi$
1654±25		³ DIBIANCA	81	DBC	$\pi^+d \rightarrow p p2(\pi^+\pi^-)$
1666±39		¹ BACCI	80	FRAG	$e^+e^- \rightarrow 2(\pi^+\pi^-)$
1780	34	KILLIAN	80	SPEC	11 $e^-p \rightarrow 2(\pi^+\pi^-)$
1500		⁴ ATIYA	79B	SPEC	50 $\gamma C \rightarrow C4\pi^\pm$
1570±60	65	⁵ ALEXANDER	75	HBC	7.5 $\gamma p \rightarrow p4\pi$
1550±60		² CONVERSI	74	OSPK	$e^+e^- \rightarrow 2(\pi^+\pi^-)$
1550±50	160	SCHACHT	74	STRC	5.5–9 $\gamma p \rightarrow p4\pi$
1450±100	340	SCHACHT	74	STRC	9–18 $\gamma p \rightarrow p4\pi$
1430±50	400	BINGHAM	72B	HBC	9.3 $\gamma p \rightarrow p4\pi$

- ¹ Simple relativistic Breit-Wigner fit with model dependent width.
- ² Simple relativistic Breit-Wigner fit with constant width.
- ³ One peak fit result.
- ⁴ Parameters roughly estimated, not from a fit.
- ⁵ Skew mass distribution compensated by Ross-Stodolsky factor.

 $\pi^+\pi^-\pi^0\pi^0$ MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

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

1660±30	ATKINSON	85B	OMEG 20–70 γp

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OCCUR=2

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NODE=M065M;LINKAGE=D

NODE=M065M5
NODE=M065M5

$3(\pi^+\pi^-)$ AND $2(\pi^+\pi^-\pi^0)$ MODES

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
1730 ± 34	¹ FRABETTI 04	E687	$\gamma p \rightarrow 3\pi^+ 3\pi^- p$
1783 ± 15	CLEGG 90	RVUE	$e^+e^- \rightarrow 3(\pi^+\pi^-)2(\pi^+\pi^-\pi^0)$

¹ From a fit with two resonances with the JACOB 72 continuum.

NODE=M065M7
NODE=M065M7

NODE=M065M;LINKAGE=PI

 $\rho(1700)$ WIDTH **$\eta\rho^0$ AND $\pi^+\pi^-$ MODES**

VALUE (MeV)	DOCUMENT ID
250 ± 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 ± 30	ANTONELLI 88	DM2	$e^+e^- \rightarrow \eta\pi^+\pi^-$
282 ± 44	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=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 ± 30	$^{+25}_{-35}$	63.5k	¹ ABRAMOWICZ12	ZEUS	$ep \rightarrow e\pi^+\pi^- p$
316 ± 26			² LEES	12G	BABR $e^+e^- \rightarrow \pi^+\pi^-\gamma$
164 ± 21	$^{+89}_{-26}$	5.4M	^{3,4} FUJIKAWA	08	BELL $\tau^- \rightarrow \pi^-\pi^0 \nu_\tau$
275 ± 45			⁵ ABELE	97	CBAR $\bar{p}n \rightarrow \pi^-\pi^0\pi^0$
310 ± 40			⁵ BERTIN	97C	OBLX $0.0 \bar{p}p \rightarrow \pi^+\pi^-\pi^0$
400 ± 100			CLEGG	94	RVUE $e^+e^- \rightarrow \pi^+\pi^-$
224 ± 22			BISELLO	89	DM2 $e^+e^- \rightarrow \pi^+\pi^-$
242.5 ± 163.0			DUBNICKA	89	RVUE $e^+e^- \rightarrow \pi^+\pi^-$
620 ± 60			GESHKEN...	89	RVUE
<315			⁶ ERKAL	85	RVUE $20-70 \gamma p \rightarrow \gamma\pi$
280 ± 30	$^{+30}_{-80}$		ABE	84B	HYBR $20 \gamma p \rightarrow \pi^+\pi^- p$
230 ± 80			⁷ ASTON	80	OMEG $20-70 \gamma p \rightarrow p2\pi$
283 ± 14			⁸ ATIYA	79B	SPEC $50 \gamma C \rightarrow C2\pi$
175 ± 98	$^{+98}_{-53}$		BECKER	79	ASPK $17 \pi^- p$ polarized
232 ± 34			⁶ LANG	79	RVUE
340			⁶ MARTIN	78C	RVUE $17 \pi^- p \rightarrow \pi^+\pi^- n$
300 ± 100			⁶ FROGGATT	77	RVUE $17 \pi^- p \rightarrow \pi^+\pi^- n$
180 ± 50			⁹ HYAMS	73	ASPK $17 \pi^- p \rightarrow \pi^+\pi^- n$

¹ Using the KUHN 90 parametrization of the pion form factor, neglecting $\rho-\omega$ interference.

² 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.

³ $|F_\pi(0)|^2$ fixed to 1.

⁴ From the GOUNARIS 68 parametrization of the pion form factor.

⁵ T-matrix pole.

⁶ From phase shift analysis of HYAMS 73 data.

⁷ Simple relativistic Breit-Wigner fit with constant width.

⁸ An additional 40 MeV uncertainty in both the mass and width is present due to the choice of the background shape.

⁹ Included in BECKER 79 analysis.

NODE=M065W1;LINKAGE=AB
NODE=M065W1;LINKAGE=LE

NODE=M065W1;LINKAGE=FU
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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 ± 26.7	27k	¹ ABELE 99D	CBAR	$\pm$	$0.0 \bar{p}p \rightarrow K^+ K^- \pi^0$
265 ± 120	1600	CLELAND 82B	SPEC	$\pm$	$50 \pi p \rightarrow K_S^0 K^\pm p$

¹ 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		¹ CORDIER 82	DM1	$e^+e^- \rightarrow 2(\pi^+\pi^-)$
400 ± 50		² ASTON 81E	OMEG	20–70 $\gamma p \rightarrow p4\pi$
400 ± 146		³ DIBIANCA 81	DBC	$\pi^+d \rightarrow pp2(\pi^+\pi^-)$
700 ± 160		¹ BACCI 80	FRAG	$e^+e^- \rightarrow 2(\pi^+\pi^-)$
100	34	KILLIAN 80	SPEC	11 $e^-p \rightarrow 2(\pi^+\pi^-)$
600		⁴ ATIYA 79B	SPEC	50 $\gamma C \rightarrow C4\pi^\pm$
340 ± 160	65	⁵ ALEXANDER 75	HBC	7.5 $\gamma p \rightarrow p4\pi$
360 ± 100		² CONVERSI 74	OSPK	$e^+e^- \rightarrow 2(\pi^+\pi^-)$
400 ± 120	160	⁶ SCHACHT 74	STRC	5.5–9 $\gamma p \rightarrow p4\pi$
850 ± 200	340	⁶ SCHACHT 74	STRC	9–18 $\gamma p \rightarrow p4\pi$
650 ± 100	400	BINGHAM 72B	HBC	9.3 $\gamma p \rightarrow p4\pi$

- ¹ Simple relativistic Breit-Wigner fit with model-dependent width.
² Simple relativistic Breit-Wigner fit with constant width.
³ One peak fit result.
⁴ Parameters roughly estimated, not from a fit.
⁵ Skew mass distribution compensated by Ross-Stodolsky factor.
⁶ Width errors enlarged by us to $4\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.

NODE=M065W4
 NODE=M065W4

OCCUR=2

NODE=M065W;LINKAGE=A
 NODE=M065W4;LINKAGE=M
 NODE=M065W;LINKAGE=O
 NODE=M065W;LINKAGE=C
 NODE=M065W;LINKAGE=D
 NODE=M065W;LINKAGE=E

 $\pi^+\pi^-\pi^0\pi^0$ MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
300 ± 50	ATKINSON 85B	OMEG	20–70 γp

NODE=M065W5
 NODE=M065W5

 $\omega\pi^0$ MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
350 to 580	¹ ACHASOV 00I	SND	$e^+e^- \rightarrow \pi^0\pi^0\gamma$
490 to 1040	² ACHASOV 00I	SND	$e^+e^- \rightarrow \pi^0\pi^0\gamma$

- ¹ Taking into account both $\rho(1450)$ and $\rho(1700)$ contributions. Using the data of ACHASOV 00I on $e^+e^- \rightarrow \omega\pi^0$ and of EDWARDS 00A on $\tau^- \rightarrow \omega\pi^-\nu_\tau$. $\rho(1450)$ mass and width fixed at 1400 MeV and 500 MeV respectively.
² Taking into account the $\rho(1700)$ contribution only. Using the data of ACHASOV 00I on $e^+e^- \rightarrow \omega\pi^0$ and of EDWARDS 00A on $\tau^- \rightarrow \omega\pi^-\nu_\tau$.

NODE=M065W9
 NODE=M065W9

OCCUR=2

NODE=M065W;LINKAGE=I1

NODE=M065W;LINKAGE=I2

3($\pi^+\pi^-$) AND 2($\pi^+\pi^-\pi^0$) MODES

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
315 ± 100	¹ FRABETTI 04	E687	$\gamma p \rightarrow 3\pi^+3\pi^-p$
285 ± 20	CLEGG 90	RVUE	$e^+e^- \rightarrow 3(\pi^+\pi^-)2(\pi^+\pi^-\pi^0)$

- ¹ From a fit with two resonances with the JACOB 72 continuum.

NODE=M065W7
 NODE=M065W7

NODE=M065W;LINKAGE=PI

 $\rho(1700)$ DECAY MODES

NODE=M065215;NODE=M065

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} $K\bar{K}^*(892) + c.c.$	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

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

 $\Gamma(2(\pi^+ \pi^-)) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{217} / \Gamma$

VALUE (keV)	DOCUMENT ID	TECN	COMMENT

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

2.6 ± 0.2	DEL COURT	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 $\Gamma(\pi^+ \pi^-) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{117} / \Gamma$

VALUE (keV)	DOCUMENT ID	TECN	COMMENT

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

0.13	¹ DIEKMAN	88	RVUE $e^+ e^- \rightarrow \pi^+ \pi^-$
0.029 ^{+0.016} _{-0.012}	KURDADZE	83	OLYA 0.64–1.4 $e^+ e^- \rightarrow \pi^+ \pi^-$

¹ Using total width = 220 MeV.

NODE=M065G4
NODE=M065G4

NODE=M065G4;LINKAGE=B

 $\Gamma(K \bar{K}^*(892) + \text{c.c.}) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{137} / \Gamma$

VALUE (keV)	DOCUMENT ID	TECN	COMMENT

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

0.305 ± 0.071	¹ BIZOT	80	DM1 $e^+ e^-$

¹ Model dependent.

NODE=M065G10
NODE=M065G10

NODE=M065G;LINKAGE=M

 $\Gamma(\eta \rho) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{147} / \Gamma$

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 $\Gamma(K \bar{K}) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{167} / \Gamma$

VALUE (keV)	DOCUMENT ID	TECN	COMMENT

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

0.035 ± 0.029	¹ BIZOT	80	DM1 $e^+ e^-$

¹ Model dependent.

NODE=M065G5
NODE=M065G5

NODE=M065G5;LINKAGE=M

 $\Gamma(\rho \pi \pi) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{37} / \Gamma$

VALUE (keV)	DOCUMENT ID	TECN	COMMENT

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

3.510 ± 0.090	¹ BIZOT	80	DM1 $e^+ e^-$

¹ Model dependent.

NODE=M065G12
NODE=M065G12

NODE=M065G12;LINKAGE=M

 $\rho(1700) \Gamma(i) / \Gamma(\text{total}) \times \Gamma(e^+ e^-) / \Gamma(\text{total})$

NODE=M065240

 $\Gamma(\pi^0 \omega) / \Gamma_{\text{total}} \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{18} / \Gamma \times \Gamma_{17} / \Gamma$

VALUE (units 10 ⁻⁶)	EVTs	DOCUMENT ID	TECN	COMMENT

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

0.09 ± 0.05	10.2k	¹ ACHASOV	16D	SND 1.05–2.00 $e^+ e^- \rightarrow \pi^0 \pi^0 \gamma$
1.7 ± 0.4	7815	² ACHASOV	13	SND 1.05–2.00 $e^+ e^- \rightarrow \pi^0 \pi^0 \gamma$

¹ From a phenomenological model based on vector meson dominance with interfering $\rho(700)$, $\rho(1450)$ and $\rho(1700)$. The $\rho(1700)$ mass and width are fixed at 1720 MeV and 250 MeV, respectively. Systematic uncertainty not estimated. Supersedes ACHASOV 2013.

² From a phenomenological model based on vector meson dominance with the interfering $\rho(1450)$ and $\rho(1700)$ and their widths fixed at 400 and 250 MeV, respectively. Systematic uncertainty not estimated.

NODE=M065R01
NODE=M065R01

OCCUR=4

NODE=M065R01;LINKAGE=B

NODE=M065R01;LINKAGE=AC

 $\rho(1700) \text{ BRANCHING RATIOS}$

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	¹ ABELE	01B	CBAR 0.0 $\bar{p} n \rightarrow 5\pi$

¹ $\omega \pi$ not included.

NODE=M065R19
NODE=M065R19

NODE=M065R;LINKAGE=BL

$\Gamma(\rho^0\pi^+\pi^-)/\Gamma(2(\pi^+\pi^-))$ Γ_4/Γ_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	$5.5-18 \gamma p \rightarrow p4\pi$
0.80		¹ BINGHAM	72B	HBC	$9.3 \gamma p \rightarrow p4\pi$

¹ The $\pi\pi$ system is in S -wave.

NODE=M065R1
NODE=M065R1

NODE=M065R1;LINKAGE=S

 $\Gamma(\rho^0\pi^0\pi^0)/\Gamma(\rho^\pm\pi^\mp\pi^0)$ Γ_5/Γ_6

VALUE	DOCUMENT ID	TECN	CHG	COMMENT

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

<0.10	ATKINSON	85B	OMEG	$20-70 \gamma p$
<0.15	ATKINSON	82	OMEG 0	$20-70 \gamma p \rightarrow p4\pi$

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	¹ ABELE	01B	CBAR	$0.0 \bar{p}n \rightarrow 5\pi$

¹ $\omega\pi$ 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	¹ ABELE	01B	CBAR	$0.0 \bar{p}n \rightarrow 5\pi$

¹ $\omega\pi$ not included.

NODE=M065R16
NODE=M065R16

NODE=M065R16;LINKAGE=BL

 $\Gamma(\pi(1300)\pi)/\Gamma(4\pi)$ Γ_9/Γ_1

VALUE	DOCUMENT ID	TECN	COMMENT

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

0.30 ± 0.10	¹ ABELE	01B	CBAR	$0.0 \bar{p}n \rightarrow 5\pi$

¹ $\omega\pi$ not included.

NODE=M065R17
NODE=M065R17

NODE=M065R17;LINKAGE=BL

 $\Gamma(\rho\rho)/\Gamma(4\pi)$ Γ_{10}/Γ_1

VALUE	DOCUMENT ID	TECN	COMMENT

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

0.09 ± 0.03	¹ ABELE	01B	CBAR	$0.0 \bar{p}n \rightarrow 5\pi$

¹ $\omega\pi$ not included.

NODE=M065R18
NODE=M065R18

NODE=M065R18;LINKAGE=BL

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

VALUE	DOCUMENT ID	TECN	COMMENT

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

$0.287^{+0.043}_{-0.042}$	BECKER	79	ASPK	$17 \pi^- p$ polarized
$0.15 \text{ to } 0.30$	¹ MARTIN	78C	RVUE	$17 \pi^- p \rightarrow \pi^+\pi^- n$
<0.20	² COSTA...	77B	RVUE	$e^+e^- \rightarrow 2\pi, 4\pi$
0.30 ± 0.05	¹ FROGGATT	77	RVUE	$17 \pi^- p \rightarrow \pi^+\pi^- n$
<0.15	³ EISENBERG	73	HBC	$5 \pi^+ p \rightarrow \Delta^{++} 2\pi$
0.25 ± 0.05	⁴ HYAMS	73	ASPK	$17 \pi^- p \rightarrow \pi^+\pi^- n$

¹ From phase shift analysis of HYAMS 73 data.

² Estimate using unitarity, time reversal invariance, Breit-Wigner.

³ Estimated using one-pion-exchange model.

⁴ Included in BECKER 79 analysis.

NODE=M065R5
NODE=M065R5

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	$20-70 \gamma p \rightarrow p2\pi$
<0.14	¹ DAVIER	73	STRC	$6-18 \gamma p \rightarrow p4\pi$
<0.2	² BINGHAM	72B	HBC	$9.3 \gamma p \rightarrow p2\pi$

¹ Upper limit is estimate.

² 2σ upper limit.

NODE=M065R3
NODE=M065R3

NODE=M065R3;LINKAGE=E
NODE=M065R3;LINKAGE=S

$\Gamma(\pi\pi)/\Gamma(4\pi)$

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.16 ± 0.04	^{1,2} ABELE	01B	CBAR $0.0 \bar{p} n \rightarrow 5\pi$
¹ Using ABELE 97.			
² $\omega\pi$ not included.			

 Γ_{12}/Γ_1

NODE=M065R20
 NODE=M065R20

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

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
possibly seen	COAN	04	CLEO $\tau^- \rightarrow K^- \pi^- K^+ \nu_\tau$

 Γ_{13}/Γ

NODE=M065R21
 NODE=M065R21

 $\Gamma(K\bar{K}^*(892)+c.c.)/\Gamma(2(\pi^+\pi^-))$

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.15 ± 0.03	¹ DELCOURT	81B	DM1 $e^+e^- \rightarrow \bar{K}K\pi$
¹ Assuming $\rho(1700)$ and ω radial excitations to be degenerate in mass.			

 Γ_{13}/Γ_2

NODE=M065R9
 NODE=M065R9

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

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
possibly seen		AKHMETSHIN	00D	$e^+e^- \rightarrow \eta\pi^+\pi^-$
<0.04		DONNACHIE	87B	RVUE
<0.02	58	ATKINSON	86B	OMEG $20-70 \gamma p$

 Γ_{14}/Γ

NODE=M065R12
 NODE=M065R12

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

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.123 ± 0.027	DELCOURT	82	DM1 $e^+e^- \rightarrow \pi^+\pi^- \text{MM}$
~ 0.1	ASTON	80	OMEG $20-70 \gamma p$

 Γ_{14}/Γ_2

NODE=M065R8
 NODE=M065R8

 $\Gamma(\pi^+\pi^- \text{ neutrals})/\Gamma(2(\pi^+\pi^-))$

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
2.6 ± 0.4	¹ BALLAM	74	HBC $9.3 \gamma p$
¹ Upper limit. Background not subtracted.			

 $(\Gamma_5+\Gamma_6+0.714\Gamma_{14})/\Gamma_2$

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		¹ DELCOURT	81B	DM1	$e^+e^- \rightarrow \bar{K}K$
<0.04	95	BINGHAM	72B	HBC	$9.3 \gamma p$
¹ Assuming $\rho(1700)$ and ω radial excitations to be degenerate in mass.					

 Γ_{16}/Γ_2

NODE=M065R4
 NODE=M065R4

 $\Gamma(K\bar{K})/\Gamma(K\bar{K}^*(892)+c.c.)$

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	EVS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
not seen		MATVIENKO	15	BELL $\bar{B}^0 \rightarrow D^{*+} \omega \pi^-$
seen	1.6k	ACHASOV	12	SND $e^+e^- \rightarrow \pi^0 \pi^0 \gamma$
not seen	2382	AKHMETSHIN	03B	CMD2 $e^+e^- \rightarrow \pi^0 \pi^0 \gamma$
seen		ACHASOV	97	RVUE $e^+e^- \rightarrow \omega \pi^0$

 Γ_{18}/Γ

NODE=M065R13
 NODE=M065R13

$\rho(1700)$ REFERENCES

NODE=M065

AAIJ	16N	PR D93 052018	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=57273
ACHASOV	16D	PR D94 112001	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=57618
MATVIENKO	15	PR D92 012013	D. Matvienko <i>et al.</i>	(BELLE Collab.)	REFID=56601
ACHASOV	13	PR D88 054013	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=55584
ABRAMOWICZ	12	EPJ C72 1869	H. Abramowicz <i>et al.</i>	(ZEUS Collab.)	REFID=54274
ACHASOV	12	JETPL 94 734	M.N. Achasov <i>et al.</i>		REFID=54275
		Translated from ZETFP 94 796.			
LEES	12G	PR D86 032013	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=54299
FUJIKAWA	08	PR D78 072006	M. Fujikawa <i>et al.</i>	(BELLE Collab.)	REFID=52536
COAN	04	PRL 92 232001	T.E. Coan <i>et al.</i>	(CLEO Collab.)	REFID=49945
FRABETTI	04	PL B578 290	P.L. Frabetti <i>et al.</i>	(FNAL E687 Collab.)	REFID=49614
AKHMETSHIN	03B	PL B562 173	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=49406
ABELE	01B	EPJ C21 261	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)	REFID=48356
ACHASOV	00I	PL B486 29	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47931
AKHMETSHIN	00D	PL B489 125	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=47935
AMELIN	00	NP A668 83	D. Amelin <i>et al.</i>	(VES Collab.)	REFID=47432
EDWARDS	00A	PR D61 072003	K.W. Edwards <i>et al.</i>	(CLEO Collab.)	REFID=47465
ABELE	99D	PL B468 178	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)	REFID=47401
ABELE	97	PL B391 191	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)	REFID=45415
ACHASOV	97	PR D55 2663	N.N. Achasov <i>et al.</i>	(NOVM)	REFID=45382
BERTIN	97C	PL B408 476	A. Bertin <i>et al.</i>	(OBELIX Collab.)	REFID=45701
CLEGG	94	ZPHY C62 455	A.B. Clegg, A. Donnachie	(LANC, MCHS)	REFID=44081
CLEGG	90	ZPHY C45 677	A.B. Clegg, A. Donnachie	(LANC, MCHS)	REFID=41355
KUHN	90	ZPHY C48 445	J.H. Kuhn <i>et al.</i>	(MPIM)	REFID=45862
BISELLO	89	PL B220 321	D. Bisello <i>et al.</i>	(DM2 Collab.)	REFID=40740
DUBNICKA	89	JP G15 1349	S. Dubnicka <i>et al.</i>	(JINR, SLOV)	REFID=44082
GESHKEN...	89	ZPHY C45 351	B.V. Geshkenbein	(ITEP)	REFID=41017
ANTONELLI	88	PL B212 133	A. Antonelli <i>et al.</i>	(DM2 Collab.)	REFID=40583
DIEKMANN	88	PRPL 159 99	B. Diekmann	(BONN)	REFID=40272
FUKUI	88	PL B202 441	S. Fukui <i>et al.</i>	(SUGI, NAGO, KEK, KYOT+)	REFID=40273
DONNACHIE	87B	ZPHY C34 257	A. Donnachie, A.B. Clegg	(MCHS, LANC)	REFID=40920
ATKINSON	86B	ZPHY C30 531	M. Atkinson <i>et al.</i>	(BONN, CERN, GLAS+)	REFID=21508
ATKINSON	85B	ZPHY C26 499	M. Atkinson <i>et al.</i>	(BONN, CERN, GLAS+)	REFID=21506
ERKAL	85	ZPHY C29 485	C. Erkal, M.G. Olsson	(WISC)	REFID=20136
ABE	84B	PRL 53 751	K. Abe <i>et al.</i>	(SLAC HFP Collab.)	REFID=21503
KURDADZE	83	JETPL 37 733	L.M. Kurdadze <i>et al.</i>	(NOVO)	REFID=20133
		Translated from ZETFP 37 613.			
ATKINSON	82	PL 108B 55	M. Atkinson <i>et al.</i>	(BONN, CERN, GLAS+)	REFID=21493
BUON	82	PL 118B 221	J. Buon <i>et al.</i>	(LALO, MONP)	REFID=21494
CLELAND	82B	NP B208 228	W.E. Cleland <i>et al.</i>	(DURH, GEVA, LAUS+)	REFID=21281
CORDIER	82	PL 109B 129	A. Cordier <i>et al.</i>	(LALO)	REFID=21495
DELCOURT	82	PL 113B 93	B. Delcourt <i>et al.</i>	(LALO)	REFID=21496
ASTON	81E	NP B189 15	D. Aston	(BONN, CERN, EPOL, GLAS, LANC+)	REFID=21487
DELCOURT	81B	Bonn Conf. 205	B. Delcourt	(ORSAY)	REFID=21490
Also		PL 109B 129	A. Cordier <i>et al.</i>	(LALO)	REFID=21495
DIBIANCA	81	PR D23 595	F.A. di Bianca <i>et al.</i>	(CASE, CMU)	REFID=21492
ASTON	80	PL 92B 215	D. Aston	(BONN, CERN, EPOL, GLAS, LANC+)	REFID=21478
BACCI	80	PL 95B 139	C. Bacci <i>et al.</i>	(ROMA, FRAS)	REFID=21481
BIZOT	80	Madison Conf. 546	J.C. Bizot <i>et al.</i>	(LALO, MONP)	REFID=21482
KILLIAN	80	PR D21 3005	T.J. Killian <i>et al.</i>	(CORN)	REFID=21484
ATIYA	79B	PRL 43 1691	M.S. Atiya <i>et al.</i>	(COLU, ILL, FNAL)	REFID=21470
BECKER	79	NP B151 46	H. Becker <i>et al.</i>	(MPIM, CERN, ZEEM, CRAC)	REFID=21084
LANG	79	PR D19 956	C.B. Lang, A. Mas-Parada	(GRAZ)	REFID=20126
MARTIN	78C	ANP 114 1	A.D. Martin, M.R. Pennington	(CERN)	REFID=21661
COSTA...	77B	PL 71B 345	B. Costa de Beauregard, B. Pire, T.N. Truong	(EPOL)	REFID=21465
FROGGATT	77	NP B129 89	C.D. Froggatt, J.L. Petersen	(GLAS, NORD)	REFID=21072
ALEXANDER	75	PL 57B 487	G. Alexander <i>et al.</i>	(TELA)	REFID=21450
BALLAM	74	NP B76 375	J. Ballam <i>et al.</i>	(SLAC, LBL, MPIM)	REFID=20610
CONVERSI	74	PL 52B 493	M. Conversi <i>et al.</i>	(ROMA, FRAS)	REFID=20637
SCHACHT	74	NP B81 205	P. Schacht <i>et al.</i>	(MPIM)	REFID=21449
DAVIER	73	NP B58 31	M. Davier <i>et al.</i>	(SLAC)	REFID=21434
EISENBERG	73	PL 43B 149	Y. Eisenberg <i>et al.</i>	(REHO)	REFID=21435
HYAMS	73	NP B64 134	B.D. Hyams <i>et al.</i>	(CERN, MPIM)	REFID=20107
BINGHAM	72B	PL 41B 635	H.H. Bingham <i>et al.</i>	(LBL, UCB, SLAC) IGJP	REFID=21426
JACOB	72	PR D5 1847	M. Jacob, R. Slansky		REFID=49668
GOUNARIS	68	PRL 21 244	G.J. Gounaris, J.J. Sakurai		REFID=48054

$a_2(1700)$

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

NODE=M162

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

NODE=M162M;LINKAGE=TT
 NODE=M162M;LINKAGE=SC
 NODE=M162M;LINKAGE=ST
 NODE=M162M;LINKAGE=HA
 NODE=M162M;LINKAGE=GR

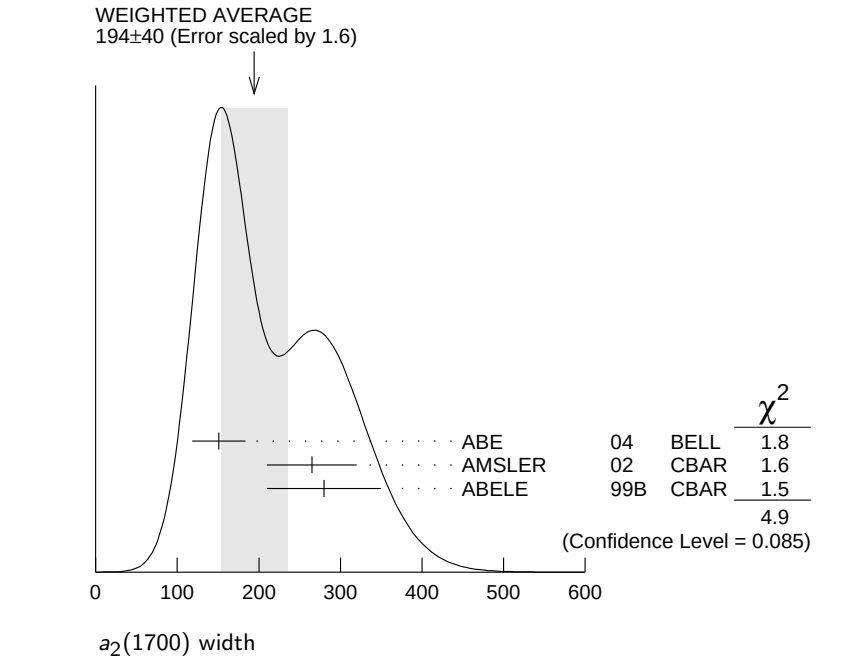
 $a_2(1700)$ WIDTH

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

NODE=M162W;LINKAGE=TT
 NODE=M162W;LINKAGE=SC
 NODE=M162W;LINKAGE=ST
 NODE=M162W;LINKAGE=HA



$a_2(1700)$ DECAY MODES

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

NODE=M162215;NODE=M162

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

$\Gamma(\eta\pi)$					Γ_1
VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT	
● ● ● 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
VALUE (keV)	EVTs	DOCUMENT ID	TECN	COMMENT	
● ● ● 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
VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT	
● ● ● 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=M162220

NODE=M162W3
NODE=M162W3

NODE=M162W2
NODE=M162W2

NODE=M162W1
NODE=M162W1

NODE=M162W1;LINKAGE=SC

$a_2(1700)$ $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

$[\Gamma(\rho\pi) + \Gamma(f_2(1270)\pi)] \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$					$(\Gamma_3 + \Gamma_4)\Gamma_2/\Gamma$
VALUE (keV)	EVTs	DOCUMENT ID	TECN	COMMENT	
$0.29 \pm 0.04 \pm 0.02$		ACCIARRI 97T L3		$\gamma\gamma \rightarrow \pi^+\pi^-\pi^0$	
● ● ● 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	$\gamma\gamma \rightarrow \pi^+\pi^-\pi^0$	

NODE=M162225

NODE=M162G1
NODE=M162G1

$\Gamma(K\bar{K}) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_5\Gamma_2/\Gamma$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$20.6 \pm 4.2 \pm 4.6$	¹² ABE	04 BELL	$10.6 e^+ e^- \rightarrow e^+ e^- K^+ K^-$
$49 \pm 11 \pm 13$	¹³ ACCIARRI	01H L3	$\gamma\gamma \rightarrow K_S^0 K_S^0, E_{\text{cm}}^{\text{ee}} = 91, 183\text{--}209 \text{ GeV}$

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=M162G2
NODE=M162G2NODE=M162G1;LINKAGE=SC
NODE=M162G2;LINKAGE=AB
NODE=M162G;LINKAGE=HA $a_2(1700)$ BRANCHING RATIOS $\Gamma(\rho\pi)/\Gamma(f_2(1270)\pi)$ Γ_3/Γ_4

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=M162235

NODE=M162R01
NODE=M162R01

NODE=M162R01;LINKAGE=SC

 $a_2(1700)$ REFERENCES

ANISOVICH	09	IJMP A24 2481	V.V. Anisovich, A.V. Sarantsev
SCHEGELSKY	06	EPJ A27 199	V.A. Schegelsky <i>et al.</i>
SCHEGELSKY	06A	EPJ A27 207	V.A. Schegelsky <i>et al.</i>
UMAN	06	PR D73 052009	I. Uman <i>et al.</i> (FNAL E835)
LU	05	PRL 94 032002	M. Lu <i>et al.</i> (BNL E852 Collab.)
ABE	04	EPJ C32 323	K. Abe <i>et al.</i> (BELLE Collab.)
AMSLER	02	EPJ C23 29	C. AMSler <i>et al.</i>
ACCIARRI	01H	PL B501 173	M. Acciarri <i>et al.</i> (L3 Collab.)
ABELE	99B	EPJ C8 67	A. Abele <i>et al.</i> (Crystal Barrel Collab.)
GRYGOREV	99	PAN 62 470	V.K. Grygorev <i>et al.</i>
		Translated from YAF 62 513.	
ACCIARRI	97T	PL B413 147	M. Acciarri <i>et al.</i> (L3 Collab.)

NODE=M162

REFID=52719
REFID=51186
REFID=51185
REFID=51063
REFID=50459
REFID=49650
REFID=48580
REFID=48321
REFID=46904
REFID=46909

REFID=45761

NODE=M068

 $f_0(1710)$

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

See 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

 $f_0(1710)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1723^{+6}_{-5}	OUR AVERAGE	Error includes scale factor of 1.6. See the ideogram below.		
$1759 \pm 6^{+14}_{-25}$	5.5k	¹ ABLIKIM	13N BES3	$e^+ e^- \rightarrow J/\psi \rightarrow \gamma \eta \eta$
1750^{+6}_{-7}		UEHARA	13 BELL	$\gamma\gamma \rightarrow K_S^0 K_S^0$
$1701 \pm 5^{+9}_{-2}$	4k	² CHEKANOV	08 ZEUS	$e p \rightarrow K_S^0 K_S^0 X$
1765^{+4}_{-3}	± 13	ABLIKIM	06V BES2	$e^+ e^- \rightarrow J/\psi \rightarrow \gamma \pi^+ \pi^-$
$1760 \pm 15^{+15}_{-10}$		³ ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$
1738 ± 30		ABLIKIM	04E BES2	$J/\psi \rightarrow \omega K^+ K^-$
$1740 \pm 4^{+10}_{-25}$		⁴ BAI	03G BES	$J/\psi \rightarrow \gamma K \bar{K}$
1740^{+30}_{-25}		⁴ BAI	00A BES	$J/\psi \rightarrow \gamma(\pi^+ \pi^- \pi^+ \pi^-)$
1698 ± 18		⁵ BARBERIS	00E	$450 p p \rightarrow p_f \eta \eta p_s$
$1710 \pm 12 \pm 11$		⁶ BARBERIS	99D OMEG	$450 p p \rightarrow K^+ K^-, \pi^+ \pi^-$
1710 ± 25		⁷ FRENCH	99	$300 p p \rightarrow p_f(K^+ K^-) p_s$
1707 ± 10		⁸ AUGUSTIN	88 DM2	$J/\psi \rightarrow \gamma K^+ K^-, K_S^0 K_S^0$
1698 ± 15		⁸ AUGUSTIN	87 DM2	$J/\psi \rightarrow \gamma \pi^+ \pi^-$
$1720 \pm 10 \pm 10$		⁹ BALTRUSAIT.	87 MRK3	$J/\psi \rightarrow \gamma K^+ K^-$
1742 ± 15		⁸ WILLIAMS	84 MPSF	$200 \pi^- N \rightarrow 2 K_S^0 X$
1670 ± 50		BLOOM	83 CBAL	$J/\psi \rightarrow \gamma 2\eta$

NODE=M068M

NODE=M068M

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

1744 ± 7 ± 5	381	^{10,11}	DOBBS	15	$J/\psi \rightarrow \gamma \pi^+ \pi^-$	
1705 ± 11 ± 5	237	^{10,11}	DOBBS	15	$\psi(2S) \rightarrow \gamma \pi^+ \pi^-$	OCCUR=2
1706 ± 4 ± 5	1.0k	^{10,11}	DOBBS	15	$J/\psi \rightarrow \gamma K^+ K^-$	OCCUR=3
1690 ± 8 ± 3	349	^{10,11}	DOBBS	15	$\psi(2S) \rightarrow \gamma K^+ K^-$	OCCUR=4
1750 ± 13			AMSLER	06	CBAR $1.64 \bar{p} p \rightarrow K^+ K^- \pi^0$	
1747 ± 5	80k	^{12,13}	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		³	ABLIKIM	05	BES2 $J/\psi \rightarrow \phi \pi^+ \pi^-$	
1670 ± 20		¹²	BINON	05	GAMS $33 \pi^- p \rightarrow \eta \eta n$	
1726 ± 7	74	¹³	CHEKANOV	04	ZEUS $e p \rightarrow K_S^0 K_S^0 X$	
1732 ± 15		¹⁴	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	3.6k	^{4,15}	NICHITIU	02	OBLX	
1770 ± 12		^{16,17}	ANISOVICH	99B	SPEC $0.6-1.2 p \bar{p} \rightarrow \eta \eta \pi^0$	
1730 ± 15		⁴	BARBERIS	99	OMEG $450 p p \rightarrow p_s p_f K^+ K^-$	
1750 ± 20		⁴	BARBERIS	99B	OMEG $450 p p \rightarrow p_s p_f \pi^+ \pi^-$	
1750 ± 30		¹⁸	ANISOVICH	98B	RVUE Compilation	
1720 ± 39			BAI	98H	BES $J/\psi \rightarrow \gamma \pi^0 \pi^0$	
1775 ± 1.5	57	¹⁹	BARKOV	98	$\pi^- p \rightarrow K_S^0 K_S^0 n$	
1690 ± 11		²⁰	ABREU	96C	DLPH $Z^0 \rightarrow K^+ K^- + X$	
1696 ± 5 ⁺⁹ ₋₃₄		⁹	BAI	96C	BES $J/\psi \rightarrow \gamma K^+ K^-$	
1781 ± 8 ⁺¹⁰ ₋₃₁		⁴	BAI	96C	BES $J/\psi \rightarrow \gamma K^+ K^-$	OCCUR=2
1768 ± 14			BALOSHIN	95	SPEC $40 \pi^- C \rightarrow K_S^0 K_S^0 X$	
1750 ± 15		²¹	BUGG	95	MRK3 $J/\psi \rightarrow \gamma \pi^+ \pi^- \pi^+ \pi^-$	
1620 ± 16		⁹	BUGG	95	MRK3 $J/\psi \rightarrow \gamma \pi^+ \pi^- \pi^+ \pi^-$	OCCUR=2
1748 ± 10		⁸	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		²²	ALDE	92D	GAM2 $38 \pi^- p \rightarrow \eta \eta n$	
1713 ± 10		²³	ARMSTRONG	89D	OMEG $300 p p \rightarrow p p K^+ K^-$	
1706 ± 10		²³	ARMSTRONG	89D	OMEG $300 p p \rightarrow p p K_S^0 K_S^0$	OCCUR=2
1700 ± 15		⁹	BOLONKIN	88	SPEC $40 \pi^- p \rightarrow K_S^0 K_S^0 n$	
1720 ± 60		⁴	BOLONKIN	88	SPEC $40 \pi^- p \rightarrow K_S^0 K_S^0 n$	OCCUR=2
1638 ± 10		²⁴	FALVARD	88	DM2 $J/\psi \rightarrow \phi K^+ K^-, K_S^0 K_S^0$	
1690 ± 4		²⁵	FALVARD	88	DM2 $J/\psi \rightarrow \phi K^+ K^-, K_S^0 K_S^0$	OCCUR=2
1755 ± 8		²⁶	ALDE	86C	GAM2 $38 \pi^- p \rightarrow n 2 \eta$	
1730 ⁺² ₋₁₀		²⁷	LONGACRE	86	RVUE $22 \pi^- p \rightarrow n 2 K_S^0$	
1650 ± 50			BURKE	82	MRK2 $J/\psi \rightarrow \gamma 2 \rho$	
1640 ± 50	28,29		EDWARDS	82D	CBAL $J/\psi \rightarrow \gamma 2 \eta$	
1730 ± 10 ± 20	30		ETKIN	82C	MPS $23 \pi^- p \rightarrow n 2 K_S^0$	

¹ From partial wave analysis including all possible combinations of 0^{++} , 2^{++} , and 4^{++} resonances.

² 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.

³ This state may be different from $f_0(1710)$, see CLOSE 05.

⁴ $J^P = 0^+$.

⁵ T-matrix pole.

⁶ Supersedes BARBERIS 99 and BARBERIS 99B.

⁷ $J^P = 0^+$, supersedes by ARMSTRONG 89D.

⁸ No J^{PC} determination.

⁹ $J^P = 2^+$.

¹⁰ Using CLEO-c data but not authored by the CLEO Collaboration.

¹¹ From a fit to a Breit-Wigner line shape with fixed $\Gamma = 135$ MeV.

¹² Breit-Wigner mass.

¹³ Systematic errors not estimated.

¹⁴ 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.

¹⁵ Decaying to $f_0(1370) \pi \pi$.

¹⁶ $J^P = 0^+$.

¹⁷ Not seen by AMSLER 02.

¹⁸ T-matrix pole, assuming $J^P = 0^+$

¹⁹ No J^{PC} determination.

NODE=M068M;LINKAGE=D

NODE=M068M;LINKAGE=HE

NODE=M068M;LINKAGE=AB

NODE=M068M;LINKAGE=A8

NODE=M068M;LINKAGE=TP

NODE=M068M;LINKAGE=BD

NODE=M068M;LINKAGE=C3

NODE=M068M;LINKAGE=A1

NODE=M068M;LINKAGE=A3

NODE=M068M;LINKAGE=F

NODE=M068M;LINKAGE=G

NODE=M068M;LINKAGE=BW

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NODE=M068M;LINKAGE=NC

NODE=M068M;LINKAGE=AV

NODE=M068M;LINKAGE=NS

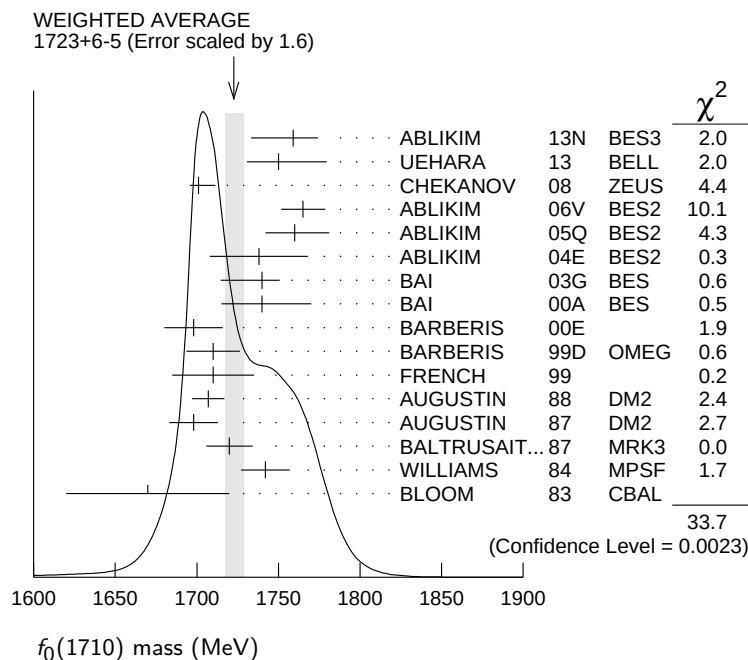
NODE=M068M;LINKAGE=AN

NODE=M068M;LINKAGE=4A

- 20 No J^{PC} determination, width not determined.
 21 From a fit to the 0^+ partial wave.
 22 ALDE 92D combines all the GAMS-2000 data.
 23 $J^P = 2^+$, superseded by FRENCH 99.
 24 From an analysis ignoring interference with $f'_2(1525)$.
 25 From an analysis including interference with $f'_2(1525)$.
 26 Superseded by ALDE 92D.
 27 Uses MRK3 data. From a partial-wave analysis of data using a K-matrix formalism with 5 poles, but assuming spin 2. Fit with constrained inelasticity.
 28 $J^P = 2^+$ preferred.
 29 From fit neglecting nearby $f'_2(1525)$. Replaced by BLOOM 83.
 30 Superseded by LONGACRE 86.

NODE=M068M;LINKAGE=A4
 NODE=M068M;LINKAGE=Q0
 NODE=M068M;LINKAGE=AA
 NODE=M068M;LINKAGE=C
 NODE=M068M;LINKAGE=A
 NODE=M068M;LINKAGE=B
 NODE=M068M;LINKAGE=BB
 NODE=M068M;LINKAGE=A9

 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
139 ± 8	OUR AVERAGE	Error includes scale factor of 1.1.		
172 ± 10	$^{+32}_{-16}$ 5.5k	1 ABLIKIM	13N BES3	$e^+e^- \rightarrow J/\psi \rightarrow \gamma\eta\eta$
139 $^{+11}_{-12}$	$^{+96}_{-50}$	UEHARA	13 BELL	$\gamma\gamma \rightarrow K_S^0 K_S^0$
100 ± 24	$^{+7}_{-22}$ 4k	2 CHEKANOV	08 ZEUS	$ep \rightarrow K_S^0 K_S^0 X$
145 ± 8	±69	ABLIKIM	06V BES2	$e^+e^- \rightarrow J/\psi \rightarrow \gamma\pi^+\pi^-$
125 ± 25	$^{+10}_{-15}$	3 ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma\pi^+\pi^- K^+ K^-$
125 ± 20		ABLIKIM	04E BES2	$J/\psi \rightarrow \omega K^+ K^-$
166 $^{+5}_{-8}$	$^{+15}_{-10}$	4 BAI	03G BES	$J/\psi \rightarrow \gamma K \bar{K}$
120 $^{+50}_{-40}$		4 BAI	00A BES	$J/\psi \rightarrow \gamma(\pi^+\pi^-\pi^+\pi^-)$
120 ± 26		5 BARBERIS	00E	450 $pp \rightarrow p_f \eta \eta p_s$
126 ± 16	±18	6 BARBERIS	99D OMEG	450 $pp \rightarrow K^+ K^-, \pi^+\pi^-$
105 ± 34		7 FRENCH	99	300 $pp \rightarrow p_f(K^+ K^-) p_s$
166.4 ± 33.2		8 AUGUSTIN	88 DM2	$J/\psi \rightarrow \gamma K^+ K^-, K_S^0 K_S^0$
136 ± 28		8 AUGUSTIN	87 DM2	$J/\psi \rightarrow \gamma\pi^+\pi^-$
130 ± 20		9 BALTRUSAIT...	87 MRK3	$J/\psi \rightarrow \gamma K^+ K^-$
57 ± 38		10 WILLIAMS	84 MPSF	200 $\pi^- N \rightarrow 2K_S^0 X$
160 ± 80		BLOOM	83 CBAL	$J/\psi \rightarrow \gamma 2\eta$

NODE=M068W

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

148	$\pm \frac{40}{30}$		AMSLER	06	CBAR	1.64	$\bar{p}p \rightarrow K^+ K^- \pi^0$	
188	± 13	80k	3,11 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	$\pm \frac{60}{30}$		12 ABLIKIM	05	BES2	$J/\psi \rightarrow \phi \pi^+ \pi^-$		
260	± 50		3 BINON	05	GAMS	33	$\pi^- p \rightarrow \eta \eta n$	
38	$\pm \frac{20}{14}$	74	11 CHEKANOV	04	ZEUS	$e p \rightarrow K_S^0 K_S^0 X$		
144	± 30		13,14 ANISOVICH	03	RVUE			
320	$\pm \frac{50}{20}$		14,15 ANISOVICH	03	RVUE			OCCUR=2
102	± 26		TIKHOMIROV	03	SPEC	40.0	$\pi^- C \rightarrow K_S^0 K_S^0 K_L^0 X$	
267	± 44	3651	4,16 NICHITIU	02	OBLX			
220	± 40		17,18 ANISOVICH	99B	SPEC	0.6-1.2	$p\bar{p} \rightarrow \eta \eta \pi^0$	
100	± 25		4 BARBERIS	99	OMEG	450	$p p \rightarrow p_s p_f K^+ K^-$	
160	± 30		4 BARBERIS	99B	OMEG	450	$p p \rightarrow p_s p_f \pi^+ \pi^-$	
250	± 140		19 ANISOVICH	98B	RVUE	Compilation		
30	± 7	57	20 BARKOV	98		$\pi^- p \rightarrow K_S^0 K_S^0 n$		
103	± 18	$\pm \frac{30}{11}$	9 BAI	96C	BES	$J/\psi \rightarrow \gamma K^+ K^-$		
85	± 24	$\pm \frac{22}{19}$	4 BAI	96C	BES	$J/\psi \rightarrow \gamma K^+ K^-$		OCCUR=2
56	± 19		BALOSHIN	95	SPEC	40	$\pi^- C \rightarrow K_S^0 K_S^0 X$	
160	± 40		21 BUGG	95	MRK3	$J/\psi \rightarrow \gamma \pi^+ \pi^- \pi^+ \pi^-$		
160	$\pm \frac{60}{20}$		9 BUGG	95	MRK3	$J/\psi \rightarrow \gamma \pi^+ \pi^- \pi^+ \pi^-$		OCCUR=2
264	± 25		8 ARMSTRONG	93C	E760	$\bar{p}p \rightarrow \pi^0 \eta \eta \rightarrow 6\gamma$		
200	to 300		BREAKSTONE	93	SFM	$p p \rightarrow p p \pi^+ \pi^- \pi^+ \pi^-$		
< 80 90% CL			22 ALDE	92D	GAM2	38	$\pi^- p \rightarrow \eta \eta N^*$	
181	± 30		23 ARMSTRONG	89D	OMEG	300	$p p \rightarrow p p K^+ K^-$	
104	± 30		23 ARMSTRONG	89D	OMEG	300	$p p \rightarrow p p K_S^0 K_S^0$	OCCUR=2
30	± 20		9 BOLONKIN	88	SPEC	40	$\pi^- p \rightarrow K_S^0 K_S^0 n$	
350	± 150		4 BOLONKIN	88	SPEC	40	$\pi^- p \rightarrow K_S^0 K_S^0 n$	OCCUR=2
148	± 17		24 FALVARD	88	DM2	$J/\psi \rightarrow \phi K^+ K^-, K_S^0 K_S^0$		
184	± 6		25 FALVARD	88	DM2	$J/\psi \rightarrow \phi K^+ K^-, K_S^0 K_S^0$		OCCUR=2
122	$\pm \frac{74}{15}$		26 LONGACRE	86	RVUE	22	$\pi^- p \rightarrow n 2 K_S^0$	
200	± 100		BURKE	82	MRK2	$J/\psi \rightarrow \gamma 2 p$		
220	$\pm \frac{100}{70}$		27,28 EDWARDS	82D	CBAL	$J/\psi \rightarrow \gamma 2 \eta$		
200	$\pm \frac{156}{9}$		29 ETKIN	82B	MPS	23	$\pi^- p \rightarrow n 2 K_S^0$	

1 From partial wave analysis including all possible combinations of 0^{++} , 2^{++} , and 4^{++} resonances.

2 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.

3 Breit-Wigner width.

4 $J^P = 0^+$.

5 T-matrix pole.

6 Supersedes BARBERIS 99 and BARBERIS 99B.

7 $J^P = 0^+$, supersedes by ARMSTRONG 89D.

8 No J^{PC} determination.

9 $J^P = 2^+$.

10 No J^{PC} determination.

11 Systematic errors not estimated.

12 This state may be different from $f_0(1710)$, see CLOSE 05.

13 (Solution I)

14 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.

15 (Solution I)

16 Decaying to $f_0(1370) \pi \pi$.

17 $J^P = 0^+$.

18 Not seen by AMSLER 02.

19 T-matrix pole, assuming $J^P = 0^+$

20 No J^{PC} determination.

21 From a fit to the 0^+ partial wave.

NODE=M068W;LINKAGE=F

NODE=M068W;LINKAGE=HE

NODE=M068W;LINKAGE=BW

NODE=M068W;LINKAGE=A8

NODE=M068W;LINKAGE=TP

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

- 22 ALDE 92D combines all the GAMS-2000 data.
 23 $J^P = 2^+, (0^+ \text{ excluded})$.
 24 From an analysis ignoring interference with $f'_2(1525)$.
 25 From an analysis including interference with $f'_2(1525)$.
 26 Uses MRK3 data. From a partial-wave analysis of data using a K-matrix formalism with 5 poles, but assuming spin 2. Fit with constrained inelasticity.
 27 $J^P = 2^+$ preferred.
 28 From fit neglecting nearby $f'_2(1525)$. Replaced by BLOOM 83.
 29 From an amplitude analysis of the $K_S^0 K_S^0$ system, superseded by LONGACRE 86.

NODE=M068W;LINKAGE=AA
 NODE=M068W;LINKAGE=B
 NODE=M068W;LINKAGE=C
 NODE=M068W;LINKAGE=D
 NODE=M068W;LINKAGE=A9

 NODE=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	
$12^{+3}_{-2} - 227_8$		UEHARA	13	BELL $\gamma\gamma \rightarrow K_S^0 K_S^0$	

NODE=M068220

NODE=M068G2
 NODE=M068G2

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

<480	95	ALBRECHT	90G	ARG	$\gamma\gamma \rightarrow K^+ K^-$
<110	95	¹ BEHREND	89C	CELL	$\gamma\gamma \rightarrow K_S^0 K_S^0$
<280	95	¹ ALTHOFF	85B	TASS	$\gamma\gamma \rightarrow K\bar{K}\pi$

¹ Assuming helicity 2.

NODE=M068G2;LINKAGE=F

$\Gamma(\pi\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$					$\Gamma_3\Gamma_4/\Gamma$
VALUE (keV)	CL%	DOCUMENT ID	TECN	COMMENT	
<0.82	95	¹ BARATE	00E	ALEP $\gamma\gamma \rightarrow \pi^+ \pi^-$	

NODE=M068G3
 NODE=M068G3

¹ Assuming spin 0.

NODE=M068G;LINKAGE=Z

$f_0(1710)$ BRANCHING RATIOS

$\Gamma(K\bar{K})/\Gamma_{\text{total}}$					Γ_1/Γ
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
seen	1004	¹ DOBBS	15	$J/\psi \rightarrow \gamma K^+ K^-$	
seen	349	¹ DOBBS	15	$\psi(2S) \rightarrow \gamma K^+ K^-$	
0.36 ± 0.12		ALBALADEJO	08	RVUE	
$0.38^{+0.09}_{-0.19}$		² LONGACRE	86	MPS $22 \pi^- p \rightarrow n 2 K_S^0$	

NODE=M068225

NODE=M068R2
 NODE=M068R2

OCCUR=2

¹ Using CLEO-c data but not authored by the CLEO Collaboration.

² From a partial-wave analysis of data using a K-matrix formalism with 5 poles, but assuming spin 2. Fit with constrained inelasticity.

NODE=M068R2;LINKAGE=A
 NODE=M068R;LINKAGE=L

$\Gamma(\eta\eta)/\Gamma_{\text{total}}$					Γ_2/Γ
VALUE		DOCUMENT ID	TECN		
0.22 ± 0.12		ALBALADEJO	08	RVUE	
$0.18^{+0.03}_{-0.13}$		¹ LONGACRE	86	RVUE	

NODE=M068R1
 NODE=M068R1

¹ From a partial-wave analysis of data using a K-matrix formalism with 5 poles, but assuming spin 2. Fit with constrained inelasticity.

NODE=M068R1;LINKAGE=L

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

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
seen	381	¹ DOBBS	15	$J/\psi \rightarrow \gamma\pi^+\pi^-$
seen	237	¹ DOBBS	15	$\psi(2S) \rightarrow \gamma\pi^+\pi^-$
not seen		AMSLER	02	CBAR $0.9 \bar{p}p \rightarrow \pi^0\eta\eta, \pi^0\pi^0\pi^0$
$0.039^{+0.002}_{-0.024}$		² LONGACRE	86	RVUE

¹ Using CLEO-c data but not authored by the CLEO Collaboration.

² From a partial-wave analysis of data using a K-matrix formalism with 5 poles, but assuming spin 2. Fit with constrained inelasticity.

NODE=M068R5
NODE=M068R5

OCCUR=2

NODE=M068R5;LINKAGE=A
NODE=M068R5;LINKAGE=L

$\Gamma(\pi\pi)/\Gamma(K\bar{K})$ Γ_3/Γ_1

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$0.41^{+0.11}_{-0.17}$		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	¹ ABLIKIM	04E	BES2 $J/\psi \rightarrow \omega K^+K^-$
$5.8^{+9.1}_{-5.5}$		² ANISOVICH	02D	SPEC Combined fit
$0.2 \pm 0.024 \pm 0.036$		BARBERIS	99D	OMEG 450 $pp \rightarrow K^+K^-, \pi^+\pi^-$
0.39 ± 0.14		ARMSTRONG	91	OMEG 300 $pp \rightarrow pp\pi\pi, ppK\bar{K}$

¹ Using data from ABLIKIM 04A.

² From a combined K-matrix analysis of Crystal Barrel ($0. \bar{p}p \rightarrow \pi^0\pi^0\pi^0, \pi^0\eta\eta, \pi^0\pi^0\eta$), GAMS ($\pi p \rightarrow \pi^0\pi^0 n, \eta\eta n, \eta\eta' n$), and BNL ($\pi p \rightarrow K\bar{K} n$) data.

NODE=M068R6
NODE=M068R6

NODE=M068R;LINKAGE=AB
NODE=M068R;LINKAGE=CH

$\Gamma(\eta\eta)/\Gamma(K\bar{K})$ Γ_2/Γ_1

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
0.48 ± 0.15		BARBERIS	00E	450 $pp \rightarrow p_f\eta\eta p_s$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$0.46^{+0.70}_{-0.38}$		¹ ANISOVICH	02D	SPEC Combined fit
< 0.02	90	² PROKOSHKIN	91	GA24 $300 \pi^- p \rightarrow \pi^- p\eta\eta$

¹ From a combined K-matrix analysis of Crystal Barrel ($0. \bar{p}p \rightarrow \pi^0\pi^0\pi^0, \pi^0\eta\eta, \pi^0\pi^0\eta$), GAMS ($\pi p \rightarrow \pi^0\pi^0 n, \eta\eta n, \eta\eta' n$), and BNL ($\pi p \rightarrow K\bar{K} n$) data.

² Combining results of GAM4 with those of ARMSTRONG 89D.

NODE=M068R7
NODE=M068R7

NODE=M068R7;LINKAGE=CH

NODE=M068R;LINKAGE=A

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

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
seen	180	ABLIKIM	06H	BES $J/\psi \rightarrow \gamma\omega\omega$

NODE=M068R3
NODE=M068R3

$f_0(1710)$ REFERENCES

DOBBS	15	PR D91 052006	S. Dobbs <i>et al.</i>	(NWES)	REFID=56805
ABLIKIM	13N	PR D87 092009	Ablikim M. <i>et al.</i>	(BES III Collab.)	REFID=55387
UEHARA	13	PTEP 2013 123C01	S. Uehara <i>et al.</i>	(BELLE Collab.)	REFID=55592
ALBALADEJO	08	PRL 101 252002	M. Albaladejo, J.A. Oller		REFID=52656
CHEKANOV	08	PRL 101 112003	S. Chekanov <i>et al.</i>	(ZEUS Collab.)	REFID=52275
ABLIKIM	06H	PR D73 112007	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51125
ABLIKIM	06V	PL B642 441	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51507
AMSLER	06	PL B639 165	C. Amsler <i>et al.</i>	(CBAR Collab.)	REFID=51136
UMAN	06	PR D73 052009	I. Uman <i>et al.</i>	(FNAL E835)	REFID=51063
VLADIMIRSK...	06	PAN 69 493	V.V. Vladimirov <i>et al.</i>	(ITEP, Moscow)	REFID=51191
		Translated from YAF 69 515.			
ABLIKIM	05	PL B607 243	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50450
ABLIKIM	05Q	PR D72 092002	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50958
BINON	05	PAN 68 960	F. Binon <i>et al.</i>		REFID=50780
		Translated from YAF 68 998.			
CLOSE	05	PR D71 094022	F.E. Close, Q. Zhao		REFID=50788
ABLIKIM	04A	PL B598 149	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=49740
ABLIKIM	04E	PL B603 138	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50174
CHEKANOV	04	PL B578 33	S. Chekanov <i>et al.</i>	(ZEUS Collab.)	REFID=49672
PDG	04	PL B592 1	S. Eidelman <i>et al.</i>	(PDG Collab.)	REFID=49653
ANISOVICH	03	EPJ A16 229	V.V. Anisovich <i>et al.</i>		REFID=49401
BAI	03G	PR D68 052003	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49580
TIKHOMIROV	03	PAN 66 828	G.D. Tikhomirov <i>et al.</i>		REFID=49423
		Translated from YAF 66 860.			
AMSLER	02	EPJ C23 29	C. Amsler <i>et al.</i>		REFID=48580
ANISOVICH	02D	PAN 65 1545	V.V. Anisovich <i>et al.</i>		REFID=48831
		Translated from YAF 65 1583.			

NODE=M068

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
1751±15 OUR AVERAGE				
1768 ⁺²⁴ ₋₂₅ ±10	465	¹ ZHANG	12A BELL	$e^+e^- \rightarrow e^+e^-\eta'\pi^+\pi^-$
1744±10±15	1045	² ABLIKIM	06H BES	$J/\psi \rightarrow \gamma\omega\omega$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1703 ⁺¹² ₋₁₁ ±2		³ ZHANG	12A BELL	$e^+e^- \rightarrow e^+e^-\eta'\pi^+\pi^-$
1760±11	320	⁴ BISELLO	89B DM2	$J/\psi \rightarrow 4\pi\gamma$

¹ From a single-resonance fit.² From a partial wave analysis including $\eta(1760)$, $f_0(1710)$, $f_2(1640)$, and $f_2(1910)$.³ From a two-resonance fit.⁴ Estimated by us from various fits. Systematic uncertainties not estimated. **$\eta(1760)$ WIDTH**

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
240±30 OUR AVERAGE				
224 ⁺⁶² ₋₅₆ ±25	465	⁵ ZHANG	12A BELL	$e^+e^- \rightarrow e^+e^-\eta'\pi^+\pi^-$
244 ⁺²⁴ ₋₂₁ ±25	1045	⁶ ABLIKIM	06H BES	$J/\psi \rightarrow \gamma\omega\omega$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
42 ⁺³⁶ ₋₂₂ ±15		⁷ ZHANG	12A BELL	$e^+e^- \rightarrow e^+e^-\eta'\pi^+\pi^-$
60±16	320	⁸ BISELLO	89B DM2	$J/\psi \rightarrow 4\pi\gamma$

⁵ From a single-resonance fit.⁶ From a partial wave analysis including $\eta(1760)$, $f_0(1710)$, $f_2(1640)$, and $f_2(1910)$.⁷ From a two-resonance fit.⁸ Estimated by us from various fits. Systematic uncertainties not estimated.

NODE=M114

NODE=M114

NODE=M114M

NODE=M114M

OCCUR=2

NODE=M114M;LINKAGE=ZA
 NODE=M114M;LINKAGE=MA
 NODE=M114M;LINKAGE=ZH
 NODE=M114M;LINKAGE=A

NODE=M114W

NODE=M114W

OCCUR=2

NODE=M114W;LINKAGE=ZA
 NODE=M114W;LINKAGE=MA
 NODE=M114W;LINKAGE=ZH
 NODE=M114W;LINKAGE=B

$\eta(1760)$ DECAY MODES

NODE=M114215;NODE=M1114

Mode	Fraction (Γ_i/Γ)
Γ_1 4π	
Γ_2 $2\pi^+ 2\pi^-$	seen
Γ_3 $\pi^+ \pi^- 2\pi^0$	seen
Γ_4 $\rho^0 \rho^0$	seen
Γ_5 $\rho^+ \rho^-$	seen
Γ_6 $2(\pi^+ \pi^- \pi^0)$	
Γ_7 $\omega\omega$	seen
Γ_8 $\eta' \pi^+ \pi^-$	seen
Γ_9 $\gamma\gamma$	seen

DESIG=1

DESIG=2

DESIG=3

DESIG=4

DESIG=5

DESIG=6

DESIG=7

DESIG=8;OUR EVAL;→ UNCHECKED ←

DESIG=9;OUR EVAL;→ UNCHECKED ←

 $\eta(1760) \Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

NODE=M114225

$\Gamma(\eta'\pi^+\pi^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$						$\Gamma_8\Gamma_9/\Gamma$
VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT		
$28.2^{+7.9}_{-7.5} \pm 3.7$	465	⁹ ZHANG	12A BELL	$e^+e^- \rightarrow e^+e^-\eta'\pi^+\pi^-$		
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●						
$3.0^{+2.0}_{-1.2} \pm 0.8$	52	¹⁰ ZHANG	12A BELL	$e^+e^- \rightarrow e^+e^-\eta'\pi^+\pi^-$		
$18^{+13}_{-10} \pm 5$	315	¹¹ ZHANG	12A BELL	$e^+e^- \rightarrow e^+e^-\eta'\pi^+\pi^-$		

OCCUR=2

OCCUR=3

⁹ From a single-resonance fit.¹⁰ From a two-resonance fit. For constructive interference with the X(1835).¹¹ From a two-resonance fit. For destructive interference with the X(1835).

NODE=M114G01;LINKAGE=ZH

NODE=M114G01;LINKAGE=ZA

NODE=M114G01;LINKAGE=ZN

 $\eta(1760)$ BRANCHING RATIOS

NODE=M114210

$\Gamma(2\pi^+ 2\pi^-)/\Gamma_{\text{total}}$	Γ_2/Γ		
VALUE	DOCUMENT ID	TECN	COMMENT
seen	BISELLO	89B DM2	$J/\psi \rightarrow \gamma 2\pi^+ 2\pi^-$
$\Gamma(\pi^+ \pi^- 2\pi^0)/\Gamma_{\text{total}}$	Γ_3/Γ		
VALUE	DOCUMENT ID	TECN	COMMENT
seen	BISELLO	89B DM2	$J/\psi \rightarrow \gamma \pi^+ \pi^- 2\pi^0$
$\Gamma(\rho^0 \rho^0)/\Gamma_{\text{total}}$	Γ_4/Γ		
VALUE	DOCUMENT ID	TECN	COMMENT
seen	BISELLO	89B DM2	$J/\psi \rightarrow \gamma \rho^0 \rho^0$
seen	BALTRUSAIT...86	MRK3	$J/\psi \rightarrow \gamma \rho^0 \rho^0$
$\Gamma(\rho^+ \rho^-)/\Gamma_{\text{total}}$	Γ_5/Γ		
VALUE	DOCUMENT ID	TECN	COMMENT
seen	BISELLO	89B DM2	$J/\psi \rightarrow \gamma \rho^+ \rho^-$
seen	BALTRUSAIT...86	MRK3	$J/\psi \rightarrow \gamma \rho^+ \rho^-$
$\Gamma(\omega\omega)/\Gamma_{\text{total}}$	Γ_7/Γ		
VALUE	DOCUMENT ID	TECN	COMMENT
seen	BISELLO	87 DM2	$J/\psi \rightarrow \omega\omega$
seen	BALTRUSAIT...85C	MRK3	$J/\psi \rightarrow \gamma\omega\omega$

NODE=M114R01

NODE=M114R01

NODE=M114R02

NODE=M114R02

NODE=M114R03

NODE=M114R03

NODE=M114R04

NODE=M114R04

NODE=M114R06

NODE=M114R06

 $\eta(1760)$ REFERENCES

NODE=M114

ZHANG	12A	PR D86 052002	C.C. Zhang <i>et al.</i>	(BELLE Collab.)	REFID=54763
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
BALTRUSAIT...	86	PR D33 629	R.M. Baltrusaitis <i>et al.</i>	(Mark III Collab.)	REFID=22009
BALTRUSAIT...	86B	PR D33 1222	R.M. Baltrusaitis <i>et al.</i>	(Mark III Collab.)	REFID=22100
BALTRUSAIT...	85C	PRL 55 1723	R.M. Baltrusaitis <i>et al.</i>	(CIT, UCSC+)	REFID=22095

$\pi(1800)$

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

See also minireview under non- $q\bar{q}$ candidates in PDG 06, Journal of Physics **G33** 1 (2006).

NODE=M075

NODE=M075

NODE=M075M

NODE=M075M

OCCUR=2

NODE=M075M;LINKAGE=SP

NODE=M075M;LINKAGE=C1

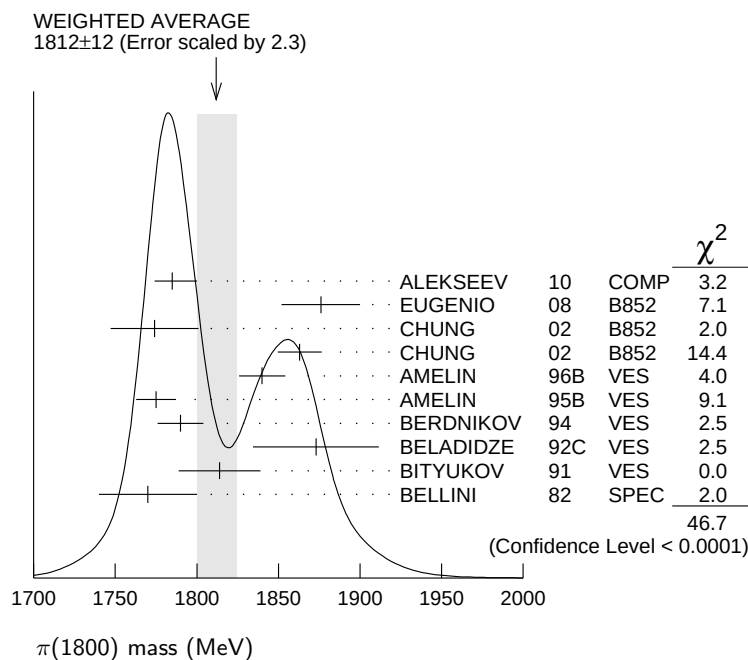
NODE=M075M;LINKAGE=C2

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.

NODE=M075W;LINKAGE=SP

NODE=M075W;LINKAGE=C1

NODE=M075W;LINKAGE=C2

NODE=M075W;LINKAGE=AX

NODE=M075W;LINKAGE=A

NODE=M075215;NODE=M075

 $\pi(1800)$ 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

DESIG=10;OUR EST;→ UNCHECKED ←

DESIG=11;OUR EST;→ UNCHECKED ←

DESIG=3;OUR EST;→ UNCHECKED ←

DESIG=1

DESIG=12

DESIG=2

DESIG=7;OUR EST;→ UNCHECKED ←

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	JP G33 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. Bitjukov, G.V. Borisov	(SERP+)
		Translated from YAF 55 2748.		
BITYUKOV	91	PL B268 137	S.I. Bitjukov <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

$f_2(1810)$

$$J^{PC} = 0^{+}(2^{++})$$

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.		
1822 ⁺²⁹⁺⁶⁶ ₋₂₄₋₅₇	5.5k	¹ ABLIKIM	13N BES3	$e^+e^- \rightarrow J/\psi \rightarrow \gamma\eta\eta$
1737±9 ⁺¹⁹⁸ ₋₆₅		² UEHARA	10A BELL	10.6 $e^+e^- \rightarrow e^+e^-\eta\eta$
1800±30	40	ALDE	88D GAM4	300 $\pi^-p \rightarrow \pi^-p4\pi^0$
1806±10	1600	ALDE	87 GAM4	100 $\pi^-p \rightarrow 4\pi^0n$
1870±40		³ ALDE	86D GAM4	100 $\pi^-p \rightarrow \eta\eta n$
1857 ⁺³⁵ ₋₂₄		⁴ COSTA	80 OMEG	10 $\pi^-p \rightarrow K^+K^-n$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
1858 ⁺¹⁸ ₋₇₁		⁵ LONGACRE	86 RVUE	Compilation
1799±15		⁶ CASON	82 STRC	8 $\pi^+p \rightarrow \Delta^{++}\pi^0\pi^0$

¹ From partial wave analysis including all possible combinations of 0^{++} , 2^{++} , and 4^{++} resonances.

² Breit-Wigner mass.

³ Seen in only one solution.

⁴ Error increased by spread of two solutions. Included in LONGACRE 86 global analysis.

⁵ From a partial-wave analysis of data using a K-matrix formalism with 5 poles. Includes compilation of several other experiments.

⁶ From an amplitude analysis of the reaction $\pi^+\pi^- \rightarrow 2\pi^0$. The resonance in the $2\pi^0$ final state is not confirmed by PROKOSHKIN 97.

NODE=M038M;LINKAGE=B

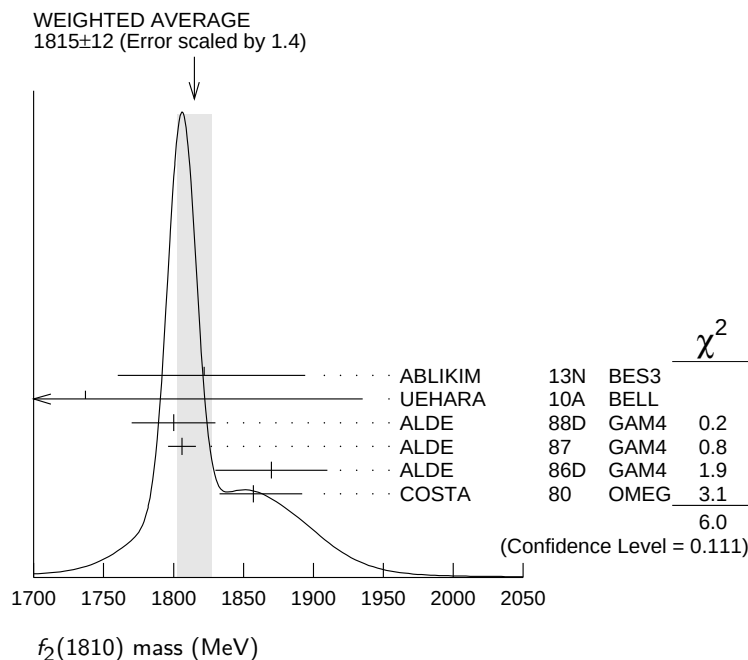
NODE=M038M;LINKAGE=UE

NODE=M038M;LINKAGE=F

NODE=M038M;LINKAGE=A

NODE=M038M;LINKAGE=L

NODE=M038M;LINKAGE=P1

 **$f_2(1810)$ WIDTH**

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
197±22 OUR AVERAGE		Error includes scale factor of 1.5. See the ideogram below.		
229 ⁺⁵²⁺⁸⁸ ₋₄₂₋₁₅₅	5.5k	⁷ ABLIKIM	13N BES3	$e^+e^- \rightarrow J/\psi \rightarrow \gamma\eta\eta$
228 ⁺²¹⁺²³⁴ ₋₂₀₋₁₅₃		⁸ UEHARA	10A BELL	10.6 $e^+e^- \rightarrow e^+e^-\eta\eta$
160±30	40	ALDE	88D GAM4	300 $\pi^-p \rightarrow \pi^-p4\pi^0$

NODE=M038W

NODE=M038W

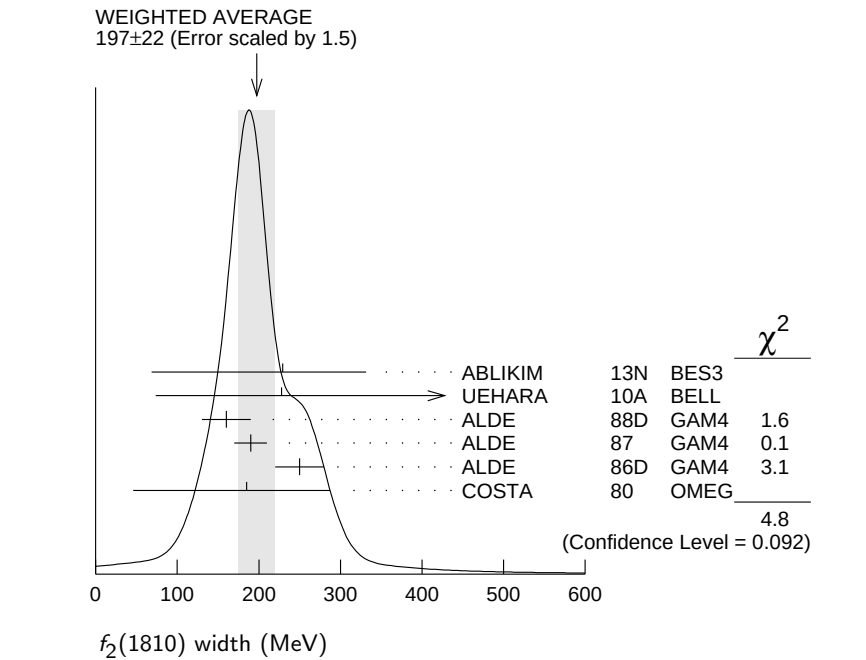
190± 20	1600	ALDE	87	GAM4	100	$\pi^- p \rightarrow 4\pi^0 n$
250± 30		⁹ ALDE	86D	GAM4	100	$\pi^- p \rightarrow \eta \eta n$
185 ⁺¹⁰² ₋₁₃₉		¹⁰ COSTA	80	OMEG	10	$\pi^- p \rightarrow K^+ K^- n$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
388 ⁺¹⁵ ₋₂₁		¹¹ LONGACRE	86	RVUE	Compilation	
280 ⁺⁴² ₋₃₅		¹² CASON	82	STRC	8	$\pi^+ p \rightarrow \Delta^{++} \pi^0 \pi^0$

- ⁷ From partial wave analysis including all possible combinations of 0^{++} , 2^{++} , and 4^{++} resonances.
⁸ Breit-Wigner width.
⁹ Seen in only one solution.
¹⁰ Error increased by spread of two solutions. Included in LONGACRE 86 global analysis.
¹¹ From a partial-wave analysis of data using a K-matrix formalism with 5 poles. Includes compilation of several other experiments.
¹² From an amplitude analysis of the reaction $\pi^+ \pi^- \rightarrow 2\pi^0$. The resonance in the $2\pi^0$ final state is not confirmed by PROKOSHKIN 97.

NODE=M038W;LINKAGE=B

NODE=M038W;LINKAGE=UE
NODE=M038W;LINKAGE=F
NODE=M038W;LINKAGE=A
NODE=M038W;LINKAGE=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	$\eta \eta$	seen
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+37.3} _{-0.8-4.5}	¹³ UEHARA	10A	BELL	10.6 $e^+ e^- \rightarrow e^+ e^- \eta \eta$	

NODE=M038G01
NODE=M038G01

- ¹³ Including interference with the $f_2'(1525)$ (parameters fixed to the values from the 2008 edition of this review, PDG 08) and $f_2(1270)$. May also be the $f_0(1500)$.

NODE=M038G01;LINKAGE=UE

$f_2(1810)$ BRANCHING RATIOS

NODE=M038220

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

VALUE	DOCUMENT ID	TECN	COMMENT

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

not seen AMSLER 02 CBAR $0.9 \bar{p} p \rightarrow \pi^0 \eta \eta, \pi^0 \pi^0 \pi^0$ not seen PROKOSHKIN 97 GAM2 $38 \pi^- p \rightarrow \pi^0 \pi^0 n$ $0.21^{+0.02}_{-0.03}$ ¹⁴ LONGACRE 86 RVUE Compilation 0.44 ± 0.03 ¹⁵ CASON 82 STRC $8 \pi^+ p \rightarrow \Delta^{++} \pi^0 \pi^0$ ¹⁴ From a partial-wave analysis of data using a K-matrix formalism with 5 poles. Includes compilation of several other experiments.¹⁵ Included in LONGACRE 86 global analysis.NODE=M038R2
NODE=M038R2

NODE=M038R2;LINKAGE=L

NODE=M038R;LINKAGE=C

 $\Gamma(\eta\eta)/\Gamma_{\text{total}}$ **Γ_2/Γ**

VALUE	DOCUMENT ID	TECN	COMMENT

seen ABLIKIM 13N BES3 PWA of $J/\psi \rightarrow \gamma \eta \eta$

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

 $0.008^{+0.028}_{-0.003}$ ¹⁶ LONGACRE 86 RVUE Compilation¹⁶ 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 $100 \pi^- p \rightarrow 4\pi^0 n$ **$\Gamma(4\pi^0)/\Gamma(\eta\eta)$** **$\Gamma_3/\Gamma_2$**

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=M038R4
NODE=M038R4NODE=M038R5
NODE=M038R5 **$\Gamma(K^+ K^-)/\Gamma_{\text{total}}$** **$\Gamma_4/\Gamma$**

VALUE	DOCUMENT ID	TECN	COMMENT

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

 $0.003^{+0.019}_{-0.002}$ ¹⁷ LONGACRE 86 RVUE Compilationseen COSTA 80 OMEG $10 \pi^- p \rightarrow K^+ K^- n$ ¹⁷ 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

NODE=M038

ABLIKIM	13N	PR D87 092009	Ablikim M. <i>et al.</i>	(BES III Collab.)
UEHARA	10A	PR D82 114031	S. Uehara <i>et al.</i>	(BELLE Collab.)
PDG	08	PL B667 1	C. Amsler <i>et al.</i>	(PDG Collab.)
AMSLER	02	EPJ C23 29	C. Amsler <i>et al.</i>	
PROKOSHKIN	97	PD 42 117	Y.D. Prokoshkin <i>et al.</i>	(SERP)
		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 <i>et al.</i>	(BARI, BONN, CERN, GLAS+)

REFID=55387
REFID=53641
REFID=52166
REFID=48580
REFID=45386

REFID=44652

REFID=40221
REFID=20765
REFID=20768
REFID=20746
REFID=20737

X(1835)

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

NODE=M085

OMITTED FROM SUMMARY TABLE

Could be a superposition of two states, one with small width appearing as threshold enhancement in $p\bar{p}$, the other one with a larger width, decaying into $\pi^+\pi^-\eta'$ and $K_S^0 K_S^0 \eta$. For the former ABLIKIM 12D determine $J^{PC} = 0^{-+}$.

NODE=M085

X(1835) MASS

NODE=M085M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

NODE=M085M

1826.5^{+13.0}_{-3.4} OUR AVERAGE

NEW

[1835.8^{+4.0}_{-3.2} MeV OUR 2016 AVERAGE]

1825.3 ± 2.4 ^{+17.3} _{-2.4}		¹ ABLIKIM	16J	BES3	$J/\psi \rightarrow \gamma \pi^+ \pi^- \eta'$	
1844 ± 9 ⁺¹⁶ ₋₂₅		ABLIKIM	15T	BES3	$J/\psi \rightarrow \gamma K_S^0 K_S^0 \eta$	
• • • We do not use the following data for averages, fits, limits, etc. • • •						
1909.5 ± 15.9 ^{+9.4} _{-27.5}		² ABLIKIM	16J	BES3	$J/\psi \rightarrow \gamma \pi^+ \pi^- \eta'$	
1832 ⁺¹⁹ ₋₅ ± 26		³ ABLIKIM	12D	BES3	$J/\psi \rightarrow \gamma p\bar{p}$	
1836.5 ± 3.0 ^{+5.6} _{-2.1}	4265	⁴ ABLIKIM	11C	BES3	$J/\psi \rightarrow \gamma \pi^+ \pi^- \eta'$	
1877.3 ± 6.3 ^{+3.4} _{-7.4}		⁵ ABLIKIM	11J	BES3	$J/\psi \rightarrow \omega(\eta \pi^+ \pi^-)$	
1837 ⁺¹⁰ ₋₁₂ ± 9 ⁺⁹ ₋₇	231	^{6,7} ALEXANDER	10	CLEO	$J/\psi \rightarrow \gamma p\bar{p}$	
1833.7 ± 6.1 ± 2.7	264	ABLIKIM	05R	BES2	$J/\psi \rightarrow \gamma \pi^+ \pi^- \eta'$	
1831 ± 7		^{7,8} ABLIKIM	05R	BES2	$J/\psi \rightarrow \gamma p\bar{p}$	
1859 ⁺³ ₋₁₀ ± 5 ⁺⁵ ₋₂₅		⁷ BAI	03F	BES2	$J/\psi \rightarrow \gamma p\bar{p}$	

OCCUR=2

¹ From a fit of the measured $\pi^+\pi^-\eta'$ lineshape that accounts for the abrupt distortion observed at the $p\bar{p}$ threshold through interference with a second previously unseen narrow resonance near 1870 MeV. The fit uses Breit-Wigner functions for the signal shapes and includes known backgrounds and contributors.

NODE=M085M;LINKAGE=B

² Pole mass from a fit of the measured $\pi^+\pi^-\eta'$ lineshape to a Flatte formula that accounts for the abrupt distortion observed at the $p\bar{p}$ threshold; the fit also includes known backgrounds and contributors, as well as an *ad hoc* Breit-Wigner function ($M \approx 1919$ MeV; $\Gamma \approx 51$ MeV) that is required for a good fit.

NODE=M085M;LINKAGE=A

³ From the fit including final state interaction effects in isospin 0 *S*-wave according to SIBIRTSEV 05A. Supersedes ABLIKIM 10G.

NODE=M085M;LINKAGE=AK

⁴ 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

⁵ 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

⁶ 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

⁷ 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

⁸ 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

242⁺¹⁴₋₁₅ OUR AVERAGE

NEW

[112 ± 40 MeV OUR 2016 AVERAGE Scale factor = 2.4]

245.2 ± 13.1 ^{+4.6} _{-9.6}		¹ ABLIKIM	16J	BES3	$J/\psi \rightarrow \gamma \pi^+ \pi^- \eta'$	
192 ⁺²⁰ ₋₁₇ ± 62 ⁺⁶² ₋₄₃		ABLIKIM	15T	BES3	$J/\psi \rightarrow \gamma K_S^0 K_S^0 \eta$	

OCCUR=2

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

$273.5 \pm 21.4^{+6.1}_{-64.0}$		² ABLIKIM	16J	BES3	$J/\psi \rightarrow \gamma \pi^+ \pi^- \eta'$
< 76	90	³ ABLIKIM	12D	BES3	$J/\psi \rightarrow \gamma p \bar{p}$
$190 \pm 9^{+38}_{-36}$	4265	⁴ ABLIKIM	11C	BES3	$J/\psi \rightarrow \gamma \pi^+ \pi^- \eta'$
$57 \pm 12^{+19}_{-4}$		⁵ ABLIKIM	11J	BES3	$J/\psi \rightarrow \omega(\eta \pi^+ \pi^-)$
0^{+44}_{-0}	231	^{6,7} ALEXANDER	10	CLEO	$J/\psi \rightarrow \gamma p \bar{p}$
$67.7 \pm 20.3 \pm 7.7$	264	ABLIKIM	05R	BES2	$J/\psi \rightarrow \gamma \pi^+ \pi^- \eta'$
< 153	90	^{7,8} ABLIKIM	05R	BES2	$J/\psi \rightarrow \gamma p \bar{p}$
< 30		⁷ BAI	03F	BES2	$J/\psi \rightarrow \gamma p \bar{p}$

¹ From a fit of the measured $\pi^+ \pi^- \eta'$ lineshape that accounts for the abrupt distortion observed at the $p\bar{p}$ threshold through interference with a second previously unseen narrow resonance near 1870 MeV. The fit uses Breit-Wigner functions for the signal shapes and includes known backgrounds and contributors.

² Pole width from a fit of the measured $\pi^+ \pi^- \eta'$ lineshape to a Flatte formula that accounts for the abrupt distortion observed at the $p\bar{p}$ threshold; the fit also includes known backgrounds and contributors, as well as an *ad hoc* Breit-Wigner function ($M \approx 1919$ MeV; $\Gamma \approx 51$ MeV) that is required for a good fit.

³ From the fit including final state interaction effects in isospin 0 *S*-wave according to SIBIRTSEV 05A. Supersedes ABLIKIM 10G.

⁴ 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 $J/\psi \rightarrow \pi^0 \pi^+ \pi^- \eta'$.

⁵ 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 $\eta_2(1870)$.

⁶ 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.

⁷ 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 $\Upsilon(1S) \rightarrow p\bar{p} \gamma$.

⁸ From the fit including final state interaction effects in isospin 0 *S*-wave according to SIBIRTSEV 05A. Systematic errors not estimated.

OCCUR=2

NODE=M085W;LINKAGE=B

NODE=M085W;LINKAGE=A

NODE=M085W;LINKAGE=AK

NODE=M085W;LINKAGE=AI

NODE=M085W;LINKAGE=BL

NODE=M085W;LINKAGE=AE

NODE=M085W;LINKAGE=HF

NODE=M085W;LINKAGE=AB

X(1835) DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $p\bar{p}$	seen
Γ_2 $\eta' \pi^+ \pi^-$	seen
Γ_3 $\gamma \gamma$	
Γ_4 $K_S^0 K_S^0 \eta$	seen

NODE=M085215;NODE=M085

DESIG=1;OUR EVAL;→ UNCHECKED ←

DESIG=2

DESIG=4

DESIG=5;OUR EVAL;→ UNCHECKED ←

X(1835) $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

$\Gamma(\eta' \pi^+ \pi^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$	$\Gamma_2 \Gamma_3 / \Gamma$
VALUE (eV)	CL%

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

< 35.6	90	¹ ZHANG	12A	BELL	$e^+ e^- \rightarrow e^+ e^- \eta' \pi^+ \pi^-$
< 83	90	² ZHANG	12A	BELL	$e^+ e^- \rightarrow e^+ e^- \eta' \pi^+ \pi^-$

¹ From a two-resonance fit and constructive interference of the $\eta(1760)$ and $X(1835)$, a significance of 2.8σ .

² From a two-resonance fit and destructive interference of the $\eta(1760)$ and $X(1835)$, a significance of 2.8σ .

NODE=M085225

NODE=M085G01

NODE=M085G01

OCCUR=2

NODE=M085G01;LINKAGE=ZH

NODE=M085G01;LINKAGE=ZA

X(1835) BRANCHING RATIOS

$\Gamma(p\bar{p})/\Gamma(\eta' \pi^+ \pi^-)$	Γ_1/Γ_2
VALUE	DOCUMENT ID

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

0.333	ABLIKIM	05R	BES2	$J/\psi \rightarrow \gamma \pi^+ \pi^- \eta'$

NODE=M085220

NODE=M085R01

NODE=M085R01

$\Gamma(\eta'\pi^+\pi^-)/\Gamma(K_S^0K_S^0\eta)$	Γ_2/Γ_4
VALUE	DOCUMENT ID TECN COMMENT

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

6.7±1.8¹ ABLIKIM 15T BES3 $J/\psi \rightarrow \gamma K_S^0 K_S^0 \eta$

¹ Using resutls from ABLIKIM 05R.

NODE=M085R00
NODE=M085R00

NODE=M085R00;LINKAGE=A

$\Gamma(\eta'\pi^+\pi^-)/\Gamma_{\text{total}}$	Γ_2/Γ
VALUE	DOCUMENT ID TECN COMMENT

seen¹ ABLIKIM 16J BES3 $J/\psi \rightarrow \gamma \pi^+ \pi^- \eta'$

¹ ABLIKIM 16J quotes $B(J/\psi \rightarrow \gamma X(1835)) \times B(X(1835) \rightarrow \pi^+ \pi^- \eta') = (3.93 \pm 0.38^{+0.31}_{-0.84}) \times 10^{-4}$ from a fit of the measured $\pi^+ \pi^- \eta'$ lineshape that accounts for the abrupt distortion observed at the $p\bar{p}$ threshold with a Flatte formula in addition to known backgrounds and contributors, as well as an *ad hoc* Breit-Wigner ($M \approx 1919$ MeV; $\Gamma \approx 51$ MeV) that is required for a good fit. Another explanation for the distortion provided by ABLIKIM 16J is that a second resonance near 1870 MeV interferes with the $X(1835)$; fits to this possibility yield product branching fraction values compatible with that shown within the respective systematic uncertainties.

NODE=M085R03
NODE=M085R03

NODE=M085R03;LINKAGE=A

X(1835) REFERENCES

NODE=M085

ABLIKIM 16J PRL 117 042002 M. Ablikim <i>et al.</i> (BES III Collab.)	REFID=57454
ABLIKIM 15T PRL 115 091803 M. Ablikim <i>et al.</i> (BES III Collab.)	REFID=56785
ABLIKIM 12D PRL 108 112003 M. Ablikim <i>et al.</i> (BES III Collab.) JPC	REFID=54269
DEL-AMO-SA... 12 PR D85 092017 P. del Amo Sanchez <i>et al.</i> (BABAR Collab.)	REFID=54286
ZHANG 12A PR D86 052002 C.C. Zhang <i>et al.</i> (BELLE Collab.)	REFID=54763
ABLIKIM 11C PRL 106 072002 M. Ablikim <i>et al.</i> (BES III Collab.)	REFID=53684
ABLIKIM 11J PRL 107 182001 M. Ablikim <i>et al.</i> (BES III Collab.)	REFID=53931
ABLIKIM 10G CP C34 421 M. Ablikim <i>et al.</i> (BES III Collab.)	REFID=55685
ALEXANDER 10 PR D82 092002 J.P. Alexander <i>et al.</i> (CLEO Collab.)	REFID=53525
WEI 08 PL B659 80 J.-T. Wei <i>et al.</i> (BELLE Collab.)	REFID=52086
ATHAR 06 PR D73 032001 S.B. Athar <i>et al.</i> (CLEO Collab.)	REFID=50993
ABLIKIM 05R PRL 95 262001 M. Ablikim <i>et al.</i> (BES Collab.)	REFID=50985
AUBERT,B 05L PR D72 051101 B. Aubert <i>et al.</i> (BABAR Collab.)	REFID=50827
SIBIRTSEV 05A PR D71 054010 A. Sibirtsev, J. Haidenbauer	REFID=51038
WANG 05A PL B617 141 M.-Z. Wang <i>et al.</i> (BELLE Collab.)	REFID=50651
BAI 03F PRL 91 022001 J.Z. Bai <i>et al.</i> (BES II Collab.)	REFID=49473
ABE 02K PRL 88 181803 K. Abe <i>et al.</i> (BELLE Collab.)	REFID=48690
ABE 02W PRL 89 151802 K. Abe <i>et al.</i> (BELLE Collab.)	REFID=48980

REFID=57454
REFID=56785
REFID=54269
REFID=54286
REFID=54763
REFID=53684
REFID=53931
REFID=55685
REFID=53525
REFID=52086
REFID=50993
REFID=50985
REFID=50827
REFID=51038
REFID=50651
REFID=49473
REFID=48690
REFID=48980

X(1840)

$I^G(J^{PC}) = ?^?(???)$

NODE=M215

OMITTED FROM SUMMARY TABLE

X(1840) MASS

NODE=M215M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1842.2±4.2 ^{+7.1} _{-2.6}	0.6k	ABLIKIM	13U BES3	$J/\psi \rightarrow \gamma 3(\pi^+ \pi^-)$

NODE=M215M

X(1840) WIDTH

NODE=M215W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
83±14±11	0.6k	ABLIKIM	13U BES3	$J/\psi \rightarrow \gamma 3(\pi^+ \pi^-)$

NODE=M215W

X(1840) DECAY MODES

NODE=M215215;NODE=M215

Mode	Fraction (Γ_i/Γ)
Γ_1 3($\pi^+ \pi^-$)	seen

DESIG=1

X(1840) BRANCHING RATIOS

NODE=M215225

$\Gamma(3(\pi^+ \pi^-))/\Gamma_{\text{total}}$					Γ_1/Γ
<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
seen	0.6k	ABLIKIM	13U BES3	$J/\psi \rightarrow \gamma 3(\pi^+ \pi^-)$	

NODE=M215R01
NODE=M215R01

X(1840) REFERENCES

NODE=M215

ABLIKIM 13U PR D88 091502 M. Ablikim <i>et al.</i> (BES III Collab.)	REFID=55582

REFID=55582

$a_1(1420)$

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

OMITTED FROM SUMMARY TABLE

 $a_1(1420)$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
1414^{+15}_{-13}	¹ ADOLPH	15C	COMP 190 $\pi^- p \rightarrow \pi^- \pi^+ \pi^- p$

¹ Using the isobar model and partial-wave analysis with 88 waves. **$a_1(1420)$ WIDTH**

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
153^{+8}_{-23}	¹ ADOLPH	15C	COMP 190 $\pi^- p \rightarrow \pi^- \pi^+ \pi^- p$

¹ Using the isobar model and partial-wave analysis with 88 waves. **$a_1(1420)$ DECAY MODES**

Mode	Fraction (Γ_i/Γ)
Γ_1 $f_0(980)\pi$	seen

 $a_1(1420)$ BRANCHING RATIOS

$\Gamma(f_0(980)\pi)/\Gamma_{\text{total}}$				Γ_1/Γ
<i>VALUE</i>	<i>DOCUMENT ID</i>	<i>TECN</i>	<i>COMMENT</i>	
seen	¹ ADOLPH	15C	COMP	190 $\pi^- p \rightarrow \pi^- \pi^+ \pi^- p$

¹ Using the isobar model and partial-wave analysis with 88 waves. **$a_1(1420)$ REFERENCES**ADOLPH 15C PRL 115 082001 C. Adolph *et al.* (COMPASS 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 $K^- p \rightarrow K \bar{K} \Lambda$

NODE=M230

NODE=M230M

NODE=M230M

NODE=M230M;LINKAGE=A

NODE=M230W

NODE=M230W

NODE=M230W;LINKAGE=A

NODE=M230215;NODE=M230

DESIG=1

NODE=M230220

NODE=M230R01
NODE=M230R01

NODE=M230R01;LINKAGE=A

NODE=M230

REFID=56790

NODE=M054

NODE=M054M

NODE=M054M

NODE=M054W

NODE=M054W

$\phi_3(1850)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $K\bar{K}$	seen
Γ_2 $K\bar{K}^*(892) + \text{c.c.}$	seen

NODE=M054215;NODE=M054

DESIG=1;OUR EST;→ UNCHECKED ←

DESIG=2;OUR EST;→ UNCHECKED ←

 $\phi_3(1850)$ BRANCHING RATIOS

$\Gamma(K\bar{K}^*(892) + \text{c.c.})/\Gamma(K\bar{K})$	Γ_2/Γ_1
VALUE	DOCUMENT ID TECN COMMENT
$0.55^{+0.85}_{-0.45}$	ASTON 88E LASS 11 $K^- p \rightarrow K^- K^+ \Lambda$, $K_S^0 K^\pm \pi^\mp \Lambda$
• • • We do not use the following data for averages, fits, limits, etc. • • •	
0.8 ± 0.4	ALHARRAN 81B HBC 8.25 $K^- p \rightarrow K\bar{K}\pi\Lambda$

NODE=M054220

NODE=M054R1
NODE=M054R1 $\phi_3(1850)$ REFERENCES

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+)

NODE=M054

REFID=40577
REFID=21405
REFID=21702

NODE=M101

 $\eta_2(1870)$

$$I^G(J^{PC}) = 0^+(2^-+)$$

OMITTED FROM SUMMARY TABLE

Needs confirmation.

NODE=M101

 $\eta_2(1870)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1842 ± 8 OUR AVERAGE				
1835 ± 12		BARBERIS 00B		450 $pp \rightarrow p_f \eta \pi^+ \pi^- p_s$
1844 ± 13		BARBERIS 00C		450 $pp \rightarrow p_f 4\pi p_s$
1840 ± 25		BARBERIS 97B OMEG		450 $pp \rightarrow pp2(\pi^+ \pi^-)$
1875 ± 20 ± 35		ADOMEIT 96 CBAR		1.94 $\bar{p}p \rightarrow \eta 3\pi^0$
1881 ± 32 ± 40	26	KARCH 92 CBAL		$e^+ e^- \rightarrow e^+ e^- \eta \pi^0 \pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1860 ± 5 ± 15		ANISOVICH 00E SPEC		0.9–1.94 $\bar{p}p \rightarrow \eta 3\pi^0$
1840 ± 15		BAI 99 BES		$J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$

NODE=M101M

NODE=M101M

 $\eta_2(1870)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
225 ± 14 OUR AVERAGE				
235 ± 22		BARBERIS 00B		450 $pp \rightarrow p_f \eta \pi^+ \pi^- p_s$
228 ± 23		BARBERIS 00C		450 $pp \rightarrow p_f 4\pi p_s$
200 ± 40		BARBERIS 97B OMEG		450 $pp \rightarrow pp2(\pi^+ \pi^-)$
200 ± 25 ± 45		ADOMEIT 96 CBAR		1.94 $\bar{p}p \rightarrow \eta 3\pi^0$
221 ± 92 ± 44	26	KARCH 92 CBAL		$e^+ e^- \rightarrow e^+ e^- \eta \pi^0 \pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
250 ± 25 $^{+50}_{-35}$		ANISOVICH 00E SPEC		0.9–1.94 $\bar{p}p \rightarrow \eta 3\pi^0$
170 ± 40		BAI 99 BES		$J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$

NODE=M101W

NODE=M101W

 $\eta_2(1870)$ DECAY MODES

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

NODE=M101225;NODE=M101

DESIG=1

DESIG=4

DESIG=8

DESIG=2

DESIG=9

$\eta_2(1870)$ BRANCHING RATIOS $\Gamma(a_2(1320)\pi)/\Gamma(f_2(1270)\eta)$ Γ_2/Γ_3

VALUE	DOCUMENT ID	TECN	COMMENT
1.7 ± 0.4 OUR AVERAGE			
1.60 ± 0.40	¹ ANISOVICH	11	SPEC 0.9–1.94 $p\bar{p}$
20.4 ± 6.6	BARBERIS	00B	450 $p p \rightarrow p_f \eta \pi^+ \pi^- p_s$
4.1 ± 2.3	ADOMEIT	96	CBAR 1.94 $\bar{p} p \rightarrow \eta 3\pi^0$

¹ Reanalysis of ADOMEIT 96 and ANISOVICH 00E.

NODE=M101230

NODE=M101R2
NODE=M101R2

NODE=M101R2;LINKAGE=AN

 $\Gamma(a_2(1320)\pi)/\Gamma(a_0(980)\pi)$ Γ_2/Γ_4

VALUE	DOCUMENT ID	COMMENT
32.6 ± 12.6	BARBERIS	00B 450 $p p \rightarrow p_f \eta \pi^+ \pi^- p_s$

NODE=M101R4
NODE=M101R4 $\Gamma(a_0(980)\pi)/\Gamma(f_2(1270)\eta)$ Γ_4/Γ_3

VALUE	DOCUMENT ID	TECN	COMMENT
0.48 ± 0.45	² ANISOVICH	11	SPEC 0.9–1.94 $p\bar{p}$

² Reanalysis of ADOMEIT 96 and ANISOVICH 00E.NODE=M101R01
NODE=M101R01

NODE=M101R01;LINKAGE=AN

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

VALUE	DOCUMENT ID	TECN	COMMENT
seen	KARCH	92	CBAL $e^+ e^- \rightarrow e^+ e^- \eta \pi^0 \pi^0$

NODE=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

 $\pi_2(1880)$

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

 $\pi(1880)$ 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

NODE=M185215;NODE=M185

Mode	
Γ_1	$\eta \eta \pi^-$
Γ_2	$a_0(980) \eta$
Γ_3	$a_2(1320) \eta$
Γ_4	$f_0(1500) \pi$
Γ_5	$f_1(1285) \pi$
Γ_6	$\omega \pi^- \pi^0$

DESIG=1

DESIG=2

DESIG=3

DESIG=4

DESIG=5

DESIG=6

 $\Gamma(a_2(1320)\eta)/\Gamma(f_1(1285)\pi)$ Γ_3/Γ_5

VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
22.7 ± 7.3	69k	KUHN	04	B852	– 18 $\pi^- p \rightarrow \eta \pi^+ \pi^- \pi^- p$

NODE=M185R01
NODE=M185R01

$\Gamma(f_0(1500)\pi)/\Gamma(a_0(980)\eta)$

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	$\gamma p \rightarrow 3\pi^+3\pi^-p$
1870 ± 10		ANTONELLI	96	SPEC	$e^+e^- \rightarrow \text{hadrons}$

¹ From the fit with two resonances.

² From a fit with two resonances with the JACOB 72 continuum.

³ Supersedes FRABETTI 01.

NODE=M170M

NODE=M170M

OCCUR=2

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	$\gamma p \rightarrow 3\pi^+3\pi^-p$
10 ± 5		ANTONELLI	96	SPEC	$e^+e^- \rightarrow \text{hadrons}$

⁴ From the fit with two resonances.

⁵ From a fit with two resonances with the JACOB 72 continuum.

⁶ Supersedes FRABETTI 01.

NODE=M170W

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

Γ(6π)/Γ _{total}					Γ ₁ /Γ
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
seen	8k	AKHMETSHIN 13	CMD3	$e^+e^- \rightarrow 3\pi^+3\pi^-$	
not seen		AGNELLO 02	OBLX	$\bar{n}p \rightarrow 3\pi^+2\pi^-\pi^0$	
seen		FRABETTI 01	E687	$\gamma p \rightarrow 3\pi^+3\pi^-p$	
seen		ANTONELLI 96	SPEC	$e^+e^- \rightarrow \text{hadrons}$	

NODE=M170230

NODE=M170R1
NODE=M170R1

ρ(1900) REFERENCES

AKHMETSHIN 13	PL B723 82	R.R. Akhmetshin <i>et al.</i>	(CMD-3 Collab.)
AUBERT 08S	PR D77 092002	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT 06D	PR D73 052003	B. Aubert <i>et al.</i>	(BABAR Collab.)
FRABETTI 04	PL B578 290	P.L. Frabetti <i>et al.</i>	(FNAL E687 Collab.)
AGNELLO 02	PL B527 39	M. Agnello <i>et al.</i>	(OBELIX Collab.)
FRABETTI 01	PL B514 240	P.L. Frabetti <i>et al.</i>	(FNAL E687 Collab.)
ANTONELLI 96	PL B365 427	A. Antonelli <i>et al.</i>	(FENICE Collab.)
JACOB 72	PR D5 1847	M. Jacob, R. Slansky	

NODE=M170

REFID=55370
REFID=52242
REFID=51047
REFID=49614
REFID=48576
REFID=48350
REFID=44633
REFID=49668

f₂(1910)

$I^G(J^{PC}) = 0^+(2^{++})$

OMITTED FROM SUMMARY TABLE

We list here three different peaks with close masses and widths seen in the mass distributions of $\omega\omega$, $\eta\eta'$, and K^+K^- final states. ALDE 91B argues that they are of different nature.

NODE=M142

NODE=M142

f₂(1910) MASS

NODE=M142205

NODE=M142MX

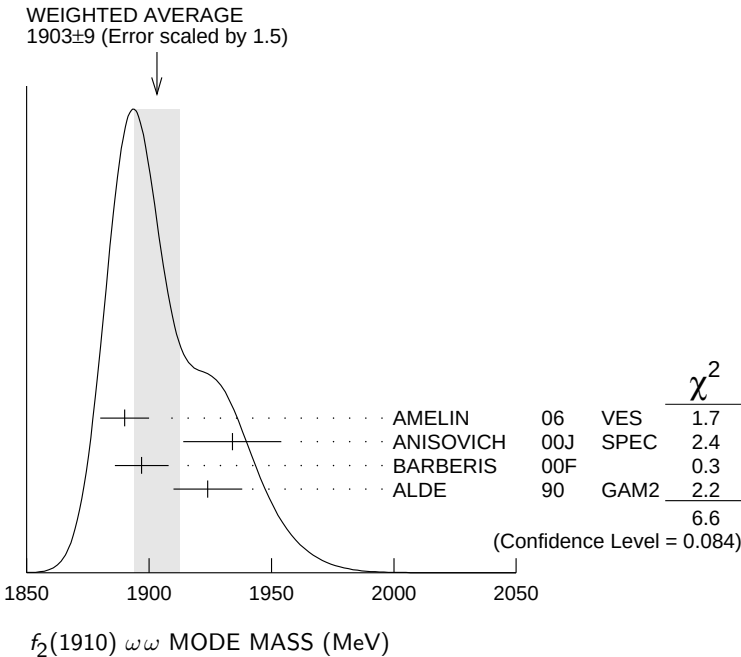
f₂(1910) ωω MODE

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		$450pp \rightarrow p_f\omega\omega p_s$
1924±14		ALDE 90	GAM2	$38\pi^-p \rightarrow \omega\omega n$

NODE=M142M2
NODE=M142M2

¹Supersedes BELADIDZE 92B.

NODE=M142M2;LINKAGE=AM



$f_2(1910) \eta \eta'$ MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
1934±16	² BARBERIS	00A	450 $p p \rightarrow p_f \eta \eta' p_s$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
1911±10	ALDE	91B	GAM2 38 $\pi^- p \rightarrow \eta \eta' n$
² Also 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

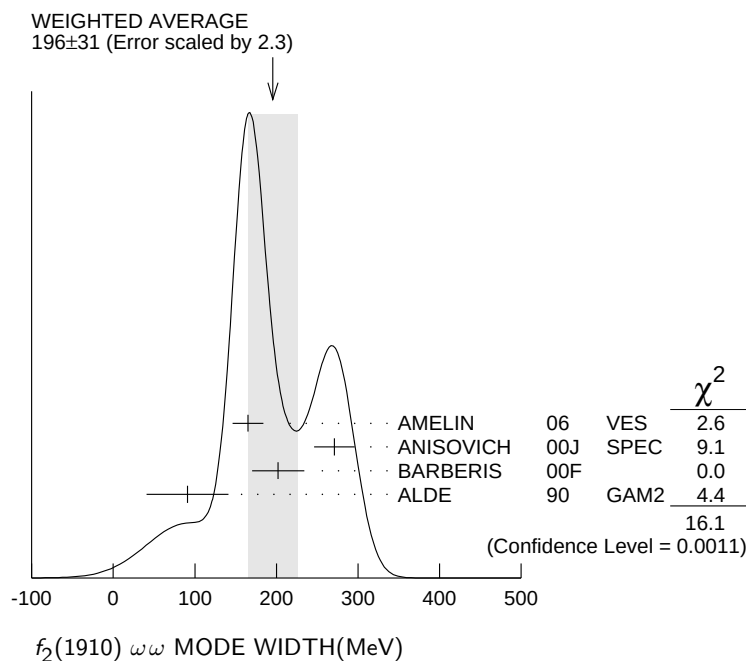
NODE=M142WX

 $f_2(1910) \omega \omega$ 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 $p p \rightarrow p_f \omega \omega p_s$
91±50	ALDE	90	GAM2 38 $\pi^- p \rightarrow \omega \omega n$
³ Supersedes BELADIDZE 92B.			

NODE=M142W2
 NODE=M142W2

NODE=M142W2;LINKAGE=AM

 **$f_2(1910) \eta \eta'$ MODE**

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
141±41	⁴ BARBERIS	00A	450 $p p \rightarrow p_f \eta \eta' p_s$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
90±35	ALDE	91B	GAM2 38 $\pi^- p \rightarrow \eta \eta' n$
⁴ Also compatible with $J^{PC}=1^-+$.			

NODE=M142W3
 NODE=M142W3

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
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=6

DESIG=11

DESIG=8

DESIG=3;OUR EST;→ UNCHECKED ←

DESIG=4;OUR EST;→ UNCHECKED ←

DESIG=5;OUR EST;→ UNCHECKED ←

DESIG=9

DESIG=10;OUR EST;→ UNCHECKED ←

DESIG=12;OUR EST;→ UNCHECKED ←

DESIG=13;OUR EST;→ UNCHECKED ←

 $f_2(1910)$ BRANCHING RATIOS

NODE=M142225

$\Gamma(K^+ K^-)/\Gamma_{\text{total}}$					Γ_2/Γ
VALUE	DOCUMENT ID	TECN	COMMENT		
seen	AMSLER	06	CBAR	$1.64 \bar{p} p \rightarrow K^+ K^- \pi^0$	

NODE=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

$\Gamma(K_S^0 K_S^0)/\Gamma(\eta \eta')$					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	$40 \pi p \rightarrow K_S^0 K_S^0 n$

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	$p p \rightarrow p_f \omega \omega p_S$	

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	$p p \rightarrow p_f \eta' \eta' p_S$	
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	$p p \rightarrow p_f \omega \omega p_S$	

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	$0.9-1.94 p \bar{p}$	
⁵ Reanalysis of ADOMEIT 96 and ANISOVICH 00E.					

NODE=M142R12

NODE=M142R12

NODE=M142R12;LINKAGE=AN

$f_2(1910)$ REFERENCES

ANISOVICH	11	EPJ C71 1511	A.V. Anisovich <i>et al.</i>	(LOQM, RAL, PNPI)
AMELIN	06	PAN 69 690	D.V. Amelin <i>et al.</i>	(VES Collab.)
		Translated from YAF 69 715.		
AMSLER	06	PL B639 165	C. Amsler <i>et al.</i>	(CBAR Collab.)
ANISOVICH	00E	PL B477 19	A.V. Anisovich <i>et al.</i>	
ANISOVICH	00J	PL B491 47	A.V. Anisovich <i>et al.</i>	
BARBERIS	00A	PL B471 429	D. Barberis <i>et al.</i>	(WA 102 Collab.)
BARBERIS	00F	PL B484 198	D. Barberis <i>et al.</i>	(WA 102 Collab.)
ADOMEIT	96	ZPHY C71 227	J. Adomeit <i>et al.</i>	(Crystal Barrel Collab.)
BELADIDZE	92B	ZPHY C54 367	G.M. Beladidze <i>et al.</i>	(VES Collab.)
BELADIDZE	92D	ZPHY C57 13	G.M. Beladidze <i>et al.</i>	(VES Collab.)
ALDE	91B	SJNP 54 455	D.M. Alde <i>et al.</i>	(SERP, BELG, LANL, LAPP+)
		Translated from YAF 54 751.		
Also		PL B276 375	D.M. Alde <i>et al.</i>	(BELG, SERP, KEK, LANL+)
ALDE	90	PL B241 600	D.M. Alde <i>et al.</i>	(SERP, BELG, LANL, LAPP+)
ALDE	89	PL B216 447	D.M. Alde <i>et al.</i>	(SERP, BELG, LANL, LAPP)
Also		SJNP 48 1035	D.M. Alde <i>et al.</i>	(BELG, SERP, LANL, LAPP)
		Translated from YAF 48 1724.		
BALOSHIN	86	SJNP 43 959	O.N. Baloshin <i>et al.</i>	(ITEP)
		Translated from YAF 43 1487.		

NODE=M142

REFID=53631
REFID=51574REFID=51136
REFID=47945
REFID=47950
REFID=47957
REFID=47962
REFID=45202
REFID=42172
REFID=43309
REFID=41844REFID=41911
REFID=40935
REFID=40727
REFID=44697

REFID=40734

 $a_0(1950)$

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

OMITTED FROM SUMMARY TABLE

Needs confirmation. Seen in $\gamma\gamma \rightarrow \eta_c(1S) \rightarrow K\bar{K}\pi$ by LEES 16A with significance 2.5σ in $K_S^0 K^\pm \pi^\mp$ and 4.2σ in $K^+ K^- \pi^0$. Spin-2 explanation ($a_2(1950)$) is not compatible with data.

NODE=M227

NODE=M227

 $a_0(1950)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$1931 \pm 14 \pm 22$	12k	^{1,2} LEES	16A BABR	$\gamma\gamma \rightarrow \eta_c(1S) \rightarrow K\bar{K}\pi$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$1949 \pm 32 \pm 76$	8k	¹ LEES	16A BABR	$\gamma\gamma \rightarrow \eta_c(1S) \rightarrow K_S^0 K^\pm \pi^\mp$
$1927 \pm 15 \pm 23$	4k	¹ LEES	16A BABR	$\gamma\gamma \rightarrow \eta_c(1S) \rightarrow K^+ K^- \pi^0$
¹ From a model-independent partial wave analysis fit to a relativistic Breit-Wigner function with a floating width.				
² Weighted average of the $K_S^0 K^\pm$ and $K^+ K^-$ decay modes.				

NODE=M227M

NODE=M227M

OCCUR=3

OCCUR=2

NODE=M227M;LINKAGE=A

NODE=M227M;LINKAGE=B

 $a_0(1950)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$271 \pm 22 \pm 29$	12k	^{1,2} LEES	16A BABR	$\gamma\gamma \rightarrow \eta_c(1S) \rightarrow K\bar{K}\pi$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$265 \pm 36 \pm 110$	8k	¹ LEES	16A BABR	$\gamma\gamma \rightarrow \eta_c(1S) \rightarrow K_S^0 K^\pm \pi^\mp$
$274 \pm 28 \pm 30$	4k	¹ LEES	16A BABR	$\gamma\gamma \rightarrow \eta_c(1S) \rightarrow K^+ K^- \pi^0$
¹ From a model-independent partial wave analysis fit to a relativistic Breit-Wigner function with a floating mass.				
² Weighted average of the $K_S^0 K^\pm$ and $K^+ K^-$ decay modes.				

NODE=M227W

NODE=M227W

OCCUR=3

OCCUR=2

NODE=M227W;LINKAGE=A

NODE=M227W;LINKAGE=B

 $a_0(1950)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad K\bar{K}$	seen

NODE=M227215;NODE=M227

DESIG=1

 $a_0(1950)$ BRANCHING RATIOS

$\Gamma(K\bar{K})/\Gamma_{\text{total}}$					Γ_1/Γ
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
seen	12k	¹ LEES	16A BABR	$\gamma\gamma \rightarrow \eta_c(1S) \rightarrow K\bar{K}\pi$	

¹ From a model-independent partial wave analysis.

NODE=M227225

NODE=M227R01
NODE=M227R01

NODE=M227R01;LINKAGE=A

 $a_0(1950)$ REFERENCES

LEES	16A	PR D93 012005	J.P. Lees <i>et al.</i>	(BABAR Collab.)

NODE=M227

REFID=57125

$f_2(1950)$

$$I^G(J^{PC}) = 0^+(2^{++})$$

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 $f_4(2050)$.

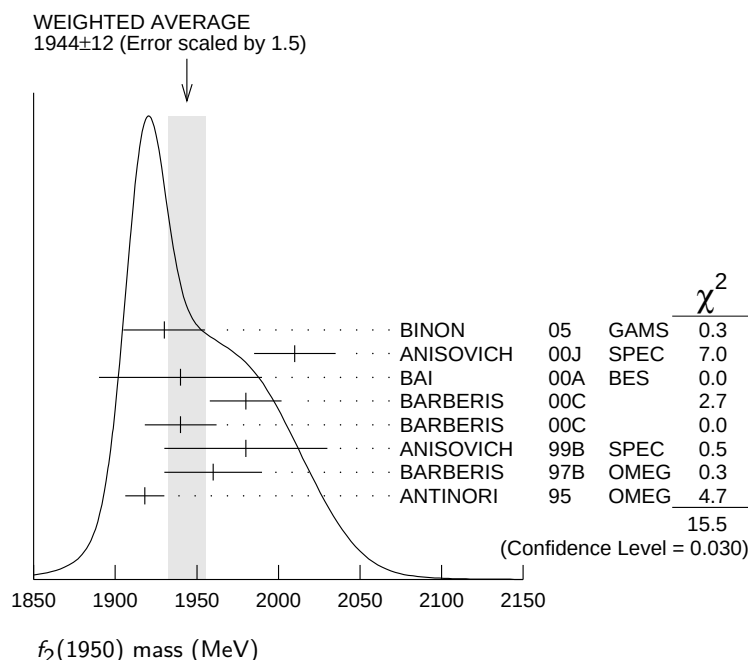
⁵ T-matrix pole.

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	TECN	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+)
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
REFID=48580
REFID=47950
REFID=47426
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 **$\Gamma(\rho\rho)/\Gamma(\omega\omega)$** **$\Gamma_3/\Gamma_4$**

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

NODE=M017M

 1995^{+10}_{-8} OUR AVERAGE

Error includes scale factor of 1.1.

1900^{+80}_{-20}		ADOLPH	15	COMP	$191 \pi^- p \rightarrow \eta^{(\prime)} \pi^- p$
$1885 \pm 13^{+50}_{-2}$	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

NODE=M017W

 257^{+25}_{-23} OUR AVERAGE

Error includes scale factor of 1.3. See the ideogram below.

300^{+80}_{-100}		ADOLPH	15	COMP	$191 \pi^- p \rightarrow \eta^{(\prime)} \pi^- p$
$294 \pm 25^{+46}_{-19}$	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		¹ 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	$18 \pi^- p \rightarrow \eta' \pi^- p$
$324 \pm 26 \pm 75$		² AMELIN	99	VES	$37 \pi^- A \rightarrow \omega \pi^- \pi^0 A^*$
370 ± 80		³ DONSKOV	96	GAM2 0	$38 \pi^- p \rightarrow \eta \pi^0 n$
380 ± 150		⁴ CLELAND	82B	SPEC $\pm$	$50 \pi p \rightarrow K_S^0 K^\pm p$
510 ± 200		⁵ CORDEN	78C	OMEG 0	$15 \pi^- p \rightarrow 3\pi n$

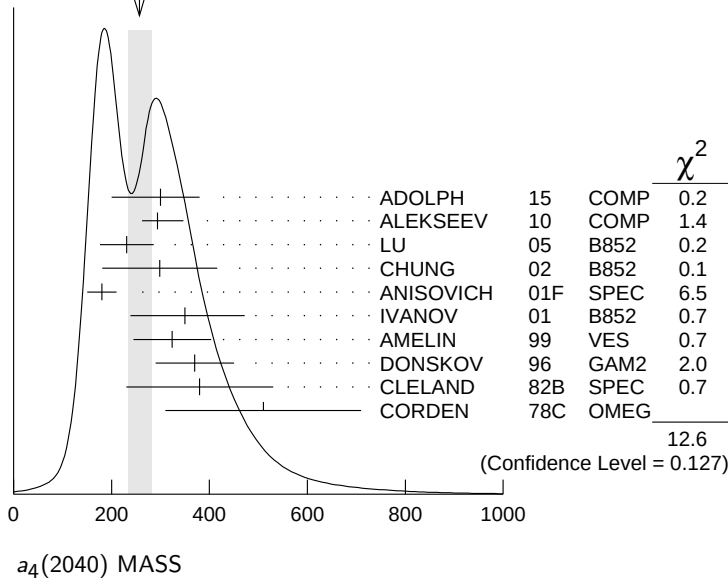
• • • We do not use the following data for averages, fits, limits, etc. • • •

401 ± 16	80k	⁶ UMAN	06	E835	$5.2 \bar{p} p \rightarrow \eta \eta \pi^0$
166 ± 43		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=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
257+25-23 (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 $\eta\pi$	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 $\pi^- p \rightarrow 3\pi p$	
$\Gamma(\eta\pi)/\Gamma_{\text{total}}$					Γ_7/Γ
VALUE	DOCUMENT ID	TECN	CHG	COMMENT	
seen	DONSKOV	96	GAM2	0 38 $\pi^- p \rightarrow \eta\pi^0 n$	
$\Gamma(\eta'(958)\pi)/\Gamma(\eta\pi)$					Γ_8/Γ_7
VALUE	DOCUMENT ID	TECN	COMMENT		
0.23 ± 0.07	ADOLPH	15	COMP	191 $\pi^- p \rightarrow \eta^{(\prime)}\pi^- p$	
$\Gamma(\omega\rho)/\Gamma_{\text{total}}$					Γ_6/Γ
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
seen	145k	LU	05	B852 18 $\pi^- p \rightarrow \omega\pi^-\pi^0 p$	

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NODE=M017R2
NODE=M017R2

NODE=M017R4
NODE=M017R4

NODE=M017R3
NODE=M017R3

NODE=M017R01
NODE=M017R01

NODE=M017R5
NODE=M017R5

$a_4(2040)$ REFERENCES

ADOLPH	15	PL B740 303	M. Adolph <i>et al.</i>	(COMPASS Collab.)
ALEKSEEV	10	PRL 104 241803	M.G. Alekseev <i>et al.</i>	(COMPASS Collab.)
UMAN	06	PR D73 052009	I. Uman <i>et al.</i>	(FNAL E835)
LU	05	PRL 94 032002	M. Lu <i>et al.</i>	(BNL E852 Collab.)
CHUNG	02	PR D65 072001	S.U. Chung <i>et al.</i>	(BNL E852 Collab.)
ANISOVICH	01F	PL B517 261	A.V. Anisovich <i>et al.</i>	
IVANOV	01	PRL 86 3977	E.I. Ivanov <i>et al.</i>	(BNL E852 Collab.)
AMELIN	99	PAN 62 445	D.V. Amelin <i>et al.</i>	(VES Collab.)
		Translated from YAF 62 487.		
ANISOVICH	99C	PL B452 173	A.V. Anisovich <i>et al.</i>	
ANISOVICH	99E	PL B452 187	A.V. Anisovich <i>et al.</i>	
DONSKOV	96	PAN 59 982	S.V. Donskov <i>et al.</i>	(GAMS Collab.) IGJPC
		Translated from YAF 59 1027.		
CLELAND	82B	NP B208 228	W.E. Cleland <i>et al.</i>	(DURH, GEVA, LAUS+)
BALDI	78	PL 74B 413	R. Baldi <i>et al.</i>	(GEVA) JP
CORDEN	78C	NP B136 77	M.J. Corden <i>et al.</i>	(BIRM, RHEL, TELA+) JP

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NODE=M016

 $f_4(2050)$

$$I^G(J^{PC}) = 0^+(4^{++})$$

 $f_4(2050)$ MASS

NODE=M016M

NODE=M016M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2018±11 OUR AVERAGE		Error includes scale factor of 2.1. See the ideogram below.		
1960±15		AMELIN	06 VES	$36 \pi^- p \rightarrow \omega \omega n$
2005±10		¹ BINON	05 GAMS	$33 \pi^- p \rightarrow \eta \eta n$
1998±15		ALDE	98 GAM4	$100 \pi^- p \rightarrow \pi^0 \pi^0 n$
2060±20		ALDE	90 GAM2	$38 \pi^- p \rightarrow \omega \omega n$
2038±30		AUGUSTIN	87 DM2	$J/\psi \rightarrow \gamma \pi^+ \pi^-$
2086±15		BALTRUSAIT..	87 MRK3	$J/\psi \rightarrow \gamma \pi^+ \pi^-$
2000±60		ALDE	86D GAM4	$100 \pi^- p \rightarrow n 2 \eta$
2020±20	40k	² BINON	84B GAM2	$38 \pi^- p \rightarrow n 2 \pi^0$
2015±28		³ CASON	82 STRC	$8 \pi^+ p \rightarrow \Delta^{++} \pi^0 \pi^0$
2031 ⁺²⁵ ₋₃₆		ETKIN	82B MPS	$23 \pi^- p \rightarrow n 2 K_S^0$
2020±30	700	APEL	75 NICE	$40 \pi^- p \rightarrow n 2 \pi^0$
2050±25		BLUM	75 ASPK	$18.4 \pi^- p \rightarrow n K^+ K^-$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
1966±25		⁴ ANISOVICH	09 RVUE	$0.0 \bar{p} p, \pi N$
1885 ⁺¹⁴⁺²¹⁸ ₋₁₃₋₂₅		⁵ UEHARA	09 BELL	$10.6 e^+ e^- \rightarrow e^+ e^- \pi^0 \pi^0$
2018± 6		ANISOVICH	00J SPEC	$2.0 \bar{p} p \rightarrow \eta \pi^0 \pi^0, \pi^0 \pi^0,$ $\eta \eta, \eta \eta', \pi \pi$
~ 2000		⁶ MARTIN	98 RVUE	$N \bar{N} \rightarrow \pi \pi$
~ 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	$25 \pi^- p \rightarrow p 3 \pi$

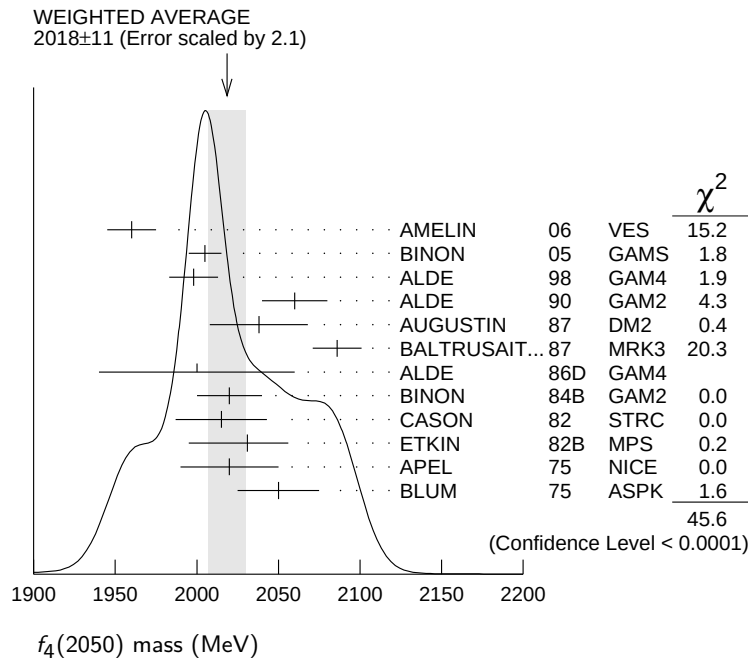
OCCUR=2

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.

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NODE=M016M;LINKAGE=NN
NODE=M016M;LINKAGE=KM
NODE=M016M;LINKAGE=UE
NODE=M016M;LINKAGE=RB
NODE=M016M;LINKAGE=BR
NODE=M016M;LINKAGE=B

NODE=M016M;LINKAGE=BB

NODE=M016M;LINKAGE=M
NODE=M016M;LINKAGE=T



$f_4(2050)$ WIDTH

NODE=M016W

NODE=M016W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
237± 18 OUR AVERAGE		Error includes scale factor of 1.9. See the ideogram below.		
290± 20		AMELIN	06	VES 36 $\pi^- p \rightarrow \omega \omega n$
340± 80		¹² BINON	05	GAMS 33 $\pi^- p \rightarrow \eta \eta n$
395± 40		ALDE	98	GAM4 100 $\pi^- p \rightarrow \pi^0 \pi^0 n$
170± 60		ALDE	90	GAM2 38 $\pi^- p \rightarrow \omega \omega n$
304± 60		AUGUSTIN	87	DM2 $J/\psi \rightarrow \gamma \pi^+ \pi^-$
210± 63		BALTRUSAIT..	87	MRK3 $J/\psi \rightarrow \gamma \pi^+ \pi^-$
400±100		ALDE	86D	GAM4 100 $\pi^- p \rightarrow n 2 \eta$
240± 40	40k	¹³ BINON	84B	GAM2 38 $\pi^- p \rightarrow n 2 \pi^0$
190± 14		DENNEY	83	LASS 10 $\pi^+ n / \pi^+ p$
186 ⁺¹⁰³ ₋₅₈		¹⁴ CASON	82	STRC 8 $\pi^+ p \rightarrow \Delta^{++} \pi^0 \pi^0$
305 ⁺³⁶ ₋₁₁₉		ETKIN	82B	MPS 23 $\pi^- p \rightarrow n 2 K_S^0$
180± 60	700	APEL	75	NICE 40 $\pi^- p \rightarrow n 2 \pi^0$
225 ⁺¹²⁰ ₋₇₀		BLUM	75	ASPK 18.4 $\pi^- p \rightarrow n K^+ K^-$

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

260± 40		¹⁵ ANISOVICH	09	RVUE 0.0 $\bar{p} p, \pi N$
453± 20 ⁺³¹ ₋₁₂₉		¹⁶ UEHARA	09	BELL 10.6 $e^+ e^- \rightarrow e^+ e^- \pi^0 \pi^0$
182± 7		ANISOVICH	00J	SPEC 2.0 $\bar{p} p \rightarrow \eta \pi^0 \pi^0, \pi^0 \pi^0,$ $\eta \eta, \eta \eta', \pi \pi$
~ 170		¹⁷ MARTIN	98	RVUE $N \bar{N} \rightarrow \pi \pi$
~ 200		¹⁸ MARTIN	97	RVUE $\bar{N} N \rightarrow \pi \pi$
~ 60		¹⁹ OAKDEN	94	RVUE 0.36-1.55 $\bar{p} p \rightarrow \pi \pi$
~ 80		²⁰ OAKDEN	94	RVUE 0.36-1.55 $\bar{p} p \rightarrow \pi \pi$
243± 16		²¹ ALPER	80	CNTR 62 $\pi^- p \rightarrow K^+ K^- n$
140± 15		²¹ ROZANSKA	80	SPRK 18 $\pi^- p \rightarrow p \bar{p} n$
263± 57		²¹ CORDEN	79	OMEG 12-15 $\pi^- p \rightarrow n 2 \pi$
100± 28		EVANGELIS...	79B	OMEG 10 $\pi^- p \rightarrow K^+ K^- n$
107± 56		²² ANTIPOV	77	CIBS 25 $\pi^- p \rightarrow p 3 \pi$

¹² From the first PWA solution.

¹³ From a partial-wave analysis of the data.

¹⁴ From an amplitude analysis of the reaction $\pi^+ \pi^- \rightarrow 2 \pi^0$.

¹⁵ K matrix pole.

¹⁶ Taking into account the $f_2(1950)$. Helicity-2 production favored.

¹⁷ Energy-dependent analysis.

¹⁸ Single energy analysis.

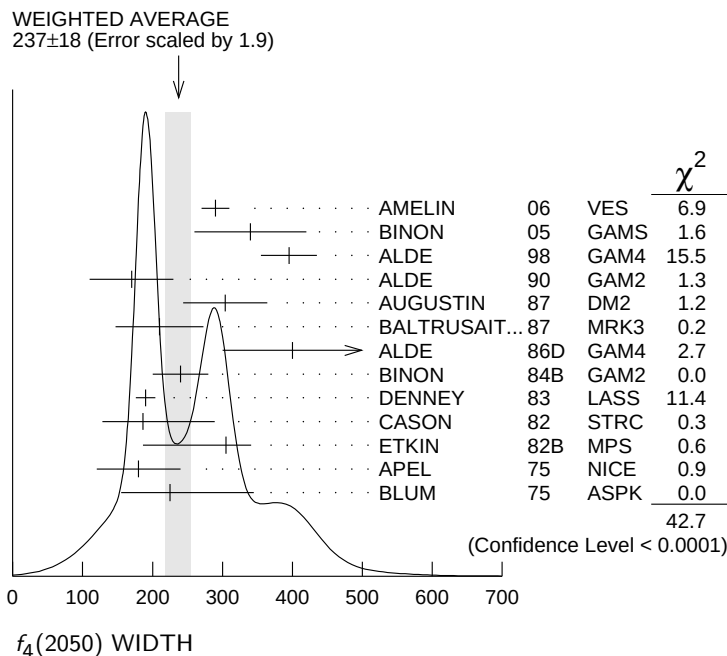
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 NODE=M016W;LINKAGE=RB
 NODE=M016W;LINKAGE=BR

- 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
$\Gamma_2 \quad \pi\pi$	$(17.0 \pm 1.5) \%$
$\Gamma_3 \quad K\bar{K}$	$(6.8^{+3.4}_{-1.8}) \times 10^{-3}$
$\Gamma_4 \quad \eta\eta$	$(2.1 \pm 0.8) \times 10^{-3}$
$\Gamma_5 \quad 4\pi^0$	$< 1.2 \%$
$\Gamma_6 \quad \gamma\gamma$	seen
$\Gamma_7 \quad a_2(1320)\pi$	seen

DESIG=6

DESIG=1

DESIG=2

DESIG=3

DESIG=5

DESIG=4

DESIG=7

 $f_4(2050) \Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

NODE=M016220

$\Gamma(K\bar{K}) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$	$\Gamma_3\Gamma_6/\Gamma$
VALUE (keV) CL% DOCUMENT ID TECN COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •	
<0.29 95 ALTHOFF 85B TASS $\gamma\gamma \rightarrow K\bar{K}\pi$	

NODE=M016G2
NODE=M016G2

$\Gamma(\pi\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$	$\Gamma_2\Gamma_6/\Gamma$
VALUE (eV) CL% EVTS DOCUMENT ID TECN COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •	
$23.1^{+3.6+70.5}_{-3.3-15.6}$ 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

82B

MPS

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

86D

GAM4

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

87

GAM4

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

00

VES

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	
UEHARA	09	PR D79 052009	S. Uehara <i>et al.</i>	(BELLE Collab.)
AMELIN	06	PAN 69 690	D.V. Amelin <i>et al.</i>	(VES Collab.)
		Translated from YAF 69 715.		
BINON	05	PAN 68 960	F. Binon <i>et al.</i>	
		Translated from YAF 68 998.		
AMELIN	00	NP A668 83	D. Amelin <i>et al.</i>	(VES Collab.)
ANISOVICH	00J	PL B491 47	A.V. Anisovich <i>et al.</i>	
BARBERIS	00F	PL B484 198	D. Barberis <i>et al.</i>	(WA 102 Collab.)
ALDE	98	EPJ A3 361	D. Alde <i>et al.</i>	(GAM4 Collab.)
Also		PAN 62 405	D. Alde <i>et al.</i>	(GAMS Collab.)
		Translated from YAF 62 446.		
MARTIN	98	PR C57 3492	B.R. Martin <i>et al.</i>	
MARTIN	97	PR C56 1114	B.R. Martin, G.C. Oades	(LOUC, AARH)
KLOET	96	PR D53 6120	W.M. Kloet, F. Myhrer	(RUTG, NORD)
OAKDEN	94	NP A574 731	M.N. Oakden, M.R. Pennington	(DURH)
ALDE	90	PL B241 600	D.M. Alde <i>et al.</i>	(SERP, BELG, LANL, LAPP+)
OEST	90	ZPHY C47 343	T. Oest <i>et al.</i>	(JADE Collab.)
ALDE	87	PL B198 286	D.M. Alde <i>et al.</i>	(LANL, BRUX, SERP, LAPP)
AUGUSTIN	87	ZPHY C36 369	J.E. Augustin <i>et al.</i>	(LALO, CLER, FRAS+)
BALTRUSAITIS...	87	PR D35 2077	R.M. Baltrusaitis <i>et al.</i>	(Mark III Collab.)
ALDE	86D	NP B269 485	D.M. Alde <i>et al.</i>	(BELG, LAPP, SERP, CERN+)
ALTHOFF	85B	ZPHY C29 189	M. Althoff <i>et al.</i>	(TASSO Collab.)
BINON	84B	LNC 39 41	F.G. Binon <i>et al.</i>	(SERP, BELG, LAPP)
BINON	83C	SJNP 38 723	F.G. Binon <i>et al.</i>	(SERP, BRUX+)
		Translated from YAF 38 1199.		
DENNEY	83	PR D28 2726	D.L. Denney <i>et al.</i>	(IOWA, MICH)
CASON	82	PRL 48 1316	N.M. Cason <i>et al.</i>	(NDAM, ANL)
ETKIN	82B	PR D25 1786	A. Etkin <i>et al.</i>	(BNL, CUNY, TUFTS, VAND)
ALPER	80	PL 94B 422	B. Alper <i>et al.</i>	(AMST, CERN, CRAC, MPIM+)
ROZANSKA	80	NP B162 505	M. Rozanska <i>et al.</i>	(MPIM, CERN)
CORDEN	79	NP B157 250	M.J. Corden <i>et al.</i>	(BIRM, RHEL, TELA+) JP
EVANGELIS...	79B	NP B154 381	C. Evangelista <i>et al.</i>	(BARI, BONN, CERN+)
ANTIPOV	77	NP B119 45	Y.M. Antipov <i>et al.</i>	(SERP, GEVA)
APEL	75	PL 57B 398	W.D. Apel <i>et al.</i>	(KARLK, KARLE, PISA, SERP+) JP
BLUM	75	PL 57B 403	W. Blum <i>et al.</i>	(CERN, MPIM) JP

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REFID=21651

$\pi_2(2100)$

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

OMITTED FROM SUMMARY TABLE
Needs confirmation.

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NODE=M020M

NODE=M020M

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NODE=M020W

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NODE=M020W;LINKAGE=L

NODE=M020215;NODE=M020

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DESIG=2;OUR EST;→ UNCHECKED ←
DESIG=3;OUR EST;→ UNCHECKED ←
DESIG=4;OUR EST;→ UNCHECKED ←

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NODE=M020R2
NODE=M020R2

NODE=M020R3
NODE=M020R3

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NODE=M020R4

NODE=M020R;LINKAGE=L

NODE=M020

REFID=44433
REFID=20872

$\pi_2(2100)$ MASS				
VALUE (MeV)	DOCUMENT ID	TECN	COMMENT	
2090± 29 OUR AVERAGE				
2090± 30	¹ AMELIN	95B VES	36 $\pi^- A \rightarrow \pi^+ \pi^- \pi^- A$	
2100± 150	² DAUM	81B CNTR	63,94 $\pi^- p \rightarrow 3\pi X$	
¹ From a fit to $J^{PC} = 2^-+ f_2(1270)\pi, (\pi\pi)_S\pi$ waves.				
² From a two-resonance fit to four 2^-0^+ waves.				

$\pi_2(2100)$ WIDTH				
VALUE (MeV)	DOCUMENT ID	TECN	COMMENT	
625± 50 OUR AVERAGE	Error includes scale factor of 1.2.			
520±100	³ AMELIN	95B VES	$36 \pi^- A \rightarrow \pi^+ \pi^- \pi^- A$	
651± 50	⁴ DAUM	81B CNTR	$63,94 \pi^- p \rightarrow 3\pi X$	
³ From a fit to $J^{PC} = 2^-+ f_2(1270)\pi, (\pi\pi)_S\pi$ waves.				
⁴ From a two-resonance fit to four 2^-0^+ waves.				

$\pi_2(2100)$ DECAY MODES		
Mode	Fraction (Γ_i/Γ)	
Γ_1 3π	seen	
Γ_2 $\rho\pi$	seen	
Γ_3 $f_2(1270)\pi$	seen	
Γ_4 $(\pi\pi)_S\pi$	seen	

$\pi_2(2100)$ BRANCHING RATIOS				
$\Gamma(\rho\pi)/\Gamma(3\pi)$				Γ_2/Γ_1
VALUE	DOCUMENT ID	TECN	COMMENT	
0.19±0.05	⁵ DAUM	81B CNTR	63,94 $\pi^- p$	
$\Gamma(f_2(1270)\pi)/\Gamma(3\pi)$				Γ_3/Γ_1
VALUE	DOCUMENT ID	TECN	COMMENT	
0.36±0.09	⁵ DAUM	81B CNTR	63,94 $\pi^- p$	
$\Gamma((\pi\pi)_s\pi)/\Gamma(3\pi)$				Γ_4/Γ_1
VALUE	DOCUMENT ID	TECN	COMMENT	
0.45±0.07	⁵ DAUM	81B CNTR	63,94 $\pi^- p$	
D-wave/S-wave RATIO FOR $\pi_2(2100) \rightarrow f_2(1270)\pi$				
VALUE	DOCUMENT ID	TECN	COMMENT	
0.39±0.23	⁵ DAUM	81B CNTR	63,94 $\pi^- p$	
⁵ From a two-resonance fit to four 2^-0^+ waves.				

$\pi_2(2100)$ REFERENCES				
AMELIN	95B	PL B356 595	D.V. Amelin <i>et al.</i> (SERP, TBIL)	
DAUM	81B	NP B182 269	C. Daum <i>et al.</i> (AMST, CERN, CRAC, MPIM+)	

$f_0(2100)$

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

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
2101 ± 7 OUR AVERAGE				
2081 ± 13 ⁺²⁴ ₋₃₆	5.5k	¹ ABLIKIM	13N BES3	$e^+e^- \rightarrow J/\psi \rightarrow \gamma\eta\eta$
2102 ± 13		² 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	$0.6\text{--}1.94 \bar{p}p \rightarrow \eta\eta, \eta\eta'$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2090 ± 10 ± 6	529	^{3,4} DOBBS	15	$J/\psi \rightarrow \gamma\pi^+\pi^-$
2099 ± 17 ± 8	283	^{3,4} DOBBS	15	$\psi(2S) \rightarrow \gamma\pi^+\pi^-$
2105 ± 8	80k	⁵ 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 From partial wave analysis including all possible combinations of 0^{++} , 2^{++} , and 4^{++} resonances.

² Includes the data of ANISOVICH 00B indicating to exotic decay pattern.

³ Using CLEO-c data but not authored by the CLEO Collaboration.

⁴ From a fit to a Breit-Wigner line shape with fixed $\Gamma = 209$ MeV.

⁵ Statistical error only.

OCCUR=2

NODE=M168M;LINKAGE=A

NODE=M168M;LINKAGE=AN

NODE=M168M;LINKAGE=B

NODE=M168M;LINKAGE=C

NODE=M168M;LINKAGE=ST

 $f_0(2100)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
224⁺₋₂₁ ± 23 OUR AVERAGE				
Error includes scale factor of 1.3. See the ideogram below.				
273 ⁺ ₋₂₄ ± 70 ⁺ ₋₂₃	5.5k	⁶ ABLIKIM	13N BES3	$e^+e^- \rightarrow J/\psi \rightarrow \gamma\eta\eta$
211 ± 29		⁷ ANISOVICH	00J SPEC	$2.0 \bar{p}p \rightarrow \eta\pi^0\pi^0, \pi^0\pi^0, \eta\eta, \eta\eta', \pi^+\pi^-$
330 ± 100		BAI	00A BES	$J/\psi \rightarrow \gamma(\pi^+\pi^-\pi^+\pi^-)$
200 ± 25		ANISOVICH	99K SPEC	$0.6\text{--}1.94 \bar{p}p \rightarrow \eta\eta, \eta\eta'$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
236 ± 14	80k	⁸ 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	$\bar{p}p \rightarrow \pi\pi$

⁶ From partial wave analysis including all possible combinations of 0^{++} , 2^{++} , and 4^{++} resonances.

⁷ Includes the data of ANISOVICH 00B indicating to exotic decay pattern.

⁸ Statistical error only.

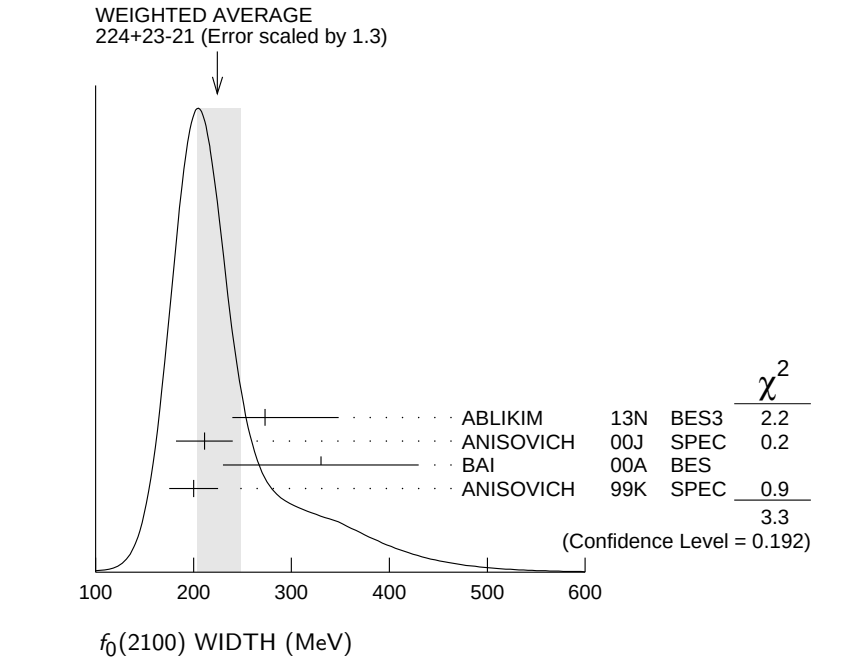
NODE=M168W

NODE=M168W

NODE=M168W;LINKAGE=A

NODE=M168W;LINKAGE=AN

NODE=M168W;LINKAGE=ST



$f_0(2100)$ REFERENCES

DOBBS	15	PR D91 052006	S. Dobbs <i>et al.</i>	(NWES)
ABLIKIM	13N	PR D87 092009	Ablikim M. <i>et al.</i>	(BES III Collab.)
UMAN	06	PR D73 052009	I. Uman <i>et al.</i>	(FNAL E835)
ANISOVICH	00B	NP A662 319	A.V. Anisovich <i>et al.</i>	
ANISOVICH	00J	PL B491 47	A.V. Anisovich <i>et al.</i>	
BAI	00A	PL B472 207	J.Z. Bai <i>et al.</i>	(BES Collab.)
ANISOVICH	99K	PL B468 309	A.V. Anisovich <i>et al.</i>	
BUGG	95	PL B353 378	D.V. Bugg <i>et al.</i>	(LOQM, PNPI, WASH)
HASAN	94	PL B334 215	A. Hasan, D.V. Bugg	(LOQM)

NODE=M168

REFID=56805
REFID=55387
REFID=51063
REFID=47942
REFID=47950
REFID=47426
REFID=47472
REFID=44438
REFID=44103

$f_2(2150)$

$I^G(J^{PC}) = 0^+(2^{++})$

OMITTED FROM SUMMARY TABLE
This entry was previously called T_0 .

NODE=M042

NODE=M042

$f_2(2150)$ MASS

NODE=M042205

$f_2(2150)$ MASS, COMBINED MODES (MeV)

NODE=M042M
NODE=M042M

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.

NODE=M042M;LINKAGE=ST

$\eta\eta$ MODE

NODE=M042M3
NODE=M042M3

VALUE (MeV) DOCUMENT ID TECN COMMENT

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

2157±12 OUR AVERAGE

2151±16	BARBERIS	00E	450 $pp \rightarrow pf\eta\eta p_s$
2175±20	PROKOSHKIN	95D GAM4	300 $\pi^- N \rightarrow \pi^- N 2\eta$, 450 $pp \rightarrow pp 2\eta$
2130±35	SINGOVSKI	94 GAM4	450 $pp \rightarrow pp 2\eta$
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.

NODE=M042M3;LINKAGE=K3
NODE=M042M3;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. • • •

2135 $\pm$ 20 $\pm$ 45 ⁴ ADOMEIT 96 CBAR 0 1.94 $\bar{p}p \rightarrow \eta 3\pi^0$
⁴ ANISOVICH 00E recommends to withdraw ADOMEIT 96 that assumed a single $J^P = 2^+$ resonance.

NODE=M042M4
 NODE=M042M4

NODE=M042M4;LINKAGE=AD

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

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

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

$\sim$ 2090 ⁵ OAKDEN 94 RVUE 0.36–1.55 $\bar{p}p \rightarrow \pi\pi$
 $\sim$ 2120 ⁶ OAKDEN 94 RVUE 0.36–1.55 $\bar{p}p \rightarrow \pi\pi$
 $\sim$ 2170 ⁷ MARTIN 80B RVUE
 $\sim$ 2150 ⁷ MARTIN 80C RVUE
 $\sim$ 2150 ⁸ DULUDE 78B OSPK 1–2 $\bar{p}p \rightarrow \pi^0\pi^0$

NODE=M042M1
 NODE=M042M1

OCCUR=2

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.

NODE=M042M1;LINKAGE=B

⁶ From solution B of amplitude analysis of data on $\bar{p}p \rightarrow \pi\pi$.

NODE=M042M1;LINKAGE=BB

⁷ $I(J^P) = 0(2^+)$ from simultaneous analysis of $p\bar{p} \rightarrow \pi^-\pi^+$ and $\pi^0\pi^0$.

NODE=M042M1;LINKAGE=P

⁸ $I^G(J^P) = 0^+(2^+)$ from partial-wave amplitude analysis.

NODE=M042M1;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. • • •

2139 $^{+8}_{-9}$ ⁹ EVANGELIS... 97 SPEC 0.6–2.4 $\bar{p}p \rightarrow K_S^0 K_S^0$
 $\sim$ 2190 ⁹ CUTTS 78B CNTR 0.97–3 $\bar{p}p \rightarrow \bar{N}N$
 2155 $\pm$ 15 ^{9,10} COUPLAND 77 CNTR 0 0.7–2.4 $\bar{p}p \rightarrow \bar{p}p$
 2193 $\pm$ 2 ^{9,11} ALSPECTOR 73 CNTR $\bar{p}p$ S channel

⁹ Isospins 0 and 1 not separated.

NODE=M042M2;LINKAGE=I

¹⁰ From a fit to the total elastic cross section.

NODE=M042M2;LINKAGE=E

¹¹ Referred to as T or $\bar{T}$ region by ALSPECTOR 73.

NODE=M042M2;LINKAGE=M

 $K\bar{K}$ MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

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

2200 $\pm$ 13 VLADIMIRSK...06 SPEC 40 $\pi^- p \rightarrow K_S^0 K_S^0 n$
 2150 $\pm$ 20 ABLIKIM 04E BES2 $J/\psi \rightarrow \omega K^+ K^-$
 2130 $\pm$ 35 BARBERIS 99 OMEG 450 $p\bar{p} \rightarrow p_S p_f K^+ K^-$

NODE=M042M5
 NODE=M042M5

 $f_2(2150)$ WIDTH

NODE=M042210

 $f_2(2150)$ WIDTH, COMBINED MODES (MeV)

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

152 $\pm$ 30 OUR AVERAGE Includes data from the 2 datablocks that follow this one. Error includes scale factor of 1.4. See the ideogram below.

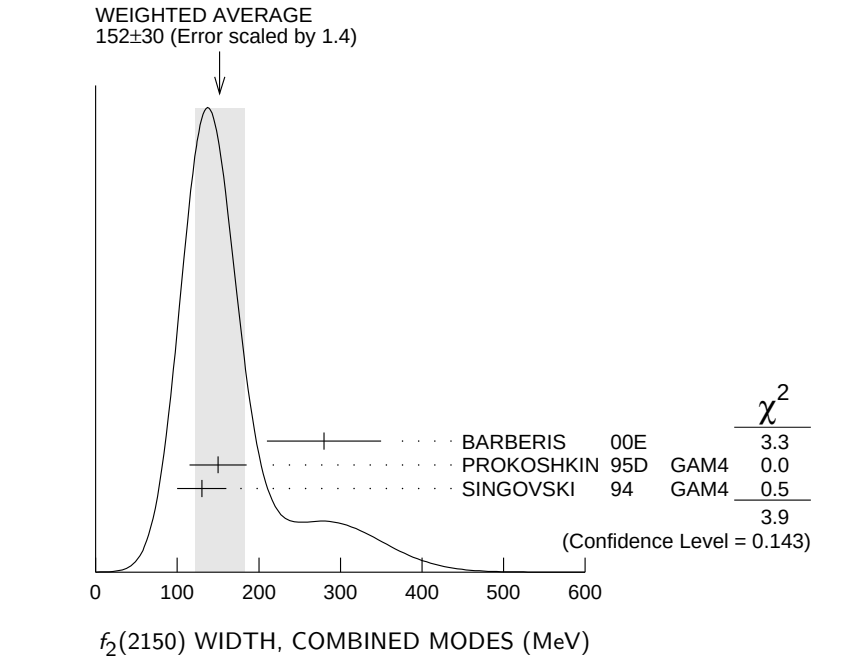
NODE=M042W
 NODE=M042W

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

182 $\pm$ 11 80k ¹² UMAN 06 E835 5.2 $\bar{p}p \rightarrow \eta\eta\pi^0$

¹² Statistical error only.

NODE=M042W;LINKAGE=ST

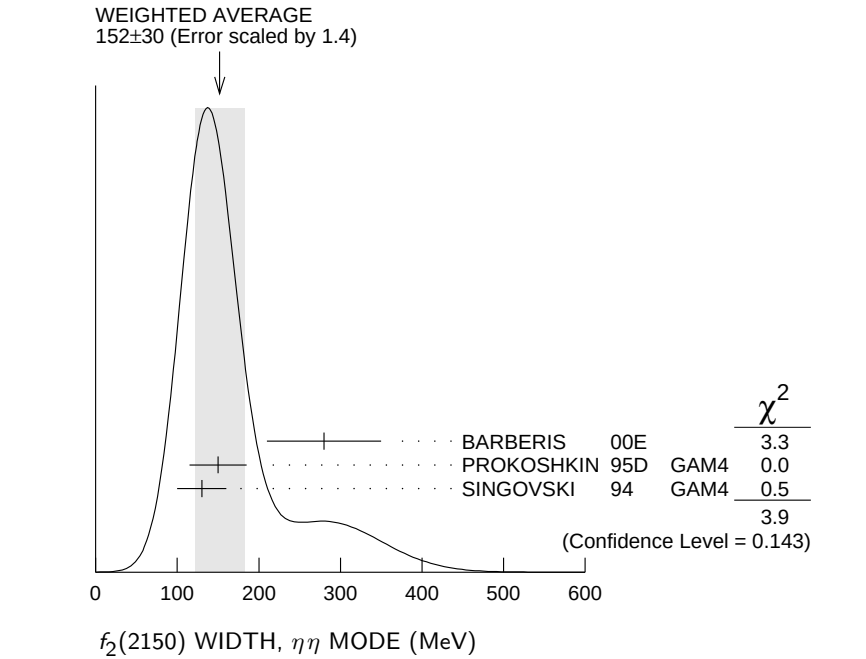


$\eta\eta$ MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
152±30 OUR AVERAGE			Error includes scale factor of 1.4. See the ideogram below.
280±70	BARBERIS 00E		450 $pp \rightarrow pf\eta\eta p_s$
150±35	PROKOSHKIN 95D	GAM4	300 $\pi^- N \rightarrow \pi^- N 2\eta$, 450 $pp \rightarrow pp 2\eta$
130±30	SINGOVSKI 94	GAM4	450 $pp \rightarrow pp 2\eta$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
310±50	¹³ ABELE 99B	CBAR	
203±10	¹⁴ ARMSTRONG 93C	E760	$\bar{p}p \rightarrow \pi^0 \eta\eta \rightarrow 6\gamma$
¹³ Spin not determined.			
¹⁴ No J^{PC} determination.			

NODE=M042W3
NODE=M042W3

NODE=M042W3;LINKAGE=K3
NODE=M042W3;LINKAGE=A



$\eta\pi\pi$ MODE

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
250±25±45	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. • • •

NODE=M042W4
NODE=M042W4

¹⁵ ANISOVICH 00E recommends to withdraw ADOMEIT 96 that assumed a single $J^P = 2^+$ resonance.

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 $p\bar{p}$	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

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

VALUE	CL%	DOCUMENT ID	TECN	COMMENT	Γ_3/Γ_2

1.28 ± 0.23 BARBERIS 00E 450 $pp \rightarrow p_f \eta \eta p_s$

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

<0.1	95	²² PROKOSHKIN 95D	GAM4	300 $\pi^- N \rightarrow \pi^- N 2\eta$, 450 $pp \rightarrow pp 2\eta$

²² Using data from ARMSTRONG 89D.

NODE=M042220

NODE=M042R1
NODE=M042R1

NODE=M042R1;LINKAGE=A

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

VALUE	CL%	DOCUMENT ID	TECN	COMMENT	Γ_1/Γ_2

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

<0.33	95	²³ PROKOSHKIN 95D	GAM4	300 $\pi^- N \rightarrow \pi^- N 2\eta$, 450 $pp \rightarrow pp 2\eta$

²³ Derived from a $\pi^0\pi^0/\eta\eta$ limit.

NODE=M042R2
NODE=M042R2

NODE=M042R2;LINKAGE=A

$\Gamma(f_2(1270)\eta)/\Gamma(a_2(1320)\pi)$

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_4/Γ_5

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

$\Gamma(p\bar{p})/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
seen	73	ALEXANDER 10	CLEO	$\psi(2S) \rightarrow \gamma p \bar{p}$

NODE=M042R04
 NODE=M042R04

 $f_2(2150)$ REFERENCES

ALEXANDER 10	PR D82 092002	J.P. Alexander <i>et al.</i>	(CLEO Collab.)
UMAN 06	PR D73 052009	I. Uman <i>et al.</i>	(FNAL E835)
VLADIMIRSK... 06	PAN 69 493	V.V. Vladimirovsky <i>et al.</i>	(ITEP, Moscow)
	Translated from YAF 69 515.		
ABLIKIM 04E	PL B603 138	M. Ablikim <i>et al.</i>	(BES Collab.)
ANISOVICH 00E	PL B477 19	A.V. Anisovich <i>et al.</i>	
BARBERIS 00E	PL B479 59	D. Barberis <i>et al.</i>	(WA 102 Collab.)
ABELE 99B	EPJ C8 67	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
BARBERIS 99	PL B453 305	D. Barberis <i>et al.</i>	(Omega Expt.)
EVANGELIS... 97	PR D56 3803	C. Evangelista <i>et al.</i>	(LEAR Collab.)
MARTIN 97	PR C56 1114	B.R. Martin, G.C. Oades	(LOUC, AARH)
ADOMEIT 96	ZPHY C71 227	J. Adomeit <i>et al.</i>	(Crystal Barrel Collab.)
KLOET 96	PR D53 6120	W.M. Kloet, F. Myhrer	(RUTG, NORD)
PROKOSHKIN 95D	PD 40 495	Y.D. Prokoshkin	(SERP) IGJPC
	Translated from DANS 344 469.		
HASAN 94	PL B334 215	A. Hasan, D.V. Bugg	(LOQM)
OAKDEN 94	NP A574 731	M.N. Oakden, M.R. Pennington	(DURH)
SINGOVSKI 94	NC 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
 REFID=47945
 REFID=47961
 REFID=46904
 REFID=46921
 REFID=45687
 REFID=45685
 REFID=45202
 REFID=45212
 REFID=44647

REFID=44103
 REFID=45210
 REFID=44648
 REFID=43587
 REFID=41010
 REFID=21838
 REFID=21837
 REFID=21733
 REFID=21850
 REFID=21830
 REFID=21813

 $\rho(2150)$

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

OMITTED FROM SUMMARY TABLE

This entry was previously called $T_1(2190)$. See our mini-review under the $\rho(1700)$.

NODE=M032

NODE=M032

 $\rho(2150)$ MASS

NODE=M032205

 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	$e^+e^- \rightarrow 3(\pi^+\pi^-), 2(\pi^+\pi^-\pi^0)$

NODE=M032M3
 NODE=M032M3

OCCUR=2

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

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	

NODE=M032M1
 NODE=M032M1

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	$0.6\text{--}1.9 p\bar{p} \rightarrow \omega\pi^0, \omega\eta\pi^0, \pi^+\pi^-$
~ 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 $\bar{p}N$

NODE=M032M2
 NODE=M032M2

$\pi^- p \rightarrow \omega \pi^0 n$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
2155±21 OUR AVERAGE			
2140±30	ALDE	95	GAM2 38 $\pi^- p \rightarrow \omega \pi^0 n$
2170±30	ALDE	92C	GAM4 100 $\pi^- p \rightarrow \omega \pi^0 n$

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.

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

 $\rho(2150)$ WIDTH

NODE=M032210

 $e^+ e^-$ 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± 40±50	AUBERT	07AU	BABR 10.6 $e^+ e^- \rightarrow f_1(1285) \pi^+ \pi^- \gamma$
310±140	AUBERT	07AU	BABR 10.6 $e^+ e^- \rightarrow \eta' \pi^+ \pi^- \gamma$
389± 79	BIAGINI	91	RVUE $e^+ e^- \rightarrow \pi^+ \pi^-, K^+ K^-$
410±100	¹¹ CLEGG	90	RVUE $e^+ e^- \rightarrow 3(\pi^+ \pi^-), 2(\pi^+ \pi^- \pi^0)$

NODE=M032W3
NODE=M032W3

OCCUR=2

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

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

 $\pi^- p \rightarrow \omega \pi^0 n$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
320±70	ALDE	95	GAM2 38 $\pi^- p \rightarrow \omega \pi^0 n$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
~ 300	ALDE	92C	GAM4 100 $\pi^- p \rightarrow \omega \pi^0 n$

NODE=M032W4
NODE=M032W4

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=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} $\rho\bar{\rho}$	

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

 $\rho(2150)$ $\Gamma(i)\Gamma(e^+e^-)/\Gamma^2(\text{total})$

$$\Gamma(f_1(1285)\pi^+\pi^-)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_7/\Gamma \times \Gamma_1/\Gamma$$

VALUE (units 10^{-7})	DOCUMENT ID	TECN	COMMENT
$3.1 \pm 0.6 \pm 0.5$	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

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

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

REFID=47950

REFID=45212

REFID=44371

REFID=44103

REFID=45210

REFID=41859

REFID=41894

REFID=41355

REFID=22000

REFID=21838

REFID=21837

REFID=21733

REFID=21830

REFID=21824

REFID=21813

REFID=21807

REFID=21805

REFID=48054

$\phi(2170)$

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

Observed by AUBERT,BE 06D in the initial-state radiation process
 $e^+e^- \rightarrow \phi f_0(980)\gamma$.

NODE=M103

NODE=M103

NODE=M103M

NODE=M103M

NEW

OCCUR=2

NODE=M103M;LINKAGE=A
 NODE=M103M;LINKAGE=AB
 NODE=M103M;LINKAGE=SH
 NODE=M103M;LINKAGE=AU
 NODE=M103M;LINKAGE=B

 $\phi(2170)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2188±10 OUR AVERAGE		Error includes scale factor of 1.8. See the ideogram below. [2189 ± 11 MeV OUR 2016 AVERAGE Scale factor = 1.8]		
2200±6±5	471	ABLIKIM	15H BES3	$J/\psi \rightarrow \eta \phi \pi^+ \pi^-$
2180±8±8	1,2	LEES	12F BABR	$10.6 e^+ e^- \rightarrow \phi \pi^+ \pi^- \gamma$
2186±10±6	52	ABLIKIM	08F BES	$J/\psi \rightarrow \eta \phi f_0(980)$
2125±22±10	483	AUBERT	08S BABR	$10.6 e^+ e^- \rightarrow \phi \eta \gamma$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
2079±13 ⁺⁷⁹ ₋₂₈	4.8k	3 SHEN	09 BELL	$10.6 e^+ e^- \rightarrow K^+ K^- \pi^+ \pi^- \gamma$
2192±14	116	4 AUBERT	07AK BABR	$10.6 e^+ e^- \rightarrow K^+ K^- \pi^+ \pi^- \gamma$
2169±20	149	4 AUBERT	07AK BABR	$10.6 e^+ e^- \rightarrow K^+ K^- \pi^0 \pi^0 \gamma$
2175±10±15	201	2,5 AUBERT,BE	06D BABR	$10.6 e^+ e^- \rightarrow K^+ K^- \pi \pi \gamma$

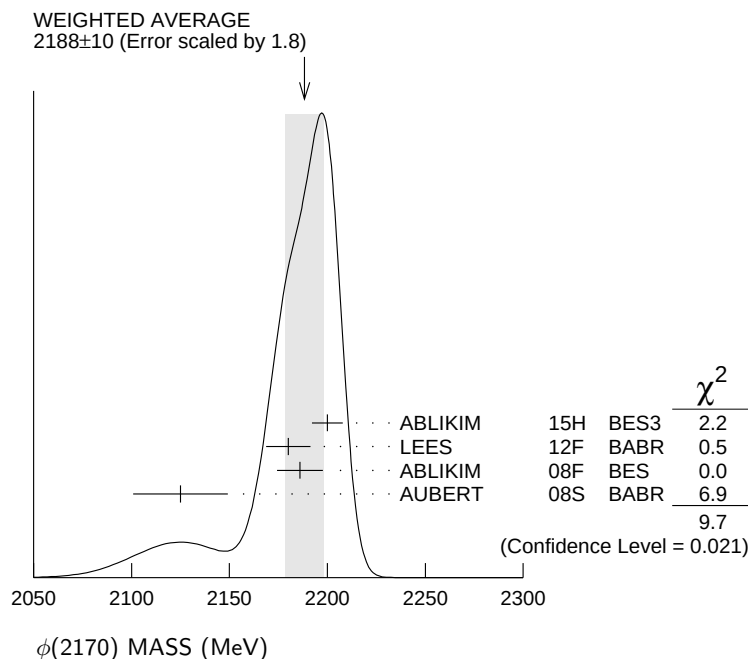
¹ Fit includes interference with the $\phi(1680)$.

² From the $\phi f_0(980)$ component.

³ From a fit with two incoherent Breit-Wigners.

⁴ From the $K^+ K^- f_0(980)$ component.

⁵ Superseded by LEES 12F.

 $\phi(2170)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
83±12 OUR AVERAGE		[79 ± 14 MeV OUR 2016 AVERAGE]		
104±15±15	471	ABLIKIM	15H BES3	$J/\psi \rightarrow \eta \phi \pi^+ \pi^-$
77±15±10	6,7	LEES	12F BABR	$10.6 e^+ e^- \rightarrow \phi \pi^+ \pi^- \gamma$
65±23±17	52	ABLIKIM	08F BES	$J/\psi \rightarrow \eta \phi f_0(980)$
61±50±13	483	AUBERT	08S BABR	$10.6 e^+ e^- \rightarrow \phi \eta \gamma$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
192±23 ⁺²⁵ ₋₆₁	4.8k	8 SHEN	09 BELL	$10.6 e^+ e^- \rightarrow K^+ K^- \pi^+ \pi^- \gamma$
71±21	116	9 AUBERT	07AK BABR	$10.6 e^+ e^- \rightarrow K^+ K^- \pi^+ \pi^- \gamma$
102±27	149	9 AUBERT	07AK BABR	$10.6 e^+ e^- \rightarrow K^+ K^- \pi^0 \pi^0 \gamma$
58±16±20	201 ^{7,10}	AUBERT,BE	06D BABR	$10.6 e^+ e^- \rightarrow K^+ K^- \pi \pi \gamma$

NODE=M103W

NODE=M103W

NEW

OCCUR=2

- ⁶ Fit includes interference with the $\phi(1680)$.
⁷ From the $\phi f_0(980)$ component.
⁸ From a fit with two incoherent Breit-Wigners.
⁹ From the $K^+ K^- f_0(980)$ component.
¹⁰ Superseded by LEES 12F.

NODE=M103W;LINKAGE=A
 NODE=M103W;LINKAGE=AB
 NODE=M103W;LINKAGE=SH
 NODE=M103W;LINKAGE=AU
 NODE=M103W;LINKAGE=B

$\phi(2170)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $e^+ e^-$	seen
Γ_2 $\phi \eta$	
Γ_3 $\phi \pi \pi$	
Γ_4 $\phi f_0(980)$	seen
Γ_5 $K^+ K^- \pi^+ \pi^-$	
Γ_6 $K^+ K^- f_0(980) \rightarrow K^+ K^- \pi^+ \pi^-$	seen
Γ_7 $K^+ K^- \pi^0 \pi^0$	
Γ_8 $K^+ K^- f_0(980) \rightarrow K^+ K^- \pi^0 \pi^0$	seen
Γ_9 $K^{*0} K^\pm \pi^\mp$	not seen
Γ_{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

$\phi(2170) \Gamma(i) \Gamma(e^+ e^-) / \Gamma(\text{total})$

$\Gamma(\phi \eta) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$	$\Gamma_2 \Gamma_1 / \Gamma$
VALUE (eV) EVTS DOCUMENT ID TECN COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •	
$1.7 \pm 0.7 \pm 1.3$ 483 AUBERT 08S BABR 10.6 $e^+ e^- \rightarrow \phi \eta \gamma$	

NODE=M103230

NODE=M103G2
 NODE=M103G2

$\Gamma(\phi f_0(980)) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$	$\Gamma_4 \Gamma_1 / \Gamma$
VALUE (eV) EVTS DOCUMENT ID TECN COMMENT	
2.3 ± 0.4 OUR AVERAGE [2.5 ± 0.9 eV OUR 2016 AVERAGE]	
$2.3 \pm 0.3 \pm 0.3$ ^{11,12} LEES 12F BABR 10.6 $e^+ e^- \rightarrow \phi \pi^+ \pi^- \gamma$	
• • • We do not use the following data for averages, fits, limits, etc. • • •	
$2.5 \pm 0.8 \pm 0.4$ 201 ^{12,13} AUBERT,BE 06D BABR 10.6 $e^+ e^- \rightarrow K^+ K^- \pi \pi \gamma$	
¹¹ From a fit with constructive interference with the $\phi(1680)$. In a fit with destructive interference, the value is larger by a factor of 12.	
¹² From the $\phi f_0(980)$ component.	
¹³ Superseded by LEES 12F.	

NODE=M103G1
 NODE=M103G1
 NEW

NODE=M103G1;LINKAGE=A

NODE=M103G1;LINKAGE=AB
 NODE=M103G1;LINKAGE=B

$\phi(2170) \Gamma(i) \Gamma(e^+ e^-) / \Gamma^2(\text{total})$

$\Gamma(\phi \pi \pi) / \Gamma_{\text{total}} \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$	$\Gamma_3 / \Gamma \times \Gamma_1 / \Gamma$
VALUE (units 10^{-7}) EVTS DOCUMENT ID TECN COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •	
$1.65 \pm 0.15 \pm 0.18$ 4.8k ¹⁴ SHEN 09 BELL 10.6 $e^+ e^- \rightarrow K^+ K^- \pi^+ \pi^- \gamma$	
¹⁴ 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 $e^+ e^- \rightarrow K^+ K^- \pi^0 \pi^0 \gamma$	
$\Gamma(K^{*0} K^\pm \pi^\mp) / \Gamma_{\text{total}}$	Γ_9 / Γ
VALUE DOCUMENT ID TECN COMMENT	
not seen AUBERT 07AK BABR 10.6 GeV $e^+ e^-$	

NODE=M103225

NODE=M103R01
 NODE=M103R01

NODE=M103R02
 NODE=M103R02

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

ABLIKIM	15H	PR D91 052017	M. Ablikim <i>et al.</i>	(BES III Collab.)
LEES	12F	PR D86 012008	J.P. Lees <i>et al.</i>	(BABAR Collab.)
ABLIKIM	10C	PL B685 27	M. Ablikim <i>et al.</i>	(BES II Collab.)
SHEN	09	PR D80 031101	C.P. Shen <i>et al.</i>	(BELLE Collab.)
ABLIKIM	08F	PRL 100 102003	M. Ablikim <i>et al.</i>	(BES Collab.)
AUBERT	08S	PR D77 092002	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT	07AK	PR D76 012008	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT,BE	06D	PR D74 091103	B. Aubert <i>et al.</i>	(BABAR Collab.)

NODE=M103

REFID=56773
 REFID=54298
 REFID=53349
 REFID=53000
 REFID=52154
 REFID=52242
 REFID=51908
 REFID=51511

 $f_0(2200)$

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

OMITTED FROM SUMMARY TABLE

Seen in $K_S^0 K_S^0$ (AUGUSTIN 88), $K^+ K^-$ (ABLIKIM 05Q) and $\eta\eta$ (BINON 05) system. Not seen in $\Upsilon(1S)$ radiative decays (BARU 89).

NODE=M112

NODE=M112

 $f_0(2200)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2189±13 OUR AVERAGE				
$2170 \pm 20^{+10}_{-15}$		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. • • •				
$2206 \pm 12 \pm 8$	381	^{3,4} DOBBS	15	$J/\psi \rightarrow \gamma K^+ K^-$
$2188 \pm 17 \pm 16$	203	^{3,4} DOBBS	15	$\psi(2S) \rightarrow \gamma K^+ K^-$
~ 2122		HASAN	94 RVUE	$\bar{p} p \rightarrow \pi \pi$
~ 2321		HASAN	94 RVUE	$\bar{p} p \rightarrow \pi \pi$

NODE=M112M

NODE=M112M

OCCUR=2

OCCUR=2

¹ First solution, PWA is ambiguous.² Cannot determine spin to be 0.³ Using CLEO-c data but not authored by the CLEO Collaboration.⁴ From a fit to a Breit-Wigner line shape with fixed $\Gamma = 238$ MeV.

NODE=M112M;LINKAGE=BI

NODE=M112M;LINKAGE=A

NODE=M112M;LINKAGE=B

NODE=M112M;LINKAGE=C

 $f_0(2200)$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
238±50 OUR AVERAGE Error includes scale factor of 1.2.			
$220 \pm 60^{+40}_{-45}$	ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$
380 ± 90	⁵ BINON	05 GAMS	$33 \pi^- p \rightarrow \eta \eta n$
201 ± 51	⁶ 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

NODE=M112W

OCCUR=2

⁵ First solution, PWA is ambiguous.⁶ Cannot determine spin to be 0.

NODE=M112W;LINKAGE=BI

NODE=M112W;LINKAGE=A

 $f_0(2200)$ REFERENCES

DOBBS	15	PR D91 052006	S. Dobbs <i>et al.</i>	(NWES)
ABLIKIM	05Q	PR D72 092002	M. Ablikim <i>et al.</i>	(BES Collab.)
BINON	05	PAN 68 960	F. Binon <i>et al.</i>	
		Translated from YAF 68 998.		
HASAN	94	PL B334 215	A. Hasan, D.V. Bugg	(LOQM)
BARU	89	ZPHY C42 505	S.E. Baru <i>et al.</i>	(NOVO)
AUGUSTIN	88	PRL 60 2238	J.E. Augustin <i>et al.</i>	(DM2 Collab.)

NODE=M112

REFID=56805
 REFID=50958
 REFID=50780

REFID=44103
 REFID=40917
 REFID=40574

$f_J(2220)$

$$J^G(J^{PC}) = 0^+(2^{++} \text{ or } 4^{++})$$

OMITTED FROM SUMMARY TABLE

Needs confirmation. See our mini-review in the 2004 edition of this Review, PDG 04.

NODE=M082

NODE=M082

 $f_J(2220)$ MASS

NODE=M082M

NODE=M082M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2231.1 ± 3.5 OUR AVERAGE				
2235 ± 4 ± 6	74	BAI	96B BES	$e^+e^- \rightarrow J/\psi \rightarrow \gamma\pi^+\pi^-$
2230 $^{+6}_{-7}$ ± 16	46	BAI	96B BES	$e^+e^- \rightarrow J/\psi \rightarrow \gamma K^+K^-$
2232 $^{+8}_{-7}$ ± 15	23	BAI	96B BES	$e^+e^- \rightarrow J/\psi \rightarrow \gamma K_S^0 K_S^0$
2235 ± 4 ± 5	32	BAI	96B BES	$e^+e^- \rightarrow J/\psi \rightarrow \gamma p\bar{p}$
2209 $^{+17}_{-15}$ ± 10		ASTON	88F LASS	$11 K^-p \rightarrow K^+K^- \Lambda$
2230 ± 20		BOLONKIN	88 SPEC	$40 \pi^-p \rightarrow K_S^0 K_S^0 n$
2220 ± 10	41	¹ ALDE	86B GA24	$38-100 \pi p \rightarrow n\eta\eta'$
2230 ± 6 ± 14	93	BALTRUSAIT..86D	MRK3	$e^+e^- \rightarrow \gamma K^+K^-$
2232 ± 7 ± 7	23	BALTRUSAIT..86D	MRK3	$e^+e^- \rightarrow \gamma K_S^0 K_S^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2223.9 ± 2.5		² VLADIMIRSK...08	SPEC	$40 \pi^-p \rightarrow K_S^0 K_S^0 n + m\pi^0$
2246 ± 36		BAI	98H BES	$J/\psi \rightarrow \gamma \pi^0 \pi^0$
¹ ALDE 86B uses data from both the GAMS-2000 and GAMS-4000 detectors. ² $J^{PC} = 2^{++}$. Systematic uncertainties not evaluated				

OCCUR=2

OCCUR=3

OCCUR=4

OCCUR=2

NODE=M082M;LINKAGE=A
NODE=M082M;LINKAGE=VL **$f_J(2220)$ WIDTH**

NODE=M082W

NODE=M082W

VALUE (MeV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
23 $^{+8}_{-7}$ OUR AVERAGE					
19 $^{+13}_{-11}$ ± 12		74	BAI	96B BES	$e^+e^- \rightarrow J/\psi \rightarrow \gamma\pi^+\pi^-$
20 $^{+20}_{-15}$ ± 17		46	BAI	96B BES	$e^+e^- \rightarrow J/\psi \rightarrow \gamma K^+K^-$
20 $^{+25}_{-16}$ ± 14		23	BAI	96B BES	$e^+e^- \rightarrow J/\psi \rightarrow \gamma K_S^0 K_S^0$
15 $^{+12}_{-9}$ ± 9		32	BAI	96B BES	$e^+e^- \rightarrow J/\psi \rightarrow \gamma p\bar{p}$
60 $^{+107}_{-57}$			ASTON	88F LASS	$11 K^-p \rightarrow K^+K^- \Lambda$
80 ± 30			BOLONKIN	88 SPEC	$40 \pi^-p \rightarrow K_S^0 K_S^0 n$
26 $^{+20}_{-16}$ ± 17		93	BALTRUSAIT..86D	MRK3	$e^+e^- \rightarrow \gamma K^+K^-$
18 $^{+23}_{-15}$ ± 10		23	BALTRUSAIT..86D	MRK3	$e^+e^- \rightarrow \gamma K_S^0 K_S^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
8.6 ± 2.5			¹ VLADIMIRSK...08	SPEC	$40 \pi^-p \rightarrow K_S^0 K_S^0 n + m\pi^0$
<80	90		ALDE	87C GAM2	$38 \pi^-p \rightarrow \eta'\eta n$
¹ $J^{PC} = 2^{++}$. Systematic uncertainties not evaluated					

OCCUR=2

OCCUR=3

OCCUR=4

OCCUR=2

NODE=M082W;LINKAGE=VL

 $f_J(2220)$ DECAY MODES

NODE=M082215;NODE=M082

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \pi\pi$	not seen
$\Gamma_2 \pi^+\pi^-$	not seen
$\Gamma_3 K\bar{K}$	not seen
$\Gamma_4 p\bar{p}$	not seen
$\Gamma_5 \gamma\gamma$	not seen
$\Gamma_6 \eta\eta'(958)$	seen
$\Gamma_7 \phi\phi$	not seen
$\Gamma_8 \eta\eta$	not seen

DESIG=5

DESIG=6;OUR EST;→ UNCHECKED ←

DESIG=1

DESIG=4;OUR EST;→ UNCHECKED ←

DESIG=2;OUR EST;→ UNCHECKED ←

DESIG=3;OUR EST;→ UNCHECKED ←

DESIG=7;OUR EST;→ UNCHECKED ←

DESIG=8;OUR EST;→ UNCHECKED ←

$f_J(2220) \Gamma(i) \Gamma(\gamma\gamma) / \Gamma(\text{total})$

NODE=M082220

 $\Gamma(K\bar{K}) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$ $\Gamma_3 \Gamma_5 / \Gamma$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
< 1.4	95	¹ ACCIARRI	01H L3	$\gamma\gamma \rightarrow K_S^0 K_S^0, E_{\text{cm}}^{\text{ee}} = 91, 183-209 \text{ GeV}$

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

< 5.6	95	¹ GODANG	97 CLE2	$\gamma\gamma \rightarrow K_S^0 K_S^0$
< 86	95	¹ ALBRECHT	90G ARG	$\gamma\gamma \rightarrow K^+ K^-$
< 1000	95	² ALTHOFF	85B TASS	$\gamma\gamma, K\bar{K}\pi$

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

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
< 2.5	95	ALAM	98C CLE2	$\gamma\gamma \rightarrow \pi^+ \pi^-$

¹ Assuming $J^P = 2^+$.² True for $J^P = 0^+$ and $J^P = 2^+$.NODE=M082G3
NODE=M082G3NODE=M082G1;LINKAGE=D
NODE=M082G1;LINKAGE=C $f_J(2220) \Gamma(i) \Gamma(p\bar{p}) / \Gamma^2(\text{total})$

NODE=M082223

 $\Gamma(p\bar{p}) / \Gamma_{\text{total}} \times \Gamma(\pi\pi) / \Gamma_{\text{total}}$ $\Gamma_4 / \Gamma \times \Gamma_1 / \Gamma$

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
< 18	95	¹ AMSLER	01 CBAR	$1.4-1.5 p\bar{p} \rightarrow \pi^0 \pi^0$

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

< (11-42)	99	² HASAN	96 SPEC	$1.35-1.55 p\bar{p} \rightarrow \pi^+ \pi^-$

NODE=M082GG1
NODE=M082GG1 $\Gamma(p\bar{p}) / \Gamma_{\text{total}} \times \Gamma(\phi\phi) / \Gamma_{\text{total}}$ $\Gamma_4 / \Gamma \times \Gamma_7 / \Gamma$

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
< 6	95	³ EVANGELIS...	98 SPEC	$1.1-2.0 p\bar{p} \rightarrow \phi\phi$

NODE=M082GG2
NODE=M082GG2 $\Gamma(p\bar{p}) / \Gamma_{\text{total}} \times \Gamma(\eta\eta) / \Gamma_{\text{total}}$ $\Gamma_4 / \Gamma \times \Gamma_8 / \Gamma$

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
< 4	95	¹ AMSLER	01 CBAR	$1.4-1.5 p\bar{p} \rightarrow \eta\eta$

¹ For $J^P = 2^+$ in the mass range 2222-2240 MeV and the total width between 10 and 20 MeV.² For $J^P = 2^+$ and $J^P = 4^+$ in the mass range 2220-2245 MeV and the total width of 15 MeV.³ For $J^P = 2^+$, the mass of 2235 MeV and the total width of 15 MeV.NODE=M082GG3
NODE=M082GG3

NODE=M082GG;LINKAGE=A

NODE=M082GG;LINKAGE=B

NODE=M082GG;LINKAGE=C

 $f_J(2220) \text{ BRANCHING RATIOS}$

NODE=M082225

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

VALUE	DOCUMENT ID	COMMENT
not seen	¹ DOBBS 15	$J/\psi \rightarrow \gamma\pi\pi$
not seen	¹ DOBBS 15	$\psi(2S) \rightarrow \gamma\pi\pi$

¹ Using CLEO-c data but not authored by the CLEO Collaboration.NODE=M082R00
NODE=M082R00

OCCUR=2

NODE=M082R00;LINKAGE=A

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

VALUE	DOCUMENT ID	COMMENT
not seen	¹ DOBBS 15	$J/\psi \rightarrow \gamma K\bar{K}$
not seen	¹ DOBBS 15	$\psi(2S) \rightarrow \gamma K\bar{K}$

¹ Using CLEO-c data but not authored by the CLEO Collaboration.NODE=M082R01
NODE=M082R01

OCCUR=2

NODE=M082R01;LINKAGE=A

 $\Gamma(\pi\pi) / \Gamma(K\bar{K})$ Γ_1 / Γ_3

VALUE	DOCUMENT ID	TECN	COMMENT
1.0 ± 0.5	BAI 96B	BES	$e^+ e^- \rightarrow J/\psi \rightarrow \gamma 2\pi, K\bar{K}$

NODE=M082R2
NODE=M082R2 $\Gamma(p\bar{p}) / \Gamma_{\text{total}}$ Γ_4 / Γ

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

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

not seen		¹ AUBERT	07AV BABR	$B \rightarrow p\bar{p}K(*)$
not seen		WANG	05A BELL	$B^+ \rightarrow \bar{p}pK^+$
< 3.0	95	² EVANGELIS...	97 SPEC	$1.96-2.40 p\bar{p} \rightarrow K_S^0 K_S^0$
< 1.1	99.7	³ BARNES	93 SPEC	$1.3-1.57 p\bar{p} \rightarrow K_S^0 K_S^0$
< 2.6	99.7	³ BARDIN	87 CNTR	$1.3-1.5 p\bar{p} \rightarrow K^+ K^-$
< 3.6	99.7	³ SCULLI	87 CNTR	$1.29-1.55 p\bar{p} \rightarrow K^+ K^-$

NODE=M082R1
NODE=M082R1

¹ Assuming $\Gamma < 30$ MeV.² Assuming $\Gamma \sim 20$ MeV, $J^P = 2^+$ and $B(f_J(2220) \rightarrow K\bar{K}) = 100\%$.³ Assuming $\Gamma = 30\text{--}35$ MeV, $J^P = 2^+$ and $B(f_J(2220) \rightarrow K\bar{K}) = 100\%$. $\Gamma(p\bar{p})/\Gamma(K\bar{K})$ 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=M082R1;LINKAGE=AU

NODE=M082R1;LINKAGE=C

NODE=M082R1;LINKAGE=B

NODE=M082R3

NODE=M082R3

 $f_J(2220)$ REFERENCES

DOBBS	15	PR D91 052006	S. Dobbs <i>et al.</i>	(NWES)
VLADIMIRSK...	08	PAN 71 2129	V.V. Vladimirovsky <i>et al.</i>	(ITEP)
		Translated from YAF 71 2166.		
AUBERT	07AV	PR D76 092004	B. Aubert <i>et al.</i>	(BABAR Collab.)
WANG	05A	PL B617 141	M.-Z. Wang <i>et al.</i>	(BELLE Collab.)
PDG	04	PL B592 1	S. Eidelman <i>et al.</i>	(PDG Collab.)
ACCIARRI	01H	PL B501 173	M. Acciarri <i>et al.</i>	(L3 Collab.)
AMSLER	01	PL B520 175	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
ALAM	98C	PRL 81 3328	M.S. Alam <i>et al.</i>	(CLEO Collab.)
BAI	98H	PRL 81 1179	J.Z. Bai <i>et al.</i>	(BES Collab.)
EVANGELIS...	98	PR D57 5370	C. Evangelista <i>et al.</i>	(JETSET Collab.)
EVANGELIS...	97	PR D56 3803	C. Evangelista <i>et al.</i>	(LEAR Collab.)
GODANG	97	PRL 79 3829	R. Godang <i>et al.</i>	(CLEO Collab.)
BAI	96B	PRL 76 3502	J.Z. Bai <i>et al.</i>	(BES Collab.)
HASAN	96	PL B388 376	A. Hasan, D.V. Bugg	(BRUN, LOQM)
BARNES	93	PL B309 469	P.D. Barnes <i>et al.</i>	(PS185 Collab.)
ALBRECHT	90G	ZPHY C48 183	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
ASTON	88F	PL B215 199	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS) JP
BOLONKIN	88	NP B509 426	B.V. Bolonkin <i>et al.</i>	(ITEP, SERP)
ALDE	87C	SJNP 45 255	D. Alde <i>et al.</i>	
		Translated from YAF 45 405.		
BARDIN	87	PL B195 292	G. Bardin <i>et al.</i>	(SACL, FERR, CERN, PADO+)
SCULLI	87	PRL 58 1715	J. Sculli <i>et al.</i>	(NYU, BNL)
ALDE	86B	PL B177 120	D.M. Alde <i>et al.</i>	(SERP, BELG, LANL, LAPP)
BALTRUSAIT...	86D	PRL 56 107	R.M. Baltrusaitis	(CIT, UCSC, ILL, SLAC+)
ALTHOFF	85B	ZPHY C29 189	M. Althoff <i>et al.</i>	(TASSO Collab.)

NODE=M082

REFID=56805

REFID=52681

REFID=51990

REFID=50651

REFID=49653

REFID=48321

REFID=48558

REFID=46326

REFID=46342

REFID=46365

REFID=45687

REFID=45760

REFID=44736

REFID=45197

REFID=43601

REFID=41374

REFID=40585

REFID=40580

REFID=47474

REFID=40235

REFID=40023

REFID=21864

REFID=21865

REFID=21349

OTHER RELATED PAPERS

DEL-AMO-SA...	100	PRL 105 172001	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)

REFID=53533

NODE=M115

 $\eta(2225)$

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

OMITTED FROM SUMMARY TABLE

Seen in $J/\psi \rightarrow \gamma \phi \phi$. Possibly seen in $B \rightarrow \phi \phi K$ by LEES 11A.

NODE=M115

 $\eta(2225)$ MASS

NODE=M115M

NODE=M115M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

 2221^{+13}_{-10} OUR AVERAGE

[2226 ± 16 MeV OUR 2016 AVERAGE]

NEW

2216^{+4+21}_{-5-11}		¹ ABLIKIM	16N BES3	$J/\psi \rightarrow \gamma K^+ K^- K^+ K^-$
2240^{+30+30}_{-20-20}	196 ± 19	ABLIKIM	08I BES	$J/\psi \rightarrow \gamma K^+ K^- K_S^0 K_L^0$
$2230 \pm 25 \pm 15$		BAI	90B MRK3	$J/\psi \rightarrow \gamma K^+ K^- K^+ K^-$
$2214 \pm 20 \pm 13$		BAI	90B MRK3	$J/\psi \rightarrow \gamma K^+ K^- K_S^0 K_L^0$

OCCUR=2

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

~ 2220		BISELLO	86B DM2	$J/\psi \rightarrow \gamma K^+ K^- K^+ K^-$

¹ From a partial wave analysis of $J/\psi \rightarrow \gamma \phi \phi$ that also finds significant signals for $\eta(2100)$, 0^-+ phase space, $f_0(2100)$, $f_2(2010)$, $f_2(2300)$, $f_2(2340)$, and a previously unseen 0^-+ state X(2500) ($M = 2470^{+15+101}_{-19-23}$ MeV, $\Gamma = 230^{+64+56}_{-35-33}$ MeV).

NODE=M115M;LINKAGE=B

 $\eta(2225)$ WIDTH

NODE=M115W

NODE=M115W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

 185^{+40}_{-20} OUR AVERAGE[185⁺⁷⁰₋₄₀ MeV OUR 2016 AVERAGE]

NEW

185^{+12+43}_{-14-17}		¹ ABLIKIM	16N BES3	$J/\psi \rightarrow \gamma K^+ K^- K^+ K^-$
$190 \pm 30^{+60}_{-40}$	196 ± 19	ABLIKIM	08I BES	$J/\psi \rightarrow \gamma K^+ K^- K_S^0 K_L^0$
$150^{+300}_{-60} \pm 60$		BAI	90B MRK3	$J/\psi \rightarrow \gamma K^+ K^- K^+ K^-$

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

~ 80		BISELLO	86B DM2	$J/\psi \rightarrow \gamma K^+ K^- K^+ K^-$

¹ From a partial wave analysis of $J/\psi \rightarrow \gamma \phi \phi$ that also finds significant signals for for $\eta(2100)$, 0^{-+} phase space, $f_0(2100)$, $f_2(2010)$, $f_2(2300)$, $f_2(2340)$, and a previously unseen 0^{-+} state $X(2500)$ ($M = 2470^{+15+101}_{-19-23}$ MeV, $\Gamma = 230^{+64+56}_{-35-33}$ MeV).

NODE=M115W;LINKAGE=A

$\eta(2225)$ REFERENCES

ABLIKIM	16N	PR D93 112011	M. Ablikim	(BES III Collab.)
LEES	11A	PR D84 012001	J.P. Lees <i>et al.</i>	(BABAR Collab.)
ABLIKIM	08I	PL B662 330	M. Ablikim <i>et al.</i>	(BES Collab.)
BAI	90B	PRL 65 1309	Z. Bai <i>et al.</i>	(Mark III Collab.)
BISELLO	86B	PL B179 294	D. Bisello <i>et al.</i>	(DM2 Collab.)

NODE=M115

REFID=57512
REFID=16595
REFID=52255
REFID=41354
REFID=22101

NODE=M044

$\rho_3(2250)$

$$I^G(J^{PC}) = 1^{+}(3^{-}-)$$

OMITTED FROM SUMMARY TABLE

Contains results mostly from formation experiments. For further production experiments see the Further States entry. See also $\rho(2150)$, $f_2(2150)$, $f_4(2300)$, $\rho_5(2350)$.

NODE=M044

$\rho_3(2250)$ MASS

NODE=M044205

$\bar{p}p \rightarrow \pi\pi$ or $K\bar{K}$

VALUE (MeV)	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	$0.36\text{--}1.55 \bar{p}p \rightarrow \pi\pi$
~ 2250	² MARTIN	80B	RVUE	
~ 2300	² MARTIN	80C	RVUE	
~ 2140	³ CARTER	78B	CNTR 0	$0.7\text{--}2.4 \bar{p}p \rightarrow K^- K^+$
~ 2150	⁴ CARTER	77	CNTR 0	$0.7\text{--}2.4 \bar{p}p \rightarrow \pi\pi$

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
NODE=M044M1

NODE=M044M1;LINKAGE=CC

NODE=M044M1;LINKAGE=P
NODE=M044M1;LINKAGE=K
NODE=M044M1;LINKAGE=J

S-CHANNEL $\bar{N}N$

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT

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

2260 ± 20	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	$0.7\text{--}2.4 \bar{p}p \rightarrow \bar{p}p$
2193 ± 2	^{6,8} ALSPECTOR	73	CNTR	$\bar{p}p$ S channel
2190 ± 10	⁹ ABRAMS	70	CNTR	S channel $\bar{p}N$

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=M044M2
NODE=M044M2

NODE=M044M;LINKAGE=AY

NODE=M044M2;LINKAGE=I
NODE=M044M2;LINKAGE=E
NODE=M044M2;LINKAGE=M
NODE=M044M2;LINKAGE=B

$\pi^- p \rightarrow \eta\pi\pi$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

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

$2290 \pm 20 \pm 30$	AMELIN	00	VES	$37 \pi^- p \rightarrow \eta\pi^+\pi^- n$

NODE=M044M3
NODE=M044M3

$\rho_3(2250)$ WIDTH

NODE=M044210

$\bar{p}p \rightarrow \pi\pi$ or $K\bar{K}$

VALUE (MeV)	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
NODE=M044W1

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	0.7–2.4 $p\bar{p} \rightarrow \bar{p}p$
98 ± 8	¹⁶ ALSPECTOR	73	CNTR	$p\bar{p}$ S channel
~ 85	¹⁷ ABRAMS	70	CNTR	S channel $p\bar{N}$

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 $p\bar{p}$ 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=21837
REFID=21964
REFID=21733
REFID=21963
REFID=21830
REFID=21824
REFID=21813
REFID=21807
REFID=21805

$f_2(2300)$

$$J^{PC} = 0^{+}(2^{++})$$

NODE=M107

 $f_2(2300)$ MASS

NODE=M107M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
2297±28	¹ ETKIN	88	MPS 22 $\pi^- p \rightarrow \phi \phi n$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
2243 ⁺⁷ ₋₆ ⁺³ ₋₂₉	UEHARA	13	BELL $\gamma\gamma \rightarrow K_S^0 K_S^0$
2270±12	VLADIMIRSK...06	SPEC	40 $\pi^- p \rightarrow K_S^0 K_S^0 n$
2327±9±6	ABE	04	BELL 10.6 $e^+ e^- \rightarrow e^+ e^- K^+ K^-$
2231±10	BOOTH	86	OMEG 85 $\pi^- Be \rightarrow 2\phi Be$
2220 ⁺⁹⁰ ₋₂₀	LINDENBAUM	84	RVUE
2320±40	ETKIN	82	MPS 22 $\pi^- p \rightarrow 2\phi n$

¹ Includes data of ETKIN 85. The percentage of the resonance going into $\phi\phi$ 2⁺⁺ S_2 , D_2 , and D_0 is 6⁺¹⁵₋₅, 25⁺¹⁸₋₁₄, and 69⁺¹⁶₋₂₇, respectively.

NODE=M107M

NODE=M107M;LINKAGE=C

 $f_2(2300)$ WIDTH

NODE=M107W

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. • • •			
145±12 ⁺²⁷ ₋₃₄	UEHARA	13	BELL $\gamma\gamma \rightarrow K_S^0 K_S^0$
90±29	VLADIMIRSK...06	SPEC	40 $\pi^- p \rightarrow K_S^0 K_S^0 n$
275±36±20	ABE	04	BELL 10.6 $e^+ e^- \rightarrow e^+ e^- K^+ K^-$
133±50	BOOTH	86	OMEG 85 $\pi^- Be \rightarrow 2\phi Be$
200±50	LINDENBAUM	84	RVUE
220±70	ETKIN	82	MPS 22 $\pi^- p \rightarrow 2\phi n$

² Includes data of ETKIN 85.

NODE=M107W

NODE=M107W;LINKAGE=C

 $f_2(2300)$ DECAY MODES

NODE=M107215;NODE=M107

Mode	Fraction (Γ_i/Γ)
Γ_1 $\phi\phi$	seen
Γ_2 $K\bar{K}$	seen
Γ_3 $\gamma\gamma$	seen

DESIG=1;OUR EST;→ UNCHECKED ←

DESIG=2;OUR EST;→ UNCHECKED ←

DESIG=3;OUR EST;→ UNCHECKED ←

 $f_2(2300)$ $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

NODE=M107225

$\Gamma(K\bar{K}) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$	DOCUMENT ID	TECN	COMMENT	$\Gamma_2\Gamma_3/\Gamma$
3.2 ^{+0.5} _{-0.4} ^{+1.3} _{-2.2}	UEHARA	13	BELL $\gamma\gamma \rightarrow K_S^0 K_S^0$	
44 ±6 ±12	³ ABE	04	BELL 10.6 $e^+ e^- \rightarrow e^+ e^- K^+ K^-$	

³ Assuming spin 2.

NODE=M107G1

NODE=M107G1

NODE=M107G1;LINKAGE=AB

 $f_2(2300)$ REFERENCES

NODE=M107

UEHARA	13	PTEP 2013 123C01	S. Uehara <i>et al.</i>	(BELLE Collab.)
VLADIMIRSK... 06		PAN 69 493	V.V. Vladimirsky <i>et al.</i>	(ITEP, Moscow)
		Translated from YAF 69 515.		
ABE	04	EPJ C32 323	K. Abe <i>et al.</i>	(BELLE Collab.)
ETKIN	88	PL B201 568	A. Etkin <i>et al.</i>	(BNL, CUNY)
BOOTH	86	NP B273 677	P.S.L. Booth <i>et al.</i>	(LIVP, GLAS, CERN)
ETKIN	85	PL 165B 217	A. Etkin <i>et al.</i>	(BNL, CUNY)
LINDENBAUM	84	CNPP 13 285	S.J. Lindenbaum	(CUNY)
ETKIN	82	PRL 49 1620	A. Etkin <i>et al.</i>	(BNL, CUNY)

REFID=55592

REFID=51191

REFID=49650

REFID=40285

REFID=21870

REFID=21871

REFID=21869

REFID=21866

$f_4(2300)$

$$I^G(J^{PC}) = 0^+(4^{++})$$

NODE=M041

OMITTED FROM SUMMARY TABLE

This entry was previously called $U_0(2350)$. Contains results mostly from formation experiments. For further production experiments see the Further States entry. See also $\rho(2150)$, $f_2(2150)$, $\rho_3(2250)$, $\rho_5(2350)$.

NODE=M041

 $f_4(2300)$ MASS

NODE=M041205

NODE=M041M

 $\bar{p}p \rightarrow \pi\pi$ or $\bar{K}K$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
~ 2314	HASAN	94	RVUE $\bar{p}p \rightarrow \pi\pi$
~ 2300	¹ MARTIN	80B	RVUE
~ 2300	¹ MARTIN	80C	RVUE
~ 2340	² CARTER	78B	CNTR $0.7-2.4 \bar{p}p \rightarrow K^- K^+$
~ 2330	DULUDE	78B	OSPK $1-2 \bar{p}p \rightarrow \pi^0 \pi^0$
~ 2310	³ CARTER	77	CNTR $0.7-2.4 \bar{p}p \rightarrow \pi\pi$

NODE=M041M1
NODE=M041M1

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		

NODE=M041M4
NODE=M041M4
→ UNCHECKED ←

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

2332 ± 15	BARBERIS	00F	450 $pp \rightarrow p_f \omega \omega p_S$

 $f_4(2300)$ WIDTH

NODE=M041210

 $\bar{p}p \rightarrow \pi\pi$ or $\bar{K}K$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
~ 278	HASAN	94	RVUE $\bar{p}p \rightarrow \pi\pi$
~ 200	⁸ MARTIN	80C	RVUE
~ 150	⁹ CARTER	78B	CNTR $0.7-2.4 \bar{p}p \rightarrow K^- K^+$
~ 210	¹⁰ CARTER	77	CNTR $0.7-2.4 \bar{p}p \rightarrow \pi\pi$

NODE=M041W1
NODE=M041W1

⁸ $I(J^P) = 0(4^+)$ from simultaneous analysis of $p\bar{p} \rightarrow \pi^- \pi^+$ and $\pi^0 \pi^0$.

⁹ $I(J^P) = 0(4^+)$ from Barrelet-zero analysis.

¹⁰ $I(J^P) = 0(4^+)$ from amplitude analysis.

NODE=M041W1;LINKAGE=P
NODE=M041W1;LINKAGE=K
NODE=M041W1;LINKAGE=J

S-CHANNEL $\bar{p}p$ or $\bar{N}N$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
310 ± 25	¹¹ ANISOVICH	00J	SPEC
135^{+150}_{-65}	^{12,13} COUPLAND	77	CNTR $0.7-2.4 \bar{p}p \rightarrow \bar{p}p$
165^{+18}_{-8}	¹³ ALSPECTOR	73	CNTR $\bar{p}p$ S channel
~ 190	ABRAMS	70	CNTR S channel $\bar{N}N$
¹¹ From the combined analysis of ANISOVICH 99C and ANISOVICH 99F on $\bar{p}p \rightarrow \eta\pi^0\pi^0$, $\pi^0\pi^0$, $\eta\eta$, $\eta\eta'$, $\pi^+\pi^-$.			
¹² From a fit to the total elastic cross section.			
¹³ Isospins 0 and 1 not separated.			

NODE=M041W2
 NODE=M041W2

NODE=M041W2;LINKAGE=AN

NODE=M041W2;LINKAGE=E
 NODE=M041W2;LINKAGE=I

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

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$235 \pm 50 \pm 40$	AMELIN	00	VES $37 \pi^-p \rightarrow \eta\pi^+\pi^-n$

NODE=M041W3
 NODE=M041W3

 pp CENTRAL PRODUCTION

VALUE (MeV)	DOCUMENT ID	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •		
260 ± 57	BARBERIS	00F 450 $pp \rightarrow p_f\omega\omega p_s$

NODE=M041W4
 NODE=M041W4
 → UNCHECKED ←

 $f_4(2300)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $\rho\rho$	seen
Γ_2 $\omega\omega$	seen
Γ_3 $\eta\pi\pi$	seen
Γ_4 $\pi\pi$	seen
Γ_5 $K\bar{K}$	seen
Γ_6 $N\bar{N}$	seen

NODE=M041215;NODE=M041

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

 $f_4(2300)$ BRANCHING RATIOS

$\Gamma(\rho\rho)/\Gamma(\omega\omega)$				Γ_1/Γ_2
VALUE	DOCUMENT ID	COMMENT		
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
2.8 ± 0.5	BARBERIS	00F 450 $pp \rightarrow p_f \omega \omega p_s$		

NODE=M041220

NODE=M041R1
 NODE=M041R1

 $f_4(2300)$ REFERENCES

AMELIN	00	NP A668 83	D. Amelin <i>et al.</i>	(VES Collab.)
ANISOVICH	00J	PL B491 47	A.V. Anisovich <i>et al.</i>	
BARBERIS	00F	PL B484 198	D. Barberis <i>et al.</i>	(WA 102 Collab.)
ANISOVICH	99C	PL B452 173	A.V. Anisovich <i>et al.</i>	
ANISOVICH	99F	NP A651 253	A.V. Anisovich <i>et al.</i>	
HASAN	94	PL B334 215	A. Hasan, D.V. Bugg	(LOQM)
MARTIN	80B	NP B176 355	B.R. Martin, D. Morgan	(LOUC, RHEL) JP
MARTIN	80C	NP B169 216	A.D. Martin, M.R. Pennington	(DURH) JP
CARTER	78B	NP B141 467	A.A. Carter	(LOQM)
CUTTS	78B	PR D17 16	D. Cutts <i>et al.</i>	(STON, WISC)
DULUDE	78B	PL 79B 335	R.S. Dulude <i>et al.</i>	(BROW, MIT, BARI) JP
CARTER	77	PL 67B 117	A.A. Carter <i>et al.</i>	(LOQM, RHEL) JP
COUPLAND	77	PL 71B 460	M. Coupland <i>et al.</i>	(LOQM, RHEL)
ALSPECTOR	73	PRL 30 511	J. Alspector <i>et al.</i>	(RUTG, UPNJ)
ABRAMS	70	PR D1 1917	R.J. Abrams <i>et al.</i>	(BNL)

NODE=M041

REFID=47432
 REFID=47950
 REFID=47962
 REFID=46903
 REFID=46926
 REFID=44103
 REFID=21838
 REFID=21837
 REFID=21964
 REFID=21733
 REFID=21850
 REFID=21963
 REFID=21830
 REFID=21813
 REFID=21807

$f_0(2330)$

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

OMITTED FROM SUMMARY TABLE

 $f_0(2330)$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
2314 ± 25	¹ BUGG	04A	RVUE
2337 ± 14	ANISOVICH	00J	SPEC $2.0 \bar{p} p \rightarrow \pi \pi, \eta \eta$
~ 2321	HASAN	94	RVUE $\bar{p} p \rightarrow \pi \pi$
¹ Partial wave analysis of the data on $p \bar{p} \rightarrow \bar{\Lambda} \Lambda$ from BARNES 00.			

NODE=M169M

NODE=M169M

NODE=M169M;LINKAGE=BU

 $f_0(2330)$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
144 ± 20	² BUGG	04A	RVUE
217 ± 33	ANISOVICH	00J	SPEC $2.0 \bar{p} p \rightarrow \pi \pi, \eta \eta$
~ 223	HASAN	94	RVUE $\bar{p} p \rightarrow \pi \pi$
² Partial wave analysis of the data on $p \bar{p} \rightarrow \bar{\Lambda} \Lambda$ from BARNES 00.			

NODE=M169W

NODE=M169W

NODE=M169W;LINKAGE=BU

 $f_0(2330)$ REFERENCES

BUGG	04A	EPJ C36 161	D.V. Bugg
ANISOVICH	00J	PL B491 47	A.V. Anisovich <i>et al.</i>
BARNES	00	PR C62 055203	P.D. Barnes <i>et al.</i>
HASAN	94	PL B334 215	A. Hasan, D.V. Bugg

(LOQM)

NODE=M169

REFID=50158
REFID=47950
REFID=47965
REFID=44103

NODE=M108

 $f_2(2340)$

$$I^G(J^{PC}) = 0^+(2^{++})$$

 $f_2(2340)$ MASS

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
2345^{+50}_{-40} OUR AVERAGE				
$2362^{+31+140}_{-30-63}$	5.5k	¹ ABLIKIM	13N	BES3 $e^+ e^- \rightarrow J/\psi \rightarrow \gamma \eta \eta$
2339 ± 55		² ETKIN	88	MPS $22 \pi^- p \rightarrow \phi \phi n$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2350 ± 7	80k	³ UMAN	06	E835 $5.2 \bar{p} p \rightarrow \eta \eta \pi^0$
2392 ± 10		BOOTH	86	OMEG $85 \pi^- \text{Be} \rightarrow 2 \phi \text{Be}$
2360 ± 20		LINDENBAUM	84	RVUE

¹ From partial wave analysis including all possible combinations of 0^{++} , 2^{++} , and 4^{++} resonances.² Includes data of ETKIN 85. The percentage of the resonance going into $\phi \phi 2^{++} S_2$, D_2 , and D_0 is 37 ± 19 , 4^{+12}_{-4} , and 59^{+21}_{-19} , respectively.³ Statistical error only.

NODE=M108M

NODE=M108M

NODE=M108M;LINKAGE=A

NODE=M108M;LINKAGE=C

NODE=M108M;LINKAGE=ST

 $f_2(2340)$ WIDTH

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
322^{+70}_{-60} OUR AVERAGE				
$334^{+62+165}_{-54-100}$	5.5k	⁴ ABLIKIM	13N	BES3 $e^+ e^- \rightarrow J/\psi \rightarrow \gamma \eta \eta$
319^{+81}_{-69}		⁵ ETKIN	88	MPS $22 \pi^- p \rightarrow \phi \phi n$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
218 ± 16	80k	⁶ UMAN	06	E835 $5.2 \bar{p} p \rightarrow \eta \eta \pi^0$
198 ± 50		BOOTH	86	OMEG $85 \pi^- \text{Be} \rightarrow 2 \phi \text{Be}$
150^{+150}_{-50}		LINDENBAUM	84	RVUE

NODE=M108W

NODE=M108W

⁴ From partial wave analysis including all possible combinations of 0^{++} , 2^{++} , and 4^{++} resonances.

⁵ Includes data of ETKIN 85.

⁶ Statistical error only.

$f_2(2340)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \phi\phi$	seen
$\Gamma_2 \quad \eta\eta$	seen

$f_2(2340)$ BRANCHING RATIOS

$\Gamma(\eta\eta)/\Gamma_{\text{total}}$	DOCUMENT ID	TECN	COMMENT	Γ_2/Γ
VALUE				
seen	UMAN	06	E835	$5.2 \bar{p}p \rightarrow \eta\eta\pi^0$

$f_2(2340)$ REFERENCES

ABLIKIM	13N	PR D87 092009	Ablikim M. <i>et al.</i>	(BES III Collab.)	REFID=55387
UMAN	06	PR D73 052009	I. Uman <i>et al.</i>	(FNAL E835)	REFID=51063
ETKIN	88	PL B201 568	A. Etkin <i>et al.</i>	(BNL, CUNY)	REFID=40285
BOOTH	86	NP B273 677	P.S.L. Booth <i>et al.</i>	(LIVP, GLAS, CERN)	REFID=21870
ETKIN	85	PL 165B 217	A. Etkin <i>et al.</i>	(BNL, CUNY)	REFID=21871
LINDENBAUM	84	CNPP 13 285	S.J. Lindenbaum	(CUNY)	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 $\rho(2150)$, $f_2(2150)$, $\rho_3(2250)$, $f_4(2300)$.

$\rho_5(2350)$ MASS

$\pi^- p \rightarrow \omega \pi^0 n$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
2330 ± 35	ALDE	95	GAM2 $38 \pi^- p \rightarrow \omega \pi^0 n$

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
~ 2303	HASAN	94	RVUE	$\bar{p}p \rightarrow \pi\pi$
~ 2300	¹ MARTIN	80B	RVUE	
~ 2250	¹ MARTIN	80C	RVUE	
~ 2500	² CARTER	78B	CNTR 0	$0.7-2.4 \bar{p}p \rightarrow K^- K^+$
~ 2480	³ CARTER	77	CNTR 0	$0.7-2.4 \bar{p}p \rightarrow \pi\pi$

S-CHANNEL $\bar{N}N$

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	$0.6-1.9 \bar{p}p \rightarrow \omega \pi^0, \omega \eta \pi^0, \pi^+ \pi^-$
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	$\bar{p}(pn), K^* K 2\pi$

NODE=M108W;LINKAGE=A

NODE=M108W;LINKAGE=C

NODE=M108W;LINKAGE=ST

NODE=M108215;NODE=M108

DESIG=1;OUR EST;→ UNCHECKED ←

DESIG=2

NODE=M108220

NODE=M108R01

NODE=M108R01

NODE=M108

REFID=55387

REFID=51063

REFID=40285

REFID=21870

REFID=21871

REFID=21869

NODE=M033

NODE=M033

NODE=M033205

NODE=M033M

NODE=M033M3

NODE=M033M3

NODE=M033M1

NODE=M033M2

NODE=M033M2

$\pi^- p \rightarrow K^+ K^- n$

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2307 ± 6	ALPER	80	CNTR	0 62 $\pi^- p \rightarrow K^+ K^- n$
¹ $I(J^P) = 1(5^-)$ from simultaneous analysis of $p\bar{p} \rightarrow \pi^- \pi^+$ and $\pi^0 \pi^0$. ² $I = 0(1)$; $J^P = 5^-$ from Barrelet-zero analysis. ³ $I(J^P) = 1(5^-)$ from amplitude analysis. ⁴ From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02. ⁵ Isospins 0 and 1 not separated. ⁶ From a fit to the total elastic cross section. ⁷ Referred to as U or U region by ALSPECTOR 73. ⁸ For $I = 1 \bar{N}N$. ⁹ No evidence for this bump seen in the $\bar{p}p$ data of CHAPMAN 71B. Narrow state not confirmed by OH 73 with more data.				

NODE=M033M4
 NODE=M033M4

NODE=M033M1;LINKAGE=P
 NODE=M033M1;LINKAGE=K
 NODE=M033M1;LINKAGE=J
 NODE=M033M2;LINKAGE=AY

NODE=M033M2;LINKAGE=I
 NODE=M033M2;LINKAGE=E
 NODE=M033M2;LINKAGE=M
 NODE=M033M2;LINKAGE=A
 NODE=M033M2;LINKAGE=N

 $\rho_5(2350)$ WIDTH **$\pi^- p \rightarrow \omega \pi^0 n$**

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
400 ± 100	ALDE	95	GAM2	38 $\pi^- p \rightarrow \omega \pi^0 n$

NODE=M033210

NODE=M033W3
 NODE=M033W3

 $\bar{p}p \rightarrow \pi\pi$ or $\bar{K}K$

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
~ 169	HASAN	94	RVUE	$\bar{p}p \rightarrow \pi\pi$
~ 250	10 MARTIN	80B	RVUE	
~ 300	10 MARTIN	80C	RVUE	
~ 150	11 CARTER	78B	CNTR	0 0.7-2.4 $\bar{p}p \rightarrow K^- K^+$
~ 210	12 CARTER	77	CNTR	0 0.7-2.4 $\bar{p}p \rightarrow \pi\pi$

NODE=M033W1
 NODE=M033W1

S-CHANNEL $\bar{N}N$

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
260 ± 75	13 ANISOVICH	02	SPEC	0.6-1.9 $p\bar{p} \rightarrow \omega \pi^0$, $\omega \eta \pi^0$, $\pi^+ \pi^-$
235 ⁺⁶⁵ ₋₄₀	ANISOVICH	00J	SPEC	
135 ⁺¹⁵⁰ ₋₆₅	14,15 COUPLAND	77	CNTR	0 0.7-2.4 $\bar{p}p \rightarrow \bar{p}p$
165 ⁺¹⁸ ₋₈	15 ALSPECTOR	73	CNTR	$\bar{p}p$ S channel
< 60	16 OH	70B	HDBC	-0 $\bar{p}(pn)$, $K^* K 2\pi$
~ 140	ABRAMS	67C	CNTR	S channel $\bar{p}N$

NODE=M033W2
 NODE=M033W2

 $\pi^- p \rightarrow K^+ K^- n$

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
245 ± 20	ALPER	80	CNTR	0 62 $\pi^- p \rightarrow K^+ K^- n$
¹⁰ $I(J^P) = 1(5^-)$ from simultaneous analysis of $p\bar{p} \rightarrow \pi^- \pi^+$ and $\pi^0 \pi^0$. ¹¹ $I = 0(1)$; $J^P = 5^-$ from Barrelet-zero analysis. ¹² $I(J^P) = 1(5^-)$ from amplitude analysis. ¹³ From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02. ¹⁴ From a fit to the total elastic cross section. ¹⁵ Isospins 0 and 1 not separated. ¹⁶ No evidence for this bump seen in the $\bar{p}p$ data of CHAPMAN 71B. Narrow state not confirmed by OH 73 with more data.				

NODE=M033W4
 NODE=M033W4

OCCUR=2

NODE=M033W1;LINKAGE=P
 NODE=M033W1;LINKAGE=K
 NODE=M033W1;LINKAGE=J
 NODE=M033W2;LINKAGE=AY

NODE=M033W2;LINKAGE=E
 NODE=M033W2;LINKAGE=I
 NODE=M033W2;LINKAGE=N

$\rho_5(2350)$ REFERENCES

ANISOVICH	02	PL B542 8	A.V. Anisovich <i>et al.</i>	
ANISOVICH	01D	PL B508 6	A.V. Anisovich <i>et al.</i>	
ANISOVICH	01E	PL B513 281	A.V. Anisovich <i>et al.</i>	
ANISOVICH	00J	PL B491 47	A.V. Anisovich <i>et al.</i>	
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.

NODE=M024

NODE=M024

$a_6(2450)$ MASS

NODE=M024M

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.				

NODE=M024M

NODE=M024M;LINKAGE=C

$a_6(2450)$ WIDTH

NODE=M024W

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.				

NODE=M024W

NODE=M024W;LINKAGE=C

$a_6(2450)$ DECAY MODES

NODE=M024215;NODE=M024

Mode
$\Gamma_1 \quad K \bar{K}$

DESIG=1

$a_6(2450)$ REFERENCES

NODE=M024

CLELAND	82B	NP B208 228	W.E. Cleland <i>et al.</i>	(DURH, GEVA, LAUS+)

REFID=21281

$f_6(2510)$

$I^G(J^{PC}) = 0^+(6^{++})$

OMITTED FROM SUMMARY TABLE
Needs confirmation.

NODE=M089

NODE=M089

NODE=M089M

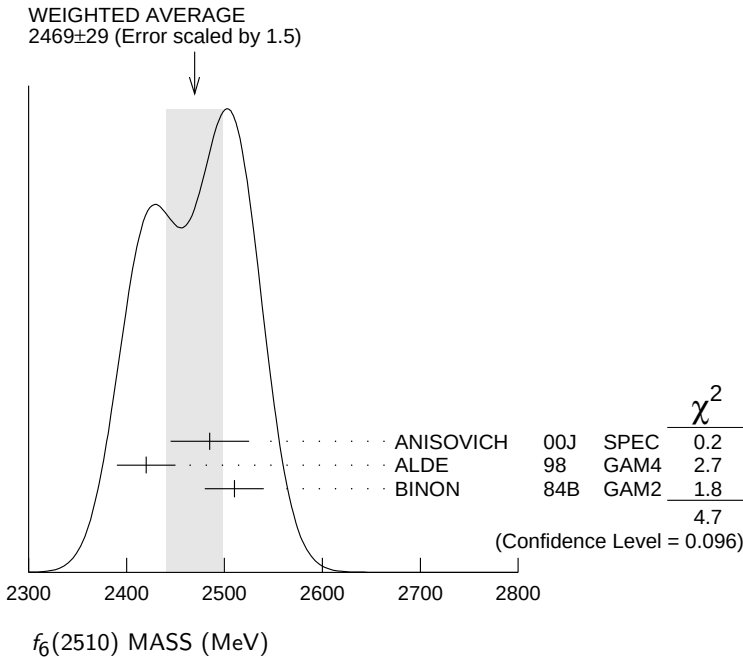
NODE=M089M

NODE=M089M;LINKAGE=AN

$f_6(2510)$ 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 $\pi^- p \rightarrow \pi^0 \pi^0 n$
2510±30	BINON	84B GAM2	38 $\pi^- p \rightarrow n 2\pi^0$

¹ From the combined analysis of ANISOVICH 99C, ANISOVICH 99F, ANISOVICH 99J, ANISOVICH 99K, and ANISOVICH 00B.



$f_6(2510)$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
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

$f_0(2510)$ 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

NODE=MXXX015

Further States

NODE=M300

OMITTED FROM SUMMARY TABLE

This section contains states observed by a single group or states poorly established that thus need confirmation.

NODE=M300

QUANTUM NUMBERS, MASSES, WIDTHS, AND BRANCHING RATIOS

$X(360)$		$I^G(J^{PC}) = ?^?(?^{?+})$					
MASS (MeV)	WIDTH (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT		
$360 \pm 7 \pm 9$	64 ± 18	2.3k	¹ ABRAAMYAN 09	CNTR	$2.75 d C \rightarrow \gamma \gamma X$		
¹ Not seen in $p C \rightarrow \gamma \gamma X$ at 5.5 GeV/c.							

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

$f_0(1200-1600)$		$I^G(J^{PC}) = 0^+(0^{++})$					
MASS (MeV)	WIDTH (MeV)		DOCUMENT ID	TECN	COMMENT		
1323 ± 8	237 ± 20		VLADIMIRSK...06	SPEC	$40 \pi^- p \rightarrow K_S^0 K_S^0 n$		
1480^{+100}_{-150}	1030^{+80}_{-170}		³ ANISOVICH 03	SPEC			
1530^{+90}_{-250}	560 ± 40		⁴ ANISOVICH 03	SPEC			

NODE=M300J98
NODE=M300J98

OCCUR=2

³ K-matrix pole from combined analysis of $\pi^- p \rightarrow \pi^0 \pi^0 n$, $\pi^- p \rightarrow K \bar{K} n$, $\pi^+ \pi^- \rightarrow \pi^+ \pi^-$, $\bar{p} p \rightarrow \pi^0 \pi^0 \pi^0$, $\pi^0 \eta \eta$, $\pi^0 \pi^0 \eta$, $\pi^+ \pi^- \pi^0$, $K^+ K^- \pi^0$, $K_S^0 K_S^0 \pi^0$, $K^+ K_S^0 \pi^-$ 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=M300;LINKAGE=KM

⁴ K-matrix pole from combined analysis of $\pi^- p \rightarrow \pi^0 \pi^0 n$, $\pi^- p \rightarrow K \bar{K} n$, $\bar{p} p \rightarrow \pi^0 \pi^0 \pi^0$, $\pi^0 \eta \eta$, $\pi^0 \pi^0 \eta$ at rest.

NODE=M300;LINKAGE=MK

$X(1420)$		$I^G(J^{PC}) = 2^+(0^{++})$					
MASS (MeV)	WIDTH (MeV)		DOCUMENT ID	TECN	COMMENT		
1420 ± 20	160 ± 10		FILIPPI	00	OBLX	$0 \bar{n} p \rightarrow \pi^+ \pi^+ \pi^-$	

NODE=M300J61
NODE=M300J61

$X(1545)$		$I^G(J^{PC}) = ?^?(?^{++})$					
MASS (MeV)	WIDTH (MeV)		DOCUMENT ID	COMMENT			
1545 ± 3	6.0 ± 2.5		⁵ VLADIMIRSK...08	$40 \pi^- p \rightarrow K_S^0 K_S^0 n + m \pi^0$			

NODE=M300K07
NODE=M300K07

⁵ Supersedes VLADIMIRSKII 00.

NODE=M300K07;LINKAGE=VL

X(1575) $J^G(J^{PC}) = ?^?(1^- -)$					
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) $J^G(J^{PC}) = 2^+(2^+ +)$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
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) $J^G(J^{PC}) = 0^-(?^? -)$					
MASS (MeV)	WIDTH (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1652 ± 7	< 50	100	PROKOSHKIN 96	GAM2	$32,38 \pi p \rightarrow \omega \eta n$

NODE=M300J62
NODE=M300J62

X(1730) $J^G(J^{PC}) = ?^?(?^? +)$					
MASS (MeV)	WIDTH (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$1731.0 \pm 1.2 \pm 2.0$	$3.2 \pm 0.8 \pm 1.3$	58	VLADIMIRSK...07	SPEC	$40 \pi^- p \rightarrow K_S^0 K_S^0 X$

NODE=M300K06
NODE=M300K06

X(1750) $J^G(J^{PC}) = ?^?(1^- -)$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
$1753.5 \pm 1.5 \pm 2.3$	$122.2 \pm 6.2 \pm 8.0$	LINK	02k FOCS	$20-160 \gamma p \rightarrow K^+ K^- p$	

NODE=M300J94
NODE=M300J94

B(X(1750) $\rightarrow \bar{K}^*(892)^0 K^0 \rightarrow K^\pm \pi^\mp K_S^0$)/B(X(1750) $\rightarrow K^+ K^-$)					
VALUE	CL%	DOCUMENT ID	TECN		
< 0.065	90	LINK	02k FOCS		

NODE=M300B5
NODE=M300B5

B(X(1750) $\rightarrow K^*(892)^\pm K^\mp \rightarrow K^\mp \pi^\pm K_S^0$)/B(X(1750) $\rightarrow K^+ K^-$)					
VALUE	CL%	DOCUMENT ID	TECN		
< 0.183	90	LINK	02k FOCS		

NODE=M300B6
NODE=M300B6

f₂(1750) $J^G(J^{PC}) = 0^+(2^+ +)$					
MASS (MeV)	WIDTH (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1755 ± 10	67 ± 12	870	⁸ SCHEGELSKY 06A	RVUE	$\gamma\gamma \rightarrow K_S^0 K_S^0$

NODE=M300JAM
NODE=M300JAM

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

$\Gamma(\gamma\gamma)$					
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

$\Gamma(\pi\pi)$					
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

$\Gamma(\eta\eta)$					
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

⁸From analysis of L3 data at 91 and 183–209 GeV.⁹From 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=M300K29¹⁰Not 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	$e^+e^- \rightarrow \text{hadrons}$

NODE=M300K28
NODE=M300K28¹¹This limit is center-of-mass energy dependent. We quote the most stringent one.

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

a₃(1875) $I^G(J^{PC}) = 1^-(3^{++})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
1874±43±96	385 ± 121 ± 114	CHUNG	02	B852	18.3 $\pi^- p \rightarrow \pi^+\pi^-\pi^-p$

NODE=M300J95
NODE=M300J95

B(a₃(1875) → f₂(1270)π)/B(a₃(1875) → ρπ)					
VALUE	DOCUMENT ID	TECN	COMMENT		
0.8±0.2	¹² CHUNG	02	B852	18.3 $\pi^- p \rightarrow \pi^+\pi^-\pi^-p$	

NODE=M300B7
NODE=M300B7¹²Using the observable fractions of 50.0% ρπ, 56.5% f₂π, and 11.8% ρ₃π.

NODE=M300B;LINKAGE=C1

B(a₃(1875) → ρ₃(1690)π)/B(a₃(1875) → ρπ)					
VALUE	DOCUMENT ID	TECN	COMMENT		
0.9±0.3	¹³ CHUNG	02	B852	18.3 $\pi^- p \rightarrow \pi^+\pi^-\pi^-p$	

NODE=M300B8
NODE=M300B8¹³Using the observable fractions of 50.0% ρπ, 56.5% f₂π, and 11.8% ρ₃π.

NODE=M300B8;LINKAGE=C1

a₁(1930) $I^G(J^{PC}) = 1^-(1^{++})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
1930 ⁺³⁰ ₋₇₀	155 ± 45	ANISOVICH	01F	SPEC	2.0 $\bar{p}p \rightarrow 3\pi^0, \pi^0\eta, \pi^0\eta'$

NODE=M300J92
NODE=M300J92

X(1935) $I^G(J^{PC}) = 1^+(1^{-?})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
1935±20	215 ± 30	EVANGELIS...	79	OMEG	10,16 $\pi^- p \rightarrow \bar{p}pn$

NODE=M300J33
NODE=M300J33

ρ₂(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 $\bar{p}p \rightarrow \omega\pi^0, \omega\eta\pi^0, \pi^+\pi^-$

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 $p\bar{p} \rightarrow \omega\eta, \omega\pi^0\pi^0$

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)	EVT5	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 $p\bar{p} \rightarrow \omega\eta, \omega\pi^0\pi^0$

NODE=M300J81
NODE=M300J81

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)	EVT5	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 $\pi^-p \rightarrow \omega\pi^-\pi^0p$

NODE=M300J2
NODE=M300J2

²¹ From analysis of L3 data at 183–209 GeV.

NODE=M300J2;LINKAGE=SC

$\Gamma(\gamma\gamma) \Gamma(\pi^+\pi^-\pi^0) / \Gamma(\text{total})$				
<u>VALUE (keV)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
$0.11 \pm 0.04 \pm 0.05$	18k	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

$\rho(2000) \quad I^G(J^{PC}) = 1^+(1^- -)$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2000 ± 30	260 ± 45	²³ BUGG	04C	RVUE	Compilation
~ 1988	~ 244	HASAN	94	RVUE	$\bar{p}p \rightarrow \pi\pi$
²³ From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.					

NODE=M300J77
NODE=M300J77

NODE=M300;LINKAGE=AY

$f_2(2000) \quad I^G(J^{PC}) = 0^+(2^+ +)$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2001 ± 10	312 ± 32	ANISOVICH	00J	SPEC	
~ 1996	~ 134	HASAN	94	RVUE	$\bar{p}p \rightarrow \pi\pi$

NODE=M300J25
NODE=M300J25

$X(2000) \quad I^G(J^{PC}) = 1^-(?^? +)$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
1964 ± 35	225 ± 50	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	$+$ $15 \pi^+ p \rightarrow p\pi^+ \rho_3$
²⁴ Cannot determine spin to be 3.					
²⁵ BALTAY 77 favors $J^P = ,3^+$.					

NODE=M300K01
NODE=M300K01

NODE=M300K01;LINKAGE=AA
NODE=M300K01;LINKAGE=B

$X(2000) \quad I^G(J^{PC}) = ?^?(4^+ +)$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
$1998 \pm 3 \pm 5$	<15	VLADIMIRSK...03	SPEC	$\pi^- p \rightarrow K_S^0 K_S^0 M M$	

NODE=M300J97
NODE=M300J97

$\pi_2(2005) \quad I^G(J^{PC}) = 1^-(2^- +)$					
MASS (MeV)	WIDTH (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$1974 \pm 14 \pm 83$	$341 \pm 61 \pm 139$	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

$\eta(2010) \quad I^G(J^{PC}) = 0^+(0^- +)$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2010^{+35}_{-60}	270 ± 60	ANISOVICH	00J	SPEC	

NODE=M300J5
NODE=M300J5

$\pi_1(2015) \quad I^G(J^{PC}) = 1^-(1^- +)$					
MASS (MeV)	WIDTH (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$2014 \pm 20 \pm 16$	$230 \pm 32 \pm 73$	145k	LU	05	B852 $18 \pi^- p \rightarrow \omega \pi^- \pi^0 p$
$2001 \pm 30 \pm 92$	$333 \pm 52 \pm 49$	69k	KUHN	04	B852 $18 \pi^- p \rightarrow \eta \pi^+ \pi^- \pi^- p$

NODE=M300J05
NODE=M300J05

$a_0(2020) \quad I^G(J^{PC}) = 1^-(0^+ +)$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2025 ± 30	330 ± 75	ANISOVICH	99C	SPEC	

NODE=M300J6
NODE=M300J6

$X(2020) \quad I^G(J^{PC}) = ?^?(?^? +)$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2015 ± 3	10 ± 4	FERRER	99	RVUE	$\pi p \rightarrow p p \bar{p} \pi(\pi)$

NODE=M300J34
NODE=M300J34

$h_3(2025) \quad I^G(J^{PC}) = 0^-(3^+ -)$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2025 ± 20	145 ± 30	²⁶ ANISOVICH	02B	SPEC	$0.6\text{--}1.9 \bar{p}p \rightarrow \omega \eta, \omega \pi^0 \pi^0$

NODE=M300J78
NODE=M300J78

²⁶ From 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
2050 ⁺³⁰⁺⁷⁵ ₋₂₄₋₂₆	250 ⁺³⁶⁺¹⁸¹ ₋₃₀₋₁₆₄	35	ABLIKIM	16N	BES3 $J/\psi \rightarrow \gamma K^+ K^- K^+ K^-$
2103 ± 50	187 ± 75	586	36	BISELLO	89B DM2 $J/\psi \rightarrow 4\pi\gamma$

NODE=M300J48
NODE=M300J48

³⁵ From a partial wave analysis of $J/\psi \rightarrow \gamma\phi\phi$, for which the primary signal is $\eta(2225) \rightarrow \phi\phi$, and that also finds significant signals for for 0^{-+} phase space, $f_0(2100)$, $f_2(2010)$, $f_2(2300)$, $f_2(2340)$, and a previously unseen 0^{-+} state $X(2500)$ ($M = 2470^{+15+101}_{-19-23}$ MeV, $\Gamma = 230^{+64+56}_{-35-33}$ MeV).

NODE=M300J48;LINKAGE=A

³⁶ ASTON 81B sees no peak, has 850 events in Ajinenko+Barth bins. ARESTOV 80 sees no peak.

NODE=M300J;LINKAGE=A1

X(2100)	$I^G(J^{PC}) = ??(0^{??})$				
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2100 ± 40	250 ± 40	ALDE	86D	GAM4	100 $\pi^- p \rightarrow 2\eta X$

NODE=M300J49
NODE=M300J49

X(2110)	$I^G(J^{PC}) = 1^+(3^{-?})$				
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2110 ± 10	330 ± 20	EVANGELIS...	79	OMEG	10,16 $\pi^- p \rightarrow \bar{p}pn$

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

$\omega_2(2195) \quad I^G(J^{PC}) = 0^-(2^--)$				
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
2195 ± 30	225 ± 40	³⁷ ANISOVICH	02B	SPEC 0.6–1.9 $p\bar{p} \rightarrow \omega\eta, \omega\pi^0\pi^0$
³⁷ From the combined analysis of ANISOVICH 00D, ANISOVICH 01C, and ANISOVICH 02B.				

NODE=M300J82
NODE=M300J82

NODE=M300J82;LINKAGE=AZ

$\omega(2205) \quad I^G(J^{PC}) = 0^-(1^--)$				
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
2205 ± 30	350 ± 90	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=M300J80
NODE=M300J80

NODE=M300J80;LINKAGE=AZ

$X(2210) \quad I^G(J^{PC}) = ?^?(???)$				
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

$X(2210) \quad I^G(J^{PC}) = ?^?(???)$				
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
2207 ± 22	130	CASO	70	HBC 11.2 $\pi^- p$

NODE=M300J51
NODE=M300J51

$h_1(2215) \quad I^G(J^{PC}) = 0^-(1^+-)$				
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
2215 ± 40	325 ± 55	³⁹ ANISOVICH	02B	SPEC 0.6–1.9 $p\bar{p} \rightarrow \omega\eta, \omega\pi^0\pi^0$
³⁹ From the combined analysis of ANISOVICH 00D, ANISOVICH 01C, and ANISOVICH 02B.				

NODE=M300J27
NODE=M300J27

NODE=M300J27;LINKAGE=AZ

$\rho_2(2225) \quad I^G(J^{PC}) = 1^+(2^--)$				
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
2225 ± 35	335 $^{+100}_{-50}$	⁴⁰ ANISOVICH	02	SPEC 0.6–1.9 $p\bar{p} \rightarrow \omega\pi^0, \omega\eta\pi^0, \pi^+\pi^-$
⁴⁰ From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.				

NODE=M300J70
NODE=M300J70

NODE=M300J70;LINKAGE=AY

$\rho_4(2230) \quad I^G(J^{PC}) = 1^+(4^--)$				
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
2230 ± 25	210 ± 30	⁴¹ ANISOVICH	02	SPEC 0.6–1.9 $p\bar{p} \rightarrow \omega\pi^0, \omega\eta\pi^0, \pi^+\pi^-$
⁴¹ From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.				

NODE=M300J74
NODE=M300J74

NODE=M300J74;LINKAGE=AY

$b_1(2240) \quad I^G(J^{PC}) = 1^+(1^+-)$				
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
2240 ± 35	320 ± 85	⁴² ANISOVICH	02	SPEC 0.6–1.9 $p\bar{p} \rightarrow \omega\pi^0, \omega\eta\pi^0, \pi^+\pi^-$
⁴² From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.				

NODE=M300J87
NODE=M300J87

NODE=M300J87;LINKAGE=AY

$f_2(2240) \quad I^G(J^{PC}) = 0^+(2^++)$				
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
2240 ± 15	241 ± 30	⁴³ ANISOVICH	00J	SPEC 1.92–2.41 $p\bar{p}$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
~ 2226	~ 226	HASAN	94	RVUE $p\bar{p} \rightarrow \pi\pi$
⁴³ From the combined analysis of ANISOVICH 99C, ANISOVICH 99F, ANISOVICH 99J, ANISOVICH 99K, and ANISOVICH 00B. See also ANISOVICH 12.				

NODE=M300K26
NODE=M300K26

NODE=M300K26;LINKAGE=AN

$b_3(2245) \quad I^G(J^{PC}) = 1^+(3^+-)$				
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	
2245 ± 50	320 ± 70	⁴⁴ BUGG	04C	RVUE

NODE=M300K10
NODE=M300K10

⁴⁴ From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.

NODE=M300K10;LINKAGE=AY

$\eta_2(2250)$ $I^G(J^{PC}) = 0^+(2^-+)$				
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
2248 ± 20	280 ± 20	ANISOVICH 00I	SPEC	
2267 ± 14	290 ± 50	ANISOVICH 00J	SPEC	

NODE=M300J17
NODE=M300J17

$\pi_4(2250)$ $I^G(J^{PC}) = 1^-(4^-+)$				
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
2250 ± 15	215 ± 25	ANISOVICH 01F	SPEC	2.0 $\bar{p}p \rightarrow 3\pi^0, \pi^0\eta, \pi^0\eta'$

NODE=M300J73
NODE=M300J73

$\omega_4(2250)$ $I^G(J^{PC}) = 0^-(4^{--})$				
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
2250 ± 30	150 ± 50	⁴⁵ ANISOVICH 02B	SPEC	0.6–1.9 $p\bar{p} \rightarrow \omega\eta, \omega\pi^0\pi^0$

⁴⁵ From the combined analysis of ANISOVICH 00D, ANISOVICH 01C, and ANISOVICH 02B.

NODE=M300J84
NODE=M300J84

NODE=M300J84;LINKAGE=AZ

$\omega_5(2250)$ $I^G(J^{PC}) = 0^-(5^{--})$				
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
2250 ± 70	320 ± 95	⁴⁶ BUGG 04	RVUE	

⁴⁶ From the combined analysis of ANISOVICH 00D, ANISOVICH 01C, and ANISOVICH 02B.

NODE=M300K11
NODE=M300K11

NODE=M300;LINKAGE=AZ

$\omega_3(2255)$ $I^G(J^{PC}) = 0^-(3^{--})$				
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
2255 ± 15	175 ± 30	⁴⁷ ANISOVICH 02B	SPEC	0.6–1.9 $p\bar{p} \rightarrow \omega\eta, \omega\pi^0\pi^0$

⁴⁷ From the combined analysis of ANISOVICH 00D, ANISOVICH 01C, and ANISOVICH 02B.

NODE=M300J66
NODE=M300J66

NODE=M300J66;LINKAGE=AZ

$a_4(2255)$ $I^G(J^{PC}) = 1^-(4^{++})$				
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
2237 ± 5	291 ± 12	UMAN 06	E835	5.2 $\bar{p}p \rightarrow \eta\eta\pi^0$
2255 ± 40	330 ⁺¹¹⁰ ₋₅₀	⁴⁸ ANISOVICH 01F	SPEC	1.96–2.41 $\bar{p}p$

⁴⁸ From the combined analysis of ANISOVICH 99C, ANISOVICH 99E, and ANISOVICH 01F.

NODE=M300K21
NODE=M300K21

NODE=M300K21;LINKAGE=AN

$a_2(2255)$ $I^G(J^{PC}) = 1^-(2^{++})$				
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
2255 ± 20	230 ± 15	⁴⁹ ANISOVICH 01G	SPEC	1.96–2.41 $\bar{p}p$

⁴⁹ From the combined analysis of ANISOVICH 99C, ANISOVICH 99E, ANISOVICH 01F, and ANISOVICH 01G.

NODE=M300K22
NODE=M300K22

NODE=M300K22;LINKAGE=AN

$X(2260)$ $I^G(J^{PC}) = 0^+(4^{+?})$				
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

$\rho(2270)$ $I^G(J^{PC}) = 1^+(1^{--})$				
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
2265 ± 40	325 ± 80	⁵⁰ 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 $\gamma p \rightarrow p\omega\pi^+\pi^-\pi^0$

NODE=M300J86
NODE=M300J86

⁵⁰ From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.

NODE=M300J86;LINKAGE=AY

$a_1(2270)$ $I^G(J^{PC}) = 1^-(1^{++})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2270^{+55}_{-40}	305^{+70}_{-40}	ANISOVICH	01F	SPEC	$2.0 \bar{p}p \rightarrow 3\pi^0, \pi^0\eta, \pi^0\eta'$

NODE=M300J72
NODE=M300J72

$h_3(2275)$ $I^G(J^{PC}) = 0^-(3^{+-})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2275 ± 25	190 ± 45	⁵¹ ANISOVICH	02B	SPEC	$0.6\text{--}1.9 \bar{p}p \rightarrow \omega\eta, \omega\pi^0\pi^0$

NODE=M300J28
NODE=M300J28

⁵¹ 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}	⁵² ANISOVICH	01G	SPEC	$1.96\text{--}2.41 \bar{p}p$

NODE=M300K19
NODE=M300K19

⁵² From the combined analysis of ANISOVICH 99C, ANISOVICH 99E, ANISOVICH 01F, and ANISOVICH 01G.

NODE=M300K19;LINKAGE=AN

$\pi_2(2285)$ $I^G(J^{PC}) = 1^-(2^{-+})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
$2285 \pm 20 \pm 25$	$250 \pm 20 \pm 25$	⁵³ ANISOVICH	11	SPEC	$0.9\text{--}1.94 \bar{p}p$

NODE=M300K25
NODE=M300K25

⁵³ 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	⁵⁴ BUGG	04A	RVUE	
2285 ± 60	230 ± 40	⁵⁵ ANISOVICH	02B	SPEC	$0.6\text{--}1.9 \bar{p}p \rightarrow \omega\eta, \omega\pi^0\pi^0$

NODE=M300J83
NODE=M300J83

⁵⁴ Partial wave analysis of the data on $\bar{p}p \rightarrow \bar{\Lambda}\Lambda$ from BARNES 00.

NODE=M300J83;LINKAGE=BU

⁵⁵ From the combined analysis of ANISOVICH 00D, ANISOVICH 01C, and ANISOVICH 02B.

NODE=M300J83;LINKAGE=AZ

$\omega(2290)$ $I^G(J^{PC}) = 0^-(1^{--})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2290 ± 20	275 ± 35	⁵⁶ BUGG	04A	RVUE	

NODE=M300J02
NODE=M300J02

⁵⁶ Partial wave analysis of the data on $\bar{p}p \rightarrow \bar{\Lambda}\Lambda$ 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	⁵⁷ ANISOVICH	00J	SPEC	$1.92\text{--}2.41 \bar{p}p$

NODE=M300K27
NODE=M300K27

⁵⁷ 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	⁵⁸ BUGG	04A	RVUE	

NODE=M300J19
NODE=M300J19

⁵⁸ Partial wave analysis of the data on $\bar{p}p \rightarrow \bar{\Lambda}\Lambda$ 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	⁵⁹ ANISOVICH	00M	SPEC	

NODE=M300J18
NODE=M300J18

⁵⁹ 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	⁶⁰ BALTAY	75	HBC 15 $\pi^+ p \rightarrow p 5\pi$
⁶⁰ 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=M300J54
NODE=M300J54

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

$X(2540)$ $I^G(J^{PC}) = 0^+(0^{++})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2539 ± 14 $^{+38}_{-14}$	274 $^{+77+126}_{-61-163}$	UEHARA	13	BELL	$\gamma\gamma \rightarrow K_S^0 K_S^0$

NODE=M300K30
NODE=M300K30

$\Gamma(\gamma\gamma) \times B(K\bar{K})$					
VALUE (eV)	DOCUMENT ID	TECN	COMMENT		
40 $^{+9+17}_{-7-40}$	UEHARA	13	BELL	$\gamma\gamma \rightarrow K_S^0 K_S^0$	

NODE=M300K3G
NODE=M300K3G

$X(2632)$ $I^G(J^{PC}) = ??(???)$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2635.2 ± 3.3		⁶¹ EVDOKIMOV	04	SELX	$X(2632) \rightarrow D_s^+ \eta$
2631.6 ± 2.1	< 17	⁶² EVDOKIMOV	04	SELX	$X(2632) \rightarrow D_s^0 K^+$

NODE=M300J03
NODE=M300J03

OCCUR=2

⁶¹ From a mass difference to D_s^+ of 666.9 ± 3.3 MeV.

⁶² 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	⁶³ EVDOKIMOV	04	SELX		

NODE=M300B01
NODE=M300B01

⁶³ 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

f₆(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	$X(3250) \rightarrow \Lambda \bar{p} K^-$

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	$X(3250) \rightarrow \Lambda \bar{p} K^- \pi^\mp$
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	⁶⁴ GABYSHEV	06A	BELL $B^- \rightarrow \Lambda_c^+ \bar{p} \pi^-$

NODE=M300J09
NODE=M300J09

⁶⁴A 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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STRANGE MESONS

($S = \pm 1, C = B = 0$)

$K^+ = u\bar{s}, K^0 = d\bar{s}, \bar{K}^0 = \bar{d}s, K^- = \bar{u}s$, similarly for K^{*} 's

$K_0^*(800)$

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).

$K_0^*(800)$ MASS

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 FOCS	$D^+ \rightarrow K^- \pi^+ \pi^+$
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	$^{+65}_{-30}$		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 $K_S^0 \pi^-$ invariant mass spectrum in $\tau^- \rightarrow K_S^0 \pi^- \nu_\tau$ 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.

NODE=MXXX020

NODE=MXXX020

NODE=M174

NODE=M174

NODE=M174M

NODE=M174M

NODE=M174M;LINKAGE=LI

NODE=M174M;LINKAGE=BL

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NODE=M174M;LINKAGE=BW

NODE=M174M;LINKAGE=BU

NODE=M174M;LINKAGE=CA

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.

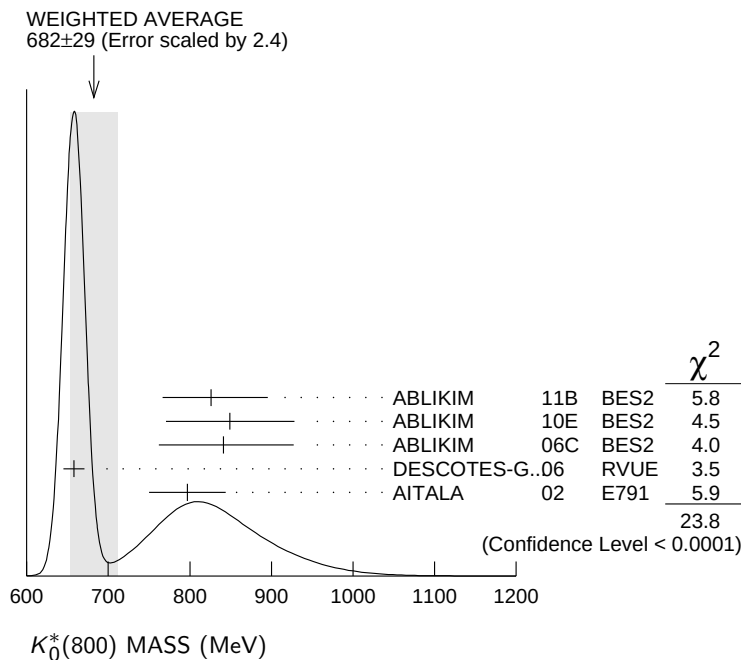
¹⁷ Reanalysis of ASTON 88 using interfering Breit-Wigner amplitudes.

NODE=M174M;LINKAGE=ZH

NODE=M174M;LINKAGE=PE

NODE=M174M;LINKAGE=A1

NODE=M174M;LINKAGE=IS



$K_0^*(800)$ WIDTH

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 $J/\psi \rightarrow K_S^0 K_S^0 \pi^+ \pi^-$
512 ± 80	$^{+92}_{-44}$	1421	19,20 ABLIKIM	10E BES2 $J/\psi \rightarrow K^\pm K_S^0 \pi^\mp \pi^0$
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	0.6k	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 $11 K^- p \rightarrow K^- \pi^+ n$

NODE=M174W

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.

NODE=M174W;LINKAGE=LI

¹⁹ S-matrix pole.

NODE=M174W;LINKAGE=AB

²⁰ From a fit including ten additional resonances and energy-independent Breit-Wigner width.

NODE=M174W;LINKAGE=BL

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.

NODE=M174W;LINKAGE=EP

²² S-matrix pole. Using Roy-Steiner equations (ROY 71) as well as unitarity, analyticity and crossing symmetry constraints.

NODE=M174W;LINKAGE=DE

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 $D^+ \rightarrow K^- \pi^+ \mu^+ \nu_\mu$.

NODE=M174W;LINKAGE=A

- 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.

NODE=M174W;LINKAGE=AU

NODE=M174W;LINKAGE=BG

NODE=M174W;LINKAGE=TM

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NODE=M174W;LINKAGE=BU

NODE=M174W;LINKAGE=CA

NODE=M174W;LINKAGE=ZH

NODE=M174W;LINKAGE=PE

NODE=M174W;LINKAGE=A1

NODE=M174W;LINKAGE=IS

$K_0^*(800)$ 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

CHARGED ONLY, HADROPRODUCED

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
891.76 ± 0.25 OUR AVERAGE					
[891.66 ± 0.26 MeV OUR 2016 AVERAGE]					
893.2 ± 0.1 ± 1.0	190k	¹ AAIJ 16N	LHCB		$D^0 \rightarrow K_S^0 K^\pm \pi^\mp$
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	² 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	³ DEBAERE 67B	HBC	+	$3.5 K^+ p \rightarrow K^0 \pi^+ p$
891.0 ± 1.2	1700	⁴ 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	⁵ ABELE 99D	CBAR	±	$0.0 \bar{p} p \rightarrow K^+ K^- \pi^0$
890.4 ± 0.2 ± 0.5	80k	⁶ BIRD 89	LASS	-	$11 K^- p \rightarrow \bar{K}^0 \pi^- p$
890.0 ± 2.3	800	^{3,4} CLELAND 82	SPEC	+	$30 K^+ p \rightarrow K_S^0 \pi^+ p$
896.0 ± 1.1	3200	^{3,4} CLELAND 82	SPEC	+	$50 K^+ p \rightarrow K_S^0 \pi^+ p$
893 ± 1	3600	^{3,4} CLELAND 82	SPEC	-	$50 K^+ p \rightarrow K_S^0 \pi^- p$
896.0 ± 1.9	380	DELFOSE 81	SPEC	+	$50 K^\pm p \rightarrow K^\pm \pi^0 p$
886.0 ± 2.3	187	DELFOSE 81	SPEC	-	$50 K^\pm p \rightarrow K^\pm \pi^0 p$
894.2 ± 2.0	765	³ CLARK 73	HBC	-	$3.13 K^- p \rightarrow \bar{K}^0 \pi^- p$
894.3 ± 1.5	1150	^{3,4} CLARK 73	HBC	-	$3.3 K^- p \rightarrow \bar{K}^0 \pi^- p$
892.0 ± 2.6	341	³ SCHWEING...68	HBC	-	$5.5 K^- p \rightarrow \bar{K}^0 \pi^- p$

¹ Average of fit results with different parametrizations for the $K\pi$ S-wave.² Inclusive reaction. Complicated background and phase-space effects.³ Mass errors enlarged by us to $\Gamma/\sqrt{N}$. See note.⁴ Number of events in peak reevaluated by us.⁵ K-matrix pole.⁶ From a partial wave amplitude analysis.

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NODE=M018M1;LINKAGE=F

CHARGED ONLY, PRODUCED IN τ LEPTON DECAYS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
895.47 ± 0.20 ± 0.74				
• • • We do not use the following data for averages, fits, limits, etc. • • •				
892.0 ± 0.5		² BOITO 10	RVUE	$\tau^- \rightarrow K_S^0 \pi^- \nu_\tau$
892.0 ± 0.9		^{3,4} BOITO 09	RVUE	$\tau^- \rightarrow K_S^0 \pi^- \nu_\tau$
895.3 ± 0.2		^{4,5} JAMIN 08	RVUE	$\tau^- \rightarrow K_S^0 \pi^- \nu_\tau$
896.4 ± 0.9	12k	⁶ BONVICINI 02	CLEO	$\tau^- \rightarrow K^- \pi^0 \nu_\tau$
895 ± 2		⁷ BARATE 99R	ALEP	$\tau^- \rightarrow K^- \pi^0 \nu_\tau$

¹ From a fit in the $K_0^*(800) + K^*(892) + K^*(1410)$ model.² From the pole position of the $K\pi$ vector form factor using EPIFANOV 07 and constraints from K_{J3} decays in ANTONELLI 10.³ From the pole position of the $K\pi$ vector form factor in the complex s-plane and using EPIFANOV 07 data.⁴ Systematic uncertainties not estimated.⁵ Reanalysis of EPIFANOV 07 using resonance chiral theory.⁶ Calculated by us from the shift by 4.7 ± 0.9 MeV (statistical uncertainty only) reported in BONVICINI 02 with respect to the world average value from PDG 00.⁷ With mass and width of the $K^*(1410)$ fixed at 1412 MeV and 227 MeV, respectively.

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NODE=M018MCT;LINKAGE=JA

NODE=M018MCT;LINKAGE=BO

NODE=M018MCT;LINKAGE=BA

NEUTRAL ONLY

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
895.55±0.20 OUR AVERAGE		Error includes scale factor of 1.7. See the ideogram below.		
[895.81 ± 0.19 MeV OUR 2016 AVERAGE Scale factor = 1.4]				
894.68±0.25±0.05		¹ ABLIKIM	16F BES3	$D^+ \rightarrow K^- \pi^+ e^+ \nu_e$
895.4 ±0.2 ±0.2	243k	² DEL-AMO-SA...11I	BABR	$D^+ \rightarrow K^- \pi^+ e^+ \nu_e$
895.7 ±0.2 ±0.3	141k	³ BONVICINI	08A CLEO	$D^+ \rightarrow K^- \pi^+ \pi^+$
895.41±0.32 ^{+0.35} _{-0.43}	18k	⁴ LINK	05I FOCS	$D^+ \rightarrow K^- \pi^+ \mu^+ \nu_\mu$
896 ±2		BARBERIS	98E OMEG	450 $pp \rightarrow p_f p_s K^* \bar{K}^*$
895.9 ±0.5 ±0.2		ASTON	88 LASS	11 $K^- p \rightarrow K^- \pi^+ n$
894.52±0.63	25k	⁵ ATKINSON	86 OMEG	20-70 γp
894.63±0.76	20k	⁵ 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 $K^- p \rightarrow K^- \pi^+ n$
897.1 ±0.7	22k	⁵ PALER	75 HBC	14.3 $K^- p \rightarrow (K\pi)^0 X$
896.0 ±0.6	10k	FOX	74 RVUE	2 $K^- p \rightarrow K^- \pi^+ n$
896.0 ±0.6		FOX	74 RVUE	2 $K^+ n \rightarrow K^+ \pi^- p$
896 ±2		⁶ MATISON	74 HBC	12 $K^+ p \rightarrow K^+ \pi^- \Delta$
896 ±1	3186	LEWIS	73 HBC	2.1-2.7 $K^+ p \rightarrow K \pi \pi p$
894.0 ±1.3		⁶ LINGLIN	73 HBC	2-13 $K^+ p \rightarrow$ $K^+ \pi^- \pi^+ p$
898.4 ±1.3	1700	⁷ BUCHNER	72 DBC	4.6 $K^+ n \rightarrow K^+ \pi^- p$
897.9 ±1.1	2934	⁷ AGUILAR-...	71B HBC	3.9,4.6 $K^- p \rightarrow K^- \pi^+ n$
898.0 ±0.7	5362	⁷ AGUILAR-...	71B HBC	3.9,4.6 $K^- p \rightarrow$ $K^- \pi^+ \pi^- p$
895 ±1	4300	⁸ HABER	70 DBC	3 $K^- N \rightarrow K^- \pi^+ X$
893.7 ±2.0	10k	DAVIS	69 HBC	12 $K^+ p \rightarrow K^+ \pi^- \pi^+ p$
894.7 ±1.4	1040	⁷ DAUBER	67B HBC	2.0 $K^- p \rightarrow K^- \pi^+ \pi^- p$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
895.53±0.17		LEES	13F BABR	$D^+ \rightarrow K^+ K^- \pi^+$
894.9 ±0.5 ±0.7	14.4k	⁹ MITCHELL	09A CLEO	$D_s^+ \rightarrow K^+ K^- \pi^+$
896.2 ±0.3	20k	¹⁰ AUBERT	07AK BABR	10.6 $e^+ e^- \rightarrow$ $K^{*0} K^\pm \pi^\mp \gamma$
900.7 ±1.1	5900	BARTH	83 HBC	70 $K^+ p \rightarrow K^+ \pi^- X$

¹ Taking also into account the $K_0^*(1430)^0$ and $K_2^*(1430)^0$.

² Taking into account the $K^*(892)^0$, S -wave and P -wave ($K^*(1410)^0$).

³ From the isobar model with a complex pole for the κ .

⁴ Fit to $K\pi$ mass spectrum includes a non-resonant scalar component.

⁵ Inclusive reaction. Complicated background and phase-space effects.

⁶ From pole extrapolation.

⁷ Mass errors enlarged by us to $\Gamma/\sqrt{N}$. See note.

⁸ Number of events in peak reevaluated by us.

⁹ This value comes from a fit with χ^2 of 178/117.

¹⁰ Systematic uncertainties not estimated.

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NODE=M018M2

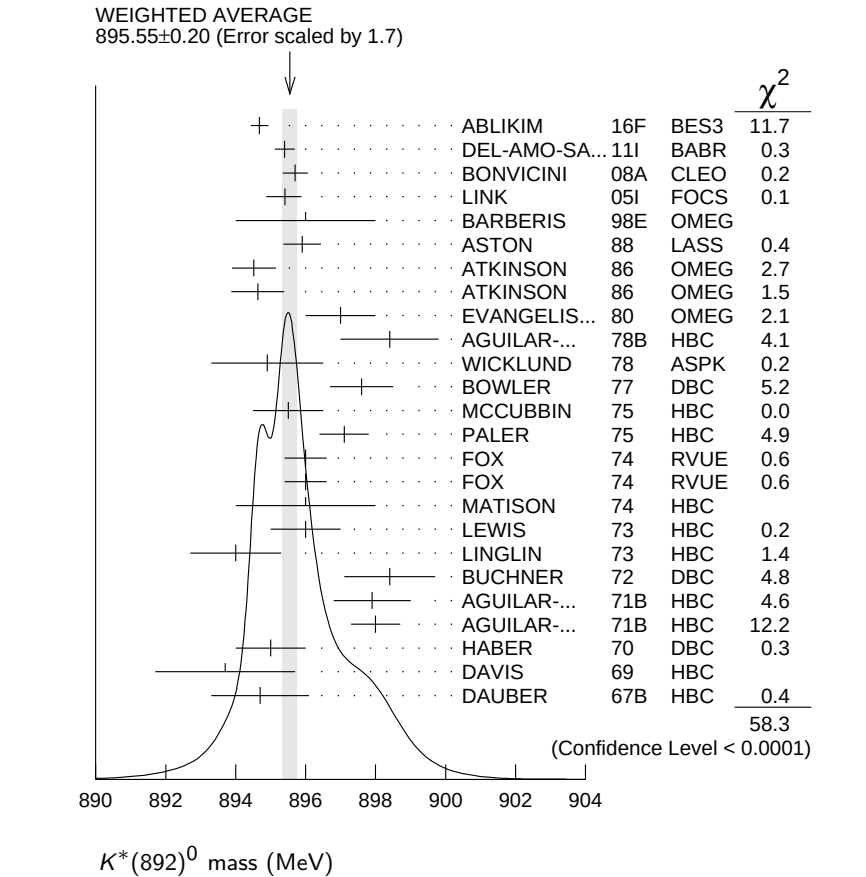
NEW

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NODE=M018M2;LINKAGE=W
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NODE=M018M2;LINKAGE=NS



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NODE=M018209

$m_{K^*(892)^0} - m_{K^*(892)^\pm}$						
<u>VALUE (MeV)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>CHG</u>	<u>COMMENT</u>	
6.7±1.2 OUR AVERAGE						
7.7±1.7	2980	AGUILAR-...	78B	HBC	±0	0.76 $\bar{p}p \rightarrow K^\mp K_S^0 \pi^\pm$
5.7±1.7	7338	AGUILAR-...	71B	HBC	-0	3.9,4.6 $K^- p$
6.3±4.1	283	¹ BARASH	67B	HBC		0.0 $\bar{p}p$
¹ Number of events in peak reevaluated by us.						

NODE=M018D

NODE=M018D

NODE=M018D;LINKAGE=W

$K^*(892)$ RANGE PARAMETER						
All from partial wave amplitude analyses.						
VALUE (GeV ⁻¹)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT	
2.1 ±0.5 ±0.5	243k	¹ DEL-AMO-SA.11I	BABR	0	$D^+ \rightarrow K^- \pi^+ e^+ \nu_e$	
3.96±0.54 ^{+1.31} _{-0.90}	18k	² LINK	05I	FOCS	0	$D^+ \rightarrow K^- \pi^+ \mu^+ \nu_\mu$
3.4 ±0.7		ASTON	88	LASS	0	11 $K^- p \rightarrow K^- \pi^+ n$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
12.1 ±3.2 ±3.0		BIRD	89	LASS	-	11 $K^- p \rightarrow \bar{K}^0 \pi^- p$
¹ Taking into account the $K^*(892)^0$, S-wave and P-wave ($K^*(1410)^0$).						
² Fit to $K \pi$ mass spectrum includes a non-resonant scalar component.						

NODE=M018R

NODE=M018R

NODE=M018R

NODE=M018R;LINKAGE=DE

NODE=M018R;LINKAGE=LI

$K^*(892)$ WIDTH						
CHARGED ONLY, HADROPRODUCED						
VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT	
50.3±0.8 OUR FIT						
[50.8 ± 0.9 MeV OUR 2016 FIT]						
50.3±0.8 OUR AVERAGE						

NODE=M018215

NODE=M018W1

NODE=M018W1

NEW

NEW

[50.8 ± 0.9 MeV OUR 2016 AVERAGE]

47.2±0.3±2.3	190k	¹ AAIJ	16N	LHCB	$D^0 \rightarrow K_S^0 K^\pm \pi^\mp$
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	² COOPER	78	HBC	0.76 $\bar{p} p \rightarrow (K\pi)^\pm X$
52.1±2.2	9000	³ PALER	75	HBC	14.3 $K^- p \rightarrow (K\pi)^- X$
46.3±6.7	765	² CLARK	73	HBC	3.13 $K^- p \rightarrow \bar{K}^0 \pi^- p$
48.2±5.7	1150	^{2,4} CLARK	73	HBC	3.3 $K^- p \rightarrow \bar{K}^0 \pi^- p$
54.3±3.3	4404	² AGUILAR-...	71B	HBC	3.9,4.6 $K^- p \rightarrow (K\pi)^- p$
46 ±5	1700	^{2,4} 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	⁵ ABELE	99D	CBAR	± 0.0 $\bar{p} p \rightarrow K^+ K^- \pi^0$
45.2±1 ±2	80k	⁶ 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	^{2,4} CLELAND	82	SPEC	30 $K^+ p \rightarrow K_S^0 \pi^+ p$
62.0±4.4	3200	^{2,4} CLELAND	82	SPEC	50 $K^+ p \rightarrow K_S^0 \pi^+ p$
55 ±4	3600	^{2,4} CLELAND	82	SPEC	50 $K^+ p \rightarrow K_S^0 \pi^- p$
62.6±3.8	380	DELFOSE	81	SPEC	50 $K^\pm p \rightarrow K^\pm \pi^0 p$
50.5±3.9	187	DELFOSE	81	SPEC	50 $K^\pm p \rightarrow K^\pm \pi^0 p$

¹ Average of fit results with different parametrizations for the $K\pi$ S-wave.² Width errors enlarged by us to $4 \times \Gamma/\sqrt{N}$; see note.³ Inclusive reaction. Complicated background and phase-space effects.⁴ Number of events in peak reevaluated by us.⁵ K-matrix pole.⁶ From a partial wave amplitude analysis.

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OCCUR=2

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NODE=M018W5
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CHARGED ONLY, PRODUCED IN τ LEPTON DECAYS

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
46.2±0.6±1.2	53k	¹ EPIFANOV	07	BELL $\tau^- \rightarrow K_S^0 \pi^- \nu_\tau$
46.5±1.1		² BOITO	10	RVUE $\tau^- \rightarrow K_S^0 \pi^- \nu_\tau$
46.2±0.4		^{3,4} BOITO	09	RVUE $\tau^- \rightarrow K_S^0 \pi^- \nu_\tau$
47.5±0.4		^{4,5} JAMIN	08	RVUE $\tau^- \rightarrow K_S^0 \pi^- \nu_\tau$
55 ±8		⁶ BARATE	99R	ALEP $\tau^- \rightarrow K^- \pi^0 \nu_\tau$

¹ From a fit in the $K_0^*(800) + K^*(892) + K^*(1410)$ model.² From the pole position of the $K\pi$ vector form factor using EPIFANOV 07 and constraints from K_{J3} decays in ANTONELLI 10.³ From the pole position of the $K\pi$ vector form factor in the complex s -plane and using EPIFANOV 07 data.⁴ Systematic uncertainties not estimated.⁵ Reanalysis of EPIFANOV 07 using resonance chiral theory.⁶ With mass and width of the $K^*(1410)$ fixed at 1412 MeV and 227 MeV, respectively.

NODE=M018W5;LINKAGE=EF
 NODE=M018W5;LINKAGE=BT

NODE=M018W5;LINKAGE=BI

NODE=M018W5;LINKAGE=NS
 NODE=M018W5;LINKAGE=JA
 NODE=M018W5;LINKAGE=BA

NEUTRAL ONLY

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
47.3 ±0.5 OUR FIT				Error includes scale factor of 1.9. [47.4 ± 0.6 MeV OUR 2016 FIT Scale factor = 2.2]

47.3 ±0.5 OUR AVERAGE Error includes scale factor of 2.0. See the ideogram below.
 [47.4 ± 0.6 MeV OUR 2016 AVERAGE Scale factor = 2.0]

46.53±0.56±0.31		¹ ABLIKIM	16F	BES3	$D^+ \rightarrow K^- \pi^+ e^+ \nu_e$
46.5 ±0.3 ±0.2	243k	² DEL-AMO-SA..11i	BABR		$D^+ \rightarrow K^- \pi^+ e^+ \nu_e$
45.3 ±0.5 ±0.6	141k	³ BONVICINI	08A	CLEO	$D^+ \rightarrow K^- \pi^+ \pi^+$
47.79±0.86 ^{+1.32} _{-1.06}	18k	⁴ LINK	05i	FOCS	$D^+ \rightarrow K^- \pi^+ \mu^+ \nu_\mu$
54 ±3		BARBERIS	98E	OMEG	450 $pp \rightarrow p_f p_s K^* \bar{K}^*$
50.8 ±0.8 ±0.9		ASTON	88	LASS	11 $K^- p \rightarrow K^- \pi^+ n$
46.5 ±4.3	5900	BARTH	83	HBC	70 $K^+ p \rightarrow K^+ \pi^- X$
54 ±2	28k	EVANGELIS...	80	OMEG	10 $\pi^- p \rightarrow K^+ \pi^- (\Lambda, \Sigma)$
45.9 ±4.8	1180	AGUILAR-...	78B	HBC	0.76 $\bar{p} p \rightarrow K^\mp K_S^0 \pi^\pm$
51.2 ±1.7		WICKLUND	78	ASPK	3,4,6 $K^\pm N \rightarrow (K\pi)^0 N$
48.9 ±2.5		BOWLER	77	DBC	5.4 $K^+ d \rightarrow K^+ \pi^- pp$

NODE=M018W2
 NODE=M018W2

NEW

NEW

48	$+3$ -2	3600	MCCUBBIN	75	HBC	$3.6 K^- p \rightarrow K^- \pi^+ n$
50.6	± 2.5	22k	⁵ PALER	75	HBC	$14.3 K^- p \rightarrow (K\pi)^0 X$
47	± 2	10k	FOX	74	RVUE	$2 K^- p \rightarrow K^- \pi^+ n$
51	± 2		FOX	74	RVUE	$2 K^+ n \rightarrow K^+ \pi^- p$
46.0	± 3.3	3186	⁶ LEWIS	73	HBC	$2.1-2.7 K^+ p \rightarrow K\pi\pi p$
51.4	± 5.0	1700	⁶ BUCHNER	72	DBC	$4.6 K^+ n \rightarrow K^+ \pi^- p$
55.8	$+4.2$ -3.4	2934	⁶ AGUILAR-...	71B	HBC	$3.9,4.6 K^- p \rightarrow K^- \pi^+ n$
48.5	± 2.7	5362	AGUILAR-...	71B	HBC	$3.9,4.6 K^- p \rightarrow$ $K^- \pi^+ \pi^- p$
54.0	± 3.3	4300	^{6,7} HABER	70	DBC	$3 K^- N \rightarrow K^- \pi^+ X$
53.2	± 2.1	10k	⁶ DAVIS	69	HBC	$12 K^+ p \rightarrow K^+ \pi^- \pi^+ p$
44	± 5.5	1040	⁶ DAUBER	67B	HBC	$2.0 K^- p \rightarrow K^- \pi^+ \pi^- p$

OCCUR=2

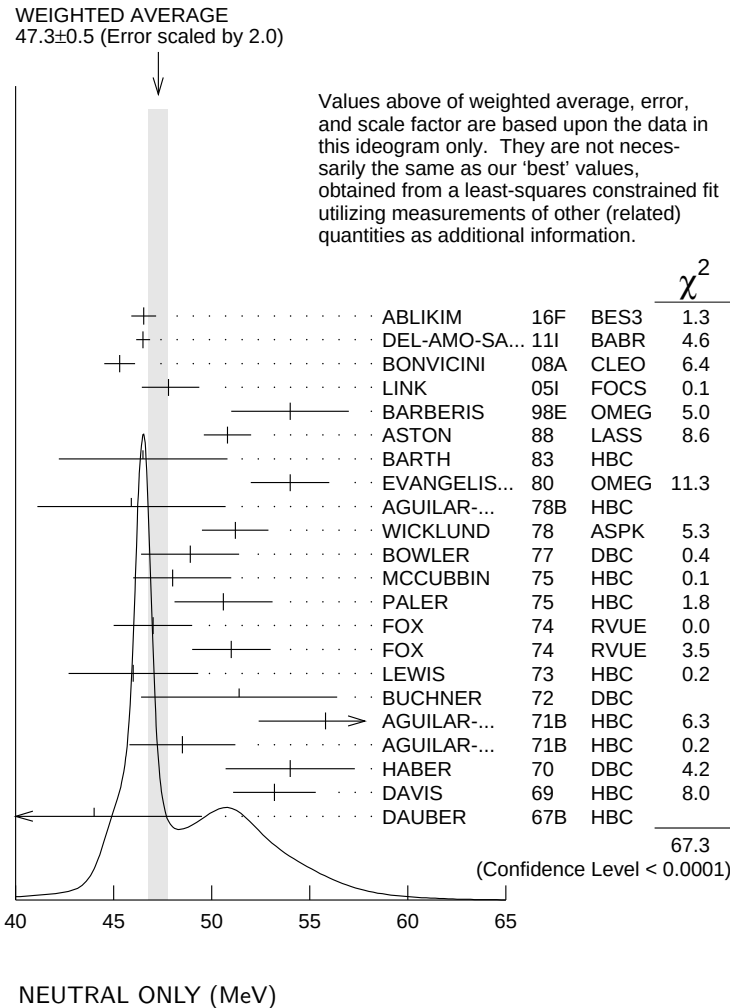
OCCUR=2

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

44.90 ± 0.30		LEES	13F	BABR	$D^+ \rightarrow K^+ K^- \pi^+$
45.7 $\pm 1.1 \pm 0.5$	14.4k	⁸ MITCHELL	09A	CLEO	$D_s^+ \rightarrow K^+ K^- \pi^+$
50.6 ± 0.9	20k	⁹ AUBERT	07AK	BABR	$10.6 e^+ e^- \rightarrow$ $K^{*0} K^\pm \pi^\mp \gamma$

- ¹ Taking also into account the $K_0^*(1430)^0$ and $K_2^*(1430)^0$.
² Taking into account the $K^*(892)^0$, S -wave and P -wave ($K^*(1410)^0$).
³ From the isobar model with a complex pole for the κ .
⁴ Fit to $K\pi$ mass spectrum includes a non-resonant scalar component.
⁵ Inclusive reaction. Complicated background and phase-space effects.
⁶ Width errors enlarged by us to $4 \times \Gamma/\sqrt{N}$; see note.
⁷ Number of events in peak reevaluated by us.
⁸ This value comes from a fit with χ^2 of 178/117.
⁹ Systematic uncertainties not estimated.

NODE=M018W2;LINKAGE=B
NODE=M018W2;LINKAGE=DE
NODE=M018W2;LINKAGE=BO
NODE=M018W2;LINKAGE=LN
NODE=M018W2;LINKAGE=I
NODE=M018W2;LINKAGE=D
NODE=M018W2;LINKAGE=W
NODE=M018W2;LINKAGE=MI
NODE=M018W2;LINKAGE=NS



$K^*(892)$ DECAY MODES

NODE=M018220;NODE=M018

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 $K\pi$	~ 100	%
Γ_2 $(K\pi)^\pm$	$(99.900 \pm 0.009) \%$	
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 $K^\pm\gamma$	$(1.00 \pm 0.09) \times 10^{-3}$	
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 14 measurements and one constraint to determine 3 parameters. The overall fit has a $\chi^2 = 9.8$ 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_5	Γ	-100	
		18	-18
		x_2	x_5

Mode	Rate (MeV)
Γ_2 $(K\pi)^\pm$	50.2 ± 0.8
Γ_5 $K^\pm\gamma$	0.050 ± 0.005

DESIG=11
 DESIG=3

CONSTRAINED FIT INFORMATION

An overall fit to the total width and a partial width uses 23 measurements and one constraint to determine 3 parameters. The overall fit has a $\chi^2 = 68.4$ for 21 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta p_i \delta p_j \rangle / (\delta p_i \cdot \delta p_j)$, 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_4	Γ	-100	
		12	-12
		x_3	x_4

Mode	Rate (MeV)	Scale factor
Γ_3 $(K\pi)^0$	47.2 ± 0.5	1.9
Γ_4 $K^0\gamma$	0.117 ± 0.010	

DESIG=12
 DESIG=4

 $K^*(892)$ PARTIAL WIDTHS

NODE=M018225

$\Gamma(K^0\gamma)$						Γ_4
VALUE (keV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT	
116 ± 10	OUR FIT					
116.5 ± 9.9	584	CARLSMITH	86	SPEC	0	$K_L^0 A \rightarrow K_S^0 \pi^0 A$

NODE=M018W4
 NODE=M018W4

$\Gamma(K^\pm\gamma)$						Γ_5
VALUE (keV)	DOCUMENT ID	TECN	CHG	COMMENT		
50 ± 5	OUR FIT					
50 ± 5	OUR AVERAGE					
48 ± 11	BERG	83	SPEC	—	156 $K^- A \rightarrow \bar{K} \pi A$	
51 ± 5	CHANDLEE	83	SPEC	+	200 $K^+ A \rightarrow K \pi A$	

NODE=M018W3
 NODE=M018W3

$K^*(892)$ BRANCHING RATIOS

NODE=M018230

 $\Gamma(K^0\gamma)/\Gamma_{\text{total}}$ Γ_4/Γ VALUE (units 10^{-3})

DOCUMENT ID TECN CHG COMMENT

 2.46 ± 0.21 OUR FIT

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

 1.5 ± 0.7 CARITHERS 75B CNTR 0 8-16 $\overline{K}^0 A$ $\Gamma(K^\pm\gamma)/\Gamma_{\text{total}}$ Γ_5/Γ VALUE (units 10^{-3})

CL%

DOCUMENT ID TECN CHG COMMENT

 1.00 ± 0.09 OUR FIT[[$(0.99 \pm 0.09) \times 10^{-3}$ OUR 2016 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 $K^- p \rightarrow p \overline{K}^0 2\pi$

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

< 20×10^{-4} WOJCICKI 64 HBC - 1.7 $K^- p \rightarrow \overline{K}^0 \pi^- p$ **$K^*(892)$ REFERENCES**

NODE=M018

AAIJ	16N	PR D93 052018	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=57273
ABLIKIM	16F	PR D94 032001	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=57307
LEES	13F	PR D87 052010	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=55127
DEL-AMO-SA...	11I	PR D83 072001	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)	REFID=16493
ANTONELLI	10	EPJ C69 399	M. Antonelli <i>et al.</i>	(FlaviaNet Working Group)	REFID=53448
BOITO	10	JHEP 1009 031	D.R. Boito, R. Escribano, M. Jamin	(BARC)	REFID=53632
BOITO	09	EPJ C59 821	D.R. Boito, R. Escribano, M. Jamin		REFID=52728
MITCHELL	09A	PR D79 072008	R.E. Mitchell <i>et al.</i>	(CLEO Collab.)	REFID=52756
BONVICINI	08A	PR D78 052001	G. Bonvicini <i>et al.</i>	(CLEO Collab.)	REFID=52426
JAMIN	08	PL B664 78	M. Jamin, A. Pich, J. Portoles		REFID=52285
AUBERT	07AK	PR D76 012008	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51908
EPIFANOV	07	PL B654 65	D. Epifanov <i>et al.</i>	(BELLE Collab.)	REFID=51929
LINK	05I	PL B621 72	J.M. Link <i>et al.</i>	(FNAL FOCUS Collab.)	REFID=50679
BONVICINI	02	PRL 88 111803	G. Bonvicini <i>et al.</i>	(CLEO Collab.)	REFID=48701
PDG	00	EPJ C15 1	D.E. Groom <i>et al.</i>	(PDG Collab.)	REFID=47469
ABELE	99D	PL B468 178	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)	REFID=47401
BARATE	99R	EPJ C11 599	R. Barate <i>et al.</i>	(ALEPH Collab.)	REFID=47366
BARBERIS	98E	PL B436 204	D. Barberis <i>et al.</i>	(Omega Expt.)	REFID=46348
BIRD	89	SLAC-332	P.F. Bird	(SLAC)	REFID=41002
ASTON	88	NP B296 493	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)	REFID=40262
ATKINSON	86	ZPHY C30 521	M. Atkinson <i>et al.</i>	(BONN, CERN, GLAS+)	REFID=20564
CARLSMITH	86	PRL 56 18	D. Carlsmith <i>et al.</i>	(EFI, SACL)	REFID=22461
BAUBILLIER	84B	ZPHY C26 37	M. Baubillier <i>et al.</i>	(BIRM, CERN, GLAS+)	REFID=22459
NAPIER	84	PL 149B 514	A. Napier <i>et al.</i>	(TUFTS, ARIZ, FNAL, FLOR+)	REFID=22460
BARTH	83	NP B223 296	M. Barth <i>et al.</i>	(BRUX, CERN, GENO, MONS+)	REFID=22456
BERG	83	Thesis UMI 83-21652	D.M. Berg	(ROCH)	REFID=22457
CHANDLEE	83	PRL 51 168	C. Chandlee <i>et al.</i>	(ROCH, FNAL, MINN)	REFID=22458
CLELAND	82	NP B208 189	W.E. Cleland <i>et al.</i>	(DURH, GEVA, LAUS+)	REFID=22455
DELFOSSSE	81	NP B183 349	A. Delfosse <i>et al.</i>	(GEVA, LAUS)	REFID=21277
TOAFF	81	PR D23 1500	S. Toaff <i>et al.</i>	(ANL, KANS)	REFID=22454
AJINENKO	80	ZPHY C5 177	I.V. Ajinenko <i>et al.</i>	(SERP, BRUX, MONS+)	REFID=22449
EVANGELIS...	80	NP B165 383	C. Evangelista <i>et al.</i>	(BARI, BONN, CERN+)	REFID=22450
AGUILAR-...	78B	NP B141 101	M. Aguilar-Benitez <i>et al.</i>	(MADR, TATA+)	REFID=22438
BALAND	78	NP B140 220	J.F. Baland <i>et al.</i>	(MONS, BELG, CERN+)	REFID=20369
COOPER	78	NP B136 365	A.M. Cooper <i>et al.</i>	(TATA, CERN, CDEF+)	REFID=22441
JONGEJANS	78	NP B139 383	B. Jongejans <i>et al.</i>	(ZEEM, CERN, NIJM+)	REFID=22445
WICKLUND	78	PR D17 1197	A.B. Wicklund <i>et al.</i>	(ANL)	REFID=20124
BOWLER	77	NP B126 31	M.G. Bowler <i>et al.</i>	(OXF)	REFID=22437
CARITHERS	75B	PRL 35 349	W.C.J. Carithers <i>et al.</i>	(ROCH, MCGL)	REFID=22433
MCCUBBIN	75	NP B86 13	N.A. McCubbin, L. Lyons	(OXF)	REFID=22434
PALER	75	NP B96 1	K. Paler <i>et al.</i>	(RHEL, SACL, EPOL)	REFID=22435
FOX	74	NP B80 403	G.C. Fox, M.L. Griss	(CIT)	REFID=22430
MATISON	74	PR D9 1872	M.J. Matison <i>et al.</i>	(LBL)	REFID=22431
BEMPORAD	73	NP B51 1	C. Bemporad <i>et al.</i>	(CERN, ETH, LOIC)	REFID=22416
CLARK	73	NP B54 432	A.G. Clark, L. Lyons, D. Radojicic	(OXF)	REFID=22426
LEWIS	73	NP B60 283	P.H. Lewis <i>et al.</i>	(LOWC, LOIC, CDEF)	REFID=22427
LINGLIN	73	NP B55 408	D. Linglin	(CERN)	REFID=22428
BUCHNER	72	NP B45 333	K. Buchner <i>et al.</i>	(MPIM, CERN, BRUX)	REFID=22418
AGUILAR-...	71B	PR D4 2583	M. Aguilar-Benitez, R.L. Eisner, J.B. Kinson	(BNL)	REFID=22408
HABER	70	NP B17 289	B. Haber <i>et al.</i>	(REHO, SACL, BGNA, EPOL)	REFID=22406
CRENNELL	69D	PRL 22 487	D.J. Crennell <i>et al.</i>	(BNL)	REFID=22399
DAVIS	69	PRL 23 1071	P.J. Davis <i>et al.</i>	(LRL)	REFID=22400
SCHWEING...	68	PR 166 1317	F. Schweingruber <i>et al.</i>	(ANL, NWES)	REFID=22398
BARASH	67B	PR 156 1399	N. Barash <i>et al.</i>	(COLU)	REFID=20160
BARLOW	67	NC 50A 701	J. Barlow <i>et al.</i>	(CERN, CDEF, IRAD, LIVP)	REFID=20041
DAUBER	67B	PR 153 1403	P.M. Dauber <i>et al.</i>	(UCLA)	REFID=22389
DEBAERE	67B	NC 51A 401	W. de Baere <i>et al.</i>	(BRUX, CERN)	REFID=22390
WOJCICKI	64	PR 135 B484	S.G. Wojcicki	(LRL)	REFID=22379

$K_1(1270)$

$$I(J^P) = \frac{1}{2}(1^+)$$

NODE=M028

 $K_1(1270)$ MASS

NODE=M028205

VALUE (MeV)	DOCUMENT ID
1272±7 OUR AVERAGE	Includes data from the 2 datablocks that follow this one.

NODE=M028MX

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
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.

 NODE=M028WX
 → UNCHECKED ←
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
 NODE=M028W3

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 ± 5.2 ± 6.7 GULER 11 BELL $B^+ \rightarrow J/\psi K^+ \pi^+ \pi^-$

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

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

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 K \rho$	(42 ± 6) %
$\Gamma_2 K_0^*(1430) \pi$	(28 ± 4) %
$\Gamma_3 K^*(892) \pi$	(16 ± 5) %
$\Gamma_4 K \omega$	(11.0 ± 2.0) %
$\Gamma_5 K f_0(1370)$	(3.0 ± 2.0) %
$\Gamma_6 \gamma K^0$	seen

NODE=M028215;NODE=M028

DESIG=2

DESIG=7

DESIG=1

DESIG=5

DESIG=8

DESIG=9;OUR EST;→ UNCHECKED ←

 $K_1(1270)$ PARTIAL WIDTHS **$\Gamma(K\rho)$**

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT

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

57 ± 5 MAZZUCATO 79 HBC + $4.2 K^- p \rightarrow \Xi^- (K\pi\pi)^+$
 75 ± 6 CARNEGIE 77B ASPK $\pm$ $13 K^\pm p \rightarrow (K\pi\pi)^\pm p$

Γ_1

NODE=M028W5
 NODE=M028W5

 $\Gamma(K_0^*(1430)\pi)$

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT

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

26 ± 6 CARNEGIE 77B ASPK $\pm$ $13 K^\pm p \rightarrow (K\pi\pi)^\pm p$

Γ_2

NODE=M028W7
 NODE=M028W7

 $\Gamma(K^*(892)\pi)$

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT

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

14 ± 11 MAZZUCATO 79 HBC + $4.2 K^- p \rightarrow \Xi^- (K\pi\pi)^+$
 2 ± 2 CARNEGIE 77B ASPK $\pm$ $13 K^\pm p \rightarrow (K\pi\pi)^\pm p$

Γ_3

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. Ablikim <i>et al.</i>	(BES Collab.)
ALAVI-HARATI	02B	PRL 89 072001	A. Alavi-Harati <i>et al.</i>	(FNAL KTeV Collab.)
ASNER	00B	PR D62 072006	D.M. Asner <i>et al.</i>	(CLEO Collab.)
TORNQVIST	82B	NP B203 268	N.A. Tornqvist	(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
REFID=22550
REFID=20867
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REFID=22538
REFID=22535
REFID=22536
REFID=22532
REFID=22533
REFID=22419
REFID=22505
REFID=22506
REFID=22482
REFID=22473

 $K_1(1400)$

$$I(J^P) = \frac{1}{2}(1^+)$$

NODE=M064

 $K_1(1400)$ MASS

NODE=M064M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
1403 ± 7 OUR AVERAGE					
1463 ± 64 ± 68	7k	ASNER	00B	CLEO	± $\tau^- \rightarrow K^- \pi^+ \pi^- \nu_\tau$
1373 ± 14 ± 18		¹ ASTON	87	LASS	0 $11 K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$
1392 ± 18		BAUBILLIER	82B	HBC	0 $8.25 K^- p \rightarrow K_S^0 \pi^+ \pi^- n$
1410 ± 25		DAUM	81C	CNTR	— $63 K^- p \rightarrow K^- 2\pi p$
1415 ± 15		ETKIN	80	MPS	0 $6 K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$
1404 ± 10		² CARNEGIE	77	ASPK	± $13 K^\pm p \rightarrow (K\pi\pi)^\pm p$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1418 ± 8	25k	³ ABLIKIM	06C	BES2	$J/\psi \rightarrow \bar{K}^*(892)^0 K^+ \pi^-$
~ 1350		⁴ TORNQVIST	82B	RVUE	
~ 1400		VERGEEST	79	HBC	— $4.2 K^- p \rightarrow (\bar{K}\pi\pi)^- p$
~ 1400		BRANDENB...	76	ASPK	± $13 K^\pm p \rightarrow (K\pi\pi)^\pm p$
1420		DAVIS	72	HBC	+
1368 ± 18		FIRESTONE	72B	DBC	+

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	+
241 ± 30		FIRESTONE	72B	DBC	+

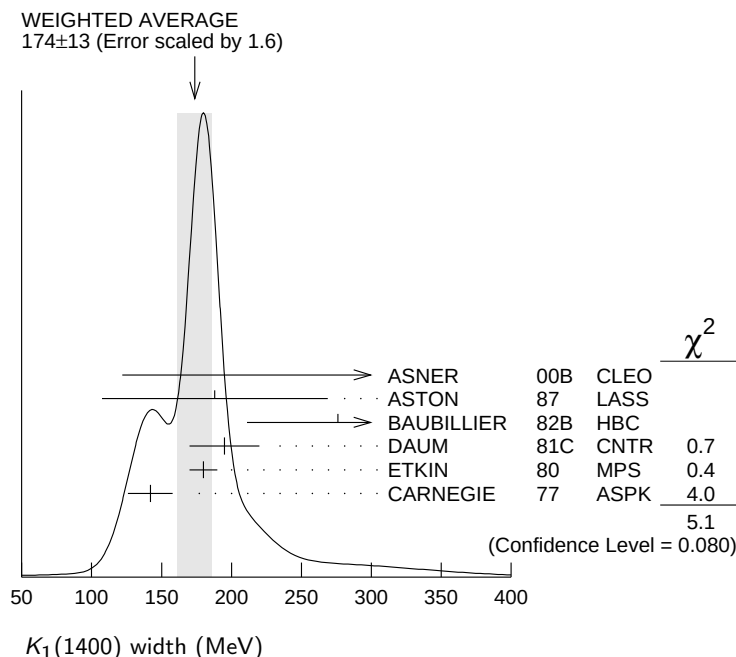
NODE=M064W

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)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

1421± 9 OUR AVERAGE

[1414 ± 15 MeV OUR 2016 AVERAGE Scale factor = 1.3]

1437± 8±16	190k	¹ AAIJ	16N	LHCB	$D^0 \rightarrow (K_S^0 \pi^\mp) K^\pm$
1426± 8±24	190k	² AAIJ	16N	LHCB	$D^0 \rightarrow K_S^0 (K^\pm \pi^\mp)$
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		^{3,4} BOITO	09	RVUE	$\tau^- \rightarrow K_S^0 \pi^- \nu_\tau$
1367±54		BIRD	89	LASS	- 11 $K^- p \rightarrow \bar{K}^0 \pi^- p$
1474±25		BAUBILLIER	82B	HBC	0 8.25 $K^- p \rightarrow \bar{K}^0 2\pi n$
1500±30		ETKIN	80	MPS	0 6 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$

¹ Using a parametrization for the $K\pi$ S-wave similar to ASTON 88 with fixed resonance width.

² Using a $K\pi$ S-wave parametrization with resonant and non-resonant contributions.

³ From the pole position of the $K\pi$ vector form factor in the complex s -plane and using EPIFANOV 07 data.

⁴ Systematic uncertainties not estimated.

NODE=M094M

NODE=M094M
NEW

OCCUR=2

NODE=M094M;LINKAGE=A

NODE=M094M;LINKAGE=C
NODE=M094M;LINKAGE=BI

NODE=M094M;LINKAGE=NS

$K^*(1410)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

236± 18 OUR AVERAGE

[232 ± 21 MeV OUR 2016 AVERAGE Scale factor = 1.1]

210± 20±60	190k	¹ AAIJ	16N	LHCB	$D^0 \rightarrow (K_S^0 \pi^\mp) K^\pm$
270± 20±40	190k	¹ AAIJ	16N	LHCB	$D^0 \rightarrow K_S^0 (K^\pm \pi^\mp)$
176± 52±22		ASTON	88	LASS	0 11 $K^- p \rightarrow K^- \pi^+ n$
240± 18±12		ASTON	87	LASS	0 11 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$

NODE=M094W

NODE=M094W
NEW

OCCUR=2

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

198^{+61}_{-87}	^{2,3} BOITO	09	RVUE	$\tau^- \rightarrow K_S^0 \pi^- \nu_\tau$
114 ± 101	BIRD	89	LASS	$11 K^- p \rightarrow \bar{K}^0 \pi^- p$
275 ± 65	BAUBILLIER	82B	HBC	$8.25 K^- p \rightarrow \bar{K}^0 2\pi n$
500 ± 100	ETKIN	80	MPS	$6 K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$

¹ Using a $K\pi$ S-wave parametrization with resonant and non-resonant contributions.

² From the pole position of the $K\pi$ vector form factor in the complex s -plane and using EPIFANOV 07 data.

³ Systematic uncertainties not estimated.

NODE=M094W;LINKAGE=A
NODE=M094W;LINKAGE=BI

NODE=M094W;LINKAGE=NS

NODE=M094215;NODE=M094

$K^*(1410)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 $K^*(892)\pi$	> 40 %	95%
Γ_2 $K\pi$	(6.6 ± 1.3) %	
Γ_3 $K\rho$	< 7 %	95%
Γ_4 γK^0	$< 2.2 \times 10^{-4}$	90%

DESIG=2

DESIG=1

DESIG=3;OUR EST;→ UNCHECKED ←

DESIG=4

$K^*(1410)$ PARTIAL WIDTHS

$\Gamma(\gamma K^0)$					Γ_4
VALUE (keV)	CL%	DOCUMENT ID	TECN	COMMENT	
<52.9	90	ALAVI-HARATI02B	KTEV	$K + A \rightarrow K^* + A$	

NODE=M094217

NODE=M094W1
NODE=M094W1

$K^*(1410)$ BRANCHING RATIOS

$\Gamma(K\rho)/\Gamma(K^*(892)\pi)$					Γ_3/Γ_1
VALUE	CL%	DOCUMENT ID	TECN	CHG	COMMENT
<0.17	95	ASTON	84	LASS	0 $11 K^- p \rightarrow \bar{K}^0 2\pi n$

NODE=M094220

NODE=M094R1
NODE=M094R1

$\Gamma(K\pi)/\Gamma(K^*(892)\pi)$					Γ_2/Γ_1
VALUE	CL%	DOCUMENT ID	TECN	CHG	COMMENT
<0.16	95	ASTON	84	LASS	0 $11 K^- p \rightarrow \bar{K}^0 2\pi n$

NODE=M094R2
NODE=M094R2

$\Gamma(K\pi)/\Gamma_{\text{total}}$					Γ_2/Γ
VALUE	DOCUMENT ID	TECN	CHG	COMMENT	
$0.066 \pm 0.010 \pm 0.008$	ASTON	88	LASS	0 $11 K^- p \rightarrow K^- \pi^+ n$	

NODE=M094R3
NODE=M094R3

$K^*(1410)$ REFERENCES

AAIJ	16N	PR D93 052018	R. Aaij <i>et al.</i>	(LHCb Collab.)
BOITO	09	EPJ C59 821	D.R. Boito, R. Escribano, M. Jamin	
EPIFANOV	07	PL B654 65	D. Epifanov <i>et al.</i>	(BELLE Collab.)
ALAVI-HARATI	02B	PRL 89 072001	A. Alavi-Harati <i>et al.</i>	(FNAL KTeV Collab.)
BIRD	89	SLAC-332	P.F. Bird	(SLAC)
ASTON	88	NP B296 493	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)
ASTON	87	NP B292 693	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)
ASTON	84	PL 149B 258	D. Aston <i>et al.</i>	(SLAC, CARL, OTTA) JP
BAUBILLIER	82B	NP B202 21	M. Baubillier <i>et al.</i>	(BIRM, CERN, GLAS+)
ETKIN	80	PR D22 42	A. Etkin <i>et al.</i>	(BNL, CUNY) JP

NODE=M094

REFID=57273
REFID=52728
REFID=51929
REFID=48822
REFID=41002
REFID=40262
REFID=40234
REFID=22689
REFID=22551
REFID=22545

$K_0^*(1430)$

$$I(J^P) = \frac{1}{2}(0^+)$$

See our minireview in the 1994 edition and in this edition under the $f_0(500)$.

NODE=M019

NODE=M019

 $K_0^*(1430)$ MASS

NODE=M019M

NODE=M019M
→ UNCHECKED ←

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1425 ±50 OUR ESTIMATE				
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
1438 ± 8 ± 4	5.4k	¹ LEES	14E BABR	$\eta_c(1S) \rightarrow K^+ K^- \eta/\pi^0$
1427 ± 4 ± 13		² BUGG	10 RVUE	S-matrix pole
1466.6 ± 0.7 ± 3.4	141k	³ BONVICINI	08A CLEO	$D^+ \rightarrow K^- \pi^+ \pi^+$
~ 1412		⁴ LINK	07 FOCS	$D^+ \rightarrow K^- K^+ \pi^+$
1461.0 ± 4.0 ± 2.1	54k	⁵ LINK	07B FOCS	$D^+ \rightarrow K^- \pi^+ \pi^+$
1406 ± 29		⁶ BUGG	06 RVUE	
1435 ± 6		⁷ ZHOU	06 RVUE	$K p \rightarrow K^- \pi^+ n$
1455 ± 20 ± 15		ABLIKIM	05Q BES2	$\psi(2S) \rightarrow$ $\gamma \pi^+ \pi^- K^+ K^-$
1456 ± 8		⁸ ZHENG	04 RVUE	$K^- p \rightarrow K^- \pi^+ n$
~ 1419		⁹ BUGG	03 RVUE	$11 K^- p \rightarrow K^- \pi^+ n$
~ 1440		¹⁰ LI	03 RVUE	$11 K^- p \rightarrow K^- \pi^+ n$
1459 ± 9	15k	¹¹ AITALA	02 E791	$D^+ \rightarrow K^- \pi^+ \pi^+$
~ 1440		¹² JAMIN	00 RVUE	$K p \rightarrow K p$
1436 ± 8		¹³ BARBERIS	98E OMEG	$450 p p \rightarrow$ $p_f p_s K^+ K^- \pi^+ \pi^-$
1415 ± 25		⁹ ANISOVICH	97C RVUE	$11 K^- p \rightarrow K^- \pi^+ n$
~ 1450		¹⁴ TORNQVIST	96 RVUE	$\pi \pi \rightarrow \pi \pi, K \bar{K}, K \pi$
1412 ± 6		¹⁵ ASTON	88 LASS	$11 K^- p \rightarrow K^- \pi^+ n$
~ 1430		BAUBILLIER	84B HBC	$8.25 K^- p \rightarrow \bar{K}^0 \pi^- p$
~ 1425		¹⁶ ESTABROOKS	78 ASPK	$13 K^\pm p \rightarrow K^\pm \pi^\pm (n, \Delta)$
~ 1450.0		MARTIN	78 SPEC	$10 K^\pm p \rightarrow K_S^0 p$

¹ Using both $\eta \rightarrow \gamma\gamma$ and $\eta \rightarrow \pi^+ \pi^- \pi^0$. From a likelihood scan in the presence of several interfering scalar-meson resonances with fixed width $\Gamma(K_0^*(1430)) = 210$ MeV.

² S-Matrix pole. Supersedes BUGG 06. Combined analysis of ASTON 88, ABLIKIM 06C, AITALA 06, and LINK 09 using an s-dependent width with couplings to $K\pi$ and $K\eta'$, and the Adler zero near thresholds.

³ From the isobar model with a complex pole for the κ .

⁴ From a non-parametric analysis.

⁵ A Breit-Wigner mass and width.

⁶ S-matrix pole. Reanalysis of ASTON 88, AITALA 02, and ABLIKIM 06C including the κ with an s-dependent width and an Adler zero near threshold.

⁷ S-matrix pole. Using ASTON 88 and assuming $K_0^*(800)$, $K_0^*(1950)$.

⁸ Using ASTON 88 and assuming $K_0^*(800)$.

⁹ T-matrix pole. Reanalysis of ASTON 88 data.

¹⁰ Breit-Wigner fit. Using ASTON 88.

¹¹ Assuming a low-mass scalar $K\pi$ resonance, $\kappa(800)$.

¹² T-matrix pole. Using data from ESTABROOKS 78 and ASTON 88.

¹³ J^P not determined, could be $K_2^*(1430)$.

¹⁴ T-matrix pole.

¹⁵ Uses a model for the background, without this background they get a mass 1340 MeV, where the phase shift passes 90° .

¹⁶ Mass defined by pole position. From elastic $K\pi$ partial-wave analysis.

NODE=M019M;LINKAGE=LE

NODE=M019M;LINKAGE=BG

NODE=M019M;LINKAGE=BO

NODE=M019M;LINKAGE=LI

NODE=M019M;LINKAGE=BW

NODE=M019M;LINKAGE=BU

NODE=M019M;LINKAGE=ZU

NODE=M019M;LINKAGE=ZH

NODE=M019M;LINKAGE=A1

NODE=M019M;LINKAGE=E

NODE=M019M;LINKAGE=A0

NODE=M019M;LINKAGE=JM

NODE=M019M;LINKAGE=JP

NODE=M019M;LINKAGE=TT

NODE=M019M;LINKAGE=D

NODE=M019M;LINKAGE=A

 $K_0^*(1430)$ WIDTH

NODE=M019W

NODE=M019W
→ UNCHECKED ←

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
270 ±80 OUR ESTIMATE				

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

210 ±20 ±12 5.4k	¹ LEES	14E BABR	$\eta_c(1S) \rightarrow K^+ K^- \eta/\pi^0$
270 ±10 ±40	² BUGG	10 RVUE	S-matrix pole
174.2± 1.9± 3.2 141k	³ BONVICINI	08A CLEO	$D^+ \rightarrow K^- \pi^+ \pi^+$
~ 500	⁴ LINK	07 FOCS	$D^+ \rightarrow K^- K^+ \pi^+$
177.0± 8.0± 3.4 54k	⁵ LINK	07B FOCS	$D^+ \rightarrow K^- \pi^+ \pi^+$
350 ±40	⁶ BUGG	06 RVUE	
288 ±22	⁷ ZHOU	06 RVUE	$K p \rightarrow K^- \pi^+ n$
270 ±45 ⁺³⁰ ₋₃₅	ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$
217 ±31	⁸ ZHENG	04 RVUE	$K^- p \rightarrow K^- \pi^+ n$
~ 316	⁹ BUGG	03 RVUE	$11 K^- p \rightarrow K^- \pi^+ n$
~ 350	¹⁰ LI	03 RVUE	$11 K^- p \rightarrow K^- \pi^+ n$
175 ±17 15k	¹¹ AITALA	02 E791	$D^+ \rightarrow K^- \pi^+ \pi^+$
~ 300	¹² JAMIN	00 RVUE	$K p \rightarrow K p$
196 ±45	¹³ BARBERIS	98E OMEG	$450 p p \rightarrow$ $p_f p_s K^+ K^- \pi^+ \pi^-$
330 ±50	⁹ ANISOVICH	97C RVUE	$11 K^- p \rightarrow K^- \pi^+ n$
~ 320	¹⁴ TORNQVIST	96 RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}, K\pi$
294 ±23	ASTON	88 LASS	$11 K^- p \rightarrow K^- \pi^+ n$
~ 200	BAUBILLIER	84B HBC	$8.25 K^- p \rightarrow \bar{K}^0 \pi^- p$
200 to 300	¹⁵ ESTABROOKS	78 ASPK	$13 K^\pm p \rightarrow K^\pm \pi^\pm (n, \Delta)$

¹ Using both $\eta \rightarrow \gamma\gamma$ and $\eta \rightarrow \pi^+ \pi^- \pi^0$. From a likelihood scan in the presence of several interfering scalar-meson resonances with fixed mass $M(K_0^*(1430)) = 1435$ MeV.

² S-Matrix pole. Supersedes BUGG 06. Combined analysis of ASTON 88, ABLIKIM 06C, AITALA 06, and LINK 09 using an s-dependent width with couplings to $K\pi$ and $K\eta'$, and the Adler zero near thresholds.

³ From the isobar model with a complex pole for the κ .

⁴ From a non-parametric analysis.

⁵ A Breit-Wigner mass and width.

⁶ S-matrix pole. Reanalysis of ASTON 88, AITALA 02, and ABLIKIM 06C including the κ with an s-dependent width and an Adler zero near threshold.

⁷ S-matrix pole. Using ASTON 88 and assuming $K_0^*(800)$, $K_0^*(1950)$.

⁸ Using ASTON 88 and assuming $K_0^*(800)$.

⁹ T-matrix pole. Reanalysis of ASTON 88 data.

¹⁰ Breit-Wigner fit. Using ASTON 88.

¹¹ Assuming a low-mass scalar $K\pi$ resonance, $\kappa(800)$.

¹² T-matrix pole. Using data from ESTABROOKS 78 and ASTON 88.

¹³ J^P not determined, could be $K_2^*(1430)$.

¹⁴ T-matrix pole.

¹⁵ From elastic $K\pi$ partial-wave analysis.

NODE=M019W;LINKAGE=LE

NODE=M019W;LINKAGE=BG

NODE=M019W;LINKAGE=BO
NODE=M019W;LINKAGE=LI
NODE=M019W;LINKAGE=BW
NODE=M019W;LINKAGE=BU

NODE=M019W;LINKAGE=ZU
NODE=M019W;LINKAGE=ZH
NODE=M019W;LINKAGE=A1
NODE=M019W;LINKAGE=E
NODE=M019W;LINKAGE=A0
NODE=M019W;LINKAGE=JM
NODE=M019W;LINKAGE=JP
NODE=M019W;LINKAGE=TT
NODE=M019W;LINKAGE=C

$K_0^*(1430)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $K\pi$	(93 ±10) %
Γ_2 $K\eta$	(8.6 ⁺ ₋ 2.7 ⁺ _{3.4}) %
Γ_3 $K\eta'(958)$	seen

NODE=M019215;NODE=M019

DESIG=1

DESIG=2

DESIG=3

$K_0^*(1430)$ BRANCHING RATIOS

$\Gamma(K\pi)/\Gamma_{\text{total}}$	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=M019220

NODE=M019R1
NODE=M019R1

$\Gamma(K\eta)/\Gamma(K\pi)$	Γ_2/Γ_1
VALUE (%)	EVTS DOCUMENT ID TECN COMMENT
9.2±2.5⁺_{-2.5}	5.4k ¹ LEES 14E BABR $\eta_c(1S) \rightarrow K^+ K^- \eta/\pi^0$

NODE=M019R01
NODE=M019R01

¹ Using both $\eta \rightarrow \gamma\gamma$ and $\eta \rightarrow \pi^+ \pi^- \pi^0$. From a Dalitz analysis in the presence of several interfering scalar-meson resonances.

NODE=M019R01;LINKAGE=LE

$\Gamma(K\eta'(958))/\Gamma_{\text{total}}$	Γ_3/Γ
VALUE	DOCUMENT ID TECN COMMENT
seen	ABLIKIM 14J BES3 $\psi(2S) \rightarrow \gamma K^+ K^- \eta'(958)$

NODE=M019R00
NODE=M019R00

$K_0^*(1430)$ REFERENCES

ABLIKIM	14J	PR D89 074030	M. Ablikim <i>et al.</i>	(BES III Collab.)
LEES	14E	PR D89 112004	J.P. Lees <i>et al.</i>	(BABAR Collab.)
BUGG	10	PR D81 014002	D.V. Bugg	(LOQM)
LINK	09	PL B681 14	J.M. Link <i>et al.</i>	(FNAL FOCUS Collab.)
BONVICINI	08A	PR D78 052001	G. Bonvicini <i>et al.</i>	(CLEO Collab.)
LINK	07	PL B648 156	J.M. Link <i>et al.</i>	(FNAL FOCUS Collab.)
LINK	07B	PL B653 1	J.M. Link <i>et al.</i>	(FNAL FOCUS Collab.)
ABLIKIM	06C	PL B633 681	M. Ablikim <i>et al.</i>	(BES Collab.)
AITALA	06	PR D73 032004	E.M. Aitala <i>et al.</i>	(FNAL E791 Collab.)
Also		PR D74 059901 (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)

NODE=M019

REFID=55901
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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 $K^- p \rightarrow \bar{K}^0 \pi^- p$

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

1423.4 ± 2 ± 3	24809 ± 820	⁴ BIRD 89	LASS	—	11 $K^- p \rightarrow \bar{K}^0 \pi^- p$

OCCUR=2

OCCUR=3

OCCUR=2

OCCUR=2

NEUTRAL ONLY

NODE=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 $K^- p$

NODE=M022W1
NODE=M022W1

OCCUR=2

OCCUR=3

OCCUR=2

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

98 ± 4 ± 4	25k	¹⁰ BIRD	89 LASS	-	11 $K^- p \rightarrow \bar{K}^0 \pi^- p$

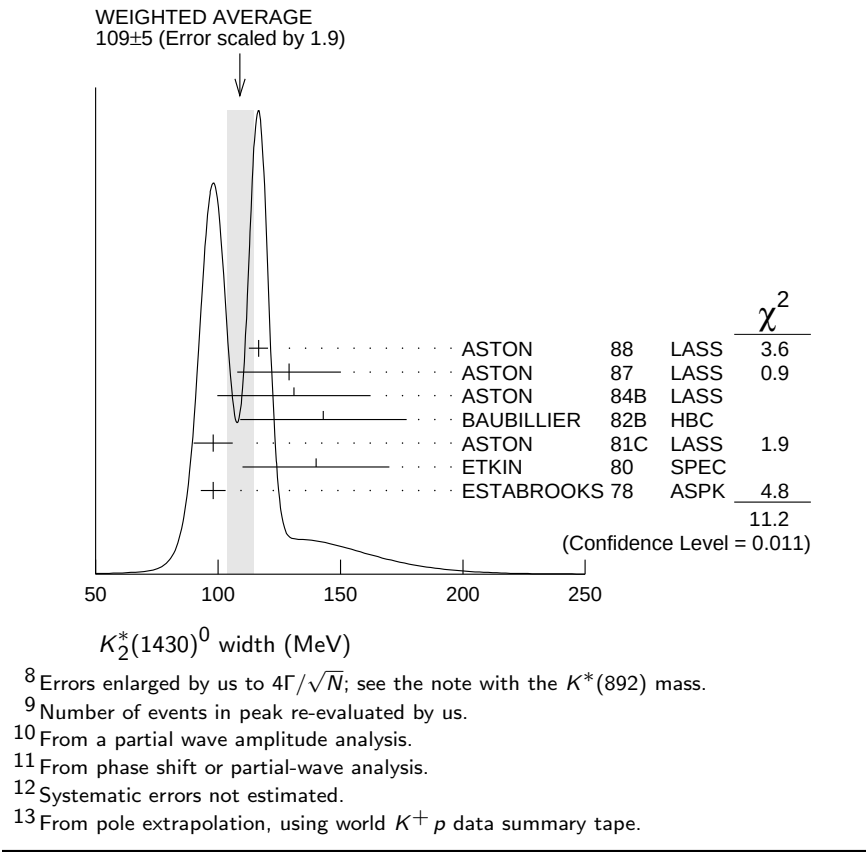
NEUTRAL ONLY

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 $K^\pm p \rightarrow pK\pi$

NODE=M022W4
NODE=M022W4

• • • 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=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	$K\pi$	$(49.9\pm1.2)\%$	
Γ_2	$K^*(892)\pi$	$(24.7\pm1.5)\%$	
Γ_3	$K^*(892)\pi\pi$	$(13.4\pm2.2)\%$	
Γ_4	$K\rho$	$(8.7\pm0.8)\%$	S=1.2
Γ_5	$K\omega$	$(2.9\pm0.8)\%$	
Γ_6	$K^+\gamma$	$(2.4\pm0.5)\times10^{-3}$	S=1.1
Γ_7	$K\eta$	$(1.5^{+3.4}_{-1.0})\times10^{-3}$	S=1.3
Γ_8	$K\omega\pi$	$<7.2\times10^{-4}$	CL=95%
Γ_9	$K^0\gamma$	$<9\times10^{-4}$	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

$K_2^*(1430)$ 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

$K_2^*(1430)$ BRANCHING RATIOS

NODE=M022225

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

Γ_1/Γ

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
0.499 ± 0.012 OUR FIT				
0.488 ± 0.014 OUR AVERAGE				
$0.485 \pm 0.006 \pm 0.020$	¹⁴ ASTON	88	LASS	0
0.49 ± 0.02	¹⁴ ESTABROOKS	78	ASPK	$\pm$
				11 $K^- p \rightarrow K^- \pi^+ n$ 13 $K^\pm p \rightarrow p K \pi$

NODE=M022R1
NODE=M022R1

$\Gamma(K^*(892)\pi)/\Gamma(K\pi)$

Γ_2/Γ_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
0.62 ± 0.19	LAUSCHER	75	HBC	0
0.54 ± 0.16	DEHM	74	DBC	0
0.47 ± 0.08	AGUILAR-...	71B	HBC	
0.47 ± 0.10	BASSANO	67	HBC	−0
0.45 ± 0.13	BADIER	65C	HBC	−
				11 $K^- p \rightarrow \bar{K}^0 2\pi n$ 10,16 $K^- p \rightarrow K^- \pi^+ n$ 4.6 $K^+ N$ 3.9,4.6 $K^- p$ 4.6,5.0 $K^- p$ 3 $K^- p$

NODE=M022R4
NODE=M022R4

$\Gamma(K\omega)/\Gamma(K\pi)$ Γ_5/Γ_1 NODE=M022R5
NODE=M022R5

VALUE	DOCUMENT ID	TECN	CHG	COMMENT

0.059±0.017 OUR FIT**0.070±0.035 OUR AVERAGE**

0.05 ±0.04	AGUILAR-...	71B	HBC	3.9,4.6 $K^- p$
0.13 ±0.07	BASSOMPIE...	69	HBC	0 5 $K^+ p$

OCCUR=2

 $\Gamma(K\rho)/\Gamma(K\pi)$ Γ_4/Γ_1 NODE=M022R6
NODE=M022R6

VALUE	DOCUMENT ID	TECN	CHG	COMMENT

0.174±0.017 OUR FIT Error includes scale factor of 1.2.**0.150^{+0.029}_{-0.017} OUR AVERAGE**

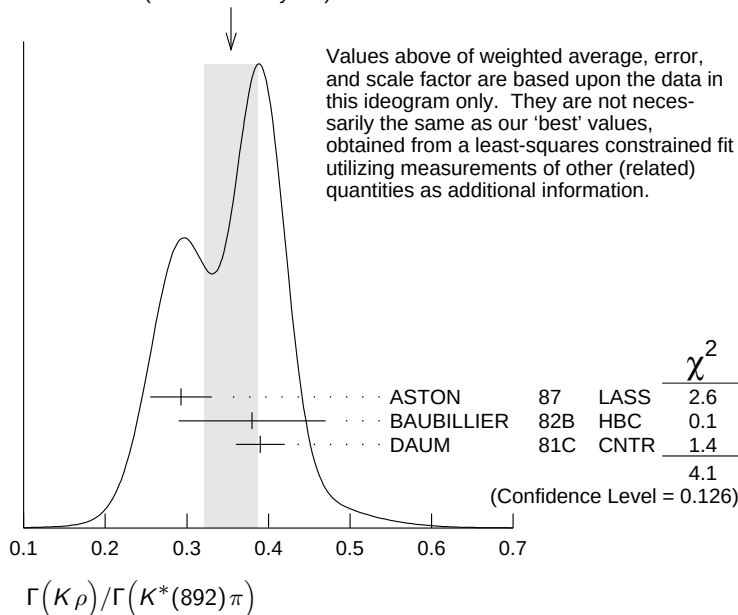
0.18 ±0.05	ASTON	84B	LASS	0 11 $K^- p \rightarrow \bar{K}^0 2\pi n$
0.02 ^{+0.10} _{-0.02}	DEHM	74	DBC	0 4.6 $K^+ N$
0.16 ±0.05	AGUILAR-...	71B	HBC	3.9,4.6 $K^- p$
0.14 ±0.10	BASSANO	67	HBC	-0 4.6,5.0 $K^- p$
0.14 ±0.07	BADIER	65C	HBC	- 3 $K^- p$

 $\Gamma(K\rho)/\Gamma(K^*(892)\pi)$ Γ_4/Γ_2 NODE=M022R7
NODE=M022R7

VALUE	DOCUMENT ID	TECN	CHG	COMMENT

0.350±0.031 OUR FIT Error includes scale factor of 1.4.**0.354±0.033 OUR AVERAGE** Error includes scale factor of 1.4. See the ideogram below.

0.293±0.032±0.020	ASTON	87	LASS	0 11 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$
0.38 ±0.09	BAUBILLIER	82B	HBC	0 8.25 $K^- p \rightarrow N K_S^0 \pi \pi$
0.39 ±0.03	DAUM	81C	CNTR	63 $K^- p \rightarrow K^- 2\pi p$

WEIGHTED AVERAGE
0.354±0.033 (Error scaled by 1.4) $\Gamma(K\omega)/\Gamma(K^*(892)\pi)$ Γ_5/Γ_2 NODE=M022R8
NODE=M022R8

VALUE	DOCUMENT ID	TECN	CHG	COMMENT

0.118±0.034 OUR FIT**0.10 ±0.04** FIELD 67 HBC - 3.8 $K^- p$ $\Gamma(K\eta)/\Gamma(K^*(892)\pi)$ Γ_7/Γ_2 NODE=M022R9
NODE=M022R9

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 $K^- p$ $\Gamma(K\eta)/\Gamma(K\pi)$ Γ_7/Γ_1 NODE=M022R10
NODE=M022R10

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 $K^+ p$

$\Gamma(K^*(892)\pi\pi)/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE	DOCUMENT ID	TECN	CHG	COMMENT

0.134±0.022 OUR FIT

0.12 ±0.04 ¹⁷ GOLDBERG 76 HBC — 3 $K^- p \rightarrow p \bar{K}^0 \pi \pi$

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 $K^- p \rightarrow p \bar{K}^0 \pi \pi$

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

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) JP	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, NIJM+)	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

NODE=M022

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.

NODE=M160

NODE=M160

 $K(1630)$ MASS

NODE=M160M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1629 ± 7	~ 75	KARNAUKHOV98	BC	$16.0 \pi^- p \rightarrow (K_S^0 \pi^+ \pi^-) X^+ \pi^- X^0$

NODE=M160M

 $K(1630)$ WIDTH

NODE=M160W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
16^{+19}_{-16}	~ 75	¹ KARNAUKHOV98	BC	$16.0 \pi^- p \rightarrow (K_S^0 \pi^+ \pi^-) X^+ \pi^- X^0$

NODE=M160W

¹ Compatible with an experimental resolution of 14 ± 1 MeV.

NODE=M160W;LINKAGE=A

 $K(1630)$ DECAY MODES

NODE=M160215;NODE=M160

Mode
$\Gamma_1 \quad K_S^0 \pi^+ \pi^-$

DESIG=1

 $K(1630)$ REFERENCES

KARNAUKHOV 98 PAN 61 203 V.M. Karnaukhov, C. Coca, V.I. Moroz
Translated from YAF 61 252.

NODE=M160

REFID=46371

NODE=M099

 $K_1(1650)$

$$I(J^P) = \frac{1}{2}(1^+)$$

OMITTED FROM SUMMARY TABLE

This entry contains various peaks in strange meson systems ($K^+ \phi$, $K \pi \pi$) reported in partial-wave analysis in the 1600–1900 mass region.

NODE=M099

 $K_1(1650)$ MASS

NODE=M099M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
1672 ± 50 OUR AVERAGE		Error includes scale factor of 1.1.			$[1650 \pm 50 \text{ MeV OUR 2016 AVERAGE}]$
$1793 \pm 59^{+153}_{-101}$	4289	¹ AAIJ	17C	LHCB	$B^+ \rightarrow J/\psi \phi K^+$
1650 ± 50		FRAME	86	OMEG +	$13 K^+ p \rightarrow \phi K^+ p$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
~ 1840		ARMSTRONG	83	OMEG -	$18.5 K^- p \rightarrow 3 K p$
~ 1800		DAUM	81C	CNTR -	$63 K^- p \rightarrow K^- 2\pi p$

¹ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 7.6σ .

NODE=M099M;LINKAGE=A

 $K_1(1650)$ WIDTH

NODE=M099W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
158 ± 50 OUR AVERAGE					$[150 \pm 50 \text{ MeV OUR 2016 AVERAGE}]$
$365 \pm 157^{+138}_{-215}$	4289	² AAIJ	17C	LHCB	$B^+ \rightarrow J/\psi \phi K^+$
150 ± 50		FRAME	86	OMEG +	$13 K^+ p \rightarrow \phi K^+ p$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
~ 250		DAUM	81C	CNTR -	$63 K^- p \rightarrow K^- 2\pi p$

² From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 7.6σ .

NODE=M099W;LINKAGE=A

$K_1(1650)$ DECAY MODES

NODE=M099215;NODE=M099

Mode	
Γ_1	$K\pi\pi$
Γ_2	$K\phi$

DESIG=1

DESIG=2

 $K_1(1650)$ REFERENCES

AAIJ	17C	PRL 118 022003	R. Aaij <i>et al.</i>	(LHCb Collab.)
Also		PR D95 012002	R. Aaij <i>et al.</i>	(LHCb Collab.)
FRAME	86	NP B276 667	D. Frame <i>et al.</i>	(GLAS)
ARMSTRONG	83	NP B221 1	T.A. Armstrong <i>et al.</i>	(BARI, BIRM, CERN+)
DAUM	81C	NP B187 1	C. Daum <i>et al.</i>	(AMST, CERN, CRAC, MPIM+)

NODE=M099

 REFID=57657
 REFID=57636
 REFID=20569
 REFID=22801
 REFID=22548

NODE=M095

 $K^*(1680)$

$$I(J^P) = \frac{1}{2}(1^-)$$

 $K^*(1680)$ MASS

NODE=M095M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
1718±18 OUR AVERAGE					
[1717 ± 27 MeV OUR 2016 AVERAGE Scale factor = 1.4]					
1722±20 ⁺³³ ₋₁₀₉	4289	¹ AAIJ	17C	LHCB	$B^+ \rightarrow J/\psi \phi K^+$
1677±10±32		ASTON	88	LASS	0 11 $K^- p \rightarrow K^- \pi^+ n$
1735±10±20		ASTON	87	LASS	0 11 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1678±64		BIRD	89	LASS	- 11 $K^- p \rightarrow \bar{K}^0 \pi^- p$
1800±70		ETKIN	80	MPS	0 6 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$
~ 1650		ESTABROOKS	78	ASPK	0 13 $K^\pm p \rightarrow K^\pm \pi^\pm n$

¹ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 8.5 σ .

NODE=M095M;LINKAGE=A

 $K^*(1680)$ WIDTH

NODE=M095W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
322±110 OUR AVERAGE					
Error includes scale factor of 4.2.					
354±75 ⁺¹⁴⁰ ₋₁₈₁	4289	² AAIJ	17C	LHCB	$B^+ \rightarrow J/\psi \phi K^+$
205±16±34		ASTON	88	LASS	0 11 $K^- p \rightarrow K^- \pi^+ n$
423±18±30		ASTON	87	LASS	0 11 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
454±270		BIRD	89	LASS	- 11 $K^- p \rightarrow \bar{K}^0 \pi^- p$
170±30		ETKIN	80	MPS	0 6 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$
250 to 300		ESTABROOKS	78	ASPK	0 13 $K^\pm p \rightarrow K^\pm \pi^\pm n$

² From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 8.5 σ .

NODE=M095W;LINKAGE=A

 $K^*(1680)$ DECAY MODES

NODE=M095215;NODE=M095

Mode	Fraction (Γ_i/Γ)
Γ_1	$K\pi$
Γ_2	$K\rho$
Γ_3	$K^*(892)\pi$
Γ_4	$K\phi$

DESIG=1

DESIG=3

DESIG=2

DESIG=4

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

x_2	−36	
x_3	−39	−72
	x_1	x_2

$K^*(1680)$ BRANCHING RATIOS

NODE=M095220

$\Gamma(K\pi)/\Gamma_{\text{total}}$						Γ_1/Γ
VALUE	DOCUMENT ID	TECN	CHG	COMMENT		
0.387 ± 0.026 OUR FIT						
$0.388 \pm 0.014 \pm 0.022$	ASTON	88	LASS	0	11 $K^- p \rightarrow K^- \pi^+ n$	

NODE=M095R4
NODE=M095R4

$\Gamma(K\pi)/\Gamma(K^*(892)\pi)$						Γ_1/Γ_3
VALUE	DOCUMENT ID	TECN	CHG	COMMENT		
$1.30^{+0.23}_{-0.14}$ OUR FIT						
2.8 ± 1.1	ASTON	84	LASS	0	11 $K^- p \rightarrow \bar{K}^0 2\pi n$	

NODE=M095R2
NODE=M095R2

$\Gamma(K\rho)/\Gamma(K\pi)$						Γ_2/Γ_1
VALUE	DOCUMENT ID	TECN	CHG	COMMENT		
$0.81^{+0.14}_{-0.09}$ OUR FIT						
1.2 ± 0.4	ASTON	84	LASS	0	11 $K^- p \rightarrow \bar{K}^0 2\pi n$	

NODE=M095R3
NODE=M095R3

$\Gamma(K\rho)/\Gamma(K^*(892)\pi)$						Γ_2/Γ_3
VALUE	DOCUMENT ID	TECN	CHG	COMMENT		
$1.05^{+0.27}_{-0.11}$ OUR FIT						
$0.97 \pm 0.09^{+0.30}_{-0.10}$	ASTON	87	LASS	0	11 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$	

NODE=M095R1
NODE=M095R1

$\Gamma(K\phi)/\Gamma_{\text{total}}$						Γ_4/Γ
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT		
seen	4289	³ AAIJ	17C	LHCB	$B^+ \rightarrow J/\psi \phi K^+$	

NODE=M095R00
NODE=M095R00

³ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 8.5σ .

NODE=M095R00;LINKAGE=A

$K^*(1680)$ REFERENCES

NODE=M095

AAIJ	17C	PRL 118 022003	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=57657
Also		PR D95 012002	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=57636
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	87	NP B292 693	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)	REFID=40234
ASTON	84	PL 149B 258	D. Aston <i>et al.</i>	(SLAC, CARL, OTTA) JP	REFID=22689
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+) JP	REFID=22443

$K_2(1770)$

$$I(J^P) = \frac{1}{2}(2^-)$$

See our mini-review in the 2004 edition of this *Review*, PDG 04.

NODE=M023

NODE=M023

NODE=M023M

NODE=M023M

 $K_2(1770)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
1773± 8 OUR AVERAGE					
$1777 \pm 35^{+122}_{-77}$	4289	¹ AAIJ	17C	LHCB	$B^+ \rightarrow J/\psi \phi K^+$
1773 ± 8		² 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 -		$18.5 K^- p \rightarrow 3 K p$
~ 1780		³ DAUM 81C	CNTR -		$63 K^- p \rightarrow K^- 2\pi p$
1710 ± 15	60	CHUNG 74	HBC -		$7.3 K^- p \rightarrow K^- \omega p$
1767 ± 6		BLIEDEN 72	MMS -		$11-16 K^- p$
1730 ± 20	306	⁴ FIRESTONE 72B	DBC +		$12 K^+ d$
1765 ± 40		⁵ COLLEY 71	HBC +		$10 K^+ p \rightarrow K 2\pi N$
1740		DENEGRI 71	DBC -		$12.6 K^- d \rightarrow \bar{K} 2\pi d$
1745 ± 20		AGUILAR-...	70C HBC -		$4.6 K^- p$
1780 ± 15		BARTSCH 70C	HBC -		$10.1 K^- p$
1760 ± 15		LUDLAM 70	HBC -		$12.6 K^- p$

¹ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 5.0 σ .² From a partial wave analysis of the $K^- \omega$ system.³ From a partial wave analysis of the $K^- 2\pi$ system.⁴ Produced in conjunction with excited deuteron.⁵ Systematic errors added correspond to spread of different fits.

NODE=M023M;LINKAGE=C
 NODE=M023M;LINKAGE=A
 NODE=M023M;LINKAGE=B
 NODE=M023M;LINKAGE=P
 NODE=M023M;LINKAGE=X

 $K_2(1770)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
186± 14 OUR AVERAGE					
$217 \pm 116^{+221}_{-154}$	4289	⁶ AAIJ	17C	LHCB	$B^+ \rightarrow J/\psi \phi K^+$
186 ± 14		⁷ ASTON	93	LASS	$11 K^- p \rightarrow K^- \omega p$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
147 ± 70		TIKHOMIROV 03	SPEC		$40.0 \pi^- C \rightarrow K_S^0 K_S^0 K_L^0 X$
140 ± 40		FRAME 86	OMEG +		$13 K^+ p \rightarrow \phi K^+ p$
~ 220		ARMSTRONG 83	OMEG -		$18.5 K^- p \rightarrow 3 K p$
~ 210		⁸ DAUM 81C	CNTR -		$63 K^- p \rightarrow K^- 2\pi p$
110 ± 50	60	CHUNG 74	HBC -		$7.3 K^- p \rightarrow K^- \omega p$
100 ± 26		BLIEDEN 72	MMS -		$11-16 K^- p$
210 ± 30	306	⁹ FIRESTONE 72B	DBC +		$12 K^+ d$
90 ± 70		¹⁰ COLLEY 71	HBC +		$10 K^+ p \rightarrow K 2\pi N$
130		DENEGRI 71	DBC -		$12.6 K^- d \rightarrow \bar{K} 2\pi d$
100 ± 50		AGUILAR-...	70C HBC -		$4.6 K^- p$
138 ± 40		BARTSCH 70C	HBC -		$10.1 K^- p$
50^{+40}_{-20}		LUDLAM 70	HBC -		$12.6 K^- p$

⁶ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 5.0 σ .⁷ From a partial wave analysis of the $K^- \omega$ system.⁸ From a partial wave analysis of the $K^- 2\pi$ system.⁹ Produced in conjunction with excited deuteron.¹⁰ Systematic errors added correspond to spread of different fits.

NODE=M023W

NODE=M023W

NODE=M023W;LINKAGE=A
 NODE=M023W;LINKAGE=B
 NODE=M023W;LINKAGE=C
 NODE=M023W;LINKAGE=P
 NODE=M023W;LINKAGE=X

$K_2(1770)$ DECAY MODES

NODE=M023215;NODE=M023

Mode	Fraction (Γ_i/Γ)
Γ_1 $K\pi\pi$	
Γ_2 $K_2^*(1430)\pi$	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

DESIG=1;OUR EST;→ UNCHECKED ←
 DESIG=2;OUR EST;→ UNCHECKED ←
 DESIG=4;OUR EST;→ UNCHECKED ←
 DESIG=9;OUR EST;→ UNCHECKED ←
 DESIG=11
 DESIG=10
 DESIG=8

 $K_2(1770)$ BRANCHING RATIOS

NODE=M023220

$\Gamma(K_2^*(1430)\pi)/\Gamma(K\pi\pi)$ **Γ_2/Γ_1**
 $(K_2^*(1430) \rightarrow K\pi)$

NODE=M023R1

NODE=M023R1

NODE=M023R1

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
~ 0.03	DAUM	81C	CNTR	63 $K^- p \rightarrow K^- 2\pi p$
~ 1.0	¹¹ FIRESTONE	72B	DBC	+ 12 $K^+ d$
< 1.0	COLLEY	71	HBC	10 $K^+ p$
0.2 ± 0.2	AGUILAR-...	70C	HBC	- 4.6 $K^- p$
< 1.0	BARTSCH	70C	HBC	- 10.1 $K^- p$
1.0	BARBARO-...	69	HBC	+ 12.0 $K^+ p$

¹¹ Produced in conjunction with excited deuteron.

NODE=M023R1;LINKAGE=P

$\Gamma(K^*(892)\pi)/\Gamma(K\pi\pi)$ **Γ_3/Γ_1**

NODE=M023R3

NODE=M023R3

VALUE	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
~ 0.23	DAUM	81C	CNTR 63 $K^- p \rightarrow K^- 2\pi p$

$\Gamma(K f_2(1270))/\Gamma(K\pi\pi)$ **Γ_4/Γ_1**
 $(f_2(1270) \rightarrow \pi\pi)$

NODE=M023R4

NODE=M023R4

NODE=M023R4

VALUE	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
~ 0.74	DAUM	81C	CNTR 63 $K^- p \rightarrow K^- 2\pi p$

$\Gamma(K f_0(980))/\Gamma_{\text{total}}$ **Γ_5/Γ**

NODE=M023R6

NODE=M023R6

VALUE	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
possibly seen	TIKHOMIROV	03	SPEC 40.0 $\pi^- C \rightarrow K_S^0 K_S^0 K_L^0 X$

$\Gamma(K\phi)/\Gamma_{\text{total}}$ **Γ_6/Γ**

NODE=M023R5

NODE=M023R5

VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
seen	4289	¹² AAIJ	17C	LHCB	$B^+ \rightarrow J/\psi \phi K^+$
seen		ARMSTRONG	83	OMEG	- 18.5 $K^- p \rightarrow K^- \phi N$

¹² From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 5.0 σ .

NODE=M023R5;LINKAGE=A

$\Gamma(K\omega)/\Gamma_{\text{total}}$ **Γ_7/Γ**

NODE=M023R2

NODE=M023R2

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
seen	OTTER	81	HBC	$\pm$ 8.25,10,16 $K^\pm p$
seen	CHUNG	74	HBC	- 7.3 $K^- p \rightarrow K^- \omega p$

 $K_2(1770)$ REFERENCES

NODE=M023

AAIJ	17C	PRL 118 022003	R. Aaij <i>et al.</i>	(LHCb Collab.)
Also		PR D95 012002	R. Aaij <i>et al.</i>	(LHCb Collab.)
PDG	04	PL B592 1	S. Eidelman <i>et al.</i>	(PDG Collab.)
TIKHOMIROV	03	PAN 66 828	G.D. Tikhomirov <i>et al.</i>	
ASTON	93	PL B308 186	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)
FRAME	86	NP B276 667	D. Frame <i>et al.</i>	(GLAS)
ARMSTRONG	83	NP B221 1	T.A. Armstrong <i>et al.</i>	(BARI, BIRM, CERN+)
DAUM	81C	NP B187 1	C. Daum <i>et al.</i>	(AMST, CERN, CRAC, MPIM+)
OTTER	81	NP B181 1	G. Otter	(AACH3, BERL, LOIC, VIEN, BIRM+)
CHUNG	74	PL 51B 413	S.U. Chung <i>et al.</i>	(BNL)
BLIEDEN	72	PL 39B 668	H.R. Blieden <i>et al.</i>	(STON, NEAS)
FIRESTONE	72B	PR D5 505	A. Firestone <i>et al.</i>	(LBL)
COLLEY	71	NP B26 71	D.C. Colley <i>et al.</i>	(BIRM, GLAS)
DENEGRI	71	NP B28 13	D. Denegri <i>et al.</i>	(JHU) JP
AGUILAR-...	70C	PRL 25 54	M. Aguilar-Benitez <i>et al.</i>	(BNL)
BARTSCH	70C	PL 33B 186	J. Bartsch <i>et al.</i>	(AACH, BERL, CERN+)
LUDLAM	70	PR D2 1234	T. Ludlam, J. Sandweiss, A.J. Slaughter	(YALE)
BARBARO-...	69	PRL 22 1207	A. Barbaro-Galtieri <i>et al.</i>	(LRL)

REFID=57657

REFID=57636

REFID=49653

REFID=49423

REFID=43597

REFID=20569

REFID=22801

REFID=22548

REFID=22549

REFID=22735

REFID=22788

REFID=22506

REFID=22785

REFID=22497

REFID=22782

REFID=22783

REFID=22784

REFID=22483

$K_3^*(1780)$

$$I(J^P) = \frac{1}{2}(3^-)$$

NODE=M060

 $K_3^*(1780)$ MASS

NODE=M060M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT	
1776± 7 OUR AVERAGE Error includes scale factor of 1.1.						
1781± 8± 4		¹ ASTON	88	LASS	0 11 $K^- p \rightarrow K^- \pi^+ n$	
1740± 14± 15		¹ ASTON	87	LASS	0 11 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$	
1779± 11		² BALDI	76	SPEC	+ 10 $K^+ p \rightarrow K^0 \pi^+ p$	
1776± 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± 10± 15	6111	⁴ BIRD	89	LASS	— 11 $K^- p \rightarrow \bar{K}^0 \pi^- p$	
1749± 10		ASTON	88B	LASS	— 11 $K^- p \rightarrow K^- \eta p$	
1780± 9	300	BAUBILLIER	84B	HBC	— 8.25 $K^- p \rightarrow \bar{K}^0 \pi^- p$	
1790± 15		BAUBILLIER	82B	HBC	0 8.25 $K^- p \rightarrow K_S^0 2\pi N$	
1784± 9	2060	CLELAND	82	SPEC	± 50 $K^+ p \rightarrow K_S^0 \pi^\pm p$	
1786± 15		⁵ ASTON	81D	LASS	0 11 $K^- p \rightarrow K^- \pi^+ n$	
1762± 9	190	TOAFF	81	HBC	— 6.5 $K^- p \rightarrow \bar{K}^0 \pi^- p$	
1850± 50		ETKIN	80	MPS	0 6 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^-$	
1812± 28		BEUSCH	78	OMEG		10 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$
1786± 8		CHUNG	78	MPS	0 6 $K^- p \rightarrow K^- \pi^+ n$	

¹ 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

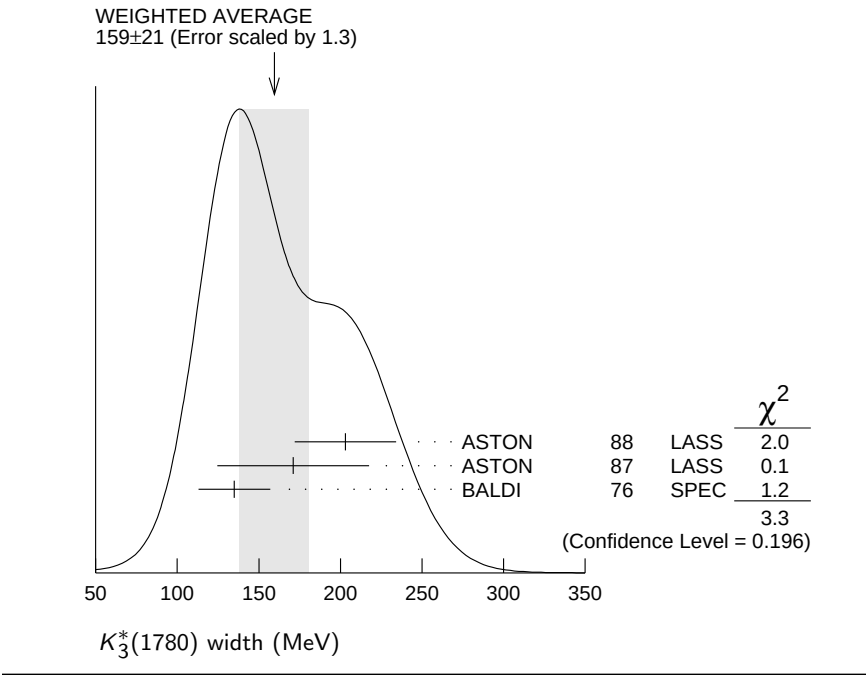
NODE=M060W

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 $K^\pm p \rightarrow K^\pm \pi^\mp N$

NODE=M060W

- 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 %	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 $K^- p \rightarrow K^- \eta p$

¹² This result supersedes ASTON 88B.

NODE=M060R8
 NODE=M060R8

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)
ASTON	88	NP B296 493	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)
ASTON	88B	PL B201 169	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS) JP
ASTON	87	NP B292 693	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)
ASTON	84B	NP B247 261	D. Aston <i>et al.</i>	(SLAC, CARL, OTTA)
BAUBILLIER	84B	ZPHY C26 37	M. Baubillier <i>et al.</i>	(BIRM, CERN, GLAS+)
BAUBILLIER	82B	NP B202 21	M. Baubillier <i>et al.</i>	(BIRM, CERN, GLAS+)
CLELAND	82	NP B208 189	W.E. Cleland <i>et al.</i>	(DURH, GEVA, LAUS+)
ASTON	81D	PL 99B 502	D. Aston <i>et al.</i>	(SLAC, CARL, OTTA) JP
TOAFF	81	PR D23 1500	S. Toaff <i>et al.</i>	(ANL, KANS)
ETKIN	80	PR D22 42	A. Etkin <i>et al.</i>	(BNL, CUNY) JP
BEUSCH	78	PL 74B 282	W. Beusch <i>et al.</i>	(CERN, AACH3, ETH) JP
CHUNG	78	PRL 40 355	S.U. Chung <i>et al.</i>	(BNL, BRAN, CUNY+) JP
ESTABROOKS	78	NP B133 490	P.G. Estabrooks <i>et al.</i>	(MCGI, CARL, DURH+) JP
Also		PR D17 658	P.G. Estabrooks <i>et al.</i>	(MCGI, CARL, DURH+)
BALDI	76	PL 63B 344	R. Baldi <i>et al.</i>	(GEVA) JP
BRANDENB...	76D	PL 60B 478	G.W. Brandenburg <i>et al.</i>	(SLAC) JP

REFID=41002
 REFID=40262
 REFID=40281
 REFID=40281
 REFID=40234
 REFID=22763
 REFID=22459
 REFID=22551
 REFID=22455
 REFID=22820
 REFID=22454
 REFID=22545
 REFID=22537
 REFID=22814
 REFID=22443
 REFID=22444
 REFID=22807
 REFID=22808

$K_2(1820)$

$$I(J^P) = \frac{1}{2}(2^-)$$

See our mini-review in the 2004 edition of this *Review* (PDG 04) under $K_2(1770)$.

NODE=M146

NODE=M146

 $K_2(1820)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1819±12 OUR AVERAGE				
[1816 ± 13 MeV OUR 2016 AVERAGE]				
1853±27 ⁺¹⁸ ₋₃₅	4289	¹ AAIJ	17C LHCb	$B^+ \rightarrow J/\psi \phi K^+$
1816±13		² ASTON	93 LASS	$11K^- p \rightarrow K^- \omega p$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
~ 1840		³ DAUM	81C CNTR	$63 K^- p \rightarrow K^- 2\pi p$
¹ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 3.0 σ .				
² From a partial wave analysis of the $K^- \omega$ system.				
³ From a partial wave analysis of the $K^- 2\pi$ system.				

NODE=M146M

NODE=M146M
NEWNODE=M146M;LINKAGE=B
NODE=M146M;LINKAGE=A
NODE=M146M;LINKAGE=C **$K_2(1820)$ WIDTH**

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
264±34 OUR AVERAGE				
[276 ± 35 MeV OUR 2016 AVERAGE]				
167±58 ⁺⁸² ₋₇₂	4289	⁴ AAIJ	17C LHCb	$B^+ \rightarrow J/\psi \phi K^+$
276±35		⁵ ASTON	93 LASS	$11K^- p \rightarrow K^- \omega p$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
~ 230		⁶ DAUM	81C CNTR	$63 K^- p \rightarrow K^- 2\pi p$
⁴ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 3.0 σ .				
⁵ From a partial wave analysis of the $K^- \omega$ system.				
⁶ From a partial wave analysis of the $K^- 2\pi$ system.				

NODE=M146W

NODE=M146W
NEWNODE=M146W;LINKAGE=A
NODE=M146W;LINKAGE=B
NODE=M146W;LINKAGE=C **$K_2(1820)$ 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
Γ_6 $K \phi$	

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 ←

DESIG=7

 $K_2(1820)$ BRANCHING RATIOS

$\Gamma(K_2^*(1430)\pi)/\Gamma(K\pi\pi)$				Γ_2/Γ_1
VALUE	DOCUMENT ID	TECN	COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
~ 0.77	DAUM	81C CNTR	$63K^- p \rightarrow \bar{K} 2\pi p$	
$\Gamma(K^*(892)\pi)/\Gamma(K\pi\pi)$				Γ_3/Γ_1
VALUE	DOCUMENT ID	TECN	COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
~ 0.05	DAUM	81C CNTR	$63K^- p \rightarrow \bar{K} 2\pi p$	
$\Gamma(K f_2(1270))/\Gamma(K\pi\pi)$				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	$63K^- p \rightarrow \bar{K} 2\pi p$	

NODE=M146220

NODE=M146R1
NODE=M146R1NODE=M146R2
NODE=M146R2NODE=M146R3
NODE=M146R3

$\Gamma(K\phi)/\Gamma_{\text{total}}$					Γ_6/Γ
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
seen	4289	⁷ AAIJ	17C LHCb	$B^+ \rightarrow J/\psi \phi K^+$	
⁷ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 3.0 σ .					

NODE=M146R00
NODE=M146R00

NODE=M146R00;LINKAGE=A

$K_2(1820)$ REFERENCES

AAIJ	17C	PRL 118 022003	R. Aaij <i>et al.</i>	(LHCb Collab.)
Also		PR D95 012002	R. Aaij <i>et al.</i>	(LHCb Collab.)
PDG	04	PL B592 1	S. Eidelman <i>et al.</i>	(PDG Collab.)
ASTON	93	PL B308 186	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)
DAUM	81C	NP B187 1	C. Daum <i>et al.</i>	(AMST, CERN, CRAC, MPIM+)

NODE=M146

REFID=57657
REFID=57636
REFID=49653
REFID=43597
REFID=22548

NODE=M088

$K(1830)$

$I(J^P) = \frac{1}{2}(0^-)$

OMITTED FROM SUMMARY TABLE
Seen in partial-wave analysis of $K\phi$ system. Needs confirmation.

NODE=M088

$K(1830)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
$1874 \pm 43^{+59}_{-115}$	4289	¹ AAIJ	17C LHCb		$B^+ \rightarrow J/\psi \phi K^+$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
~ 1830		ARMSTRONG 83	OMEG	—	$18.5 K^- p \rightarrow 3K p$
¹ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 3.5 σ .					

NODE=M088M

NODE=M088M

NODE=M088M;LINKAGE=A

$K(1830)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
$168 \pm 90^{+280}_{-104}$	4289	² AAIJ	17C LHCb		$B^+ \rightarrow J/\psi \phi K^+$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
~ 250		ARMSTRONG 83	OMEG	—	$18.5 K^- p \rightarrow 3K p$
² From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 3.5 σ .					

NODE=M088W

NODE=M088W

NODE=M088W;LINKAGE=A

NODE=M088215;NODE=M088

$K(1830)$ DECAY MODES

Mode
$\Gamma_1 K\phi$

DESIG=1

$K(1830)$ REFERENCES

AAIJ	17C	PRL 118 022003	R. Aaij <i>et al.</i>	(LHCb Collab.)
Also		PR D95 012002	R. Aaij <i>et al.</i>	(LHCb Collab.)
ARMSTRONG	83	NP B221 1	T.A. Armstrong <i>et al.</i>	(BARI, BIRM, CERN+) JP

NODE=M088

REFID=57657
REFID=57636
REFID=22801

$K_0^*(1950)$

$$I(J^P) = \frac{1}{2}(0^+)$$

OMITTED FROM SUMMARY TABLE

Seen in partial-wave analysis of the $K^- \pi^+$ system. Needs confirmation.

NODE=M134

NODE=M134

$K_0^*(1950)$ MASS

NODE=M134M

NODE=M134M

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
1945±10±20	¹ ASTON	88	LASS	0 11 $K^- p \rightarrow K^- \pi^+ n$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1917±12	² ZHOU	06	RVUE	$K p \rightarrow K^- \pi^+ n$
1820±40	³ ANISOVICH	97C	RVUE	11 $K^- p \rightarrow K^- \pi^+ n$
¹ We take the central value of the two solutions and the larger error given.				
² S-matrix pole. Using ASTON 88 and assuming $K_0^*(800)$, $K_0^*(1430)$.				
³ T-matrix pole. Reanalysis of ASTON 88 data.				

NODE=M134M;LINKAGE=A
NODE=M134M;LINKAGE=ZU
NODE=M134M;LINKAGE=A1

$K_0^*(1950)$ WIDTH

NODE=M134W

NODE=M134W

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
201± 34±79	⁴ ASTON	88	LASS	0 11 $K^- p \rightarrow K^- \pi^+ n$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
145± 38	⁵ ZHOU	06	RVUE	$K p \rightarrow K^- \pi^+ n$
250±100	⁶ ANISOVICH	97C	RVUE	11 $K^- p \rightarrow K^- \pi^+ n$
⁴ We take the central value of the two solutions and the larger error given.				
⁵ S-matrix pole. Using ASTON 88 and assuming $K_0^*(800)$, $K_0^*(1430)$.				
⁶ T-matrix pole. Reanalysis of ASTON 88 data.				

NODE=M134W;LINKAGE=A
NODE=M134W;LINKAGE=ZU
NODE=M134W;LINKAGE=A1

$K_0^*(1950)$ DECAY MODES

NODE=M134215;NODE=M134

Mode	Fraction (Γ_i/Γ)
Γ_1 $K \pi$	(52±14) %

DESIG=1

$K_0^*(1950)$ BRANCHING RATIOS

NODE=M134220

$\Gamma(K \pi)/\Gamma_{\text{total}}$					Γ_1/Γ
VALUE	DOCUMENT ID	TECN	CHG	COMMENT	
0.52±0.08±0.12	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=M134R1
NODE=M134R1

NODE=M134R1;LINKAGE=A
NODE=M134R1;LINKAGE=ZU

$K_0^*(1950)$ REFERENCES

NODE=M134

ZHOU	06	NP A775 212	Z.Y. Zhou, H.Q. Zheng
ANISOVICH	97C	PL B413 137	A.V. Anisovich, A.V. Sarantsev
ASTON	88	NP B296 493	D. Aston <i>et al.</i> (SLAC, NAGO, CINC, INUS)

REFID=51198
REFID=45815
REFID=40262

$K_2^*(1980)$

$$I(J^P) = \frac{1}{2}(2^+)$$

OMITTED FROM SUMMARY TABLE
Needs confirmation.

NODE=M104

NODE=M104

NODE=M104M

NODE=M104M
NEW

 $K_2^*(1980)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
1974±26 OUR AVERAGE [1973 ± 26 MeV OUR 2016 AVERAGE]					
2073±94 ⁺²⁴⁵ ₋₂₄₀	4289	¹ AAIJ	17C	LHCB	$B^+ \rightarrow J/\psi \phi K^+$
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	BIRD	89	LASS	- 11 $K^- p \rightarrow \bar{K}^0 \pi^- p$

¹ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 5.4 σ .

NODE=M104M;LINKAGE=B

 $K_2^*(1980)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
376± 70 OUR AVERAGE [373 ± 70 MeV OUR 2016 AVERAGE]					
678±311 ⁺¹¹⁵³ ₋₅₅₉	4289	² AAIJ	17C	LHCB	$B^+ \rightarrow J/\psi \phi K^+$
373± 33± 60		ASTON	87	LASS	0 11 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
180± 70		TIKHOMIROV	03	SPEC	40.0 $\pi^- C \rightarrow K_S^0 K_S^0 K_L^0 X$
398± 47	241± 47	BIRD	89	LASS	- 11 $K^- p \rightarrow \bar{K}^0 \pi^- p$

² From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 5.4 σ .

NODE=M104W

ERROR=13;NODE=M104W
NEW

NODE=M104W;LINKAGE=B

 $K_2^*(1980)$ 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
Γ_4 $K\phi$	

NODE=M104215;NODE=M104

DESIG=2

DESIG=3

DESIG=4

DESIG=5

 $K_2^*(1980)$ BRANCHING RATIOS

NODE=M104220

$\Gamma(K^*(892)\pi)/\Gamma_{\text{total}}$				Γ_1/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
possibly seen	GULER	11	BELL	$B^+ \rightarrow J/\psi K^+ \pi^+ \pi^-$

NODE=M104R01
NODE=M104R01

$\Gamma(K\rho)/\Gamma_{\text{total}}$				Γ_2/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
possibly seen	GULER	11	BELL	$B^+ \rightarrow J/\psi K^+ \pi^+ \pi^-$

NODE=M104R02
NODE=M104R02

$\Gamma(K\rho)/\Gamma(K^*(892)\pi)$					Γ_2/Γ_1
VALUE	DOCUMENT ID	TECN	CHG	COMMENT	
1.49±0.24±0.09	ASTON	87	LASS	0 11 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$	

NODE=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

$\Gamma(K\phi)/\Gamma_{\text{total}}$					Γ_4/Γ
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
seen	4289	³ AAIJ	17C	LHCB	$B^+ \rightarrow J/\psi \phi K^+$

NODE=M104R00
NODE=M104R00

³ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 5.4 σ .

NODE=M104R00;LINKAGE=A

$K_2^*(1980)$ REFERENCES

AAIJ	17C	PRL 118 022003	R. Aaij <i>et al.</i>	(LHCb Collab.)
Also		PR D95 012002	R. Aaij <i>et al.</i>	(LHCb Collab.)
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	SLAC-332	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)
		NP B292 693		

NODE=M104

REFID=57657
REFID=57636
REFID=53668
REFID=49423

REFID=41002
REFID=40234

NODE=M035

 $K_4^*(2045)$

$$I(J^P) = \frac{1}{2}(4^+)$$

 $K_4^*(2045)$ MASS

NODE=M035M

NODE=M035M

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 $pA \rightarrow 4KX$
2088 ± 20	650	BAUBILLIER	82	HBC	— 8.25 $K^- p \rightarrow K_S^0 \pi^- p$
2115 ± 46	488	CARMONY	77	HBC	0 9 $K^+ d \rightarrow K^+ \pi^+ s X$

¹ From a fit to all moments.² From a fit to 8 moments.³ Number of events evaluated by us.⁴ From energy-independent partial-wave analysis.

NODE=M035M;LINKAGE=E
NODE=M035M;LINKAGE=B
NODE=M035M;LINKAGE=W
NODE=M035M;LINKAGE=D

 $K_4^*(2045)$ WIDTH

NODE=M035W

NODE=M035W

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 $pA \rightarrow 4KX$
170 ⁺¹⁰⁰ ₋₅₀	650	BAUBILLIER	82	HBC	— 8.25 $K^- p \rightarrow K_S^0 \pi^- p$
240 ⁺⁵⁰⁰ ₋₁₀₀		⁸ ASTON	81C	LASS	0 11 $K^- p \rightarrow K^- \pi^+ n$
300 ± 200		CARMONY	77	HBC	0 9 $K^+ d \rightarrow K^+ \pi^+ s X$

⁵ From a fit to all moments.⁶ From a fit to 8 moments.⁷ Number of events evaluated by us.⁸ From energy-independent partial-wave analysis.

NODE=M035W;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 → 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 → 4KX

NODE=M035R7
 NODE=M035R7

⁹ Error determination is model dependent.

NODE=M035R;LINKAGE=A

 $K_4^*(2045)$ 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)
TORRES 86	PR D34 707	S. Torres <i>et al.</i>	(VPI, ARIZ, FNAL, FSU+)
BAUBILLIER 82	PL 118B 447	M. Baubillier <i>et al.</i>	(BIRM, CERN, GLAS+)
CLELAND 82	NP B208 189	W.E. Cleland <i>et al.</i>	(DURH, GEVA, LAUS+)
ASTON 81C	PL 106B 235	D. Aston <i>et al.</i>	(SLAC, CARL, OTTA) JP
CARMONY 77	PR D16 1251	D.D. Carmony <i>et al.</i>	(PURD, UCD, IUPU)

NODE=M035

REFID=40262
 REFID=22462
 REFID=22845
 REFID=22842
 REFID=22455
 REFID=22821
 REFID=22811

 $K_2(2250)$

$$I(J^P) = \frac{1}{2}(2^-)$$

OMITTED FROM SUMMARY TABLE

This entry contains various peaks in strange meson systems reported in the 2150–2260 MeV region, as well as enhancements seen in the antihyperon-nucleon system, either in the mass spectra or in the $J^P = 2^-$ wave.

NODE=M040

NODE=M040

 $K_2(2250)$ MASS

<u>VALUE (MeV)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>CHG</u>	<u>COMMENT</u>	
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 $K^+ p \rightarrow \Lambda \bar{p} X$
2240±20	20	LISSAUER 70	HBC			9 $K^+ p$

¹ $J^P = 2^-$ from moments analysis.

NODE=M040M

NODE=M040M

NODE=M040M;LINKAGE=Q

 $K_2(2250)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
180±30 OUR AVERAGE		Error includes scale factor of 1.4.			
150±30	²	ARMSTRONG 83C	OMEG	—	18 $K^- p \rightarrow \Lambda \bar{p} X$
210±30	²	CLELAND 81	SPEC	±	50 $K^+ p \rightarrow \Lambda \bar{p} X$

NODE=M040W

NODE=M040W

● ● ● 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

K2(2250) DECAY MODES

NODE=M040215;NODE=M040

Mode	
Γ_1	$K \pi \pi$
Γ_2	$K f_2(1270)$
Γ_3	$K^*(892) f_0(980)$
Γ_4	$\rho \bar{\Lambda}$

DESIG=1
DESIG=3
DESIG=4
DESIG=2

K2(2250) REFERENCES

NODE=M040

TIKHOMIROV	03	PAN 66 828	G.D. Tikhomirov <i>et al.</i>	
		Translated from YAF 66 860.		
ARMSTRONG	83C	NP B227 365	T.A. Armstrong <i>et al.</i>	(BARI, BIRM, CERN+)
BAUBILLIER	81	NP B183 1	M. Baubillier <i>et al.</i>	(BIRM, CERN, GLAS+) JP
CLELAND	81	NP B184 1	W.E. Cleland <i>et al.</i>	(PITT, GEVA, LAUS+) JP
CHLIAPNIK...	79	NP B158 253	P.V. Chliapnikov <i>et al.</i>	(CERN, BELG, MONS)
LISSAUER	70	NP B18 491	D. Lissauer <i>et al.</i>	(LBL)

REFID=49423
REFID=22852
REFID=22850
REFID=22851
REFID=22849
REFID=22847

K3(2320)

$I(J^P) = \frac{1}{2}(3^+)$

OMITTED FROM SUMMARY TABLE
Seen in the $J^P = 3^+$ wave of the antihyperon-nucleon system.
Needs confirmation.

NODE=M090

NODE=M090

K3(2320) MASS

NODE=M090M

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
2324±24 OUR AVERAGE				
2330±40	1 ARMSTRONG 83C	OMEG	-	18 $K^- p \rightarrow \Lambda \bar{p} X$
2320±30	1 CLELAND 81	SPEC	±	50 $K^+ p \rightarrow \Lambda \bar{p} X$
1 $J^P = 3^+$ from moments analysis.				

NODE=M090M

NODE=M090M;LINKAGE=P

K3(2320) WIDTH

NODE=M090W

NODE=M090W

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
150±30	2 ARMSTRONG 83C	OMEG	-	18 $K^- p \rightarrow \Lambda \bar{p} X$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
~ 250	2 CLELAND 81	SPEC	±	50 $K^+ p \rightarrow \Lambda \bar{p} X$
2 $J^P = 3^+$ from moments analysis.				

NODE=M090W;LINKAGE=P

K3(2320) DECAY MODES

NODE=M090215;NODE=M090

Mode	
Γ_1	$\rho \bar{\Lambda}$

DESIG=1

K3(2320) REFERENCES

NODE=M090

ARMSTRONG	83C	NP B227 365	T.A. Armstrong <i>et al.</i>	(BARI, BIRM, CERN+)
CLELAND	81	NP B184 1	W.E. Cleland <i>et al.</i>	(PITT, GEVA, LAUS+)

REFID=22852
REFID=22851

$K_5^*(2380)$

$$I(J^P) = \frac{1}{2}(5^-)$$

OMITTED FROM SUMMARY TABLE
Needs confirmation.

$K_5^*(2380)$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT	
2382±14±19	¹ ASTON	86	LASS	0	11 $K^-p \rightarrow K^- \pi^+ n$
¹ From a fit to all the moments.					

$K_5^*(2380)$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT	
178±37±32	² ASTON	86	LASS	0	11 $K^-p \rightarrow K^- \pi^+ n$
² From a fit to all the moments.					

$K_5^*(2380)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad K \pi$	$(6.1 \pm 1.2) \%$

$K_5^*(2380)$ BRANCHING RATIOS

$\Gamma(K \pi)/\Gamma_{\text{total}}$					Γ_1/Γ
VALUE	DOCUMENT ID	TECN	CHG	COMMENT	
0.061 ± 0.012	ASTON	88	LASS	0	11 $K^- p \rightarrow K^- \pi^+ n$

$K_5^*(2380)$ REFERENCES

ASTON	88	NP B296 493	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)
ASTON	86	PL B180 308	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)

$K_4(2500)$

$$I(J^P) = \frac{1}{2}(4^-)$$

OMITTED FROM SUMMARY TABLE
Needs confirmation.

$K_4(2500)$ MASS

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>CHG</u>	<u>COMMENT</u>	
2490±20	¹ CLELAND	81	SPEC	±	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
$\Gamma_1 \quad p \bar{\Lambda}$

$K_4(2500)$ REFERENCES

CLELAND	81	NP B184 1	W.E. Cleland <i>et al.</i>	(PITT, GEVA, LAUS+)

NODE=M098

NODE=M098

NODE=M098M

NODE=M098M

NODE=M098M;LINKAGE=E

NODE=M098W

NODE=M098W

NODE=M098W;LINKAGE=E

NODE=M098215;NODE=M098

DESIG=1

NODE=M098220

NODE=M098R1
NODE=M098R1

NODE=M098

REFID=40262
REFID=22462

NODE=M091

NODE=M091

NODE=M091M

NODE=M091M

NODE=M091M;LINKAGE=R

NODE=M091W

NODE=M091W

NODE=M091W;LINKAGE=R

NODE=M091215;NODE=M091

DESIG=1

NODE=M091

REFID=22851

$K(3100)$

$$I^G(J^{PC}) = ?^?(?^{??})$$

NODE=M129

OMITTED FROM SUMMARY TABLE

Narrow peak observed in several ($\Lambda\bar{p}$ + pions) and ($\bar{\Lambda}p$ + pions) states in Σ^- Be reactions by BOURQUIN 86 and in np and nA reactions by ALEEV 93. Not seen by BOEHNLEIN 91. If due to strong decays, this state has exotic quantum numbers ($B=0, Q=+1, S=-1$ for $\Lambda\bar{p}\pi^+\pi^+$ and $I \geq 3/2$ for $\Lambda\bar{p}\pi^-\pi^-$). Needs confirmation.

NODE=M129

 $K(3100)$ MASS

NODE=M129205

VALUE (MeV)

DOCUMENT ID

 ≈ 3100 OUR ESTIMATE

NODE=M129M

→ UNCHECKED ←

3-BODY DECAYS

NODE=M129M1

NODE=M129M1

VALUE (MeV)

DOCUMENT ID

TECN

COMMENT

3054 ± 11 OUR AVERAGE

3060 ± 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 $K(3100) \rightarrow \bar{\Lambda}p\pi^+$

OCCUR=2

OCCUR=3

OCCUR=4

4-BODY DECAYS

NODE=M129M2

NODE=M129M2

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 $K(3100) \rightarrow \bar{\Lambda}p\pi^-\pi^+$

OCCUR=2

OCCUR=3

OCCUR=4

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

3105 ± 30

BOURQUIN 86 SPEC $K(3100) \rightarrow \Lambda\bar{p}\pi^+\pi^+$

3115 ± 30

BOURQUIN 86 SPEC $K(3100) \rightarrow \Lambda\bar{p}\pi^+\pi^-$

OCCUR=2

5-BODY DECAYS

NODE=M129M3

NODE=M129M3

VALUE (MeV)

DOCUMENT ID

TECN

COMMENT

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

3095 ± 30

BOURQUIN 86 SPEC $K(3100) \rightarrow \Lambda\bar{p}\pi^+\pi^+\pi^-$ ¹ Supersedes ALEEV 90.

NODE=M129M;LINKAGE=A

 $K(3100)$ WIDTH

NODE=M129210

3-BODY DECAYS

NODE=M129W1

NODE=M129W1

VALUE (MeV)

DOCUMENT ID

TECN

COMMENT

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

42 ± 16

² ALEEV 93 BIS2 $K(3100) \rightarrow \Lambda\bar{p}\pi^+$

36 ± 15

² ALEEV 93 BIS2 $K(3100) \rightarrow \bar{\Lambda}p\pi^-$

50 ± 18

² ALEEV 93 BIS2 $K(3100) \rightarrow \Lambda\bar{p}\pi^-$

30 ± 15

² ALEEV 93 BIS2 $K(3100) \rightarrow \bar{\Lambda}p\pi^+$

OCCUR=2

OCCUR=3

OCCUR=4

4-BODY DECAYS

NODE=M129W2

NODE=M129W2

VALUE (MeV)

CL%

DOCUMENT ID

TECN

COMMENT

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

22 ± 8

² ALEEV 93 BIS2 $K(3100) \rightarrow \Lambda\bar{p}\pi^+\pi^+$

28 ± 12

² ALEEV 93 BIS2 $K(3100) \rightarrow \Lambda\bar{p}\pi^+\pi^-$

32 ± 15

² ALEEV 93 BIS2 $K(3100) \rightarrow \bar{\Lambda}p\pi^-\pi^-$

30 ± 15

² ALEEV 93 BIS2 $K(3100) \rightarrow \bar{\Lambda}p\pi^-\pi^+$

OCCUR=2

OCCUR=3

OCCUR=4

<30

90

BOURQUIN 86 SPEC $K(3100) \rightarrow \Lambda\bar{p}\pi^+\pi^+$

<80

90

BOURQUIN 86 SPEC $K(3100) \rightarrow \Lambda\bar{p}\pi^+\pi^-$

OCCUR=2

5-BODY DECAYS

NODE=M129W3

NODE=M129W3

VALUE (MeV)

CL%

DOCUMENT ID

TECN

COMMENT

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

<30

90

BOURQUIN 86 SPEC $K(3100) \rightarrow \Lambda\bar{p}\pi^+\pi^+\pi^-$ ² Supersedes ALEEV 90.

NODE=M129W;LINKAGE=A

K(3100) DECAY MODES

NODE=M129215;NODE=M129

Mode	
Γ_1	$K(3100)^0 \rightarrow \Lambda \bar{p} \pi^+$
Γ_2	$K(3100)^{--} \rightarrow \Lambda \bar{p} \pi^-$
Γ_3	$K(3100)^- \rightarrow \Lambda \bar{p} \pi^+ \pi^-$
Γ_4	$K(3100)^+ \rightarrow \Lambda \bar{p} \pi^+ \pi^+$
Γ_5	$K(3100)^0 \rightarrow \Lambda \bar{p} \pi^+ \pi^+ \pi^-$
Γ_6	$K(3100)^0 \rightarrow \Sigma(1385)^+ \bar{p}$

DESIG=1

DESIG=2

DESIG=3

DESIG=4

DESIG=5

DESIG=6

$\Gamma(\Sigma(1385)^+ \bar{p})/\Gamma(\Lambda \bar{p} \pi^+)$					Γ_6/Γ_1
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
<0.04	90	ALEEV	93	BIS2	$K(3100)^0 \rightarrow \Sigma(1385)^+ \bar{p}$

NODE=M129R1
NODE=M129R1**K(3100) REFERENCES**

ALEEV	93	PAN 56 1358	A.N. Aleev <i>et al.</i>	(BIS-2 Collab.)
		Translated from YAF 56 100.		
BOEHNLEIN	91	NPBPS B21 174	A. Boehnlein <i>et al.</i>	(FLOR, BNL, IND+)
ALEEV	90	ZPHY C47 533	A.N. Aleev <i>et al.</i>	(BIS-2 Collab.)
BOURQUIN	86	PL B172 113	M.H. Bourquin <i>et al.</i>	(GEVA, RAL, HEIDP+)

NODE=M129

REFID=43668

REFID=41743

REFID=42173

REFID=22928

CHARMED MESONS **(C = ±1)**

 $D^+ = c\bar{d}, D^0 = c\bar{u}, \bar{D}^0 = \bar{c}u, D^- = \bar{c}d,$ similarly for D^{*} 's

NODE=MXXX035

NODE=MXXX035

NODE=M061

 $D^*(2007)^0$
 $I(J^P) = \frac{1}{2}(1^-)$
 I, J, P need confirmation.
 J consistent with 1, value 0 ruled out (NGUYEN 77).

NODE=M061

 $D^*(2007)^0$ MASS

NODE=M061M

The fit includes $D^\pm, D^0, D_s^\pm, D^{*\pm}, D^{*0}, D_s^{*\pm}, D_1(2420)^0, D_2^*(2460)^0,$
 and $D_{s1}(2536)^\pm$ mass and mass difference measurements.

NODE=M061M

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
2006.85±0.05 OUR FIT	Error includes scale factor of 1.1.		
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
2006 ±1.5	¹ GOLDHABER 77	MRK1	e ⁺ e ⁻
¹ From simultaneous fit to D [*] (2010) ⁺ , D [*] (2007) ⁰ , D ⁺ , and D ⁰ .			

NODE=M061M

NODE=M061M;LINKAGE=G

 $m_{D^*(2007)^0} - m_{D^0}$

NODE=M061DM

The fit includes $D^\pm, D^0, D_s^\pm, D^{*\pm}, D^{*0}, D_s^{*\pm}, D_1(2420)^0, D_2^*(2460)^0,$
 and $D_{s1}(2536)^\pm$ mass and mass difference measurements.

NODE=M061DM

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
142.016±0.030 OUR FIT	Error includes scale factor of 1.5.			
142.016±0.030 OUR AVERAGE	Error includes scale factor of 1.5.			
142.007±0.015±0.014	10K	² TOMARADZE 15	CLEO	$e^+ e^- \rightarrow$ hadrons
142.2 ±0.3 ±0.2	145	ALBRECHT 95F	ARG	$e^+ e^- \rightarrow$ hadrons
142.12 ±0.05 ±0.05	1176	BORTOLETTO92B	CLE2	$e^+ e^- \rightarrow$ hadrons
• • • We do not use the following data for averages, fits, limits, etc. • • •				
142.2 ±2.0		SADROZINSKI 80	CBAL	$D^{*0} \rightarrow D^0 \pi^0$
142.7 ±1.7		³ GOLDHABER 77	MRK1	$e^+ e^-$

NODE=M061DM

² Obtained by analyzing CLEO-c data but not authored by the CLEO Collaboration . This value comes from the average of the results for two decay modes, $D^0 \rightarrow K^- \pi^+$ and $D^0 \rightarrow K^- \pi^+ \pi^- \pi^+$.

³ From simultaneous fit to $D^*(2010)^+$, $D^*(2007)^0$, D^+ , and D^0 .

$D^*(2007)^0$ WIDTH

VALUE (MeV)	CL%	DOCUMENT ID	TECN	COMMENT
<2.1	90	⁴ ABACHI	88B HRS	$D^{*0} \rightarrow D^+ \pi^-$

⁴ Assuming $m_{D^{*0}} = 2007.2 \pm 2.1 \text{ MeV}/c^2$.

$D^*(2007)^0$ DECAY MODES

$\bar{D}^*(2007)^0$ modes are charge conjugates of modes below.

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad D^0 \pi^0$	$(64.7 \pm 0.9) \%$
$\Gamma_2 \quad D^0 \gamma$	$(35.3 \pm 0.9) \%$

CONSTRAINED FIT INFORMATION

An overall fit to 2 branching ratios uses 5 measurements and one constraint to determine 2 parameters. The overall fit has a $\chi^2 = 2.5$ for 4 degrees of freedom.

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

$$x_2 \quad \begin{vmatrix} -100 \\ x_1 \end{vmatrix}$$

$D^*(2007)^0$ BRANCHING RATIOS

$\Gamma(D^0 \pi^0) / \Gamma(D^0 \gamma)$ Γ_1 / Γ_2

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
1.83 ± 0.07 OUR FIT	Error includes scale factor of 1.1.			
1.85 ± 0.07 OUR AVERAGE				
$1.90 \pm 0.07 \pm 0.05$	4.9k	ABLIKIM	15B BES3	$10.6 \text{ } e^+ e^- \rightarrow \text{hadrons}$
$1.74 \pm 0.02 \pm 0.13$		AUBERT,BE	05G BABR	$10.6 \text{ } e^+ e^- \rightarrow \text{hadrons}$

$\Gamma(D^0 \pi^0) / \Gamma_{\text{total}}$ Γ_1 / Γ

<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.647±0.009 OUR FIT				
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
0.655±0.008±0.005	3.2k	⁵ ABLIKIM	15B BES3	e ⁺ e ⁻ → hadrons
0.635±0.003±0.017	69k	⁵ AUBERT,BE	05G BABR	10.6 e ⁺ e ⁻ → hadrons
0.596±0.035±0.028	858	⁶ ALBRECHT	95F ARG	e ⁺ e ⁻ → hadrons
0.636±0.023±0.033	1097	⁶ BUTLER	92 CLE2	e ⁺ e ⁻ → hadrons

$\Gamma(D^0 \gamma) / \Gamma_{\text{total}}$ Γ_2 / Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.353 ± 0.009 OUR FIT				
0.381 ± 0.029 OUR AVERAGE				
$0.404 \pm 0.035 \pm 0.028$	456	⁶ ALBRECHT	95F ARG	$e^+ e^- \rightarrow \text{hadrons}$
$0.364 \pm 0.023 \pm 0.033$	621	⁶ BUTLER	92 CLE2	$e^+ e^- \rightarrow \text{hadrons}$
$0.37 \pm 0.08 \pm 0.08$		ADLER	88D MRK3	$e^+ e^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$0.345 \pm 0.008 \pm 0.005$	1.8k	⁵ ABLIKIM	15B BES3	$e^+ e^- \rightarrow \text{hadrons}$
$0.365 \pm 0.003 \pm 0.017$	68k	⁵ AUBERT,BE	05G BABR	$10.6 \text{ } e^+ e^- \rightarrow \text{hadrons}$
0.47 ± 0.23		LOW	87 HRS	$29 \text{ GeV } e^+ e^-$
0.53 ± 0.13		BARTEL	85G JADE	$e^+ e^-$, hadrons
0.47 ± 0.12		COLES	82 MRK2	$e^+ e^-$
0.45 ± 0.15		GOLDHABER	77 MRK1	$e^+ e^-$

NODE=M061DM;LINKAGE=A

NODE=M061DM;LINKAGE=G

NODE=M061W

NODE=M061W

NODE=M061W;LINKAGE=A

NODE=M061220;NODE=M061

NODE=M061

DESIG=1

DESIG=2

NODE=M061225

NODE=M061R3
NODE=M061R3

NODE=M061R2
NODE=M061R2

NODE=M061R1
NODE=M061R1

⁵ Derived from the ratio $\Gamma(D^0\pi^0) / \Gamma(D^0\gamma)$ assuming that the branching fractions of $D^{*0} \rightarrow D^0\pi^0$ and $D^{*0} \rightarrow D^0\gamma$ decays sum to 100%

⁶ The BUTLER 92 and ALBRECHT 95F branching ratios are not independent, they have been constrained by the authors to sum to 100%.

NODE=M061R;LINKAGE=AU

NODE=M061R;LINKAGE=A

$D^*(2007)^0$ REFERENCES

ABLIKIM	15B	PR D91 031101	M. Ablikim <i>et al.</i>	(BES III Collab.)
TOMARADZE	15	PR D91 011102	A. Tomaradze <i>et al.</i>	(NWES)
AUBERT,BE	05G	PR D72 091101	B. Aubert <i>et al.</i>	(BABAR Collab.)
ALBRECHT	95F	ZPHY C66 63	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
BORTOLETTO	92B	PRL 69 2046	D. Bortoletto <i>et al.</i>	(CLEO Collab.)
BUTLER	92	PRL 69 2041	F. Butler <i>et al.</i>	(CLEO Collab.)
ABACHI	88B	PL B212 533	S. Abachi <i>et al.</i>	(ANL, IND, MICH, PURD+)
ADLER	88D	PL B208 152	J. Adler <i>et al.</i>	(Mark III Collab.)
LOW	87	PL B183 232	E.H. Low <i>et al.</i>	(HRS Collab.)
BARTEL	85G	PL 161B 197	W. Bartel <i>et al.</i>	(JADE Collab.)
COLES	82	PR D26 2190	M.W. Coles <i>et al.</i>	(LBL, SLAC)
SADROZINSKI	80	Madison Conf. 681	H.F.W. Sadrozinski <i>et al.</i>	(PRIN, CIT+)
GOLDHABER	77	PL 69B 503	G. Goldhaber <i>et al.</i>	(Mark I Collab.)
NGUYEN	77	PRL 39 262	H.K. Nguyen <i>et al.</i>	(LBL, SLAC) J

NODE=M061

REFID=56375
REFID=57142
REFID=50942
REFID=44374
REFID=43116
REFID=43170
REFID=40584
REFID=40579
REFID=40017
REFID=22880
REFID=22866
REFID=22877
REFID=11434
REFID=11543

$D^*(2010)^\pm$

$I(J^P) = \frac{1}{2}(1^-)$
 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

2010.26±0.05 OUR FIT

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

2008 ±3	¹ GOLDHABER 77	MRK1 ±	e^+e^-
2008.6 ±1.0	² PERUZZI 77	LGW ±	e^+e^-

¹ From simultaneous fit to $D^*(2010)^+, D^*(2007)^0, D^+$, and D^0 ; not independent of FELDMAN 77B mass difference below.

² PERUZZI 77 mass not independent of FELDMAN 77B mass difference below and PERUZZI 77 D^0 mass value.

NODE=M062M

NODE=M062M;LINKAGE=G

NODE=M062M;LINKAGE=P

$m_{D^*(2010)^+} - m_{D^+}$

The fit includes $D^\pm, D^0, D_s^\pm, D^{*\pm}, D^{*0}, D_s^{*\pm}, D_1(2420)^0, D_2^*(2460)^0$,
and $D_{s1}(2536)^\pm$ mass and mass difference measurements.

NODE=M062MD

NODE=M062MD

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

140.67±0.08 OUR FIT

[140.68 ± 0.08 MeV OUR 2016 FIT]

140.64±0.08±0.06	620	BORTOLETTO92B	CLE2	$e^+e^- \rightarrow \text{hadrons}$

NODE=M062MD

NEW

$m_{D^*(2010)^+} - m_{D^0}$

The fit includes $D^\pm, D^0, D_s^\pm, D^{*\pm}, D^{*0}, D_s^{*\pm}, D_1(2420)^0, D_2^*(2460)^0$,
and $D_{s1}(2536)^\pm$ mass and mass difference measurements.

NODE=M062DM

NODE=M062DM

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

145.4257±0.0017 OUR FIT

145.4258±0.0020 OUR AVERAGE Error includes scale factor of 1.2.

145.4259±0.0004±0.0017	312.8k	LEES	13x	BABR	$D^{*\pm} \rightarrow D^0\pi^\pm \rightarrow (K\pi, K3\pi)\pi^\pm$
145.412 ±0.002 ±0.012		ANASTASSOV	02	CLE2	$D^{*\pm} \rightarrow D^0\pi^\pm \rightarrow (K\pi)\pi^\pm$
145.54 ±0.08	611	³ ADINOLFI	99	BEAT	$D^{*\pm} \rightarrow D^0\pi^\pm$
145.45 ±0.02		³ BREITWEG	99	ZEUS	$D^{*\pm} \rightarrow D^0\pi^\pm \rightarrow (K\pi)\pi^\pm$
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	$D^{*\pm} \rightarrow D^0\pi^\pm, D^0 \rightarrow K^-3\pi$

NODE=M062DM

OCCUR=3

OCCUR=2

145.42	± 0.11	199	⁴ BREITWEG	97	ZEUS	$D^{*\pm} \rightarrow D^0 \pi^\pm,$ $D^0 \rightarrow K^- \pi^+$	OCCUR=2
145.4	± 0.2	48	⁴ DERRICK	95	ZEUS	$D^{*\pm} \rightarrow D^0 \pi^\pm$	
145.39	$\pm 0.06 \pm 0.03$		BARLAG	92B	ACCM	π^- 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	$\pm 0.05 \pm 0.10$		ABACHI	88B	HRS	$D^{*\pm} \rightarrow D^0 \pi^\pm$	
145.46	$\pm 0.07 \pm 0.03$		ALBRECHT	85F	ARG	$D^{*\pm} \rightarrow D^0 \pi^+$	
145.5	± 0.3	28	BAILEY	83	SPEC	$D^{*\pm} \rightarrow D^0 \pi^\pm$	OCCUR=2
145.5	± 0.3	60	FITCH	81	SPEC	$\pi^- A$	
145.3	± 0.5	30	FELDMAN	77B	MRK1	$D^{*+} \rightarrow D^0 \pi^+$	

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

145.4256±0.0006±0.0017	138.5k	LEES	13x	BABR	$D^{*\pm} \rightarrow D^0 \pi^\pm \rightarrow (K^- \pi^+) \pi^\pm$	OCCUR=2
145.4266±0.0005±0.0019	174.3k	LEES	13x	BABR	$D^{*\pm} \rightarrow D^0 \pi^\pm \rightarrow (K^- 2\pi^+ \pi^-) \pi^\pm$	
145.44 ±0.09	122	⁴ BREITWEG	97B	ZEUS	$D^{*\pm} \rightarrow D^0 \pi^\pm, D^0 \rightarrow K^- \pi^+$	OCCUR=3
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.

NODE=M062DM;LINKAGE=AV
NODE=M062DM;LINKAGE=A

$m_{D^*(2010)^+} - m_{D^*(2007)^0}$

NODE=M062EM

VALUE (MeV) DOCUMENT ID TECN COMMENT

NODE=M062EM

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

2.6 ± 1.8	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;LINKAGE=P

$D^*(2010)^\pm$ WIDTH

NODE=M062W

VALUE (keV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
83.4±1.8 OUR AVERAGE					
83.3±1.2± 1.4		312.8k	⁶ LEES	13X BABR	$D^{*\pm} \rightarrow D^0 \pi^\pm \rightarrow (K \pi, K 3 \pi) \pi^\pm$
96 ±4 ±22			⁶ ANASTASSOV 02	CLE2	$D^{*\pm} \rightarrow D^0 \pi^\pm \rightarrow (K \pi) \pi^\pm$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
83.4±1.7± 1.5		138.5k	⁶ LEES	13X BABR	$D^{*\pm} \rightarrow D^0 \pi^\pm \rightarrow (K^- \pi^+) \pi^\pm$
83.2±1.5± 2.6		174.3k	⁶ LEES	13X BABR	$D^{*\pm} \rightarrow D^0 \pi^\pm \rightarrow (K^- 2 \pi^+ \pi^-) \pi^\pm$
<131	90	110	BARLAG	92B ACCM	π^- 230 GeV

⁶ Ignoring the electromagnetic contribution from $D^{*\pm} \rightarrow D^\pm \gamma$.

NODE=M062W;LINKAGE=LE

$D^*(2010)^\pm$ DECAY MODES

NODE=M062225;NODE=M062

$D^*(2010)^-$ modes are charge conjugates of the modes below.

NODE=M062

Mode	Fraction (Γ_i/Γ)
Γ_1 $D^0 \pi^+$	(67.7 ± 0.5) %
Γ_2 $D^+ \pi^0$	(30.7 ± 0.5) %
Γ_3 $D^+ \gamma$	(1.6 ± 0.4) %

DESIG=1

DESIG=3

DESIG=2

CONSTRAINED FIT INFORMATION

An overall fit to 3 branching ratios uses 6 measurements and one constraint to determine 3 parameters. The overall fit has a $\chi^2 = 0.3$ for 4 degrees of freedom.

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

x_2	-62	
x_3	-43	-44
	x_1	x_2

$D^*(2010)^+$ BRANCHING RATIOS

NODE=M062230

$\Gamma(D^0 \pi^+) / \Gamma_{\text{total}}$						Γ_1 / Γ
VALUE		DOCUMENT ID	TECN	COMMENT		
0.677 $\pm$ 0.005 OUR FIT						
0.677 $\pm$ 0.006 OUR AVERAGE						
0.6759 $\pm$ 0.0029 $\pm$ 0.0064	7,8,9	BARTELT	98	CLE2	$e^+ e^-$	
0.688 $\pm$ 0.024 $\pm$ 0.013		ALBRECHT	95F	ARG	$e^+ e^- \rightarrow$ hadrons	
0.681 $\pm$ 0.010 $\pm$ 0.013	7	BUTLER	92	CLE2	$e^+ e^- \rightarrow$ hadrons	
• • • We do not use the following data for averages, fits, limits, etc. • • •						
0.57 $\pm$ 0.04 $\pm$ 0.04		ADLER	88D	MRK3	$e^+ e^-$	
0.44 $\pm$ 0.10		COLES	82	MRK2	$e^+ e^-$	
0.6 $\pm$ 0.15	9	GOLDHABER	77	MRK1	$e^+ e^-$	

NODE=M062R1
NODE=M062R1

$\Gamma(D^+ \pi^0) / \Gamma_{\text{total}}$						Γ_2 / Γ
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT		
0.307 $\pm$ 0.005 OUR FIT						
0.3073 $\pm$ 0.0013 $\pm$ 0.0062						
	7,8,9	BARTELT	98	CLE2	$e^+ e^-$	
• • • We do not use the following data for averages, fits, limits, etc. • • •						
0.312 $\pm$ 0.011 $\pm$ 0.008	1404	ALBRECHT	95F	ARG	$e^+ e^- \rightarrow$ hadrons	
0.308 $\pm$ 0.004 $\pm$ 0.008	410	7 BUTLER	92	CLE2	$e^+ e^- \rightarrow$ hadrons	
0.26 $\pm$ 0.02 $\pm$ 0.02		ADLER	88D	MRK3	$e^+ e^-$	
0.34 $\pm$ 0.07		COLES	82	MRK2	$e^+ e^-$	

NODE=M062R3
NODE=M062R3

$\Gamma(D^+\gamma)/\Gamma_{\text{total}}$						Γ_3/Γ
VALUE	CL%	EVTS	DOCUMENT ID	TECN	COMMENT	
0.016 ±0.004 OUR FIT						
0.016 ±0.005 OUR AVERAGE						
0.0168±0.0042±0.0029			7,8 BARTELT	98	CLE2	e^+e^-
0.011 ±0.014 ±0.016		12	7 BUTLER	92	CLE2	$e^+e^- \rightarrow$ hadrons
• • • We do not use the following data for averages, fits, limits, etc. • • •						
<0.052		90	ALBRECHT	95F	ARG	$e^+e^- \rightarrow$ hadrons
0.17 ±0.05 ±0.05			ADLER	88D	MRK3	e^+e^-
0.22 ±0.12			10 COLES	82	MRK2	e^+e^-

NODE=M062R2
NODE=M062R2

⁷ The branching ratios are not independent, they have been constrained by the authors to sum to 100%.

⁸ Systematic error includes theoretical error on the prediction of the ratio of hadronic modes.

⁹ Assuming that isospin is conserved in the decay.

¹⁰ Not independent of $\Gamma(D^0 \pi^+) / \Gamma_{\text{total}}$ and $\Gamma(D^+ \pi^0) / \Gamma_{\text{total}}$ measurement.

NODE=M062R;LINKAGE=A

NODE=M062R;LINKAGE=B

NODE=M062R;LINKAGE=G

NODE=M062R;LINKAGE=C

D*(2010)[±] REFERENCES

LEES	13X	PRL 111 111801	J.P. Lees <i>et al.</i>	(BABAR Collab.)
Also		PR D88 052003	J.P. Lees <i>et al.</i>	(BABAR Collab.)
Also		PR D88 079902 (errat.)	J.P. Lees <i>et al.</i>	(BABAR Collab.)
ANASTASSOV	02	PR D65 032003	A. Anastassov <i>et al.</i>	(CLEO Collab.)
ADINOLFI	99	NP B547 3	M. Adinolfi <i>et al.</i>	(Beatrice Collab.)
BREITWEG	99	EPJ C6 67	J. Breitweg <i>et al.</i>	(ZEUS Collab.)
BARTELT	98	PRL 80 3919	J. Bartelt <i>et al.</i>	(CLEO Collab.)
ADLOFF	97B	ZPHY C72 593	C. Adloff <i>et al.</i>	(H1 Collab.)
BREITWEG	97	PL B401 192	J. Breitweg <i>et al.</i>	(ZEUS Collab.)
BREITWEG	97B	PL B407 402	J. Breitweg <i>et al.</i>	(ZEUS Collab.)
ALBRECHT	95F	ZPHY C66 63	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
DERRICK	95	PL B349 225	M. Derrick <i>et al.</i>	(ZEUS Collab.)
BARLAG	92B	PL B278 480	S. Barlag <i>et al.</i>	(ACCMOR Collab.)
BORTOLETTO	92B	PRL 69 2046	D. Bortoletto <i>et al.</i>	(CLEO Collab.)
BUTLER	92	PRL 69 2041	F. Butler <i>et al.</i>	(CLEO Collab.)
ALEXANDER	91B	PL B262 341	G. Alexander <i>et al.</i>	(OPAL Collab.)
DECAMP	91J	PL B266 218	D. Decamp <i>et al.</i>	(ALEPH Collab.)
ABACHI	88B	PL B212 533	S. Abachi <i>et al.</i>	(ANL, IND, MICH, PURD+)
ADLER	88D	PL B208 152	J. Adler <i>et al.</i>	(Mark III Collab.)
ALBRECHT	85F	PL 150B 235	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
AHLEN	83	PRL 51 1147	S.P. Ahlen <i>et al.</i>	(ANL, IND, LBL+)
BAILEY	83	PL 132B 230	R. Bailey <i>et al.</i>	(AMST, BRIS, CERN, CRAC+)
COLES	82	PR D26 2190	M.W. Coles <i>et al.</i>	(LBL, SLAC)
YELTON	82	PRL 49 430	J.M. Yelton <i>et al.</i>	(SLAC, LBL, UCB+)
FITCH	81	PRL 46 761	V.L. Fitch <i>et al.</i>	(PRIN, SACL, TORI+)
AVERY	80	PRL 44 1309	P. Avery <i>et al.</i>	(ILL, FNAL, COLU)
BLIETSCHAU	79	PL 86B 108	J. Blietschau <i>et al.</i>	(AACH3, BONN, CERN+)
FELDMAN	77B	PRL 38 1313	G.J. Feldman <i>et al.</i>	(Mark I Collab.)
GOLDHABER	77	PL 69B 503	G. Goldhaber <i>et al.</i>	(Mark I Collab.)
PERUZZI	77	PRL 39 1301	I. Peruzzi <i>et al.</i>	(LGW Collab.)

NODE=M062

REFID=55564
REFID=55547
REFID=55695
REFID=48550
REFID=46925
REFID=46604
REFID=46349
REFID=45421
REFID=45520
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REFID=22867
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REFID=22858
REFID=11434
REFID=11435

NODE=M178

D₀^{*}(2400)⁰

$I(J^P) = \frac{1}{2}(0^+)$

J^P = 0⁺ assignment favored (ABE 04D).

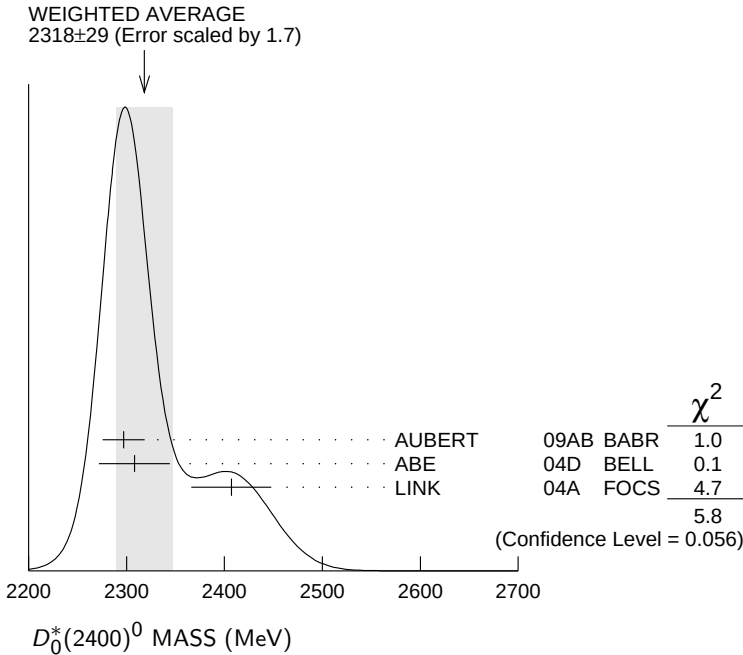
NODE=M178

D*(2400)⁰ MASS

NODE=M178M

NODE=M178M

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 ⁻ → D ⁺ π ⁻ π ⁻
2308 ± 17 ± 32		ABE	04D BELL	B ⁻ → D ⁺ π ⁻ π ⁻
2407 ± 21 ± 35	9.8k	LINK	04A FOCS	γ A



D*(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 ⁻ → D ⁺ π ⁻ π ⁻
276 ± 21 ± 63		ABE	04D BELL	B ⁻ → D ⁺ π ⁻ π ⁻
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

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.)

NODE=M178

REFID=52941
REFID=50011
REFID=49775

NODE=M179

$$D_0^*(2400)^\pm$$

$$I(J^P) = \frac{1}{2}(0^+)$$

OMITTED FROM SUMMARY TABLE

 J, P need confirmation.

NODE=M179

 $D_0^*(2400)^\pm$ MASS

NODE=M179M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2351 ± 7 OUR AVERAGE				
2360 ± 15 ± 30		¹ AAIJ	15X LHCB	$B^0 \rightarrow \bar{D}^0 K^+ \pi^-$
2349 ± 6 ± 4		² AAIJ	15Y LHCB	$B^0 \rightarrow \bar{D}^0 \pi^+ \pi^-$
2403 ± 14 ± 35	18.8k	LINK	04A FOCUS	γA
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2354 ± 7 ± 11		³ AAIJ	15Y LHCB	$B^0 \rightarrow \bar{D}^0 \pi^+ \pi^-$
¹ From the Dalitz plot analysis including various K^* and D^{**} mesons as well as broad structures in the $K\pi$ S -wave and the $D\pi$ S - and P -waves.				
² Modeling the $\pi^+ \pi^-$ S -wave with the Isobar formalism.				
³ Modeling the $\pi^+ \pi^-$ S -wave with the K-matrix formalism.				

NODE=M179M

OCCUR=2

NODE=M179M;LINKAGE=A

NODE=M179M;LINKAGE=B
NODE=M179M;LINKAGE=C **$D_0^*(2400)^\pm$ WIDTH**

NODE=M179W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
230 ± 17 OUR AVERAGE	Error includes scale factor of 1.1.			
255 ± 26 ± 51		¹ AAIJ	15X LHCB	$B^0 \rightarrow \bar{D}^0 K^+ \pi^-$
217 ± 13 ± 13		² AAIJ	15Y LHCB	$B^0 \rightarrow \bar{D}^0 \pi^+ \pi^-$
283 ± 24 ± 34	18.8k	LINK	04A FOCUS	γA
• • • We do not use the following data for averages, fits, limits, etc. • • •				
230 ± 15 ± 21		³ AAIJ	15Y LHCB	$B^0 \rightarrow \bar{D}^0 \pi^+ \pi^-$
¹ From the Dalitz plot analysis including various K^* and D^{**} mesons as well as broad structures in the $K\pi$ S -wave and the $D\pi$ S - and P -waves.				
² Modeling the $\pi^+ \pi^-$ S -wave with the Isobar formalism.				
³ Modeling the $\pi^+ \pi^-$ S -wave with the K-matrix formalism.				

NODE=M179W

OCCUR=2

NODE=M179W;LINKAGE=A

NODE=M179W;LINKAGE=B
NODE=M179W;LINKAGE=C **$D_0^*(2400)^\pm$ DECAY MODES**

NODE=M179215;NODE=M179

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad D^0 \pi^+$	seen

DESIG=1;OUR EVAL;→ UNCHECKED ←

 $D_0^*(2400)^\pm$ REFERENCES

AAIJ	15X PR D92 012012	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	15Y PR D92 032002	R. Aaij <i>et al.</i>	(LHCb Collab.)
LINK	04A PL B586 11	J.M. Link <i>et al.</i>	(FOCUS Collab.)

NODE=M179

REFID=56588
REFID=56609
REFID=49775

$D_1(2420)^0$
 $I(J^P) = \frac{1}{2}(1^+)$
 I needs confirmation.

NODE=M097

 $D_1(2420)^0$ MASS

NODE=M097M

The fit includes $D^\pm$, D^0 , $D_s^\pm$, $D^{*\pm}$, D^{*0} , $D_s^{*\pm}$, $D_1(2420)^0$, $D_2^*(2460)^0$, and $D_{s1}(2536)^\pm$ mass and mass difference measurements.

NODE=M097M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2420.8 ± 0.5 OUR FIT	Error includes scale factor of 1.3.			
2420.5 ± 0.6 OUR AVERAGE	Error includes scale factor of 1.3. See the ideogram below.			
$2419.6 \pm 0.1 \pm 0.7$	210k	AAIJ	13CC LHCB	$pp \rightarrow D^{*+} \pi^- X$
$2423.1 \pm 1.5^{+0.4}_{-1.0}$	2.7k	¹ ABRAMOWICZ13	ZEUS	$e^\pm p \rightarrow D^{(*)+} \pi^- X$
$2420.1 \pm 0.1 \pm 0.8$	103k	DEL-AMO-SA...10P	BABR	$e^+ e^- \rightarrow D^{*+} \pi^- X$
$2426 \pm 3 \pm 1$	151	ABE	05A BELL	$B^- \rightarrow D^0 \pi^+ \pi^- \pi^-$
$2421.4 \pm 1.5 \pm 0.9$		² ABE	04D BELL	$B^- \rightarrow D^{*+} \pi^- \pi^-$
$2421 \pm 1^{+1}_{-2} \pm 2$	286	AVERY	94C CLE2	$e^+ e^- \rightarrow D^{*+} \pi^- X$
$2422 \pm 2 \pm 2$	51	FRABETTI	94B E687	$\gamma Be \rightarrow D^{*+} \pi^- X$
$2428 \pm 3 \pm 2$	279	AVERY	90 CLEO	$e^+ e^- \rightarrow D^{*+} \pi^- X$
$2414 \pm 2 \pm 5$	171	ALBRECHT	89H ARG	$e^+ e^- \rightarrow D^{*+} \pi^- X$
$2428 \pm 8 \pm 5$	171	ANJOS	89C TPS	$\gamma N \rightarrow D^{*+} \pi^- X$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$2420.5 \pm 2.1 \pm 0.9$	3110 ± 340	³ CHEKANOV	09 ZEUS	$e^\pm p \rightarrow D^{*+} \pi^- X$
$2421.7 \pm 0.7 \pm 0.6$	7.5k	ABULENCIA	06A CDF	$1900 p\bar{p} \rightarrow D^{*+} \pi^- X$
2425 ± 3	235	⁴ ABREU	98M DLPH	$e^+ e^-$

NODE=M097M

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.

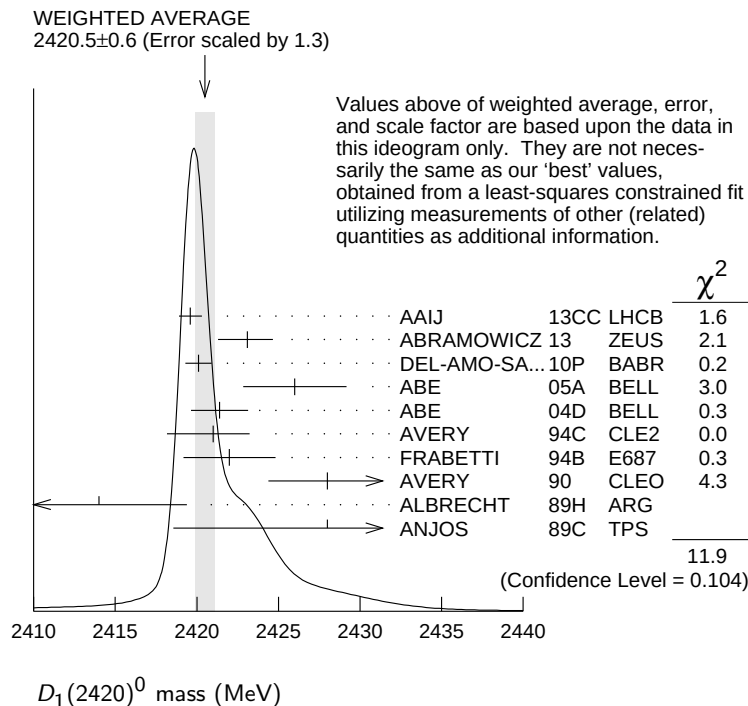
⁴ No systematic error given.

NODE=M097M;LINKAGE=AR

NODE=M097M;LINKAGE=AB

NODE=M097M;LINKAGE=CH

NODE=M097M;LINKAGE=K



$$m_{D_1^0} - m_{D^{*+}}$$

NODE=M097DM

The fit includes $D^\pm, D^0, D_s^\pm, D^{*\pm}, D^{*0}, D_s^{*\pm}, D_1(2420)^0, D_2^{*}(2460)^0$, and $D_{s1}(2536)^\pm$ mass and mass difference measurements.

NODE=M097DM

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
410.6±0.5 OUR FIT Error includes scale factor of 1.3.				
411.5±0.8 OUR AVERAGE				
410.2±2.1±0.9	3110±340	CHEKANOV	09 ZEUS	$e^\pm p \rightarrow D^{*+} \pi^- X$
411.7±0.7±0.4	7.5k	ABULENCIA	06A CDF	1900 $p\bar{p} \rightarrow D^{*+} \pi^- X$

NODE=M097DM

$D_1(2420)^0$ WIDTH

NODE=M097W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
31.7± 2.5 OUR AVERAGE Error includes scale factor of 3.5. See the ideogram below.				
35.2± 0.4± 0.9	210k	AAIJ	13CC LHCb	$pp \rightarrow D^{*+} \pi^- X$
38.8± 5.0 ^{+1.9} _{-5.4}	2.7k	¹ 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		² 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	$e^+ e^- \rightarrow D^{*+} \pi^- X$

NODE=M097W

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

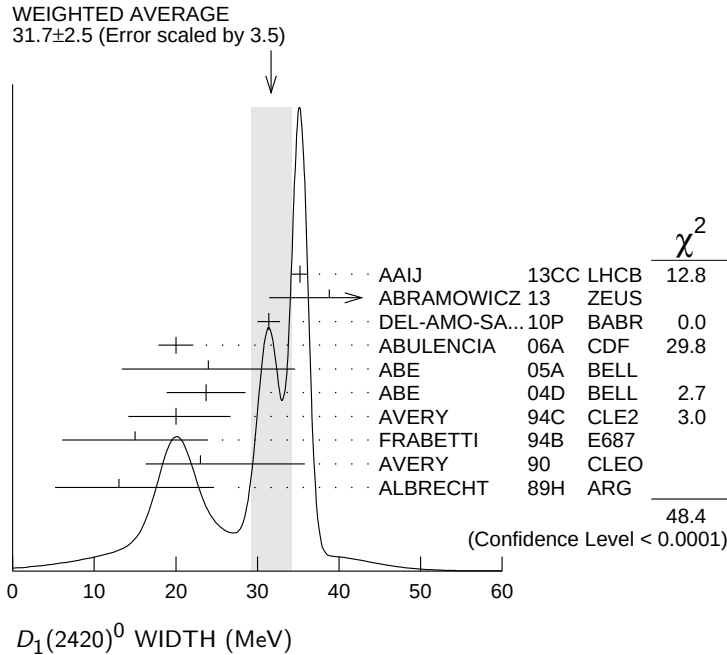
53.2± 7.2 ^{+3.3} _{-4.9}	3110±340	CHEKANOV	09 ZEUS	$e^\pm p \rightarrow D^{*+} \pi^- X$
58 ±14 ±10	171	ANJOS	89C TPS	$\gamma N \rightarrow D^{*+} \pi^- X$

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 $D_1^*(2430)^0$.

NODE=M097W;LINKAGE=AR

NODE=M097W;LINKAGE=AB



$D_1(2420)^0$ DECAY MODES

NODE=M097215;NODE=M097

$\bar{D}_1(2420)^0$ modes are charge conjugates of modes below.

NODE=M097

Mode	Fraction (Γ_i/Γ)
Γ_1 $D^{*}(2010)^+ \pi^-$	seen
Γ_2 $D^0 \pi^+ \pi^-$	seen
Γ_3 $D^0 \rho^0$	

DESIG=1

DESIG=3;OUR EST;→ UNCHECKED ←

DESIG=4

Γ_4	$D^0 f_0(500)$	
Γ_5	$D_0^*(2400)^+ \pi^-$	
Γ_6	$D^+ \pi^-$	not seen
Γ_7	$D^{*0} \pi^+ \pi^-$	not seen

DESIG=5

DESIG=6

DESIG=2;OUR EST;→ UNCHECKED ←

DESIG=7;OUR EST;→ UNCHECKED ←

 $D_1(2420)^0$ BRANCHING RATIOS

NODE=M097220

$\Gamma(D^*(2010)^+ \pi^-)/\Gamma_{\text{total}}$		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=M097R1
NODE=M097R1NODE=M097R2
NODE=M097R2 **$D_1(2420)^0$ POLARIZATION AMPLITUDE A_{D_1}**

NODE=M097PAH

A polarization amplitude A_{D_1} is a parameter that depends on the initial polarization of the D_1 and is sensitive to a possible S -wave contribution to its decay. For D_1 decays the helicity angle, θ_h , distribution varies like $1 + A_{D_1} \cos^2 \theta_h$, where θ_h is the angle in the D^* rest frame between the two pions emitted by the $D_1 \rightarrow D^* \pi$ and the $D^* \rightarrow D \pi$.

NODE=M097PAH

Unpolarized D_1 decaying purely via D -wave is predicted to give $A_{D_1} = 3$.

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
5.73±0.25 OUR AVERAGE				
7.8 $^{+6.7}_{-2.7}$ $^{+4.6}_{-1.8}$	2.7k	¹ ABRAMOWICZ13	ZEUS	$e^\pm p \rightarrow D^{(*)+} \pi^- X$
5.72±0.25	103k	DEL-AMO-SA...10P	BABR	$e^+ e^- \rightarrow D^{*+} \pi^- X$
5.9 $^{+3.0}_{-1.7}$ $^{+2.4}_{-1.0}$		CHEKANOV 09	ZEUS	$e^\pm p \rightarrow D^{*+} \pi^- X$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
3.30±0.48	210k	² AAIJ	13CC LHCb	$pp \rightarrow D^{*+} \pi^- X$
3.8 ±0.6 ±0.8		³ AUBERT	09Y BABR	$B^+ \rightarrow D_1^0 \ell^+ \nu_\ell$
2.74 $^{+1.40}_{-0.93}$		⁴ AVERY	94C CLE2	$e^+ e^- \rightarrow D^{*+} \pi^- X$

NODE=M097PAH

¹ From the combined fit of the $M(D^+ \pi^-)$ and $M(D^{*+} \pi^-)$ distributions. and A_{D_2} fixed to the theoretical prediction of -1 . A pure D -wave not excluded although some $\bar{S}$ -wave mixing possible.

NODE=M097PAH;LINKAGE=AR

² Systematic uncertainty not estimated. Resonance parameters fixed.

NODE=M097PAH;LINKAGE=A
NODE=M097PAH;LINKAGE=AU

³ Assuming $\Gamma(\Upsilon(4S) \rightarrow B^+ B^-) / \Gamma(\Upsilon(4S) \rightarrow B^0 \bar{B}^0) = 1.065 \pm 0.026$ and equal partial widths and helicity angle distributions for charged and neutral D_1 mesons.

⁴ Systematic uncertainties not estimated.

NODE=M097PAH;LINKAGE=AV

 $D_1(2420)^0$ REFERENCES

NODE=M097

AAIJ	13CC	JHEP 1309 145	R. Aaij <i>et al.</i>	(LHCb Collab.)
ABRAMOWICZ 13	NP	B866 229	H. Abramowicz <i>et al.</i>	(ZEUS Collab.)
DEL-AMO-SA... 10P	PR	D82 111101	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)
AUBERT 09Y	PRL	103 051803	B. Aubert <i>et al.</i>	(BABAR Collab.)
CHEKANOV 09	EPJ	C60 25	S. Chekanov <i>et al.</i>	(ZEUS Collab.)
ABULENCIA 06A	PR	D73 051104	A. Abulencia <i>et al.</i>	(CDF Collab.)
ABE 05A	PRL	94 221805	K. Abe <i>et al.</i>	(BELLE Collab.)
ABE 04D	PR	D69 112002	K. Abe <i>et al.</i>	(BELLE Collab.)
ABREU 98M	PL	B426 231	P. Abreu <i>et al.</i>	(DELPHI Collab.)
ACKERSTAFF 97W	ZPHY	C76 425	K. Ackerstaff <i>et al.</i>	(OPAL Collab.)
AVERY 94C	PL	B331 236	P. Avery <i>et al.</i>	(CLEO Collab.)
FRABETTI 94B	PRL	72 324	P.L. Frabetti <i>et al.</i>	(FNAL E687 Collab.)
AVERY 90	PR	D41 774	P. Avery, D. Besson	(CLEO Collab.)
ALBRECHT 89H	PL	B232 398	H. Albrecht <i>et al.</i>	(ARGUS Collab.) JP
ANJOS 89C	PRL	62 1717	J.C. Anjos <i>et al.</i>	(FNAL E691 Collab.)

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REFID=50011
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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 $D^{*0}(2007)\pi^+$. $J^P = 0^+$ ruled out.

NODE=M120

NODE=M120

NODE=M120M

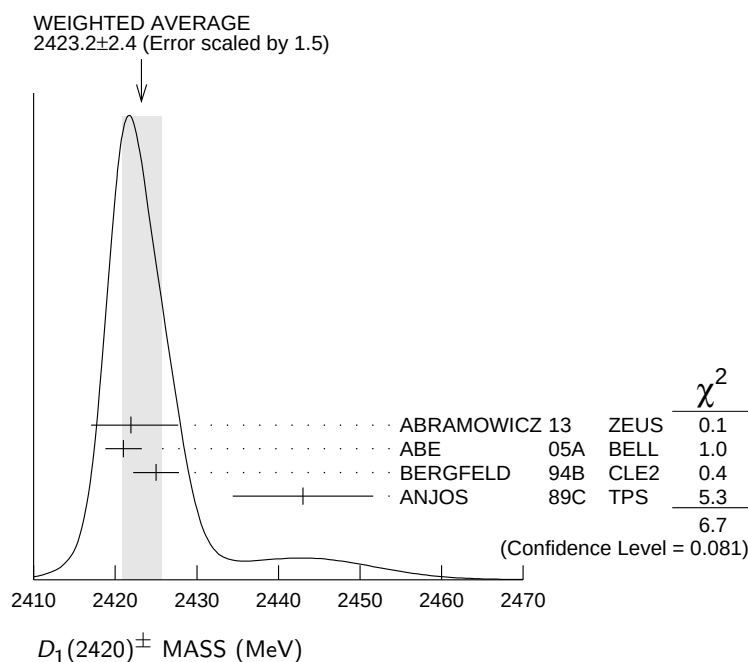
NODE=M120M

NODE=M120M;LINKAGE=AB

$D_1(2420)^\pm$ 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.		
$2421.9 \pm 4.7^{+3.4}_{-1.2}$	759	¹ ABRAMOWICZ13	ZEUS	$e^\pm p \rightarrow D^{(*)0}\pi^+ X$
$2421 \pm 2 \pm 1$	124	ABE	05A BELL	$\bar{B}^0 \rightarrow D^+\pi^+\pi^-\pi^-$
$2425 \pm 2 \pm 2$	146	BERGFELD	94B CLE2	$e^+e^- \rightarrow D^{*0}\pi^+ X$
$2443 \pm 7 \pm 5$	190	ANJOS	89C TPS	$\gamma N \rightarrow D^0\pi^+ X^0$

¹ From the fit of the $M(D^0\pi^+)$ distribution. The widths of the D_1^+ and D_2^{*+} are fixed to 25 MeV and 37 MeV, and A_{D_1} and A_{D_2} are fixed to the theoretical predictions of 3 and -1 , respectively.



$m_{D_1^*(2420)^\pm} - m_{D_1^*(2420)^0}$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$4^{+2}_{-3} \pm 3$	BERGFELD	94B CLE2	$e^+e^- \rightarrow \text{hadrons}$

NODE=M120DM

NODE=M120DM

$D_1(2420)^\pm$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
25 ± 6 OUR AVERAGE				
$21 \pm 5 \pm 8$	124	ABE	05A BELL	$\bar{B}^0 \rightarrow D^+\pi^+\pi^-\pi^-$
$26^{+8}_{-7} \pm 4$	146	BERGFELD	94B CLE2	$e^+e^- \rightarrow D^{*0}\pi^+ X$
$41 \pm 19 \pm 8$	190	ANJOS	89C TPS	$\gamma N \rightarrow D^0\pi^+ X^0$

NODE=M120W

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 $A_{D_1} = 3$.

<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

NODE=M120PAH

² Assuming $\Gamma(\Upsilon(4S) \rightarrow B^+ B^-) / \Gamma(\Upsilon(4S) \rightarrow B^0 \bar{B}^0) = 1.065 \pm 0.026$ and equal partial widths and helicity angle distributions for charged and neutral D_1 mesons.

NODE=M120PAH

NODE=M120PAH;LINKAGE=AU

 $D_1(2420)^\pm$ REFERENCES

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 ± 26 ± 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 ± 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)
Γ_1 $D^*(2010)^+ \pi^-$	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). AAIJ 13CC confirms $J^P = 2^+$ and natural parity.

 $D_2^*(2460)^0$ MASS

The fit includes $D^\pm$, D^0 , $D_s^\pm$, $D^{*\pm}$, 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
2460.7 ± 0.4 OUR FIT	Error includes scale factor of 3.1. [2460.57 ± 0.15 MeV OUR 2016 FIT Scale factor = 1.1]			
2460.56 ± 0.35 OUR AVERAGE	Error includes scale factor of 2.6. See the ideogram below. [2460.47 ± 0.21 MeV OUR 2016 AVERAGE Scale factor = 1.6]			
2463.7 ± 0.4 ± 0.7	28k	¹ AAIJ	16AH LHCB	$B^- \rightarrow D^+ \pi^- \pi^-$
2460.4 ± 0.4 ± 1.2	82k	AAIJ	13CC LHCB	$pp \rightarrow D^{*+} \pi^- X$
2460.4 ± 0.1 ± 0.1	675k	AAIJ	13CC LHCB	$pp \rightarrow D^+ \pi^- X$
2462.5 ± 2.4 ^{+1.3} _{-1.1}	2.3k	² ABRAMOWICZ13	ZEUS	$e^\pm p \rightarrow D^{(*)+} \pi^- X$
2462.2 ± 0.1 ± 0.8	243k	DEL-AMO-SA..10P	BABR	$e^+ e^- \rightarrow D^+ \pi^- X$
2460.4 ± 1.2 ± 2.2	3.4k	AUBERT	09AB BABR	$B^- \rightarrow D^+ \pi^- \pi^-$
2461.6 ± 2.1 ± 3.3		³ ABE	04D BELL	$B^- \rightarrow D^+ \pi^- \pi^-$
2464.5 ± 1.1 ± 1.9	5.8k	³ LINK	04A FOCUS	γA
2465 ± 3 ± 3	486	AVERY	94C CLE2	$e^+ e^- \rightarrow D^+ \pi^- X$
2453 ± 3 ± 2	128	FRABETTI	94B E687	$\gamma Be \rightarrow D^+ \pi^- X$
2461 ± 3 ± 1	440	AVERY	90 CLEO	$e^+ e^- \rightarrow D^{*+} \pi^- X$
2455 ± 3 ± 5	337	ALBRECHT	89B ARG	$e^+ e^- \rightarrow D^+ \pi^- X$
2459 ± 3 ± 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

OCCUR=2

OCCUR=2

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

2469.1 ± 3.7 $^{+1.2}_{-1.3}$	1.5k	⁴ CHEKANOV	09	ZEUS	$e^{\pm} p \rightarrow D^{(*)+} \pi^{-} X$
2463.3 ± 0.6 ± 0.8	20k	ABULENCIA	06A	CDF	1900 $p\bar{p} \rightarrow D^{+} \pi^{-} X$
2461 ± 6	126	⁵ ABREU	98M	DLPH	$e^{+} e^{-}$
2466 ± 7	1	ASRATYAN	95	BEBC	53,40 $\nu(\bar{\nu}) \rightarrow pX, dX$

¹ From the amplitude analysis in the model describing the $D^{+} \pi^{-}$ wave together with virtual contributions from the $D^{*}(2007)^0$ and B^{*0} states, and components corresponding to the $D_2^{*}(2460)^0$, $D_1^{*}(2680)^0$, $D_3^{*}(2760)^0$, and $D_2^{*}(3000)^0$ resonances.

² From the combined fit of the $M(D^{+} \pi^{-})$ and $M(D^{*+} \pi^{-})$ distributions. and A_{D_2} fixed to the theoretical prediction of -1 .

³ Fit includes the contribution from $D_0^{*}(2400)^0$.

⁴ 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.

⁵ No systematic error given.

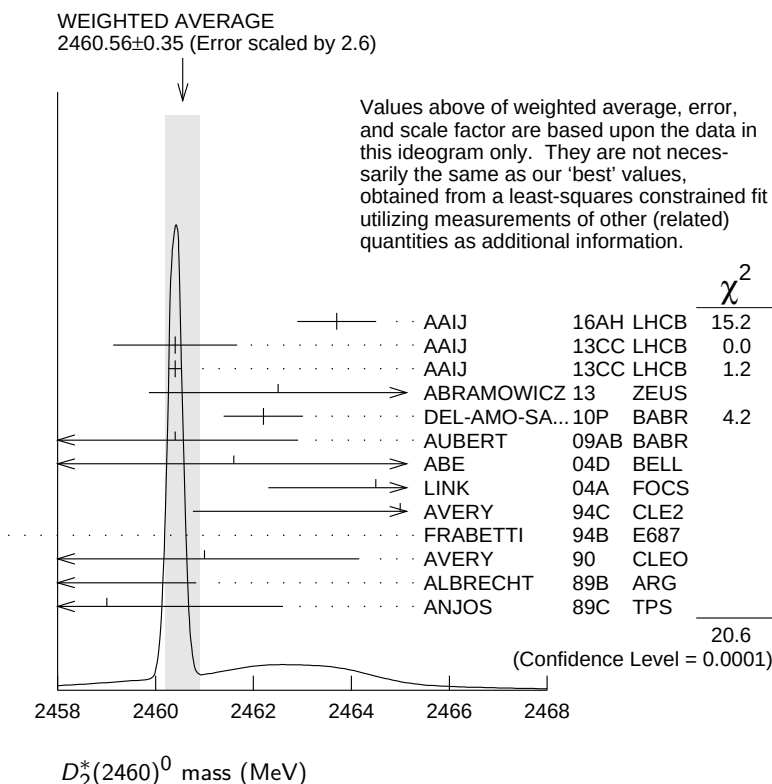
NODE=M119M;LINKAGE=B

NODE=M119M;LINKAGE=AR

NODE=M119M;LINKAGE=LI

NODE=M119M;LINKAGE=CH

NODE=M119M;LINKAGE=K



$$m_{D_2^{*0}} - m_{D^{+}}$$

NODE=M119DM

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

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
591.1$\pm$0.4 OUR FIT	Error includes scale factor of 2.6.	[590.98 $\pm$ 0.18 MeV OUR 2016 FIT Scale factor = 1.1]		
593.9$\pm$0.6$\pm$0.5	20k	ABULENCIA	06A CDF	1900 $p\bar{p} \rightarrow D^{+} \pi^{-} X$

NODE=M119DM

NEW

$$m_{D_2^{*0}} - m_{D^{*+}}$$

NODE=M119DM2

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

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
450.4 ± 0.4 OUR FIT	Error includes scale factor of 2.9. [450.31 ± 0.16 MeV OUR 2016 FIT Scale factor = 1.1]			
458.8 ± 3.7^{+1.2}_{-1.3}	1560 ± 230	CHEKANOV	09 ZEUS	$e^{\pm} p \rightarrow D^{(*)+} \pi^{-} X$

NODE=M119DM2

NEW

 $D_2^{*}(2460)^0$ WIDTH

NODE=M119W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
47.5 ± 1.1 OUR AVERAGE	Error includes scale factor of 1.8. See the ideogram below. [47.7 ± 1.3 MeV OUR 2016 AVERAGE Scale factor = 2.0]			
47.0 ± 0.8 ± 1.0	28k	⁶ AAIJ	16AH LHCB	$B^{-} \rightarrow D^{+} \pi^{-} \pi^{-}$
43.2 ± 1.2 ± 3.0	82k	AAIJ	13CC LHCB	$pp \rightarrow D^{*+} \pi^{-} X$
45.6 ± 0.4 ± 1.1	675k	AAIJ	13CC LHCB	$pp \rightarrow D^{+} \pi^{-} X$
46.6 ± 8.1 ⁺ _{-3.8}	2.3k	⁷ ABRAMOWICZ13	ZEUS	$e^{\pm} p \rightarrow D^{(*)+} \pi^{-} X$
50.5 ± 0.6 ± 0.7	243k	DEL-AMO-SA...10P	BABR	$e^{+} e^{-} \rightarrow D^{+} \pi^{-} X$
41.8 ± 2.5 ± 2.9	3.4k	AUBERT	09AB BABR	$B^{-} \rightarrow D^{+} \pi^{-} \pi^{-}$
49.2 ± 2.3 ± 1.3	20k	ABULENCIA	06A CDF	$1900 p \bar{p} \rightarrow D^{+} \pi^{-} X$
45.6 ± 4.4 ± 6.7		⁸ ABE	04D BELL	$B^{-} \rightarrow D^{+} \pi^{-} \pi^{-}$
38.7 ± 5.3 ± 2.9	5.8k	⁸ LINK	04A FOCS	γA
28 ⁺ ₋₇ ± 6	486	AVERY	94C CLE2	$e^{+} e^{-} \rightarrow D^{+} \pi^{-} X$
25 ± 10 ± 5	128	FRABETTI	94B E687	$\gamma Be \rightarrow D^{+} \pi^{-} X$
20 ⁺ ₋₁₂ ± 9 ⁺ ₋₁₀	440	AVERY	90 CLEO	$e^{+} e^{-} \rightarrow D^{*+} \pi^{-} X$
15 ⁺ ₋₁₀ ± 13 ⁺ ₋₁₀	337	ALBRECHT	89B ARG	$e^{+} e^{-} \rightarrow D^{+} \pi^{-} X$
20 ± 10 ± 5	153	ANJOS	89C TPS	$\gamma N \rightarrow D^{+} \pi^{-} X$

NODE=M119W

NEW

OCCUR=3

OCCUR=2

⁶ From the amplitude analysis in the model describing the $D^{+} \pi^{-}$ wave together with virtual contributions from the $D^{*}(2007)^0$ and B^{*0} states, and components corresponding to the $D_2^{*}(2460)^0$, $D_1^{*}(2680)^0$, $D_3^{*}(2760)^0$, and $D_2^{*}(3000)^0$ resonances.

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.

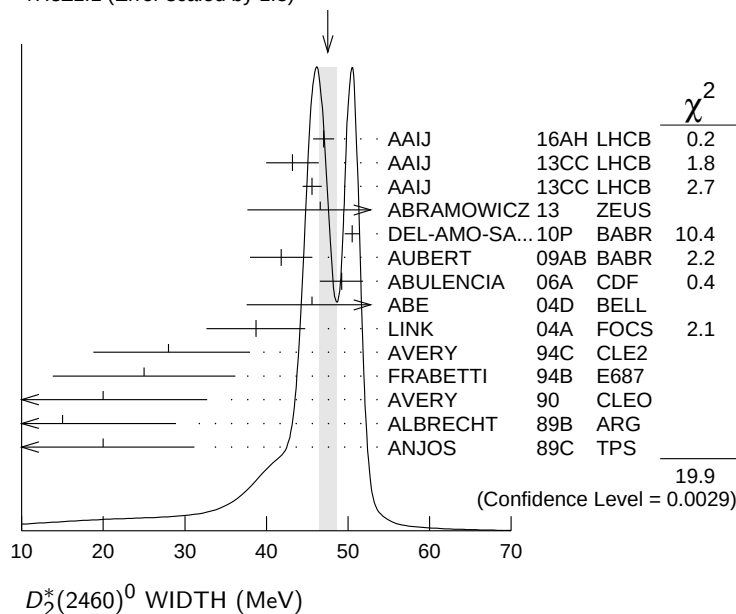
⁸ Fit includes the contribution from $D_0^{*}(2400)^0$.

NODE=M119W;LINKAGE=D

NODE=M119W;LINKAGE=AR

NODE=M119W;LINKAGE=LI

WEIGHTED AVERAGE
47.5 ± 1.1 (Error scaled by 1.8)



$D_2^*(2460)^0$ DECAY MODES $\bar{D}_2^*(2460)^0$ modes are charge conjugates of modes below.

NODE=M119215;NODE=M119

NODE=M119

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad D^+ \pi^-$	seen
$\Gamma_2 \quad D^*(2010)^+ \pi^-$	seen
$\Gamma_3 \quad D^0 \pi^+ \pi^-$	not seen
$\Gamma_4 \quad D^{*0} \pi^+ \pi^-$	not seen

CLUMP=A;DESIG=1

DESIG=2

DESIG=3;OUR EST;→ UNCHECKED ←

DESIG=4;OUR EST;→ UNCHECKED ←

 $D_2^*(2460)^0$ BRANCHING RATIOS

NODE=M119220

$\Gamma(D^+ \pi^-)/\Gamma_{\text{total}}$					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=M119R1

NODE=M119R1

$\Gamma(D^*(2010)^+ \pi^-)/\Gamma_{\text{total}}$					Γ_2/Γ
VALUE		DOCUMENT ID	TECN	COMMENT	
seen		ACKERSTAFF	97W OPAL	$e^+ e^- \rightarrow D^{*+} \pi^- X$	
seen		AVERY	90 CLEO	$e^+ e^- \rightarrow D^{*+} \pi^- X$	
seen		ALBRECHT	89H ARG	$e^+ e^- \rightarrow D^* \pi^- X$	

NODE=M119R2

NODE=M119R2

$\Gamma(D^+ \pi^-)/\Gamma(D^*(2010)^+ \pi^-)$					Γ_1/Γ_2
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
1.54 ± 0.15 OUR AVERAGE					
1.4 ± 0.3 ± 0.3	2.3k	⁹ 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 $\begin{smallmatrix} +0.5 \\ -0.6 \end{smallmatrix}$	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	$B^- \rightarrow D^{(*)+} \pi^- \pi^-$	

NODE=M119R3

NODE=M119R3

⁹ From the combined fit of the $M(D^+ \pi^-)$ and $M(D^{*+} \pi^-)$ distributions. and A_{D_2} fixed to the theoretical prediction of -1 .

NODE=M119R3;LINKAGE=AR

$\Gamma(D^+ \pi^-)/[\Gamma(D^+ \pi^-) + \Gamma(D^*(2010)^+ \pi^-)]$					$\Gamma_1/(\Gamma_1 + \Gamma_2)$
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.62 ± 0.03 ± 0.02	8414	¹⁰ AUBERT	09Y BABR	$B^+ \rightarrow D_2^{*0} \ell^+ \nu_\ell$	

NODE=M119R01

NODE=M119R01

¹⁰ Assuming $\Gamma(\Upsilon(4S) \rightarrow B^+ B^-) / \Gamma(\Upsilon(4S) \rightarrow B^0 \bar{B}^0) = 1.065 \pm 0.026$ and equal partial widths for charged and neutral D_2^* mesons.

NODE=M119R01;LINKAGE=AU

 $D_2^*(2460)^0$ POLARIZATION AMPLITUDE A_{D_2}

NODE=M119PAM

A polarization amplitude A_{D_2} is a parameter that depends on the initial polarization of the D_2 . For $\bar{D}_2^*$ 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

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
-1.16 ± 0.35	2.3k	¹¹ 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 $\begin{smallmatrix} +0.49 \\ -0.38 \end{smallmatrix}$		¹² AVERY	94C CLE2	$e^+ e^- \rightarrow D^{*+} \pi^- X$

NODE=M119PAM

¹¹ From the combined fit of the $M(D^+ \pi^-)$ and $M(D^{*+} \pi^-)$ distributions.

NODE=M119PAM;LINKAGE=AB

¹² Systematic uncertainties not estimated.

NODE=M119PAM;LINKAGE=AV

$D_2^*(2460)^0$ REFERENCES

AAIJ	16AH	PR D94 072001	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=57518
AAIJ	13CC	JHEP 1309 145	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=55581
ABRAMOWICZ	13	NP B866 229	H. Abramowicz <i>et al.</i>	(ZEUS Collab.)	REFID=54743
DEL-AMO-SA...	10P	PR D82 111101	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)	REFID=53534
AUBERT	09AB	PR D79 112004	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52941
AUBERT	09Y	PRL 103 051803	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52929
CHEKANOV	09	EPJ C60 25	S. Chekanov <i>et al.</i>	(ZEUS Collab.)	REFID=52733
ABULENCIA	06A	PR D73 051104	A. Abulencia <i>et al.</i>	(CDF Collab.)	REFID=51054
ABE	04D	PR D69 112002	K. Abe <i>et al.</i>	(BELLE Collab.)	REFID=50011
LINK	04A	PL B586 11	J.M. Link <i>et al.</i>	(FOCUS Collab.)	REFID=49775
ABREU	98M	PL B426 231	P. Abreu <i>et al.</i>	(DELPHI Collab.)	REFID=46315
ACKERSTAFF	97W	ZPHY C76 425	K. Ackerstaff <i>et al.</i>	(OPAL Collab.)	REFID=45788
ASRATYAN	95	ZPHY C68 43	A.E. Asratyan <i>et al.</i>	(BIRM, BELG, CERN+)	REFID=44439
AVERY	94C	PL B331 236	P. Avery <i>et al.</i>	(CLEO Collab.)	REFID=44096
FRABETTI	94B	PRL 72 324	P.L. Frabetti <i>et al.</i>	(FNAL E687 Collab.)	REFID=43687
AVERY	90	PR D41 774	P. Avery, D. Besson	(CLEO Collab.)	REFID=41013
ALBRECHT	89B	PL B221 422	H. Albrecht <i>et al.</i>	(ARGUS Collab.) JP	REFID=40736
ALBRECHT	89H	PL B232 398	H. Albrecht <i>et al.</i>	(ARGUS Collab.) JP	REFID=41001
ANJOS	89C	PRL 62 1717	J.C. Anjos <i>et al.</i>	(FNAL E691 Collab.)	REFID=40737

NODE=M119

$$D_2^*(2460)^\pm$$

$$I(J^P) = \frac{1}{2}(2^+)$$

$J^P = 2^+$ assignment strongly favored(ALBRECHT 89B).

NODE=M150

NODE=M150

 $D_2^*(2460)^\pm$ MASS

NODE=M150M

NODE=M150M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2465.4±1.3 OUR AVERAGE		Error includes scale factor of 3.1.	See the ideogram below.	
2465.6±1.8±1.3		¹ AAIJ	15X LHCb	$B^0 \rightarrow \bar{D}^0 K^+ \pi^-$
2468.6±0.6±0.3		² AAIJ	15Y LHCb	$B^0 \rightarrow \bar{D}^0 \pi^+ \pi^-$
2463.1±0.2±0.6	342k	AAIJ	13CC LHCb	$pp \rightarrow D^0 \pi^+ X$
2460.6±4.4 ^{+3.6} _{-0.8}	1371	³ ABRAMOWICZ13	ZEUS	$e^\pm p \rightarrow D^{(*)0} \pi^+ X$
2465.4±0.2±1.1	111k	⁴ DEL-AMO-SA...10P	BABR	$e^+ e^- \rightarrow D^0 \pi^+ X$
2465.7±1.8 ^{+1.4} _{-4.8}	2909	KUZMIN	07 BELL	$e^+ e^- \rightarrow \text{hadrons}$
2463 ±3 ±3	310	BERGFELD	94B CLE2	$e^+ e^- \rightarrow D^0 \pi^+ X$
2453 ±3 ±2	185	FRABETTI	94B E687	$\gamma \text{Be} \rightarrow D^0 \pi^+ X$
2469 ±4 ±6		ALBRECHT	89F ARG	$e^+ e^- \rightarrow D^0 \pi^+ X$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2468.1±0.6±0.5		⁵ AAIJ	15Y LHCb	$B^0 \rightarrow \bar{D}^0 \pi^+ \pi^-$
2467.6±1.5±0.8	3.5k	⁶ LINK	04A FOCS	γA

OCCUR=2

NODE=M150M;LINKAGE=A

NODE=M150M;LINKAGE=B

NODE=M150M;LINKAGE=AB

NODE=M150M;LINKAGE=DE

NODE=M150M;LINKAGE=C

NODE=M150M;LINKAGE=LI

¹ From the Dalitz plot analysis including various K^* and D^{**} mesons as well as broad structures in the $K\pi$ S -wave and the $D\pi$ S - and P -waves.

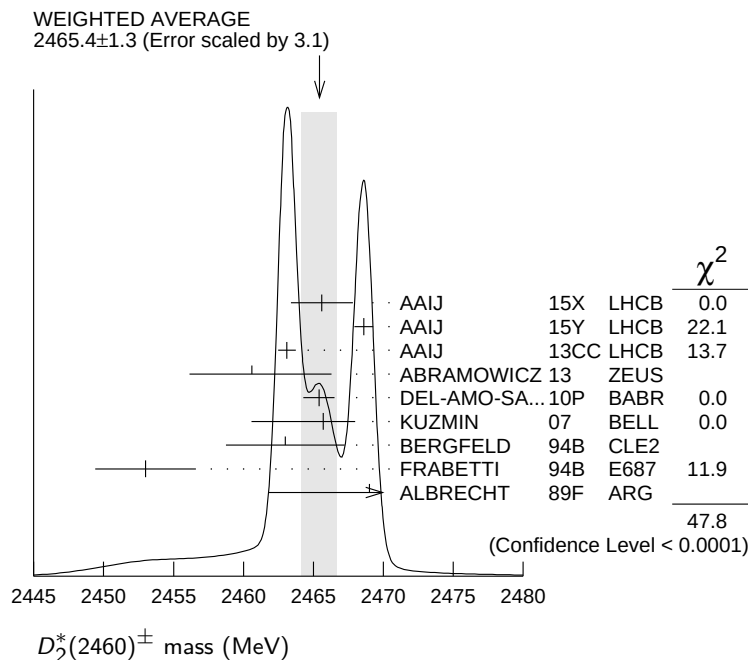
² Modeling the $\pi^+ \pi^-$ S -wave with the Isobar formalism.

³ From the fit of the $M(D^0 \pi^+)$ distribution. The widths of the D_1^+ and D_2^{*+} are fixed to 25 MeV and 37 MeV, and A_{D_1} and A_{D_2} are fixed to the theoretical predictions of 3 and -1, respectively.

⁴ At a fixed width of 50.5 MeV.

⁵ Modeling the $\pi^+ \pi^-$ S -wave with the K-matrix formalism.

⁶ Fit includes the contribution from $D_0^*(2400)^\pm$. Not independent of the corresponding mass difference measurement, $(m_{D_2^*(2460)^\pm} - (m_{D_2^*(2460)^0})$.



$$m_{D_2^*(2460)^\pm} - m_{D_2^*(2460)^0}$$

NODE=M150DM

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
2.4±1.7 OUR AVERAGE			
3.1±1.9±0.9	LINK	04A	FOCS γ A
- 2 ±4 ±4	BERGFELD	94B	CLE2 $e^+e^- \rightarrow$ hadrons
0 ±4	FRABETTI	94B	E687 γ Be $\rightarrow D\pi X$
14 ±5 ±8	ALBRECHT	89F	ARG $e^+e^- \rightarrow D^0\pi^+ X$

NODE=M150DM

$$D_2^*(2460)^\pm \text{WIDTH}$$

NODE=M150W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
46.7± 1.2 OUR AVERAGE				
46.0± 3.4±3.2		1 AAIJ	15X	LHCB $B^0 \rightarrow \bar{D}^0 K^+ \pi^-$
47.3± 1.5±0.7		2 AAIJ	15Y	LHCB $B^0 \rightarrow \bar{D}^0 \pi^+ \pi^-$
48.6± 1.3±1.9	342k	AAIJ	13CC	LHCB $pp \rightarrow D^0 \pi^+ X$
49.7± 3.8±6.4	2909	KUZMIN	07	BELL $e^+e^- \rightarrow$ hadrons
34.1± 6.5±4.2	3.5k	3 LINK	04A	FOCS γ A
27 $\pm \frac{11}{8}$ ±5	310	BERGFELD	94B	CLE2 $e^+e^- \rightarrow D^0 \pi^+ X$
23 ± 9 ±5	185	FRABETTI	94B	E687 γ Be $\rightarrow D^0 \pi^+ X$
46.0± 1.4±1.8		4 AAIJ	15Y	LHCB $B^0 \rightarrow \bar{D}^0 \pi^+ \pi^-$

NODE=M150W

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

¹ From the Dalitz plot analysis including various K^* and D^{**} mesons as well as broad structures in the $K\pi$ S-wave and the $D\pi$ S- and P-waves.

² Modeling the $\pi^+\pi^-$ S-wave with the Isobar formalism.

³ Fit includes the contribution from $D_0^*(2400)^\pm$.

⁴ Modeling the $\pi^+\pi^-$ S-wave with the K-matrix formalism.

OCCUR=2

NODE=M150W;LINKAGE=A

NODE=M150W;LINKAGE=B

NODE=M150W;LINKAGE=LI

NODE=M150W;LINKAGE=C

$$D_2^*(2460)^\pm \text{ DECAY MODES}$$

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				

NODE=M150R2
NODE=M150R2

1.1±0.4 ^{+0.3} _{-0.2}	1371	¹ ABRAMOWICZ13	ZEUS	$e^\pm p \rightarrow D^{(*)0}\pi^+X$
1.9±1.1±0.3		BERGFELD	94B	CLE2 $e^+e^- \rightarrow \text{hadrons}$

¹ From the fit of the $M(D^0\pi^+)$ distribution. The widths of the D_1^+ and D_2^{*+} are fixed to 25 MeV and 37 MeV, and A_{D_1} and A_{D_2} are fixed to the theoretical predictions of 3 and -1, respectively.

NODE=M150R2;LINKAGE=AB

$\Gamma(D^0\pi^+)/[\Gamma(D^0\pi^+) + \Gamma(D^{*0}\pi^+)]$				$\Gamma_1/(\Gamma_1+\Gamma_2)$
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

NODE=M150R01
NODE=M150R01

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

0.62±0.03±0.02	3361	¹ AUBERT	09Y	BABR $\bar{B}^0 \rightarrow D_2^{*+}\ell^-\nu_\ell$

¹ Assuming $\Gamma(\Upsilon(4S) \rightarrow B^+B^-) / \Gamma(\Upsilon(4S) \rightarrow B^0\bar{B}^0) = 1.065 \pm 0.026$ and equal partial widths for charged and neutral D_2^* mesons.

NODE=M150R01;LINKAGE=AU

 $D_2^*(2460)^\pm$ REFERENCES

NODE=M150

AAIJ	15X	PR D92 012012	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	15Y	PR D92 032002	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	13CC	JHEP 1309 145	R. Aaij <i>et al.</i>	(LHCb Collab.)
ABRAMOWICZ	13	NP B866 229	H. Abramowicz <i>et al.</i>	(ZEUS Collab.)
DEL-AMO-SA...	10P	PR D82 111101	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)
AUBERT	09Y	PRL 103 051803	B. Aubert <i>et al.</i>	(BABAR Collab.)
KUZMIN	07	PR D76 012006	A. Kuzmin <i>et al.</i>	(BELLE Collab.)
LINK	04A	PL B586 11	J.M. Link <i>et al.</i>	(FOCUS Collab.)
BERGFELD	94B	PL B340 194	T. Bergfeld <i>et al.</i>	(CLEO Collab.)
FRABETTI	94B	PRL 72 324	P.L. Frabetti <i>et al.</i>	(FNAL E687 Collab.)
ALBRECHT	89B	PL B221 422	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
ALBRECHT	89F	PL B231 208	H. Albrecht <i>et al.</i>	(ARGUS Collab.)

REFID=56588
REFID=56609
REFID=55581
REFID=54743
REFID=53534
REFID=52929
REFID=51854
REFID=49775
REFID=44099
REFID=43687
REFID=40736
REFID=40931

NODE=M198

 $D(2550)^0$

$$I(J^P) = \frac{1}{2}(?)$$

OMITTED FROM SUMMARY TABLE

Unnatural parity according to the helicity analysis of DEL-AMO-SANCHEZ 10P and AAIJ 13CC. DEL-AMO-SANCHEZ 10P suggests $J^P = 0^-$.

NODE=M198

 $D(2550)^0$ MASS

NODE=M198M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2564 ±20 OUR AVERAGE				Error includes scale factor of 3.9.
2579.5± 3.4±5.5	60k	AAIJ	13CC	LHCB $pp \rightarrow D^{*+}\pi^-X$
2539.4± 4.5±6.8	34k	DEL-AMO-SA...	10P	BABR $e^+e^- \rightarrow D^{*+}\pi^-X$

NODE=M198M

 $D(2550)^0$ WIDTH

NODE=M198W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
135 ±17 OUR AVERAGE				
177.5±17.8±46.0	60k	AAIJ	13CC	LHCB $pp \rightarrow D^{*+}\pi^-X$
130 ±12 ±13	34k	DEL-AMO-SA...	10P	BABR $e^+e^- \rightarrow D^{*+}\pi^-X$

NODE=M198W

D(2550)⁰ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad D^{*+} \pi^-$	seen

D(2550)⁰ POLARIZATION AMPLITUDE A_{D_J}

A polarization amplitude A_{D_J} is a parameter that depends on the initial polarization of the D_J . For D_J decays the helicity angle, θ_H , distribution varies like $1 + A_{D_J} \cos^2(\theta_H)$, where θ_H is the angle in the D_J rest frame between the two pions emitted in the $D_J \rightarrow D^* \pi$ and $D^* \rightarrow D \pi$ decays.

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
4.2 ± 1.3	60k	¹ AAIJ	13CC LHCB	$pp \rightarrow D^{*+} \pi^- X$
¹ Systematic uncertainty not estimated.				

D(2550)⁰ REFERENCES

AAIJ	13CC JHEP 1309 145	R. Aaij <i>et al.</i>	(LHCb Collab.)
DEL-AMO-SA... 10P	PR D82 111101	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)

$D_J^{*}(2600)$
was $D(2600)$,

$I(J^P) = \frac{1}{2}(?)$

OMITTED FROM SUMMARY TABLE
 J^P consistent with natural parity (DEL-AMO-SANCHEZ 10P, AAIJ 13CC).

D^{*}_J(2600) MASS

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	CHG	COMMENT
2623 ± 12 OUR AVERAGE Error includes scale factor of 4.8. See the ideogram below. [2622 ± 12 MeV OUR 2016 AVERAGE Scale factor = 4.7]					
2681.1 ± 5.6 ± 14.0	28k	¹ AAIJ	16AH LHCB		$B^- \rightarrow D^+ \pi^- \pi^-$
2649.2 ± 3.5 ± 3.5	51k	AAIJ	13CC LHCB		$pp \rightarrow D^{*+} \pi^- X$
2608.7 ± 2.4 ± 2.5	26k	DEL-AMO-SA...10P	BABR	0	$e^+ e^- \rightarrow D^+ \pi^- X$
2621.3 ± 3.7 ± 4.2	13k	² DEL-AMO-SA...10P	BABR	+	$e^+ e^- \rightarrow D^0 \pi^+ X$

¹ From the amplitude analysis in the model describing the $D^+ \pi^-$ wave together with virtual contributions from the $D^*(2007)^0$ and B^{*0} states, and components corresponding to the $D_2^*(2460)^0$, $D_1^*(2680)^0$, $D_3^*(2760)^0$, and $D_2^*(3000)^0$ resonances.
² At a fixed width of 93 MeV.

NODE=M198215;NODE=M198

DESIG=1;OUR EVAL;→ UNCHECKED ←

NODE=M198PAM

NODE=M198PAM

NODE=M198PAM

NODE=M198PAM;LINKAGE=A

NODE=M198

REFID=55581
REFID=53534

NODE=M199

NODE=M199

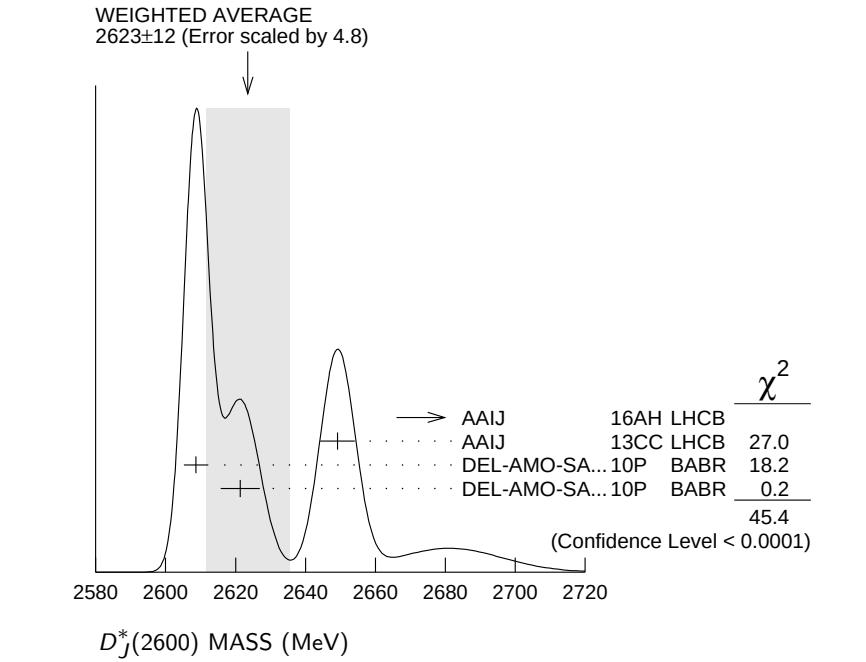
NODE=M199M

NODE=M199M
NEW

OCCUR=2

NODE=M199M;LINKAGE=A

NODE=M199M;LINKAGE=DE



$D_J^*(2600)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
139 ±31	OUR AVERAGE	Error includes scale factor of 3.2. See the ideogram below.		
[104 ± 20 MeV OUR 2016 AVERAGE Scale factor = 1.6]				
186.7± 8.5±11.9	28k	³ AAIJ	16AH LHCb	$B^- \rightarrow D^+ \pi^- \pi^-$
140.2±17.1±18.6	51k	AAIJ	13CC LHCb	$pp \rightarrow D^{*+} \pi^- X$
93 ± 6 ±13	26k	DEL-AMO-SA..10P	BABR	$e^+ e^- \rightarrow D^+ \pi^- X$

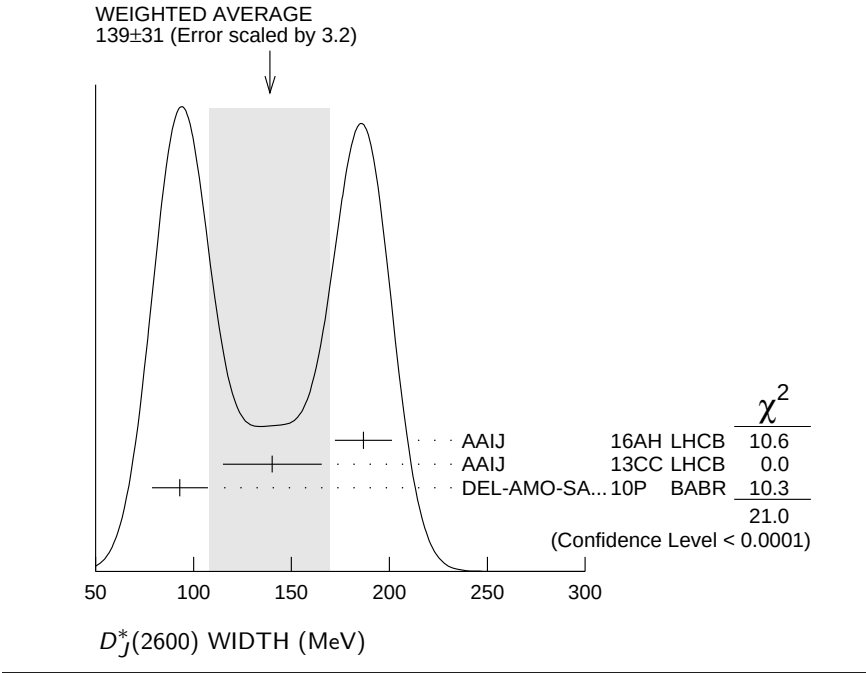
³From the amplitude analysis in the model describing the $D^+ \pi^-$ wave together with virtual contributions from the $D^*(2007)^0$ and B^{*0} states, and components corresponding to the $D_2^*(2460)^0$, $D_1^*(2680)^0$, $D_3^*(2760)^0$, and $D_2^*(3000)^0$ resonances.

NODE=M199W

NODE=M199W

NEW

NODE=M199W;LINKAGE=A



D*(2600) DECAY MODES

Mode		Fraction (Γ_i/Γ)
Γ_1	$D\pi$	seen
Γ_2	$D^+\pi^-$	seen
Γ_3	$D^0\pi^\pm$	seen
Γ_4	$D^*\pi$	seen
Γ_5	$D^{*+}\pi^-$	seen

NODE=M199215;NODE=M199

DESIG=1;OUR EVAL;→ UNCHECKED ←
DESIG=2;OUR EVAL;→ UNCHECKED ←
DESIG=3;OUR EVAL;→ UNCHECKED ←
DESIG=4;OUR EVAL;→ UNCHECKED ←
DESIG=5;OUR EVAL;→ UNCHECKED ←

D*(2600) BRANCHING RATIOS

$\Gamma(D^+\pi^-)/\Gamma(D^{*+}\pi^-)$				Γ_2/Γ_5	
VALUE	EVS	DOCUMENT ID	TECN	COMMENT	
0.32±0.02±0.09	76k	DEL-AMO-SA...10P	BABR	$e^+e^- \rightarrow D^{(*)+}\pi^- X$	

NODE=M199220

NODE=M199R01
NODE=M199R01

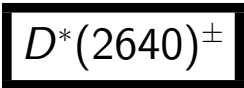
D*(2600) REFERENCES

AAIJ	16AH	PR D94 072001	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	13CC	JHEP 1309 145	R. Aaij <i>et al.</i>	(LHCb Collab.)
DEL-AMO-SA...10P	PR D82 111101		P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)

NODE=M199

REFID=57518
REFID=55581
REFID=53534

NODE=M158



$I(J^P) = \frac{1}{2}(??)$

OMITTED FROM SUMMARY TABLE
Seen in Z decays by ABREU 98M. Not seen by ABBIENDI 01N and
CHEKANOV 09. Needs confirmation.

NODE=M158

D*(2640)± MASS

VALUE (MeV)	EVS	DOCUMENT ID	TECN	COMMENT
2637±2±6	66 ± 14	ABREU	98M DLPH	$e^+e^- \rightarrow D^{*+}\pi^+\pi^- X$

NODE=M158M

NODE=M158M

D*(2640)± WIDTH

VALUE (MeV)	CL%	DOCUMENT ID	TECN	COMMENT
<15	95	ABREU	98M DLPH	$e^+e^- \rightarrow D^{*+}\pi^+\pi^- X$

NODE=M158W

NODE=M158W

D*(2640)+ DECAY MODES

D*(2640)− modes are charge conjugates of modes below.

NODE=M158215;NODE=M158

NODE=M158

Mode		Fraction (Γ_i/Γ)
Γ_1	$D^*(2010)^+\pi^+\pi^-$	seen

DESIG=1;OUR EST;→ UNCHECKED ←

D*(2640)± REFERENCES

CHEKANOV	09	EPJ C60 25	S. Chekanov <i>et al.</i>	(ZEUS Collab.)
ABBIENDI	01N	EPJ C20 445	G. Abbiendi <i>et al.</i>	(OPAL Collab.)
ABREU	98M	PL B426 231	P. Abreu <i>et al.</i>	(DELPHI Collab.)

NODE=M158

REFID=52733
REFID=48296
REFID=46315

$D(2740)^0$

$$I(J^P) = \frac{1}{2}(?)^?$$

OMITTED FROM SUMMARY TABLE
 J^P consistent with unnatural parity (AAIJ 13CC).

 $D(2740)^0$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2737.0±3.5±11.2	7.7k	AAIJ	13CC LHCb	$pp \rightarrow D^{*+} \pi^- X$

 $D(2740)^0$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
73.2±13.4±25.0	7.7k	AAIJ	13CC LHCb	$pp \rightarrow D^{*+} \pi^- X$

 $D(2740)^0$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad D^{*+} \pi^-$	seen

 $D(2740)^0$ POLARIZATION AMPLITUDE A_{D_J}

A polarization amplitude A_{D_J} is a parameter that depends on the initial polarization of the D_J . For D_J decays the helicity angle, θ_H , distribution varies like $1 + A_{D_J} \cos^2(\theta_H)$, where θ_H is the angle in the D_J rest frame between the two pions emitted in the $D_J \rightarrow D^* \pi$ and $D^* \rightarrow D \pi$ decays.

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
3.1±2.2	7.7k	¹ AAIJ	13CC LHCb	$pp \rightarrow D^{*+} \pi^- X$
¹ Systematic uncertainty not estimated.				

 $D(2740)^0$ REFERENCES

AAIJ	13CC JHEP 1309 145	R. Aaij <i>et al.</i>	(LHCb Collab.)

 $D(2750)$

$$I(J^P) = \frac{1}{2}(3^-)$$

OMITTED FROM SUMMARY TABLE
 J^P determined by AAIJ 15Y from the Dalitz plot analysis of $B^0 \rightarrow \bar{D}^0 \pi^+ \pi^-$ decays. J^P consistent with natural parity (AAIJ 13CC).

 $D(2750)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
2763.5± 3.4 OUR AVERAGE		Error includes scale factor of 2.2. See the ideogram below. [2763 ± 4 MeV OUR 2016 AVERAGE Scale factor = 2.3]			
2775.5± 4.5± 6.5	28k	¹ AAIJ	16AH LHCb		$B^- \rightarrow D^+ \pi^- \pi^-$
2798 ± 7 ± 7		² AAIJ	15Y LHCb		$B^0 \rightarrow \bar{D}^0 \pi^+ \pi^-$
2761.1± 5.1± 6.5	14k	AAIJ	13CC LHCb	0	$pp \rightarrow D^{*+} \pi^- X$
2760.1± 1.1± 3.7	56k	AAIJ	13CC LHCb	0	$pp \rightarrow D^+ \pi^- X$
2771.7± 1.7± 3.8	20k	AAIJ	13CC LHCb	+	$pp \rightarrow D^0 \pi^+ X$
2752.4± 1.7± 2.7	23.5k	³ DEL-AMO-SA..10P	BABR	0	$e^+ e^- \rightarrow D^{*+} \pi^- X$
2763.3± 2.3± 2.3	11.3k	³ DEL-AMO-SA..10P	BABR	0	$e^+ e^- \rightarrow D^+ \pi^- X$
2769.7± 3.8± 1.5	5.7k	^{3,4} DEL-AMO-SA..10P	BABR	+	$e^+ e^- \rightarrow D^0 \pi^+ X$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
2802 ±11 ±10		⁵ AAIJ	15Y LHCb		$B^0 \rightarrow \bar{D}^0 \pi^+ \pi^-$

NODE=M228

NODE=M228

NODE=M228M

NODE=M228M

NODE=M228W

NODE=M228W

NODE=M228215;NODE=M228

DESIG=1;OUR EVAL;→ UNCHECKED ←

NODE=M228PAM

NODE=M228PAM

NODE=M228PAM

NODE=M228PAM;LINKAGE=A

NODE=M228

REFID=55581

NODE=M203

NODE=M203

NODE=M203M

NODE=M203M

NEW

OCCUR=2

OCCUR=3

OCCUR=2

OCCUR=3

OCCUR=2

¹ From the amplitude analysis in the model describing the $D^+\pi^-$ wave together with virtual contributions from the $D^*(2007)^0$ and B^{*0} states, and components corresponding to the $D_2^*(2460)^0$, $D_1^*(2680)^0$, $D_3^*(2760)^0$, and $D_2^*(3000)^0$ resonances.

² Modeling the $\pi^+\pi^-$ S-wave with the Isobar formalism.

³ The states observed in the $D^*\pi$ and $D\pi$ final states are not necessarily the same.

⁴ At a fixed width of 60.9 MeV.

⁵ Modeling the $\pi^+\pi^-$ S-wave with the K-matrix formalism.

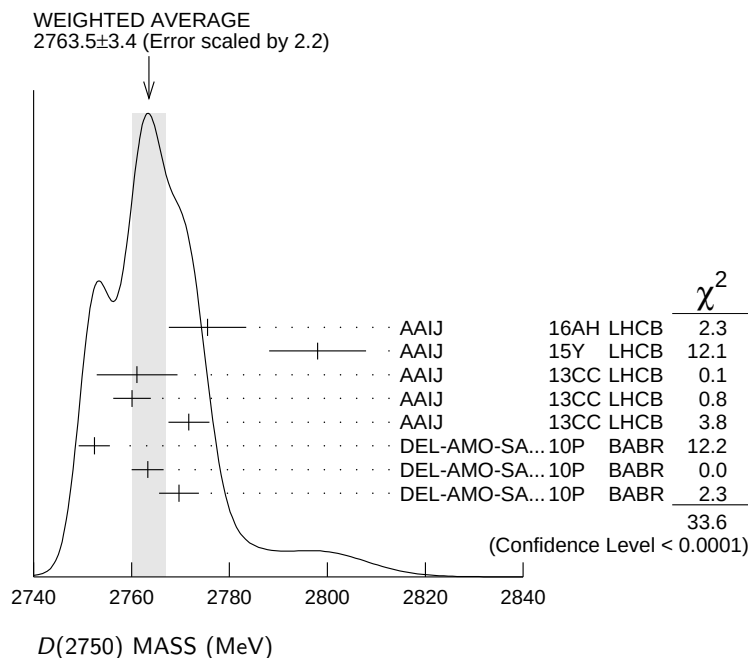
NODE=M203M;LINKAGE=C

NODE=M203M;LINKAGE=A

NODE=M203M;LINKAGE=DE

NODE=M203M;LINKAGE=DA

NODE=M203M;LINKAGE=B



D(2750) WIDTH

NODE=M203W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
66 ± 5 OUR AVERAGE					
[65 ± 5 MeV OUR 2016 AVERAGE]					
95.3 ± 9.6 ± 34.0	28k	⁶ AAIJ	16AH LHCb		$B^- \rightarrow D^+\pi^-\pi^-$
105 ± 18 ± 24		⁷ AAIJ	15Y LHCb		$B^0 \rightarrow \bar{D}^0\pi^+\pi^-$
74.4 ± 3.4 ± 37.0	14k	AAIJ	13CC LHCb 0		$pp \rightarrow D^{*+}\pi^-X$
74.4 ± 3.4 ± 19.1	56k	AAIJ	13CC LHCb 0		$pp \rightarrow D^+\pi^-X$
66.7 ± 6.6 ± 10.5	20k	AAIJ	13CC LHCb +		$pp \rightarrow D^0\pi^+X$
71 ± 6 ± 11	23.5k	⁸ DEL-AMO-SA...10P	BABR		$e^+e^- \rightarrow D^{*+}\pi^-X$
60.9 ± 5.1 ± 3.6	11.3k	⁸ DEL-AMO-SA...10P	BABR		$e^+e^- \rightarrow D^+\pi^-X$

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

154 ± 27 ± 16		⁹ AAIJ	15Y LHCb		$B^0 \rightarrow \bar{D}^0\pi^+\pi^-$

NODE=M203W
NEW

OCCUR=2
OCCUR=4

OCCUR=2

OCCUR=2

NODE=M203W;LINKAGE=C

NODE=M203W;LINKAGE=A

NODE=M203W;LINKAGE=DE

NODE=M203W;LINKAGE=B

⁶ From the amplitude analysis in the model describing the $D^+\pi^-$ wave together with virtual contributions from the $D^*(2007)^0$ and B^{*0} states, and components corresponding to the $D_2^*(2460)^0$, $D_1^*(2680)^0$, $D_3^*(2760)^0$, and $D_2^*(3000)^0$ resonances.

⁷ Modeling the $\pi^+\pi^-$ S-wave with the Isobar formalism.

⁸ The states observed in the $D^*\pi$ and $D\pi$ final states are not necessarily the same.

⁹ Modeling the $\pi^+\pi^-$ S-wave with the K-matrix formalism.

D(2750) DECAY MODES

NODE=M203215;NODE=M203

Mode	Fraction (Γ_i/Γ)
Γ_1 $D\pi$	seen
Γ_2 $D^+\pi^-$	seen
Γ_3 $D^0\pi^\pm$	seen
Γ_4 $D^*\pi$	seen
Γ_5 $D^{*+}\pi^-$	seen

DESIG=1;OUR EVAL;→ UNCHECKED ←
DESIG=2;OUR EVAL;→ UNCHECKED ←
DESIG=3;OUR EVAL;→ UNCHECKED ←
DESIG=4;OUR EVAL;→ UNCHECKED ←
DESIG=5;OUR EVAL;→ UNCHECKED ←

$D(2750)$ BRANCHING RATIOS

$\Gamma(D^+\pi^-)/\Gamma(D^{*+}\pi^-)$					Γ_2/Γ_5
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
$0.42 \pm 0.05 \pm 0.11$	34.8k	¹⁰ DEL-AMO-SA...10P	BABR	$e^+e^- \rightarrow D^{(*)+}\pi^- X$	
¹⁰ The states observed in the $D^*\pi$ and $D\pi$ final states are not necessarily the same.					

NODE=M203220

NODE=M203R01
NODE=M203R01

NODE=M203R01;LINKAGE=DE

 $D(2750)$ 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 $D^* \rightarrow D\pi$.

NODE=M203PAM

NODE=M203PAM

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
-0.33 ± 0.28	23.5k	¹¹ DEL-AMO-SA...10P	BABR	$e^+e^- \rightarrow D^{*+}\pi^- X$	
¹¹ Systematic uncertainties not estimated. The states observed in the $D^*\pi$ and $D\pi$ final states are not necessarily the same.					

NODE=M203PAM

NODE=M203PAM;LINKAGE=DE

 $D(2750)$ REFERENCES

AAIJ	16AH	PR D94 072001	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	15Y	PR D92 032002	R. Aaij <i>et al.</i>	(LHCb Collab.) JP
AAIJ	13CC	JHEP 1309 145	R. Aaij <i>et al.</i>	(LHCb Collab.)
DEL-AMO-SA...10P	PR D82 111101		P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)

NODE=M203

REFID=57518
REFID=56609
REFID=55581
REFID=53534

NODE=M229

 $D(3000)^0$

$$I(J^P) = \frac{1}{2}(??)$$

OMITTED FROM SUMMARY TABLE

Both natural- and unnatural-parity components observed depending on the decay mode (AAIJ 13CC).

NODE=M229

 $D(3000)^0$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT	
$3214 \pm 29 \pm 49$	28k	¹ AAIJ	16AH LHCB	$B^- \rightarrow D^+\pi^-\pi^-$	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
2971.8 ± 8.7	9.5k	^{2,3} AAIJ	13CC LHCB	$pp \rightarrow D^{*+}\pi^- X$	
3008.1 ± 4.0	17.6k	^{2,4} AAIJ	13CC LHCB	$pp \rightarrow D^+\pi^- X$	
¹ From the amplitude analysis in the model describing the $D^+\pi^-$ wave together with virtual contributions from the $D^*(2007)^0$ and B^{*0} states, and components corresponding to the $D_2^*(2460)^0$, $D_1^*(2680)^0$, $D_3^*(2760)^0$, and $D_2^*(3000)^0$ resonances.					
² Systematic uncertainty not estimated.					
³ Unnatural parity preferred.					
⁴ Natural parity state. A state $D(3000)^+$ is possibly seen in $D^0\pi^+$ final state.					

NODE=M229M

NODE=M229M

OCCUR=2

NODE=M229M;LINKAGE=D

NODE=M229M;LINKAGE=A
NODE=M229M;LINKAGE=B
NODE=M229M;LINKAGE=C **$D(3000)^0$ WIDTH**

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT	
$186 \pm 38 \pm 72$	28k	⁵ AAIJ	16AH LHCB	$B^- \rightarrow D^+\pi^-\pi^-$	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
188.1 ± 44.8	9.5k	^{6,7} AAIJ	13CC LHCB	$pp \rightarrow D^{*+}\pi^- X$	
110.5 ± 11.5	17.6k	^{6,8} AAIJ	13CC LHCB	$pp \rightarrow D^+\pi^- X$	
⁵ From the amplitude analysis in the model describing the $D^+\pi^-$ wave together with virtual contributions from the $D^*(2007)^0$ and B^{*0} states, and components corresponding to the $D_2^*(2460)^0$, $D_1^*(2680)^0$, $D_3^*(2760)^0$, and $D_2^*(3000)^0$ resonances.					
⁶ Systematic uncertainty not estimated.					
⁷ Unnatural parity preferred.					
⁸ Natural parity state. A state $D(3000)^+$ is possibly seen in $D^0\pi^+$ final state.					

NODE=M229W

NODE=M229W

OCCUR=2

NODE=M229W;LINKAGE=D

NODE=M229W;LINKAGE=A
NODE=M229W;LINKAGE=C
NODE=M229W;LINKAGE=B

$D(3000)^0$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad D^{*+} \pi^-$	seen

 $D(3000)^0$ POLARIZATION AMPLITUDE A_{D_J}

A polarization amplitude A_{D_J} is a parameter that depends on the initial polarization of the D_J . For D_J decays the helicity angle, θ_H , distribution varies like $1 + A_{D_J} \cos^2(\theta_H)$, where θ_H is the angle in the D_J rest frame between the two pions emitted in the $D_J \rightarrow D^* \pi$ and $D^* \rightarrow D \pi$ decays.

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1.5 ± 0.9	9.5k	⁹ AAIJ	13CC LHCb	$p p \rightarrow D^{*+} \pi^- X$
⁹ Systematic uncertainty not estimated.				

 $D(3000)^0$ REFERENCES

AAIJ	16AH PR D94 072001	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	13CC JHEP 1309 145	R. Aaij <i>et al.</i>	(LHCb Collab.)

CHARMED, STRANGE MESONS ($C = S = \pm 1$)

$$D_s^+ = c\bar{s}, D_s^- = \bar{c}s, \text{ similarly for } D_s^{* \pm}$$

$$D_s^{*\pm}$$

$$I(J^P) = 0(?^?)$$

J^P is natural, width and decay modes consistent with 1^- .

 $D_s^{*\pm}$ MASS

The fit includes $D_s^\pm, D^0, D_s^\pm, D^{*\pm}, D^{*0}, D_s^{*\pm}, D_1(2420)^0, D_2^*(2460)^0$, and $D_{s1}(2536)^\pm$ mass and mass difference measurements.

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
2112.1 ± 0.4 OUR FIT			
$2106.6 \pm 2.1 \pm 2.7$	¹ BLAYLOCK	87	MRK3 $e^+ e^- \rightarrow D_s^\pm \gamma X$
¹ Assuming $D_s^\pm$ mass = 1968.7 ± 0.9 MeV.			

 $m_{D_s^{*\pm}} - m_{D_s^\pm}$

The fit includes $D_s^\pm, D^0, D_s^\pm, D^{*\pm}, D^{*0}, D_s^{*\pm}, D_1(2420)^0, D_2^*(2460)^0$, and $D_{s1}(2536)^\pm$ mass and mass difference measurements.

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
143.8 ± 0.4 OUR FIT				
143.9 ± 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 ± 18.0	8	ASRATYAN	85	HLBC FNAL 15-ft, ν - ^2H
110 ± 46		BRANDELIK	79	DASP $e^+ e^- \rightarrow D_s^\pm \gamma X$

NODE=M229215;NODE=M229

DESIG=1;OUR EVAL;→ UNCHECKED ←

NODE=M229PAM

NODE=M229PAM

NODE=M229PAM

NODE=M229PAM;LINKAGE=A

NODE=M229

REFID=57518
REFID=55581

NODE=MXXX040

NODE=MXXX040

NODE=S074

NODE=S074

NODE=S074M

NODE=S074M

NODE=S074M

NODE=S074M;LINKAGE=E

NODE=S074DM

NODE=S074DM

NODE=S074DM

²Result includes data of ALBRECHT 84B.

NODE=S074DM;LINKAGE=A

 $D_s^{*\pm}$ WIDTH

NODE=S074W

VALUE (MeV)	CL%	DOCUMENT ID	TECN	COMMENT
< 1.9	90	GRONBERG	95 CLE2	e^+e^-
< 4.5	90	ALBRECHT	88 ARG	$E_{cm}^{ee} = 10.2$ GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •				
< 4.9	90	BROWN	94 CLE2	e^+e^-
<22	90	BLAYLOCK	87 MRK3	$e^+e^- \rightarrow D_s^{\pm}\gamma X$

NODE=S074W

 D_s^{*+} DECAY MODES

NODE=S074215;NODE=S074

 D_s^{*-} modes are charge conjugates of the modes below.

NODE=S074

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad D_s^+\gamma$	$(93.5 \pm 0.7) \%$
$\Gamma_2 \quad D_s^+\pi^0$	$(5.8 \pm 0.7) \%$
$\Gamma_3 \quad D_s^+e^+e^-$	$(6.7 \pm 1.6) \times 10^{-3}$

DESIG=1

DESIG=2

DESIG=3

CONSTRAINED FIT INFORMATION

An overall fit to 2 branching ratios uses 3 measurements and one constraint to determine 3 parameters. The overall fit has a $\chi^2 = 0.0$ for 1 degrees of freedom.

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

x_2	−97	
x_3	−19	−4
	x_1	x_2

 D_s^{*+} BRANCHING RATIOS

NODE=S074220

$\Gamma(D_s^+\gamma)/\Gamma_{\text{total}}$	DOCUMENT ID	TECN	COMMENT	Γ_1/Γ
VALUE				
0.935±0.007 OUR FIT				

NODE=S074R1

NODE=S074R1

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

seen	ASRATYAN	91 HLBC	$\bar{\nu}_\mu \text{Ne}$
seen	ALBRECHT	88 ARG	$e^+e^- \rightarrow D_s^{\pm}\gamma X$
seen	AIHARA	84D	
seen	ALBRECHT	84B	
seen	BRANDELIK	79	

$\Gamma(D_s^+\pi^0)/\Gamma(D_s^+\gamma)$	DOCUMENT ID	TECN	COMMENT	Γ_2/Γ_1
VALUE				

NODE=S074R2

NODE=S074R2

0.062±0.008 OUR FIT**0.062±0.008 OUR AVERAGE**

0.062±0.005±0.006	AUBERT,BE	05G BABR	10.6 $e^+e^- \rightarrow$ hadrons
0.062 $^{+0.020}_{-0.018}$ ±0.022	GRONBERG	95 CLE2	e^+e^-

$\Gamma(D_s^+e^+e^-)/\Gamma(D_s^+\gamma)$	DOCUMENT ID	TECN	COMMENT	Γ_3/Γ_1
VALUE (units 10^{-3})				

NODE=S074R01

NODE=S074R01

7.2±1.7 OUR FIT

7.2$^{+1.5}_{-1.3}$±1.0	38	CRONIN-HEN..12	CLEO	4.17 $e^+e^- \rightarrow$ hadrons

$D_s^{\pm}$ REFERENCES

CRONIN-HEN...12	PR D86 072005	D. Cronin-Hennessey <i>et al.</i>	(CLEO Collab.)
AUBERT,BE 05G	PR D72 091101	B. Aubert <i>et al.</i>	(BABAR Collab.)
GRONBERG 95	PRL 75 3232	J. Gronberg <i>et al.</i>	(CLEO Collab.)
BROWN 94	PR D50 1884	D. Brown <i>et al.</i>	(CLEO Collab.)
ASRATYAN 91	PL B257 525	A.E. Asratyan <i>et al.</i>	(ITEP, BELG, SACL+)
ALBRECHT 88	PL B207 349	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
BLAYLOCK 87	PRL 58 2171	G.T. Blaylock <i>et al.</i>	(Mark III Collab.)
ASRATYAN 85	PL 156B 441	A.E. Asratyan <i>et al.</i>	(ITEP, SERP)
AIHARA 84D	PRL 53 2465	H. Aihara <i>et al.</i>	(TPC Collab.)
ALBRECHT 84B	PL 146B 111	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
BRANDELIK 79	PL 80B 412	R. Brandelik <i>et al.</i>	(DASP Collab.)

NODE=S074

REFID=54627
REFID=50942
REFID=44568
REFID=43868
REFID=41582
REFID=40269
REFID=40005
REFID=22887
REFID=11561
REFID=22886
REFID=11442

 $D_{s0}^*(2317)^{\pm}$

$I(J^P) = 0(0^+)$
 J, P need confirmation.

AUBERT 06P and CHOI 15A do not observe neutral and doubly charged partners of the $D_{s0}^*(2317)^+$.

NODE=M172

NODE=M172

 $D_{s0}^*(2317)^{\pm}$ MASS

The fit includes $D^{\pm}, D^0, D_s^{\pm}, D^{*\pm}, D^{*0}, D_s^{*\pm}, D_1(2420)^0, D_2^*(2460)^0$, and $D_{s1}(2536)^{\pm}$ mass and mass difference measurements.

NODE=M172M

NODE=M172M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2317.7$\pm$0.6 OUR FIT	Error includes scale factor of 1.1.			
2318.0$\pm$1.0 OUR AVERAGE	Error includes scale factor of 1.4.			
2319.6 $\pm$ 0.2 $\pm$ 1.4	3180	AUBERT	06P BABR	10.6 $e^+e^- \rightarrow D_s^+\pi^0 X$
2317.3 $\pm$ 0.4 $\pm$ 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 $\pm$ 1.3	88	² AUBERT,B	04S BABR	$B \rightarrow D_{s0}^{(*)}(2317)^+ \bar{D}^{(*)}$
2317.2 $\pm$ 0.5 $\pm$ 0.9	761	³ MIKAMI	04 BELL	10.6 e^+e^-
2316.8 $\pm$ 0.4 $\pm$ 3.0	1267 $\pm$ 53	^{3,4} AUBERT	03G BABR	10.6 e^+e^-
2317.6 $\pm$ 1.3	273 $\pm$ 33	^{3,5} AUBERT	03G BABR	10.6 e^+e^-
2319.8 $\pm$ 2.1 $\pm$ 2.0	24	³ KROKOVNY	03B BELL	10.6 e^+e^-

NODE=M172M

OCCUR=2

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;LINKAGE=AU

NODE=M172M;LINKAGE=AB

NODE=M172M;LINKAGE=B1

NODE=M172M;LINKAGE=A1

NODE=M172M;LINKAGE=A2

 $m_{D_{s0}^*(2317)^{\pm}} = m_{D_s^{\pm}}$

The fit includes $D^{\pm}, D^0, D_s^{\pm}, D^{*\pm}, D^{*0}, D_s^{*\pm}, D_1(2420)^0, D_2^*(2460)^0$, and $D_{s1}(2536)^{\pm}$ mass and mass difference measurements.

NODE=M172DM

NODE=M172DM

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
349.4$\pm$0.6 OUR FIT	Error includes scale factor of 1.1.			
349.2$\pm$0.7 OUR AVERAGE				
348.7 $\pm$ 0.5 $\pm$ 0.7	761	MIKAMI	04 BELL	10.6 e^+e^-
350.0 $\pm$ 1.2 $\pm$ 1.0	135	BESSON	03 CLE2	10.6 e^+e^-
351.3 $\pm$ 2.1 $\pm$ 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 $\pm$ 0.4 $\pm$ 3.0	1267	^{7,8} AUBERT	03G BABR	10.6 e^+e^-
350.2 $\pm$ 1.3	273	^{9,10} AUBERT	03G BABR	10.6 e^+e^-

NODE=M172DM

OCCUR=2

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;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 $e^+e^- \rightarrow D_s^+\pi^0 X$

NODE=M172W

NODE=M172W

• • • 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	BESSION	03	CLE2	10.6 $e^+ e^-$

$D_{s0}^*(2317)^\pm$ DECAY MODES

NODE=M172215;NODE=M172

$D_{s0}^*(2317)^-$ modes are charge conjugates of modes below.

NODE=M172

Mode	Fraction (Γ_i/Γ)
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
<u>VALUE</u> <u>EVTS</u> <u>DOCUMENT ID</u> <u>TECN</u> <u>COMMENT</u>	
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 BESSION 03 CLE2 10.6 $e^+ e^-$	

NODE=M172R5

NODE=M172R5

$\Gamma(D_s^*(2112)^+ \gamma)/\Gamma(D_s^+ \pi^0)$	Γ_3/Γ_1
<u>VALUE</u> <u>CL%</u> <u>DOCUMENT ID</u> <u>TECN</u> <u>COMMENT</u>	
<0.059 90 BESSION 03 CLE2 10.6 $e^+ e^-$	
• • • We do not use the following data for averages, fits, limits, etc. • • •	
<0.16 95 AUBERT 06P BABR 10.6 $e^+ e^-$	
<0.18 90 MIKAMI 04 BELL 10.6 $e^+ e^-$	

NODE=M172R6

NODE=M172R6

$\Gamma(D_s^+ \gamma \gamma)/\Gamma(D_s^+ \pi^0)$	Γ_4/Γ_1
<u>VALUE</u> <u>CL%</u> <u>DOCUMENT ID</u> <u>TECN</u> <u>COMMENT</u>	
<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
<u>VALUE</u> <u>CL%</u> <u>DOCUMENT ID</u> <u>TECN</u> <u>COMMENT</u>	
<0.11 90 BESSION 03 CLE2 10.6 $e^+ e^-$	

NODE=M172R8

NODE=M172R8

$\Gamma(D_s^+ \pi^+ \pi^-)/\Gamma(D_s^+ \pi^0)$	Γ_6/Γ_1
<u>VALUE</u> <u>CL%</u> <u>DOCUMENT ID</u> <u>TECN</u> <u>COMMENT</u>	
<0.004 90 MIKAMI 04 BELL 10.6 $e^+ e^-$	
• • • We do not use the following data for averages, fits, limits, etc. • • •	
<0.005 95 AUBERT 06P BABR 10.6 $e^+ e^-$	
<0.019 90 BESSION 03 CLE2 10.6 $e^+ e^-$	

NODE=M172R9

NODE=M172R9

$\Gamma(D_s^+ \pi^0 \pi^0)/\Gamma(D_s^+ \pi^0)$	Γ_7/Γ_1
<u>VALUE</u> <u>CL%</u> <u>DOCUMENT ID</u> <u>TECN</u> <u>COMMENT</u>	
<0.25 95 AUBERT 06P BABR 10.6 $e^+ e^-$	

NODE=M172R10

NODE=M172R10

$D_{s0}^*(2317)^\pm$ REFERENCES

CHOI	15A	PR D91 092011	S.-K. Choi <i>et al.</i>	(BELLE Collab.)
AUBERT	06P	PR D74 032007	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT	04E	PR D69 031101	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT,B	04S	PRL 93 181801	B. Aubert <i>et al.</i>	(BABAR Collab.)
MIKAMI	04	PRL 92 012002	Y. Mikami <i>et al.</i>	(BELLE Collab.)
AUBERT	03G	PRL 90 242001	B. Aubert <i>et al.</i>	(BABAR Collab.)
BESSION	03	PR D68 032002	D. Besson <i>et al.</i>	(CLEO Collab.)
KROKOVNY	03B	PRL 91 262002	P. Krokovny <i>et al.</i>	(BELLE Collab.)

NODE=M172

REFID=56577
REFID=51144
REFID=49747
REFID=50195
REFID=49629
REFID=49417
REFID=49583
REFID=49615

 $D_{s1}(2460)^\pm$

$$I(J^P) = 0(1^+)$$

NODE=M173

 $D_{s1}(2460)^\pm$ MASS

NODE=M173M

The fit includes $D^\pm$, D^0 , $D_s^\pm$, $D^{*\pm}$, D^{*0} , $D_s^{*\pm}$, $D_1(2420)^0$, $D_2^*(2460)^0$,
and $D_{s1}(2536)^\pm$ mass and mass difference measurements.

NODE=M173M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2459.5±0.6 OUR FIT	Error includes scale factor of 1.1.			
2459.6±0.9 OUR AVERAGE	Error includes scale factor of 1.3.			
2460.1±0.2±0.8	1	AUBERT	06P	BABR 10.6 e^+e^-
2458.0±1.0±1.0	195	AUBERT	04E	BABR 10.6 e^+e^-
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2459.5±1.2±3.7	920	AUBERT	06P	BABR 10.6 $e^+e^- \rightarrow D_s^+ \gamma X$
2458.6±1.0±2.5	560	AUBERT	06P	BABR 10.6 $e^+e^- \rightarrow D_s^+ \pi^0 \gamma X$
2460.2±0.2±0.8	123	AUBERT	06P	BABR 10.6 $e^+e^- \rightarrow D_s^+ \pi^+ \pi^- X$
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.

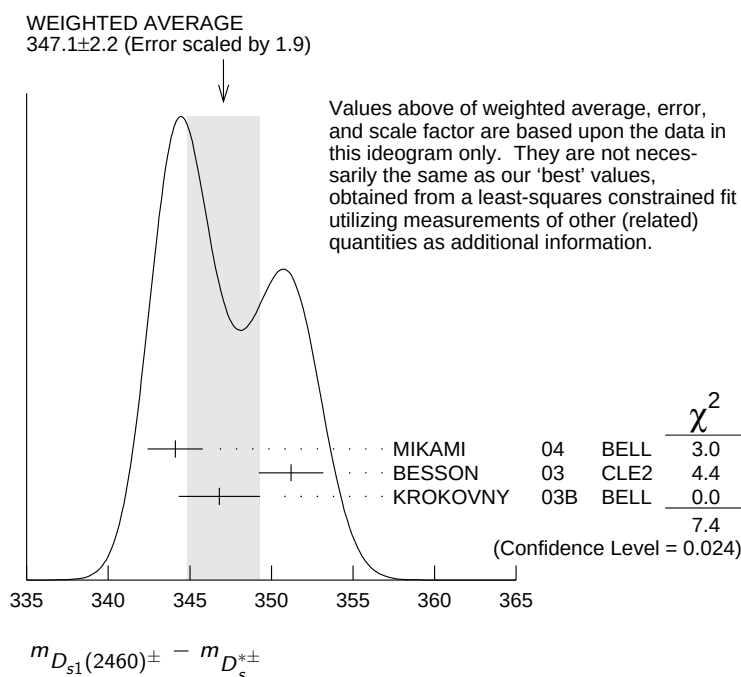
NODE=M173MD

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
347.3±0.7 OUR FIT	Error includes scale factor of 1.2.			
347.1±2.2 OUR AVERAGE	Error includes scale factor of 1.9. See the ideogram below.			
344.1±1.3±1.1	126	MIKAMI	04	BELL 10.6 e^+e^-
351.2±1.7±1.0	41	BESSION	03	CLE2 10.6 e^+e^-
346.8±1.6±1.9	57	8 KROKOVNY	03B	BELL 10.6 e^+e^-

NODE=M173MD

⁸ Recalculated by us using $m_{D_s^{*+}} = 2112.4 \pm 0.7$ MeV.

NODE=M173MD;LINKAGE=K3



$m_{D_{s1}(2460)^{\pm}} - m_{D_s^{\pm}}$

The fit includes $D^{\pm}$, D^0 , $D_s^{\pm}$, $D_s^{*\pm}$, D_s^{*0} , $D_s^{*\pm}$, $D_1(2420)^0$, $D_2^*(2460)^0$, and $D_{s1}(2536)^{\pm}$ mass and mass difference measurements.

NODE=M173DM

NODE=M173DM

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
491.2±0.6 OUR FIT	Error includes scale factor of 1.1.			
491.3±1.4 OUR AVERAGE				
491.0±1.3±1.9	152	⁹ MIKAMI	04 BELL	10.6 e^+e^-
491.4±0.9±1.5	60	¹⁰ MIKAMI	04 BELL	10.6 e^+e^-

⁹ From the decay to $D_s^{\pm}\gamma$.

¹⁰ From the decay to $D_s^{\pm}\pi^+\pi^-$.

NODE=M173DM

OCCUR=2

NODE=M173DM;LINKAGE=M1

NODE=M173DM;LINKAGE=M2

$D_{s1}(2460)^{\pm}$ WIDTH

NODE=M173W

VALUE (MeV)	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
< 3.5	95	123	AUBERT	06P BABR	10.6 $e^+e^- \rightarrow D_s^+\pi^+\pi^-X$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 6.3	95	560	AUBERT	06P BABR	10.6 $e^+e^- \rightarrow D_s^+\pi^0\gamma X$
<10		195	AUBERT	04E BABR	10.6 e^+e^-
< 5.5	90	126	MIKAMI	04 BELL	10.6 e^+e^-
< 7	90	41	BESSON	03 CLE2	10.6 e^+e^-

NODE=M173W

OCCUR=2

$D_{s1}(2460)^+$ DECAY MODES

NODE=M173215;NODE=M173

$D_{s1}(2460)^-$ modes are charge conjugates of the modes below.

NODE=M173

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
Γ_1 $D_s^{*+}\pi^0$	(48 ± 11) %	
Γ_2 $D_s^+\gamma$	(18 ± 4) %	
Γ_3 $D_s^+\pi^+\pi^-$	(4.3 ± 1.3) %	S=1.1
Γ_4 $D_s^{*+}\gamma$	< 8 %	CL=90%

DESIG=1

DESIG=2

DESIG=3

DESIG=4

Γ_5	$D_{s0}^*(2317)^+\gamma$	$(3.7^{+5.0}_{-2.4})\%$	DESIG=5
Γ_6	$D_s^+\pi^0$		DESIG=7
Γ_7	$D_s^+\pi^0\pi^0$		DESIG=8
Γ_8	$D_s^+\gamma\gamma$		DESIG=9

CONSTRAINED FIT INFORMATION

An overall fit to 7 branching ratios uses 8 measurements and one constraint to determine 5 parameters. The overall fit has a $\chi^2 = 3.4$ for 4 degrees of freedom.

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

x_2	80		
x_3	68	62	
x_5	-3	25	26
	x_1	x_2	x_3

$D_{s1}(2460)^\pm$ BRANCHING RATIOS

NODE=M173220

$\Gamma(D_s^{*+}\pi^0)/\Gamma_{\text{total}}$ Γ_1/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

0.48±0.11 OUR FIT**0.56±0.13±0.09** ¹¹ AUBERT 06N BABR $B \rightarrow D_{s1}(2460)^- \bar{D}^*$

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

seen 41 BESSON 03 CLE2 10.6 e^+e^- ¹¹ Evaluated in AUBERT 06N including measurements from AUBERT,B 04s.NODE=M173R1
NODE=M173R1

NODE=M173R1;LINKAGE=AU

$\Gamma(D_s^+\gamma)/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE	DOCUMENT ID	TECN	COMMENT

0.18±0.04 OUR FIT**0.16±0.04±0.03** ¹² AUBERT 06N BABR $B \rightarrow D_{s1}(2460)^- \bar{D}^*$ ¹² Evaluated in AUBERT 06N including measurements from AUBERT,B 04s.NODE=M173R6
NODE=M173R6

NODE=M173R6;LINKAGE=AU

$\Gamma(D_s^+\gamma)/\Gamma(D_s^{*+}\pi^0)$ Γ_2/Γ_1

VALUE	CL%	EVTS	DOCUMENT ID	TECN	COMMENT

0.38 ±0.05 OUR FIT**0.44 ±0.09 OUR AVERAGE**0.55 ±0.13 ±0.08 152 MIKAMI 04 BELL 10.6 e^+e^- 0.38 ±0.11 ±0.04 38 KROKOVNY 03B BELL 10.6 e^+e^-

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

0.274±0.045±0.020 251 ¹³ AUBERT,B 04S BABR $B \rightarrow D_{s1}(2460)^+ \bar{D}^*$ < 0.49 90 BESSON 03 CLE2 10.6 e^+e^- ¹³ Used by AUBERT 06N in their measurement of $B(D_s^{*-}\pi^0)$ and $B(D_s^-\gamma)$.NODE=M173R2
NODE=M173R2

NODE=M173R2;LINKAGE=AU

$\Gamma(D_s^+\pi^+\pi^-)/\Gamma(D_s^{*+}\pi^0)$ Γ_3/Γ_1

VALUE	CL%	EVTS	DOCUMENT ID	TECN	COMMENT

0.090±0.020 OUR FIT Error includes scale factor of 1.2.**0.14 ±0.04 ±0.02** 60 MIKAMI 04 BELL 10.6 e^+e^-

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

<0.08 90 BESSON 03 CLE2 10.6 e^+e^- NODE=M173R3
NODE=M173R3

$\Gamma(D_s^{*+}\gamma)/\Gamma(D_s^{*+}\pi^0)$ Γ_4/Γ_1

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<0.16 90 BESSON 03 CLE2 10.6 e^+e^-

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

<0.31 90 MIKAMI 04 BELL 10.6 e^+e^- NODE=M173R4
NODE=M173R4

$$\Gamma(D_{s0}^*(2317)^+\gamma)/\Gamma(D_s^{*+}\pi^0)$$

$$\Gamma_5/\Gamma_1$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.22	95	AUBERT	04E	BABR 10.6 e ⁺ e ⁻
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.58	90	BESSION	03	CLE2 10.6 e ⁺ e ⁻

NODE=M173R5
NODE=M173R5

$$\Gamma(D_s^{*+}\pi^0)/[\Gamma(D_s^{*+}\pi^0) + \Gamma(D_{s0}^*(2317)^+\gamma)]$$

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

VALUE	DOCUMENT ID	TECN	COMMENT
0.93±0.09 OUR FIT			
0.97±0.09±0.05	AUBERT	06P	BABR 10.6 e ⁺ e ⁻

NODE=M173R7
NODE=M173R7

$$\Gamma(D_s^+\gamma)/[\Gamma(D_s^{*+}\pi^0) + \Gamma(D_{s0}^*(2317)^+\gamma)]$$

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

VALUE	DOCUMENT ID	TECN	COMMENT
0.35 ±0.04 OUR FIT			
0.337±0.036±0.038	AUBERT	06P	BABR 10.6 e ⁺ e ⁻

NODE=M173R8
NODE=M173R8

$$\Gamma(D_s^+\pi^+\pi^-)/[\Gamma(D_s^{*+}\pi^0) + \Gamma(D_{s0}^*(2317)^+\gamma)]$$

$$\Gamma_3/(\Gamma_1+\Gamma_5)$$

VALUE	DOCUMENT ID	TECN	COMMENT
0.083±0.017 OUR FIT	Error includes scale factor of 1.2.		
0.077±0.013±0.008	AUBERT	06P	BABR 10.6 e ⁺ e ⁻

NODE=M173R9
NODE=M173R9

$$\Gamma(D_s^{*+}\gamma)/[\Gamma(D_s^{*+}\pi^0) + \Gamma(D_{s0}^*(2317)^+\gamma)]$$

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

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.24	95	AUBERT	06P	BABR 10.6 e ⁺ e ⁻

NODE=M173R10
NODE=M173R10

$$\Gamma(D_{s0}^*(2317)^+\gamma)/[\Gamma(D_s^{*+}\pi^0) + \Gamma(D_{s0}^*(2317)^+\gamma)]$$

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

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.25	95	AUBERT	06P	BABR 10.6 e ⁺ e ⁻

NODE=M173R11
NODE=M173R11

$$\Gamma(D_s^+\pi^0)/[\Gamma(D_s^{*+}\pi^0) + \Gamma(D_{s0}^*(2317)^+\gamma)]$$

$$\Gamma_6/(\Gamma_1+\Gamma_5)$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.042	95	AUBERT	06P	BABR 10.6 e ⁺ e ⁻

NODE=M173R12
NODE=M173R12

$$\Gamma(D_s^+\pi^0\pi^0)/[\Gamma(D_s^{*+}\pi^0) + \Gamma(D_{s0}^*(2317)^+\gamma)]$$

$$\Gamma_7/(\Gamma_1+\Gamma_5)$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.68	95	AUBERT	06P	BABR 10.6 e ⁺ e ⁻

NODE=M173R13
NODE=M173R13

$$\Gamma(D_s^+\gamma\gamma)/[\Gamma(D_s^{*+}\pi^0) + \Gamma(D_{s0}^*(2317)^+\gamma)]$$

$$\Gamma_8/(\Gamma_1+\Gamma_5)$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.33	95	AUBERT	06P	BABR 10.6 e ⁺ e ⁻

NODE=M173R14
NODE=M173R14

$D_{s1}(2460)^\pm$ REFERENCES

NODE=M173

AUBERT	06N	PR D74 031103	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT	06P	PR D74 032007	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT	04E	PR D69 031101	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT,B	04S	PRL 93 181801	B. Aubert <i>et al.</i>	(BABAR Collab.)
MIKAMI	04	PRL 92 012002	Y. Mikami <i>et al.</i>	(BELLE Collab.)
BESSION	03	PR D68 032002	D. Besson <i>et al.</i>	(CLEO Collab.)
KROKOVNY	03B	PRL 91 262002	P. Krokovny <i>et al.</i>	(BELLE Collab.)

REFID=51142
REFID=51144
REFID=49747
REFID=50195
REFID=49629
REFID=49583
REFID=49615

$$D_{s1}(2536)^{\pm}$$

$$I(J^P) = 0(1^+)$$

J, P need confirmation.

Seen in $D^*(2010)^+ K^0$, $D^*(2007)^0 K^+$, and $D_s^+ \pi^+ \pi^-$. Not seen in $D^+ K^0$ or $D^0 K^+$. $J^P = 1^+$ assignment strongly favored.

NODE=M121

NODE=M121

$D_{s1}(2536)^{\pm}$ MASS

The fit includes $D^{\pm}$, D^0 , $D_s^{\pm}$, $D^{*\pm}$, D^{*0} , $D_s^{*\pm}$, $D_1(2420)^0$, $D_2^*(2460)^0$, and $D_{s1}(2536)^{\pm}$ mass and mass difference measurements.

NODE=M121M

NODE=M121M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

NODE=M121M

2535.10±0.06 OUR FIT

2535.18±0.24 OUR AVERAGE

2535.7 ±0.6 ±0.5	46 ± 9	¹ ABAZOV	09G D0	$B_s^0 \rightarrow D_{s1}^- \mu^+ \nu_{\mu} X$
2534.78±0.31±0.40	182	AUBERT	08B BABR	$B \rightarrow \bar{D}^{(*)} D^{*} K$
2534.6 ±0.3 ±0.7	193	AUBERT	06P BABR	$10.6 e^+ e^- \rightarrow D_s^+ \pi^+ \pi^- X$
2535.3 ±0.7	92	² HEISTER	02B ALEP	$e^+ e^- \rightarrow D^{*+} K^0 X$, $D^{*0} K^+ X$
2534.2 ±1.2	9	ASRATYAN	94 BEBC	$\nu N \rightarrow D^{*} K^0 X, D^{*0} K^{\pm} X$
2535 ±0.6 ±1	75	FRABETTI	94B E687	$\gamma Be \rightarrow D^{*+} K^0 X$, $D^{*0} K^+ X$
2535.3 ±0.2 ±0.5	134	ALEXANDER	93 CLE2	$e^+ e^- \rightarrow D^{*0} K^+ X$
2534.8 ±0.6 ±0.6	44	ALEXANDER	93 CLE2	$e^+ e^- \rightarrow D^{*+} K^0 X$
2535.2 ±0.5 ±1.5	28	ALBRECHT	92R ARG	$10.4 e^+ e^- \rightarrow D^{*0} K^+ X$
2536.6 ±0.7 ±0.4		AVERY	90 CLEO	$e^+ e^- \rightarrow D^{*+} K^0 X$
2535.9 ±0.6 ±2.0		ALBRECHT	89E ARG	$D_{s1}^* \rightarrow D^*(2010) K^0$

OCCUR=2

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

2534.1 ±0.6	116	³ AUSHEV	11 BELL	$B \rightarrow D_{s1}(2536)^+ D^{(*)}$
2535.08±0.01±0.15	8038	⁴ LEES	11B BABR	$10.6 e^+ e^- \rightarrow D^{*+} K_S^0 X$
2535.57 ^{+0.44} _{-0.41} ±0.10	236 ± 30	⁵ CHEKANOV	09 ZEUS	$e^{\pm} p \rightarrow D^{*+} K_S^0 X$, $D^{*0} K^+ X$
2535 ± 28		⁶ ASRATYAN	88 HLBC	$\nu N \rightarrow D_s \gamma \gamma X$

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

$$m_{D_{s1}(2536)^{\pm}} - m_{D_s^*(2111)}$$

NODE=M121DM

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

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

NODE=M121DM

423.0± 0.4 OUR FIT

424 ±28

ASRATYAN 88 HLBC $D_s^{*\pm} \gamma$

$$m_{D_{s1}(2536)^{\pm}} - m_{D^*(2010)^{\pm}}$$

NODE=M121DN

The fit includes $D^{\pm}$, D^0 , $D_s^{\pm}$, $D^{*\pm}$, D^{*0} , $D_s^{*\pm}$, $D_1(2420)^0$, $D_2^*(2460)^0$, and $D_{s1}(2536)^{\pm}$ mass and mass difference measurements.

NODE=M121DN

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
524.84±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	$e^+ e^- \rightarrow D^{*0} K^+ X$ $e^+ e^- \rightarrow D^{*+} K^0 X$
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
528.25±0.05 OUR FIT Error includes scale factor of 1.1.				
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	$\gamma \text{Be} \rightarrow D^{*+} K^0 X,$ $D^{*0} K^+ X$
< 2.3	90	ALEXANDER	93 CLEO	$e^+ e^- \rightarrow D^{*0} K^+ X$
< 3.9	90	ALBRECHT	92R ARG	$10.4 e^+ e^- \rightarrow D^{*0} K^+ X$
< 5.44	90	AVERY	90 CLEO	$e^+ e^- \rightarrow D^{*+} K^0 X$
< 4.6	90	ALBRECHT	89E ARG	$D_{s1}^* \rightarrow D^*(2010) K^0$

⁸ Assuming *S*-wave decay of the $D_{s1}(2536)$ to $D^{*+} K_S^0$, using a Breit-Wigner line shape corresponding to *L*=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)	Confidence level
$\Gamma_1 D^*(2010)^+ K^0$	0.85 ±0.12	
$\Gamma_2 (D^*(2010)^+ K^0)_{S\text{-wave}}$	0.61 ±0.09	
$\Gamma_3 (D^*(2010)^+ K^0)_{D\text{-wave}}$		
$\Gamma_4 D^+ \pi^- K^+$	0.028±0.005	
$\Gamma_5 D^*(2007)^0 K^+$	DEFINED AS 1	
$\Gamma_6 D^+ K^0$	<0.34	90%
$\Gamma_7 D^0 K^+$	<0.12	90%
$\Gamma_8 D_s^{*+} \gamma$	possibly seen	
$\Gamma_9 D_s^+ \pi^+ \pi^-$	seen	

DESIG=1

DESIG=7

DESIG=9

DESIG=8

DESIG=4

DESIG=2

DESIG=5

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 **$\Gamma((D^*(2010)^+ K^0)_{S\text{-wave}})/\Gamma(D^*(2010)^+ K^0)$** **$\Gamma_2/\Gamma_1$**

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 **$\Gamma(D^+ \pi^- K^+)/\Gamma(D^*(2010)^+ K^0)$** **$\Gamma_4/\Gamma_1$**

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 **$\Gamma(D^+ K^0)/\Gamma(D^*(2010)^+ K^0)$** **$\Gamma_6/\Gamma_1$**

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 **$\Gamma(D^0 K^+)/\Gamma(D^*(2007)^0 K^+)$** **$\Gamma_7/\Gamma_5$**

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.12	90	ALEXANDER	93	CLEO $e^+ e^- \rightarrow D^{*0} K^+ X$

NODE=M121R4
NODE=M121R4 **$\Gamma(D_s^{*+} \gamma)/\Gamma_{\text{total}}$** **$\Gamma_8/\Gamma$**

VALUE	DOCUMENT ID	TECN	COMMENT
possibly seen	ASRATYAN	88	HLBC $\nu N \rightarrow D_s \gamma \gamma X$

NODE=M121R3
NODE=M121R3 **$\Gamma(D_s^{*+} \gamma)/\Gamma(D^*(2007)^0 K^+)$** **$\Gamma_8/\Gamma_5$**

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.42	90	ALEXANDER	93	CLEO $e^+ e^- \rightarrow D^{*0} K^+ X$

NODE=M121R5
NODE=M121R5 **$\Gamma(D_s^+ \pi^+ \pi^-)/\Gamma_{\text{total}}$** **$\Gamma_9/\Gamma$**

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	JP G33 1	W.-M. Yao <i>et al.</i>	(PDG Collab.)	REFID=51004
HEISTER	02B	PL B526 34	A. Heister <i>et al.</i>	(ALEPH Collab.)	REFID=48562
ACKERSTAFF	97W	ZPHY C76 425	K. Ackerstaff <i>et al.</i>	(OPAL Collab.)	REFID=45788
ASRATYAN	94	ZPHY C61 563	A.E. Asratyan <i>et al.</i>	(BIRM, BELG, CERN+)	REFID=43667
FRABETTI	94B	PRL 72 324	P.L. Frabetti <i>et al.</i>	(FNAL E687 Collab.)	REFID=43687
ALEXANDER	93	PL B303 377	J. Alexander <i>et al.</i>	(CLEO Collab.)	REFID=43316
ALBRECHT	92R	PL B297 425	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=43179
AVERY	90	PR D41 774	P. Avery, D. Besson	(CLEO Collab.)	REFID=41013
ALBRECHT	89E	PL B230 162	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=40914
ASRATYAN	88	ZPHY C40 483	A.E. Asratyan <i>et al.</i>	(ITEP, SERP)	REFID=40916

$D_{s2}^*(2573)$

$$I(J^P) = 0(2^+)$$

J^P is natural, width and decay modes consistent with 2^+ .

AAIJ 14AW confirms $J^P = 2^+$.

NODE=M148

NODE=M148

 $D_{s2}^*(2573)$ MASS

NODE=M148M

NODE=M148M

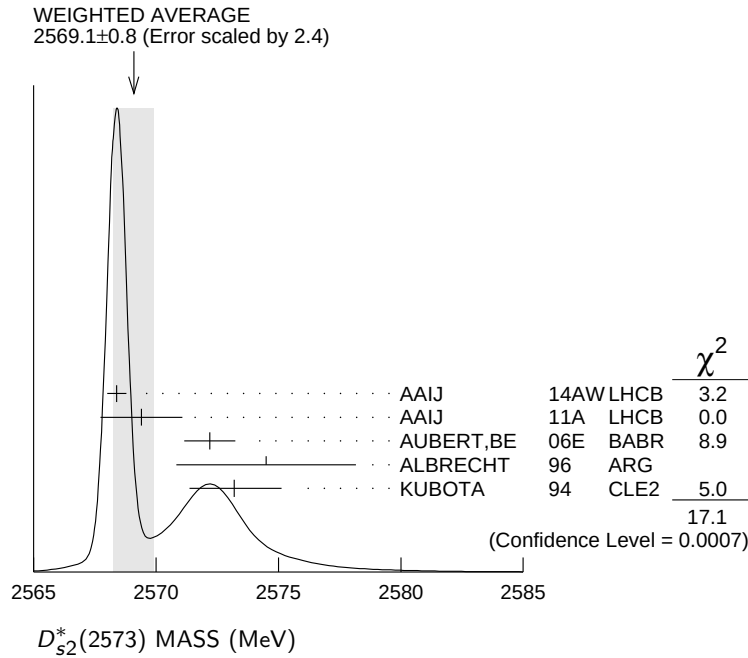
VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2569.1 ± 0.8 OUR AVERAGE		Error includes scale factor of 2.4. See the ideogram below.		
2568.39 $\pm 0.29 \pm 0.26$		AAIJ	14AW LHCb	$B_s^0 \rightarrow \bar{D}^0 K^- \pi^+$
2569.4 $\pm 1.6 \pm 0.5$	82	AAIJ	11A LHCb	$B_s \rightarrow D_{s2}^*(2573) \mu \bar{\nu} X$
2572.2 $\pm 0.3 \pm 1.0$		AUBERT,BE	06E BABR	$e^+ e^- \rightarrow D K X$
2574.5 $\pm 3.3 \pm 1.6$		ALBRECHT	96 ARG	$e^+ e^- \rightarrow D^0 K^+ X$
2573.2 $^{+1.7}_{-1.6} \pm 0.9$	217	KUBOTA	94 CLE2	$e^+ e^- \sim 10.5 \text{ GeV}$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2570.0 ± 4.3	25	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.

NODE=M148M;LINKAGE=EV

NODE=M148M;LINKAGE=HI

 **$m_{D_{s2}^*(2573)} - m_{D^0}$**

NODE=M148DM

NODE=M148DM

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
704 $\pm 3 \pm 1$	64	HEISTER	02B ALEP	$e^+ e^- \rightarrow D^0 K^+ X$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
705.4 ± 4.3	25	¹ EVDOKIMOV	04 SELX	$600 \Sigma^- A \rightarrow D^0 K^+ X$
¹ Systematic errors not estimated.				

NODE=M148DM;LINKAGE=EV

 $D_{s2}^*(2573)$ WIDTH

NODE=M148W

NODE=M148W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
16.9 ± 0.8 OUR AVERAGE				
16.9 $\pm 0.5 \pm 0.6$		AAIJ	14AW LHCb	$B_s^0 \rightarrow \bar{D}^0 K^- \pi^+$
12.1 $\pm 4.5 \pm 1.6$	82	AAIJ	11A LHCb	$B_s \rightarrow D_{s2}^*(2573) \mu \bar{\nu} X$
27.1 $\pm 0.6 \pm 5.6$		AUBERT,BE	06E BABR	$e^+ e^- \rightarrow D K X$
10.4 $\pm 8.3 \pm 3.0$		ALBRECHT	96 ARG	$e^+ e^- \rightarrow D^0 K^+ X$
16 $^{+5}_{-4} \pm 3$	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 ^{1} EVDOKIMOV 04 SELX 600 $\Sigma^- A \rightarrow D^0 K^+ X$

^{1} Systematic errors not estimated.

NODE=M148W;LINKAGE=EV

$D_{s2}^*(2573)^+$ DECAY MODES

$D_{s2}^*(2573)^-$ modes are charge conjugates of the modes below.

NODE=M148215;NODE=M148

NODE=M148

Mode	Fraction (Γ_i/Γ)
Γ_1 $D^0 K^+$	seen
Γ_2 $D^*(2007)^0 K^+$	not seen

DESIG=1

DESIG=2;OUR EVAL; $\rightarrow$ UNCHECKED $\leftarrow$

$D_{s2}^*(2573)^+$ BRANCHING RATIOS

NODE=M148220

$\Gamma(D^0 K^+)/\Gamma_{\text{total}}$						Γ_1/Γ
VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT	
seen	217	KUBOTA	94	CLE2	$\pm$ $e^+ e^- \sim 10.5$ GeV	

$\Gamma(D^*(2007)^0 K^+)/\Gamma(D^0 K^+)$						Γ_2/Γ_1
VALUE	CL%	DOCUMENT ID	TECN	CHG	COMMENT	
<0.33	90	KUBOTA	94	CLE2	$+$ $e^+ e^- \sim 10.5$ GeV	

NODE=M148R2
NODE=M148R2

NODE=M148R1
NODE=M148R1

$D_{s2}^*(2573)$ REFERENCES

AAIJ	14AW	PRL 113 162001	R. Aaij <i>et al.</i>	(LHCb Collab.) JP
AAIJ	11A	PL B698 14	R. Aaij <i>et al.</i>	(LHCb Collab.)
AUBERT,BE	06E	PRL 97 222001	B. Aubert <i>et al.</i>	(BABAR Collab.)
EVDOKIMOV	04	PRL 93 242001	A.V. Evdokimov <i>et al.</i>	(SELEX Collab.)
HEISTER	02B	PL B526 34	A. Heister <i>et al.</i>	(ALEPH Collab.)
ALBRECHT	96	ZPHY C69 405	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
KUBOTA	94	PRL 72 1972	Y. Kubota <i>et al.</i>	(CLEO Collab.)

NODE=M148

REFID=56105
REFID=16665
REFID=51512
REFID=50337
REFID=48562
REFID=44631
REFID=43781

NODE=M182

$D_{s1}^*(2700)^\pm$

$$I(J^P) = 0(1^-)$$

$D_{s1}^*(2700)^+$ MASS

NODE=M182M

NODE=M182M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$2708.3^{+4.0}_{-3.4}$ OUR AVERAGE				
2699 $^{+14}_{-7}$		^{1} LEES	15C BABR	$B \rightarrow D D^0 K^+$
2709.2 $\pm 1.9 \pm 4.5$	52k	^{2} AAIJ	12AU LHCB	$pp \rightarrow (DK)^+ X$ at 7 TeV
2710 ± 2 $^{+12}_{-7}$	10.4k	^{3} AUBERT	09AR BABR	$e^+ e^- \rightarrow D^{(*)} K X$
2708 ± 9 $^{+11}_{-10}$	182	BRODZICKA	08 BELL	$B^+ \rightarrow D^0 \bar{D}^0 K^+$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2694 ± 8 $^{+13}_{-3}$		LEES	15C BABR	$B^0 \rightarrow D^- D^0 K^+$
2707 $\pm 8 \pm 8$		LEES	15C BABR	$B^+ \rightarrow \bar{D}^0 D^0 K^+$
2688 $\pm 4 \pm 3$		^{4} AUBERT,BE	06E BABR	10.6 $e^+ e^- \rightarrow DKX$

OCCUR=2

OCCUR=3

^{1} From a combined analysis of $B^0 \rightarrow D^- D^0 K^+$ and $B^+ \rightarrow \bar{D}^0 D^0 K^+$.

^{2} From the combined fit of the $D^+ K_S^0$ and $D^0 K^+$ modes in the model including the $D_{s2}^*(2573)^+$, $D_{s1}^*(2700)^+$ and spin-0 $D_{sJ}^*(2860)^+$.

^{3} From simultaneous fits to the two DK mass spectra and to the total $D^* K$ mass spectrum.

^{4} Superseded by AUBERT 09AR.

NODE=M182M;LINKAGE=B
NODE=M182M;LINKAGE=AA

NODE=M182M;LINKAGE=AB

NODE=M182M;LINKAGE=AU

$D_{s1}^*(2700)^+$ WIDTH

NODE=M182W

NODE=M182W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
120 ± 11 OUR AVERAGE				
127 $^{+24}_{-19}$		^{5} LEES	15C BABR	$B \rightarrow D D^0 K^+$
115.8 $\pm 7.3 \pm 12.1$	52k	^{6} AAIJ	12AU LHCB	$pp \rightarrow (DK)^+ X$ at 7 TeV
149 ± 7 $^{+39}_{-52}$	10.4k	^{7} AUBERT	09AR BABR	$e^+ e^- \rightarrow D^{(*)} K X$
108 ± 23 $^{+36}_{-31}$	182	BRODZICKA	08 BELL	$B^+ \rightarrow D^0 \bar{D}^0 K^+$

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

145	± 24	$^{+22}_{-14}$	LEES	15C	BABR	$B^0 \rightarrow D^- D^0 K^+$
113	± 21	$^{+20}_{-16}$	LEES	15C	BABR	$B^+ \rightarrow \bar{D}^0 D^0 K^+$
112	± 7	± 36	⁸ AUBERT,BE	06E	BABR	$10.6 e^+ e^- \rightarrow DKX$
⁵ From a combined analysis of $B^0 \rightarrow D^- D^0 K^+$ and $B^+ \rightarrow \bar{D}^0 D^0 K^+$.						
⁶ 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 $D_{sJ}^*(2860)^+$.						
⁷ From simultaneous fits to the two DK mass spectra and to the total $D^* K$ mass spectrum.						
⁸ Superseded by AUBERT 09AR.						

OCCUR=2

OCCUR=3

NODE=M182W;LINKAGE=A

NODE=M182W;LINKAGE=AA

NODE=M182W;LINKAGE=AB

NODE=M182W;LINKAGE=AU

$D_{s1}^*(2700)^\pm$ DECAY MODES

NODE=M182215;NODE=M182

Mode	
Γ_1	DK
Γ_2	$D^0 K^+$
Γ_3	$D^+ K_S^0$
Γ_4	$D^* K$
Γ_5	$D^{*0} K^+$
Γ_6	$D^{*+} K_S^0$

DESIG=2

DESIG=1

DESIG=3

DESIG=4

DESIG=5

DESIG=6

$D_{s1}^*(2700)^\pm$ BRANCHING RATIOS

NODE=M182225

$\Gamma(D^* K)/\Gamma(DK)$				Γ_4/Γ_1	
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
$0.91 \pm 0.13 \pm 0.12$	10.4k	⁹ AUBERT	09AR BABR	$e^+ e^- \rightarrow D^{(*)} K X$	
⁹ 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	
$0.88 \pm 0.14 \pm 0.14$	7716	¹⁰ AUBERT	09AR BABR	$e^+ e^- \rightarrow D^{(*)} K X$	
¹⁰ 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	
$1.14 \pm 0.39 \pm 0.23$	2700	¹¹ AUBERT	09AR BABR	$e^+ e^- \rightarrow D^{(*)} K X$	
¹¹ 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

LEES	15C	PR D91 052002	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=56412
AAIJ	12AU	JHEP 1210 151	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=54735
AUBERT	09AR	PR D80 092003	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=53135
BRODZICKA	08	PRL 100 092001	J. Brodzicka <i>et al.</i>	(BELLE Collab.)	REFID=52144
AUBERT,BE	06E	PRL 97 222001	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51512

$$D_{s1}^*(2860)^\pm$$

$$I(J^P) = 0(1^-)$$

OMITTED FROM SUMMARY TABLE

J^P consistent with 1^- from angular analysis of AAIJ 14AW. Observed by AUBERT, BE 06E and AUBERT 09AR in inclusive production of DK and D^*K in e^+e^- annihilation.

NODE=M196

NODE=M196

$D_{s1}^*(2860)^+$ MASS

NODE=M196M

NODE=M196M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2859 ±12 ±24		¹ AAIJ	14AW LHCb	$B_s^0 \rightarrow \bar{D}^0 K^- \pi^+$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2866.1 ± 1.0 ± 6.3	36k	^{2,3} AAIJ	12AU LHCb	$pp \rightarrow (DK)^+ X$ at 7 TeV
2862 ± 2 ± $\frac{5}{2}$	3122	^{3,4} AUBERT	09AR BABR	$e^+e^- \rightarrow D^{(*)} K X$
2856.6 ± 1.5 ± 5.0		⁵ AUBERT, BE	06E BABR	$e^+e^- \rightarrow DK X$

¹ Separated from the spin-3 component $D_{s3}^*(2860)^-$ by a fit of the helicity angle of the $\bar{D}^0 K^-$ system, with a statistical significance of the spin-3 and spin-1 components in excess of 10σ .

NODE=M196M;LINKAGE=A

² From the combined fit of the $D^+ K_S^0$ and $D^0 K^+$ modes in the model including the $D_{s2}^*(2573)^+$, $D_{s1}^*(2700)^+$ and spin-0 $D_{sJ}^*(2860)^+$.

NODE=M196M;LINKAGE=AA

³ Possible contribution from the $D_{s3}^*(2860)$ state.

NODE=M196M;LINKAGE=B
NODE=M196M;LINKAGE=AB

⁴ From simultaneous fits to the two DK mass spectra and to the total D^*K mass spectrum.

⁵ Superseded by AUBERT 09AR.

NODE=M196M;LINKAGE=AU

$D_{s1}^*(2860)^+$ WIDTH

NODE=M196W

NODE=M196W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
159 ±23 ±77		¹ AAIJ	14AW LHCb	$B_s^0 \rightarrow \bar{D}^0 K^- \pi^+$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
69.9 ± 3.2 ± 6.6	36k	^{2,3} AAIJ	12AU LHCb	$pp \rightarrow (DK)^+ X$ at 7 TeV
48 ± 3 ± 6	3122	^{3,4} AUBERT	09AR BABR	$e^+e^- \rightarrow D^{(*)} K X$
47 ± 7 ± 10		⁵ AUBERT, BE	06E BABR	$e^+e^- \rightarrow DK X$

¹ Separated from the spin-3 component $D_{s3}^*(2860)^-$ by a fit of the helicity angle of the $\bar{D}^0 K^-$ system, with a statistical significance of the spin-3 and spin-1 components in excess of 10σ .

NODE=M196W;LINKAGE=A

² From the combined fit of the $D^+ K_S^0$ and $D^0 K^+$ modes in the model including the $D_{s2}^*(2573)^+$, $D_{s1}^*(2700)^+$ and spin-0 $D_{sJ}^*(2860)^+$.

NODE=M196W;LINKAGE=AA

³ Possible contribution from the $D_{s3}^*(2860)$ state.

NODE=M196W;LINKAGE=B
NODE=M196W;LINKAGE=AB

⁴ From simultaneous fits to the two DK mass spectra and to the total D^*K mass spectrum.

⁵ Superseded by AUBERT 09AR.

NODE=M196W;LINKAGE=AU

$D_{s1}^*(2860)^\pm$ DECAY MODES

NODE=M196215;NODE=M196

Mode	
Γ_1	DK
Γ_2	$D^0 K^+$
Γ_3	$D^+ K_S^0$
Γ_4	$D^* K$
Γ_5	$D^{*0} K^+$
Γ_6	$D^{*+} K_S^0$

DESIG=1

DESIG=2

DESIG=3

DESIG=4

DESIG=5

DESIG=6

$D_{s1}^*(2860)^\pm$ BRANCHING RATIOS

NODE=M196225

 $\Gamma(D^*K)/\Gamma(DK)$
 Γ_4/Γ_1

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
1.10 ± 0.15 ± 0.19	3122	¹ AUBERT	09AR BABR	$e^+e^- \rightarrow D^{(*)} K X$

NODE=M196R01
NODE=M196R01

¹ From the average of the corresponding ratios with $D^{(*)0} K^+$ and $D^{(*)+} K_S^0$.

NODE=M196R01;LINKAGE=AU

$\Gamma(D^{*0}K^+)/\Gamma(D^0K^+)$

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT

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

1.04±0.17±0.20	2241	¹ AUBERT	09AR BABR	$e^+e^- \rightarrow D^{(*)}KX$

¹ From the $D^{*0}K^+$ and D^0K^+ , where $D^{*0} \rightarrow D^0\pi^0$.

 Γ_5/Γ_2

NODE=M196R02
NODE=M196R02

NODE=M196R02;LINKAGE=AU

 $\Gamma(D^{*+}K_S^0)/\Gamma(D^+K_S^0)$

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT

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

1.38±0.35±0.49	881	¹ AUBERT	09AR BABR	$e^+e^- \rightarrow D^{(*)}KX$

¹ From the $D^{*+}K_S^0$ and $D^+K_S^0$, where $D^{*+} \rightarrow D^+\pi^0$.

 Γ_6/Γ_3

NODE=M196R03
NODE=M196R03

NODE=M196R03;LINKAGE=AU

 $D_{s1}^*(2860)^\pm$ REFERENCES

AAIJ	14AW PRL 113 162001	R. Aaij <i>et al.</i>	(LHCb Collab.) JP
AAIJ	12AU JHEP 1210 151	R. Aaij <i>et al.</i>	(LHCb Collab.)
AUBERT	09AR PR D80 092003	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT,BE	06E PRL 97 222001	B. Aubert <i>et al.</i>	(BABAR Collab.)

NODE=M196

REFID=56105
REFID=54735
REFID=53135
REFID=51512

NODE=M226

 $D_{s3}^*(2860)^\pm$ $I(J^P) = 0(3^-)$

OMITTED FROM SUMMARY TABLE

J^P consistent with 3^- from angular analysis of AAIJ 14AW.

NODE=M226

 $D_{s3}^*(2860)^+$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

2860.5±2.6±6.5	¹ AAIJ	14AW LHCB	$B_s^0 \rightarrow \bar{D}^0 K^- \pi^+$

¹ Separated from the spin-1 component $D_{s1}^*(2860)^-$ by a fit of the helicity angle of the $\bar{D}^0 K^-$ system, with a statistical significance of the spin-3 and spin-1 components in excess of 10σ .

NODE=M226M

NODE=M226M

NODE=M226M;LINKAGE=A

 $D_{s3}^*(2860)^+$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

53±7±7	¹ AAIJ	14AW LHCB	$B_s^0 \rightarrow \bar{D}^0 K^- \pi^+$

¹ Separated from the spin-1 component $D_{s1}^*(2860)^-$ by a fit of the helicity angle of the $\bar{D}^0 K^-$ system, with a statistical significance of the spin-3 and spin-1 components in excess of 10σ .

NODE=M226W

NODE=M226W

NODE=M226W;LINKAGE=A

 $D_{s3}^*(2860)^\pm$ REFERENCES

AAIJ	14AW PRL 113 162001	R. Aaij <i>et al.</i>	(LHCb Collab.) JP

NODE=M226

REFID=56105

$D_{sJ}(3040)^{\pm}$

$$I(J^P) = 0(?)^?$$

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 <i>et al.</i>	(BABAR Collab.)

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

NODE=M218

$B_1(5721)^+$

$$I(J^P) = \frac{1}{2}(1^+) \text{ Status: } **$$

I, J, P need confirmation.

Quantum numbers shown are quark-model predictions.

NODE=M218

$B_1(5721)^+$ MASS

NODE=M218M

NODE=M218M

NODE=M218M

OUR FIT uses $m_{B^{*0}}$ and $m_{B_1^+} - m_{B^{*0}}$ to determine $m_{B_1(5721)^+}$.

VALUE (MeV)	DOCUMENT ID
$5725.9^{+2.5}_{-2.7}$ OUR FIT	

$$m_{B_1^+} - m_{B^{*0}}$$

NODE=M218DM

NODE=M218DM

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
$401.2^{+2.4}_{-2.7}$ OUR FIT				
$401.2^{+2.4}_{-2.7}$ OUR AVERAGE				
$400.5 \pm 1.8 \pm 3.1$	8K	¹ AAIJ	15AB LHCb	pp at 7, 8 TeV
$402 \pm 3^{+1}_{-3}$		² AALTONEN	14l CDF	$p\bar{p}$ at 1.96 TeV

¹ AAIJ 15AB reports $[m_{B_1^+} - m_{B^0}] - (m_{B^{*0}} - m_{B^0}) - m_{\pi^+} = 260.9 \pm 1.8 \pm 3.1$

MeV which we adjust by the π^+ mass and assume $(m_{B^{*0}} - m_{B^0}) = (m_{B^{*+}} - m_{B^+}) = 45.01 \pm 0.30 \pm 0.23$ MeV. The masses inside the square brackets were measured for each candidate event.

² AALTONEN 14I reports $m_{B_1(5721)^+} - m_{B^{*0}} - m_{\pi^+} = 262 \pm 3^{+1}_{-3}$ MeV which we adjusted by the π^+ mass.

NODE=M218DM;LINKAGE=A

NODE=M218DM;LINKAGE=AA

$B_1(5721)^+$ WIDTH

NODE=M218W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
31 ± 6 OUR AVERAGE	Error includes scale factor of 1.1.			
29.1 ± 3.6 ± 4.3	8K	AAIJ	15AB LHCB	$p\bar{p}$ at 7, 8 TeV
49 $^{+12}_{-10}$ $^{+2}_{-13}$		AALTONEN	14I CDF	$p\bar{p}$ at 1.96 TeV

NODE=M218W

$B_1(5721)^+$ DECAY MODES

NODE=M218215;NODE=M218

Mode	Fraction (Γ_i/Γ)
Γ_1 $B^{*0}\pi^+$	seen

DESIG=1

$B_1(5721)^+$ BRANCHING RATIOS

NODE=M218220

$\Gamma(B^{*0}\pi^+)/\Gamma_{\text{total}}$	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_1/Γ
seen	8K	AAIJ	15AB LHCB	$p\bar{p}$ at 7, 8 TeV	
seen		AALTONEN	14I CDF	$p\bar{p}$ at 1.96 TeV	

NODE=M218R01
NODE=M218R01

$B_1(5721)^+$ REFERENCES

NODE=M218

AAIJ	15AB JHEP 1504 024	R. Aaij <i>et al.</i>	(LHCb Collab.)
AALTONEN	14I PR D90 012013	T. Aaltonen <i>et al.</i>	(CDF Collab.)

REFID=56628
REFID=56029

$$B_1(5721)^0$$

$I(J^P) = \frac{1}{2}(1^+)$ Status: ***
 I, J, P need confirmation.

Quantum numbers shown are quark-model predictions.

NODE=M183

NODE=M183

$B_1(5721)^0$ MASS

NODE=M183M

OUR FIT uses mass differences measurements listed below to determine the mass $m_{B_1(5721)^0}$.

NODE=M183M

VALUE (MeV)	DOCUMENT ID
5726.0 ± 1.3 OUR FIT	Error includes scale factor of 1.2.

NODE=M183M

$$m_{B_1^0} - m_{B^+}$$

NODE=M183DM

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
446.7 ± 1.3 OUR FIT	Error includes scale factor of 1.2.		
441.5 ± 2.4 ± 1.3	¹ ABAZOV	07T D0	$p\bar{p}$ at 1.96 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •			
446.2 $^{+1.9}_{-2.1}$ $^{+1.0}_{-1.2}$	¹ AALTONEN	09D CDF	Repl. by AALTONEN 14I

NODE=M183DM

¹ Observed in $B_1^0 \rightarrow B^{*+}\pi^-$.

$$m_{B_1^0} - m_{B^{*+}}$$

NODE=M183DM;LINKAGE=AA

NODE=M183DM2

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
401.4 ± 1.2 OUR FIT	Error includes scale factor of 1.2.			
402.8 ± 1.1 OUR AVERAGE				
403.4 ± 0.7 ± 1.5	35K	² AAIJ	15AB LHCB	$p\bar{p}$ at 7, 8 TeV
402.3 ± 0.9 $^{+1.1}_{-1.2}$		³ AALTONEN	14I CDF	$p\bar{p}$ at 1.96 TeV

NODE=M183DM2

- ² AAIJ 15AB reports $[m_{B_1^0} - m_{B^+}] - (m_{B^{*+}} - m_{B^+}) - m_{\pi^-} = 263.9 \pm 0.7 \pm 1.4$ MeV which we adjust by the π^- mass and $(m_{B^{*+}} - m_{B^+}) = 45.01 \pm 0.30 \pm 0.23$ MeV. The masses inside the square brackets were measured for each candidate event.
- ³ AALTONEN 14I reports $m_{B_1(5721)^0} - m_{B^{*+}} - m_{\pi^-} = 262.7 \pm 0.9^{+1.1}_{-1.2}$ MeV which we adjusted by the π^- mass.

NODE=M183DM2;LINKAGE=B

NODE=M183DM2;LINKAGE=AA

 $B_1(5721)^0$ WIDTH

NODE=M183W

NODE=M183W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
27.5 ± 3.4 OUR AVERAGE	Error includes scale factor of 1.1.			
$30.1 \pm 1.5 \pm 3.5$	35k	AAIJ	15AB LHCB	$p\bar{p}$ at 7, 8 TeV
$23 \pm 3 \pm 4$		AALTONEN	14I CDF	$p\bar{p}$ at 1.96 TeV

 $B_1(5721)^0$ DECAY MODES

NODE=M183215;NODE=M183

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad B^{*+} \pi^-$	dominant

DESIG=1

 $B_1(5721)^0$ BRANCHING RATIOS

NODE=M183220

$\Gamma(B^{*+} \pi^-)/\Gamma_{\text{total}}$	VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_1/Γ
seen		35K	AAIJ	15AB LHCB	$p\bar{p}$ at 7, 8 TeV	
dominant			AALTONEN	09D CDF	$p\bar{p}$ at 1.96 TeV	
dominant			⁴ ABAZOV	07T D0	$p\bar{p}$ at 1.96 TeV	
⁴ Observed in $B_1^0 \rightarrow B^{*+} \pi^-$ with $B^{*+} \rightarrow B^+ \gamma$ and $B^+ \rightarrow J/\psi \pi^+$.						

NODE=M183R01
NODE=M183R01

NODE=M183R01;LINKAGE=AB

 $B_1(5721)^0$ REFERENCES

NODE=M183

AAIJ	15AB	JHEP 1504 024	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=56628
AALTONEN	14I	PR D90 012013	T. Aaltonen <i>et al.</i>	(CDF Collab.)	REFID=56029
AALTONEN	09D	PRL 102 102003	T. Aaltonen <i>et al.</i>	(CDF Collab.)	REFID=52700
ABAZOV	07T	PRL 99 172001	V.M. Abazov <i>et al.</i>	(D0 Collab.)	REFID=52014

NODE=M151

 $B_j^*(5732)$ or B^{**}
 $I(J^P) = ?(??)$
 I, J, P need confirmation.
OMITTED FROM SUMMARY TABLE

Signal can be interpreted as stemming from several narrow and broad resonances. Needs confirmation.

NODE=M151

 $B_j^*(5732)$ MASS

NODE=M151M

NODE=M151M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
5698 ± 8 OUR AVERAGE	Error includes scale factor of 1.2.			
5710 ± 20		¹ AFFOLDER	01F CDF	$p\bar{p}$ at 1.8 TeV
5695^{+17}_{-19}		² BARATE	98L ALEP	$e^+ e^- \rightarrow Z$
$5704 \pm 4 \pm 10$	1944	³ BUSKULIC	96D ALEP	$E_{\text{cm}}^{\text{ee}} = 88-94$ GeV
$5732 \pm 5 \pm 20$	2157	ABREU	95B DLPH	$E_{\text{cm}}^{\text{ee}} = 88-94$ GeV
5681 ± 11	1738	AKERS	95E OPAL	$E_{\text{cm}}^{\text{ee}} = 88-94$ GeV

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

5713 ± 2 ⁴ ACCIARRI 99N L3 $e^+ e^- \rightarrow Z$

¹ AFFOLDER 01F uses the reconstructed B meson through semileptonic decay channels. The fraction of light B mesons that are produced at $L=1$ B^{**} states is measured to be $0.28 \pm 0.06 \pm 0.03$.

NODE=M151M;LINKAGE=MF

² BARATE 98L uses fully reconstructed B mesons to search for B^{**} production in the $B\pi^\pm$ system. In the framework of heavy quark symmetry (HQS), they also measured the mass of B_2^* to be 5739^{+8+6}_{-11-4} MeV/ c^2 and the relative production rate of $B(b \rightarrow B_2^* \rightarrow B^{(*)}\pi)/B(b \rightarrow B_{u,d}) = (31 \pm 9^{+6}_{-5})\%$.

NODE=M151M;LINKAGE=B

³ Using $m_{B\pi} - m_B = 424 \pm 4 \pm 10$ MeV.

NODE=M151M;LINKAGE=A

⁴ ACCIARRI 99N uses inclusive reconstructed B mesons to search for B^{**} production in the $B^{(*)}\pi^{\pm}$ system. In the framework of HQET, they measured the mass of B_1^* and B_2^* to be $5670 \pm 10 \pm 13$ MeV and $5768 \pm 5 \pm 6$ with the $B(b \rightarrow B^{**}) = (32 \pm 3 \pm 6) \times 10^{-2}$. They also reported the evidence for the existence of an excited B -meson state or mixture of states in the region 5.9–6.0 GeV.

NODE=M151M;LINKAGE=N

$B_J^*(5732)$ WIDTH

NODE=M151W

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
128±18 OUR AVERAGE				
145±28	2157	ABREU	95B DLPH	$E_{cm}^{ee} = 88\text{--}94$ GeV
116±24	1738	AKERS	95E OPAL	$E_{cm}^{ee} = 88\text{--}94$ GeV

NODE=M151W

$B_J^*(5732)$ DECAY MODES

NODE=M151215;NODE=M151

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad B^*\pi + B\pi$	dominant
$\Gamma_2 \quad B^*\pi(X)$	[a] (85±29) %

DESIG=1;OUR EST;→ UNCHECKED ←
DESIG=2

[a] X refers to decay modes with or without additional accompanying decay particles.

LINKAGE=151

$B_J^*(5732)$ BRANCHING RATIOS

NODE=M151220

X refers to decay modes with or without additional accompanying decay particles.

NODE=M151220

$\Gamma(B^*\pi(X))/\Gamma_{\text{total}}$	DOCUMENT ID	TECN	COMMENT	Γ_2/Γ
VALUE				
$0.85^{+0.26}_{-0.27} \pm 0.12$	ABBIENDI	02E OPAL	$e^+e^- \rightarrow Z$	

NODE=M151R1
NODE=M151R1

$B_J^*(5732)$ REFERENCES

NODE=M151

ABBIENDI	02E	EPJ C23 437	G. Abbiendi <i>et al.</i>	(OPAL Collab.)
AFFOLDER	01F	PR D64 072002	T. Affolder <i>et al.</i>	(CDF Collab.)
ACCIARRI	99N	PL B465 323	M. Acciarri <i>et al.</i>	(L3 Collab.)
BARATE	98L	PL B425 215	R. Barate <i>et al.</i>	(ALEPH Collab.)
BUSKULIC	96D	ZPHY C69 393	D. Buskulic <i>et al.</i>	(ALEPH Collab.)
ABREU	95B	PL B345 598	P. Abreu <i>et al.</i>	(DELPHI Collab.)
AKERS	95E	ZPHY C66 19	R. Akers <i>et al.</i>	(OPAL Collab.)

REFID=48742
REFID=48369
REFID=47247
REFID=46082
REFID=44677
REFID=44131
REFID=44182

$B_2^*(5747)^+$
 $I(J^P) = \frac{1}{2}(2^+)$ Status: **
 I, J, P need confirmation.

Quantum numbers shown are quark-model predictions.

NODE=M219

NODE=M219

 $B_2^*(5747)^+$ MASSOUR FIT uses m_{B^0} and $m_{B_2^{*+}} - m_{B^0}$ to determine $m_{B_2^*(5747)^+}$.

NODE=M219M

NODE=M219M

NODE=M219M

VALUE (MeV)

DOCUMENT ID

5737.2±0.7 OUR FIT **$m_{B_2^{*+}} - m_{B^0}$**

NODE=M219DM

NODE=M219DM

VALUE (MeV)

EVTS

DOCUMENT ID

TECN

COMMENT

457.5 ±0.7 OUR FIT**457.5 ±0.7 OUR AVERAGE**

457.62±0.72±0.40

4K

¹ AAIJ

15AB LHCb

 pp at 7, 8 TeV457.3 ±1.3 $^{+0.3}_{-0.9}$ ² AALTONEN

14l CDF

 $p\bar{p}$ at 1.96 TeV

¹ AAIJ 15AB reports $[m_{B_2^{*+}} - m_{B^0}] - m_{\pi^+} = 318.1 \pm 0.7 \pm 0.4$ MeV which we adjust by the π^+ mass. The masses inside the square brackets were measured for each candidate event.

² AALTONEN 14l reports $m_{B_2^*(5747)^+} - m_{B^0} - m_{\pi^+} = 317.7 \pm 1.2^{+0.3}_{-0.9}$ MeV which we adjusted by the π^+ mass.

NODE=M219DM;LINKAGE=B

NODE=M219DM;LINKAGE=A

 $B_2^*(5747)^+$ WIDTH

NODE=M219W

NODE=M219W

VALUE (MeV)

EVTS

DOCUMENT ID

TECN

COMMENT

20 ±5 OUR AVERAGE Error includes scale factor of 2.2.

23.6±2.0±2.1

4K

AAIJ

15AB LHCb

 pp at 7, 8 TeV11 $^{+4}_{-3}$ $^{+3}_{-4}$

AALTONEN

14l CDF

 $p\bar{p}$ at 1.96 TeV **$B_2^*(5747)^+$ DECAY MODES**

NODE=M219215;NODE=M219

Mode	Fraction (Γ_i/Γ)
Γ_1 $B^0\pi^+$	seen
Γ_2 $B^{*0}\pi^+$	seen

DESIG=1

DESIG=2

 $B_2^*(5747)^+$ BRANCHING RATIOS

NODE=M219220

$\Gamma(B^0\pi^+)/\Gamma_{\text{total}}$					Γ_1/Γ
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
seen	4K	AAIJ	15AB LHCb	pp at 7, 8 TeV	
seen		AALTONEN	14l CDF	$p\bar{p}$ at 1.96 TeV	

NODE=M219R01

NODE=M219R01

$\Gamma(B^{*0}\pi^+)/\Gamma_{\text{total}}$				Γ_2/Γ
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
seen	4k	AAIJ	15AB LHCb	pp at 7, 8 TeV

NODE=M219R02

NODE=M219R02

$\Gamma(B^{*0}\pi^+)/\Gamma(B^0\pi^+)$					Γ_2/Γ_1
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
1.0±0.5±0.8	4k	AAIJ	15AB LHCb	pp at 7, 8 TeV	

NODE=M219R03

NODE=M219R03

 $B_2^*(5747)^+$ REFERENCES

NODE=M219

AAIJ 15AB JHEP 1504 024
AALTONEN 14l PR D90 012013

R. Aaij *et al.*
T. Aaltonen *et al.*

(LHCb Collab.)
(CDF Collab.)

REFID=56628

REFID=56029

$B_2^*(5747)^0$
 $I(J^P) = \frac{1}{2}(2^+)$ Status: ***
 I, J, P need confirmation.

Quantum numbers shown are quark-model predictions.

 $B_2^*(5747)^0$ MASS

OUR FIT uses m_{B^+} , $m_{B_1^0} - m_{B^+}$, and $m_{B_2^{*0}} - m_{B_1^0}$ to determine $m_{B_2^*(5747)^0}$. The -0.659 correlation between statistical uncertainties of $m_{B_1^0} - m_{B^+}$ and $m_{B_2^{*0}} - m_{B_1^0}$ measurements reported by ABAZOV 07T is taken into account.

VALUE (MeV) DOCUMENT ID
5739.5±0.7 OUR FIT Error includes scale factor of 1.4.

 $m_{B_2^{*0}} - m_{B_1^0}$

VALUE (MeV) DOCUMENT ID TECN COMMENT
13.5±1.4 OUR FIT Error includes scale factor of 1.3.

26.2±3.1±0.9 ¹ ABAZOV 07T D0 $p\bar{p}$ at 1.96 TeV

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

14.9^{+2.2+1.2}_{-2.5-1.4} ¹ AALTONEN 09D CDF Repl. by AALTONEN 14I

¹ Observed in $B_2^{*0} \rightarrow B^{*+}\pi^-$ and $B_2^{*0} \rightarrow B^+\pi^-$.

 $m_{B_2^{*0}} - m_{B^+}$

VALUE (MeV) EVTS DOCUMENT ID TECN COMMENT
460.2 ±0.6 OUR FIT Error includes scale factor of 1.4.

459.9 ±0.8 OUR AVERAGE Error includes scale factor of 1.8.

460.18±0.37±0.33 17K ² AAIJ 15AB LHCb $p\bar{p}$ at 7, 8 TeV

457.5 ±1.2^{+0.8}_{-0.9} ³ AALTONEN 14I CDF $p\bar{p}$ at 1.96 TeV

² AAIJ 15AB reports $[m_{B_2^{*0}} - m_{B^+}] - m_{\pi^-} = 320.6 \pm 0.4 \pm 0.3$ MeV which we adjust by the π^- mass. The masses inside the square brackets were measured for each candidate event.

³ AALTONEN 14I reports $m_{B_2^*(5747)^0} - m_{B^+} - m_{\pi^-} = 317.9 \pm 1.2^{+0.8}_{-0.9}$ MeV which we adjusted by the π^- mass.

 $B_2^*(5747)^0$ WIDTH

VALUE (MeV) EVTS DOCUMENT ID TECN COMMENT
24.2±1.7 OUR AVERAGE

24.5±1.0±1.5 17K AAIJ 15AB LHCb $p\bar{p}$ at 7, 8 TeV

22⁺³₋₂⁺⁴₋₅ AALTONEN 14I CDF $p\bar{p}$ at 1.96 TeV

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

22.7^{+3.8+3.2}_{-3.2-10.2} AALTONEN 09D CDF Repl. by AALTONEN 14I

 $B_2^*(5747)^0$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $B^+\pi^-$	dominant
Γ_2 $B^{*+}\pi^-$	dominant

 $B_2^*(5747)^0$ BRANCHING RATIOS

$\Gamma(B^+\pi^-)/\Gamma_{\text{total}}$	Γ_1/Γ
VALUE EVTS DOCUMENT ID TECN COMMENT	
seen 17K AAIJ 15AB LHCb $p\bar{p}$ at 7, 8 TeV	
dominant AALTONEN 09D CDF $p\bar{p}$ at 1.96 TeV	
dominant ABAZOV 07T D0 $p\bar{p}$ at 1.96 TeV	

NODE=M184

NODE=M184

NODE=M184M

NODE=M184M

NODE=M184M

NODE=M184DM

NODE=M184DM

NODE=M184DM;LINKAGE=AB

NODE=M184DM2

NODE=M184DM2

NODE=M184DM2;LINKAGE=A

NODE=M184DM2;LINKAGE=AA

NODE=M184W

NODE=M184W

NODE=M184215;NODE=M184

DESIG=1

DESIG=2

NODE=M184220

NODE=M184R01
NODE=M184R01

$\Gamma(B^{*+}\pi^-)/\Gamma_{\text{total}}$					Γ_2/Γ
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
seen	17K	AAIJ	15AB LHCb	pp at 7, 8 TeV	
dominant		AALTONEN	09D CDF	$p\bar{p}$ at 1.96 TeV	
dominant		ABAZOV	07T D0	$p\bar{p}$ at 1.96 TeV	

NODE=M184R02
NODE=M184R02

$\Gamma(B^{*+}\pi^-)/\Gamma(B^+\pi^-)$					Γ_2/Γ_1
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
0.82±0.28 OUR AVERAGE					
0.71±0.14±0.30	17K	AAIJ	15AB LHCb	pp at 7, 8 TeV	
1.10±0.42±0.31		⁴ ABAZOV	07T D0	$p\bar{p}$ at 1.96 TeV	

NODE=M184R03
NODE=M184R03

⁴ Converted from measured ratio of $R = B(B_2^{*0} \rightarrow B^{*+}\pi^-) / B(B_2^{*0} \rightarrow B^{(*)+}\pi^-)$
= 0.475 ± 0.095 ± 0.069.

NODE=M184R03;LINKAGE=AB

$B_2^{*}(5747)^0$ REFERENCES

AAIJ	15AB JHEP 1504 024	R. Aaij <i>et al.</i>	(LHCb Collab.)
AALTONEN	14I PR D90 012013	T. Aaltonen <i>et al.</i>	(CDF Collab.)
AALTONEN	09D PRL 102 102003	T. Aaltonen <i>et al.</i>	(CDF Collab.)
ABAZOV	07T PRL 99 172001	V.M. Abazov <i>et al.</i>	(D0 Collab.)

NODE=M184

REFID=56628
REFID=56029
REFID=52700
REFID=52014

NODE=M224

$B_J(5840)^+$

$I(J^P) = \frac{1}{2}(?)^?$ Status: **
 I, J, P need confirmation.

OMITTED FROM SUMMARY TABLE

Quantum numbers shown are quark-model predictions.

NODE=M224

$B_J(5840)^+$ MASS

NODE=M224M

OUR FIT uses m_{B^0} and $m_{B_J(5840)^+} - m_{B^0}$ to determine $m_{B_J(5840)^+}$.

NODE=M224M

VALUE (MeV)	DOCUMENT ID
5851±19 OUR FIT	

NODE=M224M

$m_{B_J(5840)^+} - m_{B^0}$

NODE=M224DM

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
571±19 OUR FIT				

NODE=M224DM

571±13±14 7k ¹ AAIIJ 15AB LHCb pp at 7, 8 TeV

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

595±26±14 7k ² AAIIJ 15AB LHCb pp at 7, 8 TeV

OCCUR=2

¹ AAIIJ 15AB reports $[m_{B_J^+} - m_{B^0}] - m_{\pi^+} = 431 \pm 13 \pm 14$ MeV which we adjust by the π^+ mass. The masses inside the square brackets were measured for each candidate event. The result assumes $P = (-1)^J$ and uses two relativistic Breit-Wigner functions in the fit for mass difference.

NODE=M224DM;LINKAGE=A

² AAIIJ 15AB reports $[m_{B_J^+} - m_{B^0}] - m_{\pi^+} = 455 \pm 26 \pm 14$ MeV which we adjust by the π^+ mass. The masses inside the square brackets were measured for each candidate event. The result assumes $P = (-1)^J$ and uses three relativistic Breit-Wigner functions in the fit for mass difference.

NODE=M224DM;LINKAGE=B

$m_{B_J(5840)^+} - m_{B^{*0}}$

NODE=M224DM2

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

NODE=M224DM2

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

565±15±14 7k ³ AAIIJ 15AB LHCb pp at 7, 8 TeV

³ AAIIJ 15AB reports $[m_{B_J^+} - m_{B^0}] - (m_{B^{*+}} - m_{B^+}) - m_{\pi^+} = 425 \pm 15 \pm 14$ MeV which we adjust by the π^+ mass. The masses inside the square brackets were measured for each candidate event. The result assumes $P = -(-1)^J$, $(m_{B^{*0}} - m_{B^0}) = (m_{B^{*+}} - m_{B^+}) = 45.01 \pm 0.30 \pm 0.23$ MeV, and uses three relativistic Breit-Wigner functions in the fit for mass difference.

NODE=M224DM2;LINKAGE=A

$B_J(5840)^+$ WIDTH

NODE=M224W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
224 ± 24 ± 80	7k	⁴ AAIJ	15AB LHCB	pp at 7, 8 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •				
215 ± 27 ± 80	7k	⁵ AAIJ	15AB LHCB	pp at 7, 8 TeV
229 ± 27 ± 80	7k	⁶ AAIJ	15AB LHCB	pp at 7, 8 TeV
⁴ Assuming $P = (-1)^J$ and using two relativistic Breit-Wigner functions in the fit for mass difference.				
⁵ Assuming $P = (-1)^J$ and using three relativistic Breit-Wigner functions in the fit for mass difference.				
⁶ Assuming $P = -(-1)^J$ and using three relativistic Breit-Wigner functions in the fit for mass difference.				

NODE=M224W

OCCUR=2
OCCUR=3

NODE=M224W;LINKAGE=A

NODE=M224W;LINKAGE=B

NODE=M224W;LINKAGE=C

 $B_J(5840)^+$ DECAY MODES

NODE=M224215;NODE=M224

Mode	Fraction (Γ_i/Γ)
Γ_1 $B^{*0}\pi^+$	seen
Γ_2 $B^0\pi^+$	possibly seen

DESIG=1

DESIG=2

 $B_J(5840)^+$ BRANCHING RATIOS

NODE=M224220

$\Gamma(B^{*0}\pi^+)/\Gamma_{\text{total}}$				Γ_1/Γ
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
seen	7k	AAIJ	15AB LHCB	pp at 7, 8 TeV
$\Gamma(B^0\pi^+)/\Gamma_{\text{total}}$				Γ_2/Γ
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
possibly seen	7k	⁷ AAIJ	15AB LHCB	pp at 7, 8 TeV
⁷ A $B\pi$ decay is forbidden from a $P = -(-1)^J$ parent, whereas $B^*\pi$ is allowed.				

NODE=M224R01
NODE=M224R01NODE=M224R02
NODE=M224R02

NODE=M224R02;LINKAGE=A

 $B_J(5840)^+$ REFERENCESAAIJ 15AB JHEP 1504 024 R. Aaij *et al.* (LHCb Collab.)

NODE=M224

REFID=56628

NODE=M225

 $B_J(5840)^0$ $I(J^P) = \frac{1}{2}(?)$ Status: * *
 I, J, P need confirmation.

OMITTED FROM SUMMARY TABLE

Quantum numbers shown are quark-model predictions.

NODE=M225

 $B_J(5840)^0$ MASS

NODE=M225M

OUR FIT uses m_{B^+} and $m_{B_J(5840)^0} - m_{B^+}$ to determine $m_{B_J(5840)^0}$.

NODE=M225M

NODE=M225M

VALUE (MeV)	DOCUMENT ID
5863 ± 9 OUR FIT	

 $m_{B_J(5840)^0} - m_{B^+}$

NODE=M225DM

NODE=M225DM

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
584 ± 9 OUR FIT				
584 ± 5 ± 7	12k	¹ AAIJ	15AB LHCB	pp at 7, 8 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •				
610 ± 22 ± 7	12k	² AAIJ	15AB LHCB	pp at 7, 8 TeV
¹ AAIJ 15AB reports $[m_{B_J^0} - m_{B^+}] - m_{\pi^-} = 444 \pm 5 \pm 7$ MeV which we adjust by the π^- mass. The masses inside the square brackets were measured for each candidate event. The result assumes $P = (-1)^J$ and uses two relativistic Breit-Wigner functions in the fit for mass difference.				
² AAIJ 15AB reports $[m_{B_J^0} - m_{B^+}] - m_{\pi^-} = 471 \pm 22 \pm 7$ MeV which we adjust by the π^- mass. The masses inside the square brackets were measured for each candidate event. The result assumes $P = (-1)^J$ and uses three relativistic Breit-Wigner functions in the fit for mass difference.				

OCCUR=2

NODE=M225DM;LINKAGE=A

NODE=M225DM;LINKAGE=B

$m_{B_J(5840)^0} - m_{B^{*+}}$

NODE=M225DM2

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$584 \pm 5 \pm 7$	12k	³ AAIJ	15AB LHCB	pp at 7, 8 TeV
³ AAIJ 15AB reports $[m_{B_J^0} - m_{B^+}] - (m_{B^{*+}} - m_{B^+}) - m_{\pi^-} = 444 \pm 5 \pm 7$ MeV which we adjust by the π^- mass. The masses inside the square brackets were measured for each candidate event. The result assumes $P = -(-1)^J$, $(m_{B^{*+}} - m_{B^+}) = 45.01 \pm 0.30 \pm 0.23$ MeV, and uses three relativistic Breit-Wigner functions in the fit for mass difference.				

NODE=M225DM2

NODE=M225DM2;LINKAGE=A

 $B_J(5840)^0$ WIDTH

NODE=M225W

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
$127 \pm 17 \pm 34$	12k	⁴ AAIJ	15AB LHCB	pp at 7, 8 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$107 \pm 20 \pm 34$	12k	⁵ AAIJ	15AB LHCB	pp at 7, 8 TeV
$119 \pm 17 \pm 34$	12k	⁶ AAIJ	15AB LHCB	pp at 7, 8 TeV
⁴ Assuming $P = (-1)^J$ and using two relativistic Breit-Wigner functions in the fit for mass difference.				
⁵ Assuming $P = (-1)^J$ and using three relativistic Breit-Wigner functions in the fit for mass difference.				
⁶ Assuming $P = -(-1)^J$ and using three relativistic Breit-Wigner functions in the fit for mass difference.				

NODE=M225W

OCCUR=2

OCCUR=3

NODE=M225W;LINKAGE=A

NODE=M225W;LINKAGE=B

NODE=M225W;LINKAGE=C

 $B_J(5840)^0$ DECAY MODES

NODE=M225215;NODE=M225

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad B^{*+} \pi^-$	seen
$\Gamma_2 \quad B^+ \pi^-$	possibly seen

DESIG=1

DESIG=2

 $B_J(5840)^0$ BRANCHING RATIOS

NODE=M225220

$\Gamma(B^{*+}\pi^-)/\Gamma_{\text{total}}$					Γ_1/Γ
<u>VALUE</u>	<u>EVTs</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
seen	12k	AAIJ	15AB LHCB	pp at 7, 8 TeV	
$\Gamma(B^+\pi^-)/\Gamma_{\text{total}}$					Γ_2/Γ
<u>VALUE</u>		<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
possibly seen		⁷ AAIJ	15AB LHCB	pp at 7, 8 TeV	
⁷ A $B\pi$ decay is forbidden from a $P = -(-1)^J$ parent, whereas $B^*\pi$ is allowed.					

NODE=M225R01

NODE=M225R01

NODE=M225R02

NODE=M225R02

NODE=M225R02;LINKAGE=A

 $B_J(5840)^0$ REFERENCES

NODE=M225

AAIJ	15AB JHEP 1504 024	R. Aaij <i>et al.</i>	(LHCb Collab.)

REFID=56628

$B_J(5970)^+$
 $I(J^P) = \frac{1}{2}(?)^?$ Status: **
 I, J, P need confirmation.

Quantum numbers shown are quark-model predictions.

NODE=M220

NODE=M220

NODE=M220M

NODE=M220M

NODE=M220M

 $B_J(5970)^+$ MASSOUR FIT uses m_{B^0} and $m_{B_J(5970)^+} - m_{B^0}$ to determine $m_{B_J(5970)^+}$.

VALUE (MeV)

DOCUMENT ID

5964 ± 5 OUR FIT **$m_{B_J(5970)^+} - m_{B^0}$**

NODE=M220DM

NODE=M220DM

VALUE (MeV)

EVTS

DOCUMENT ID

TECN

COMMENT

685 ± 5 OUR FIT**685 ± 5 OUR AVERAGE**

685.3 ± 4.1 ± 2.5

2K

¹ AAIJ15AB LHCb pp at 7, 8 TeV

681 ± 5 ± 12

1.4k

² AALTONEN14l CDF $p\bar{p}$ at 1.96 TeV

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

686.8 ± 4.5 ± 2.5

2K

³ AAIJ15AB LHCb pp at 7, 8 TeV¹ AAIJ 15AB reports $[m_{B_J^+} - m_{B^0}] - m_{\pi^+} = 545.8 \pm 4.1 \pm 2.5$ MeV which we adjust bythe π^+ mass. The masses inside the square brackets were measured for each candidate event. The result assumes $P = (-1)^J$ and uses two relativistic Breit-Wigner functions in the fit for mass difference.² AALTONEN 14l reports $m_{B_J(5970)^+} - m_{B^0} - m_{\pi^+} = 541 \pm 5 \pm 12$ MeV which we adjusted by the π^+ mass.³ AAIJ 15AB reports $[m_{B_J^+} - m_{B^0}] - m_{\pi^+} = 547 \pm 5 \pm 3$ MeV which we adjust by the π^+ mass. The masses inside the square brackets were measured for each candidate event. The result assumes $P = (-1)^J$ and uses three relativistic Breit-Wigner functions in the fit for mass difference. **$m_{B_J(5970)^+} - m_{B^0}$**

OCCUR=2

NODE=M220DM;LINKAGE=B

NODE=M220DM;LINKAGE=A

NODE=M220DM;LINKAGE=C

NODE=M220DM2

NODE=M220DM2

NODE=M220DM2;LINKAGE=A

VALUE (MeV)

EVTS

DOCUMENT ID

TECN

COMMENT

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

686.0 ± 4.0 ± 2.5

2k

⁴ AAIJ15AB LHCb pp at 7, 8 TeV⁴ AAIJ 15AB reports $[m_{B_J^+} - m_{B^0}] - (m_{B^{*+}} - m_{B^+}) - m_{\pi^+} = 547 \pm 4 \pm 3$ MeV whichwe adjust by the π^+ mass. The masses inside the square brackets were measured for each candidate event. The result assumes $P = -(-1)^J$, $(m_{B^{*0}} - m_{B^0}) = (m_{B^{*+}} - m_{B^+}) = 45.01 \pm 0.30 \pm 0.23$ MeV, and uses three relativistic Breit-Wigner functions in the fit for mass difference. **$B_J(5970)^+$ WIDTH**

NODE=M220W

NODE=M220W

VALUE (MeV)

EVTS

DOCUMENT ID

TECN

COMMENT

62 ± 20 OUR AVERAGE

63 ± 15 ± 17

2K

⁵ AAIJ15AB LHCb pp at 7, 8 TeV60⁺³⁰₋₂₀ ± 40

1.4k

AALTONEN

14l CDF $p\bar{p}$ at 1.96 TeV

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

61 ± 14 ± 17

2K

⁶ AAIJ15AB LHCb pp at 7, 8 TeV

61 ± 15 ± 17

2K

⁷ AAIJ15AB LHCb pp at 7, 8 TeV⁵ Assuming $P = (-1)^J$ and using two relativistic Breit-Wigner functions in the fit for mass difference.⁶ Assuming $P = (-1)^J$ and using three relativistic Breit-Wigner functions in the fit for mass difference.⁷ Assuming $P = -(-1)^J$ and using three relativistic Breit-Wigner functions in the fit for mass difference.

OCCUR=2

OCCUR=3

NODE=M220W;LINKAGE=A

NODE=M220W;LINKAGE=B

NODE=M220W;LINKAGE=C

$B_J(5970)^+$ DECAY MODES

NODE=M220215;NODE=M220

Mode	Fraction (Γ_i/Γ)
Γ_1 $B^0 \pi^+$	possibly seen
Γ_2 $B^{*0} \pi^+$	seen

DESIG=1

DESIG=2

 $B_J(5970)^+$ BRANCHING RATIOS

NODE=M220220

$\Gamma(B^0\pi^+)/\Gamma_{\text{total}}$					Γ_1/Γ
<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
possibly seen	2K	⁸ AAIJ	15AB LHCB	$p\bar{p}$ at 7, 8 TeV	
possibly seen	1.4k	AALTONEN	14I CDF	$p\bar{p}$ at 1.96 TeV	
⁸ A $B\pi$ decay is forbidden from a $P = -(-1)^J$ parent, whereas $B^*\pi$ is allowed.					
$\Gamma(B^{*0}\pi^+)/\Gamma_{\text{total}}$					Γ_2/Γ
<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
seen	2k	AAIJ	15AB LHCB	$p\bar{p}$ at 7, 8 TeV	
seen	1.4k	AALTONEN	14I CDF	$p\bar{p}$ at 1.96 TeV	

NODE=M220R01
NODE=M220R01

NODE=M220R01;LINKAGE=A

NODE=M220R02
NODE=M220R02 **$B_J(5970)^+$ REFERENCES**

NODE=M220

AAIJ	15AB JHEP 1504 024	R. Aaij <i>et al.</i>	(LHCb Collab.)
AALTONEN	14I PR D90 012013	T. Aaltonen <i>et al.</i>	(CDF Collab.)

REFID=56628
REFID=56029

NODE=M221

 $B_J(5970)^0$ $I(J^P) = \frac{1}{2}(?)$ Status: * *
 I, J, P need confirmation.

Quantum numbers shown are quark-model predictions.

NODE=M221

 $B_J(5970)^0$ MASS

NODE=M221M

OUR FIT uses m_{B^+} and $m_{B_J(5970)^0} - m_{B^+}$ to determine $m_{B_J(5970)^0}$.

NODE=M221M

VALUE (MeV)	DOCUMENT ID
5971 ± 5 OUR FIT	

NODE=M221M

 $m_{B_J(5970)^0} - m_{B^+}$

NODE=M221DM

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
691 ± 5 OUR FIT				
691 ± 5 OUR AVERAGE				

NODE=M221DM

689.9 ± 2.9 ± 5.1	10K	¹ AAIJ	15AB LHCB	$p\bar{p}$ at 7, 8 TeV
698 ± 5 ± 12	2.6k	² AALTONEN	14I CDF	$p\bar{p}$ at 1.96 TeV

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

714.3 ± 6.4 ± 5.1	10K	³ AAIJ	15AB LHCB	$p\bar{p}$ at 7, 8 TeV

OCCUR=2

¹ AAIJ 15AB reports $[m_{B_J^0} - m_{B^+}] - m_{\pi^-} = 550.4 \pm 2.9 \pm 5.1$ MeV which we adjust by the π^- mass. The masses inside the square brackets were measured for each candidate event. The result assumes $P = (-1)^J$ and uses two relativistic Breit-Wigner functions in the fit for mass difference.

NODE=M221DM;LINKAGE=B

² AALTONEN 14I reports $m_{B_J(5970)^0} - m_{B^+} - m_{\pi^-} = 558 \pm 5 \pm 12$ MeV which we adjusted by the π^- mass.

NODE=M221DM;LINKAGE=A

³ AAIJ 15AB reports $[m_{B_J^0} - m_{B^+}] - m_{\pi^-} = 575 \pm 6 \pm 5$ MeV which we adjust by the π^- mass. The masses inside the square brackets were measured for each candidate event. The result assumes $P = (-1)^J$ and uses three relativistic Breit-Wigner functions in the fit for mass difference.

NODE=M221DM;LINKAGE=C

 $m_{B_J(5970)^0} - m_{B^+}$

NODE=M221DM2

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
691.6 ± 3.7 ± 5.1	10k	⁴ AAIJ	15AB LHCB	$p\bar{p}$ at 7, 8 TeV

NODE=M221DM2

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

⁴ AAIJ 15AB reports $[m_{B_J^0} - m_{B^+}] - (m_{B^{*+}} - m_{B^+}) - m_{\pi^-} = 552 \pm 4 \pm 5 \text{ MeV}$

which we adjust by the π^- mass. The masses inside the square brackets were measured for each candidate event. The result assumes $P = -(-1)^J$, $(m_{B^{*+}} - m_{B^+}) = 45.01 \pm 0.30 \pm 0.23 \text{ MeV}$, and uses three relativistic Breit-Wigner functions in the fit for mass difference.

NODE=M221DM2;LINKAGE=A

$B_J(5970)^0$ WIDTH

NODE=M221W

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT

NODE=M221W

81±12 OUR AVERAGE

82±8±9	10K	⁵ AAIJ	15AB LHCB	pp at 7, 8 TeV

70 ⁺³⁰ ₋₂₀ ±30	2.6k	AALTONEN	14l CDF	$p\bar{p}$ at 1.96 TeV

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

56±7±9	10K	⁶ AAIJ	15AB LHCB	pp at 7, 8 TeV

OCCUR=2

82±10±9	10K	⁷ AAIJ	15AB LHCB	pp at 7, 8 TeV

OCCUR=3

⁵ Assuming $P = (-1)^J$ and using two relativistic Breit-Wigner functions in the fit for mass difference.

NODE=M221W;LINKAGE=A

⁶ Assuming $P = (-1)^J$ and using three relativistic Breit-Wigner functions in the fit for mass difference.

NODE=M221W;LINKAGE=B

⁷ Assuming $P = -(-1)^J$ and using three relativistic Breit-Wigner functions in the fit for mass difference.

NODE=M221W;LINKAGE=C

$B_J(5970)^0$ DECAY MODES

NODE=M221215;NODE=M221

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad B^+ \pi^-$	possibly seen
$\Gamma_2 \quad B^{*+} \pi^-$	seen

DESIG=1

DESIG=2

$B_J(5970)^0$ BRANCHING RATIOS

NODE=M221220

$\Gamma(B^+ \pi^-)/\Gamma_{\text{total}}$	VALUE	EVTs	DOCUMENT ID	TECN	COMMENT	Γ_1/Γ

NODE=M221R01

possibly seen	10K	⁸ AAIJ	15AB LHCB	pp at 7, 8 TeV		

NODE=M221R01

possibly seen	2.6k	AALTONEN	14l CDF	$p\bar{p}$ at 1.96 TeV		

OCCUR=2

⁸ A $B\pi$ decay is forbidden from a $P = -(-1)^J$ parent, whereas $B^*\pi$ is allowed.

NODE=M221R01;LINKAGE=A

$\Gamma(B^{*+} \pi^-)/\Gamma_{\text{total}}$	VALUE	EVTs	DOCUMENT ID	TECN	COMMENT	Γ_2/Γ

NODE=M221R02

seen	10K	AAIJ	15AB LHCB	pp at 7, 8 TeV		

NODE=M221R02

seen	2.6k	AALTONEN	14l CDF	$p\bar{p}$ at 1.96 TeV		

OCCUR=2

$B_J(5970)^0$ REFERENCES

NODE=M221

AAIJ	15AB JHEP 1504 024	R. Aaij <i>et al.</i>	(LHCb Collab.)
AALTONEN	14l PR D90 012013	T. Aaltonen <i>et al.</i>	(CDF Collab.)

REFID=56628
REFID=56029

BOTTOM, STRANGE MESONS

$(B = \pm 1, S = \mp 1)$

$B_s^0 = s\bar{b}, \bar{B}_s^0 = \bar{s}b,$ similarly for $B_s^{*\prime}s$

NODE=MXXX046

NODE=MXXX046

NODE=M232

X(5568)[±]

$I(J^P) = ?(?^?)$

OMITTED FROM SUMMARY TABLE

Seen as a peak in the $B_s\pi^\pm$ mass spectrum with a significance of more than 3σ by ABAZOV 16E in inclusive $p\bar{p}$ collisions at 1.96 TeV. Not seen by AAIJ 16AI. Needs confirmation.

NODE=M232

X(5568)[±] MASS

NODE=M232M

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
5567.8±2.9 ^{+0.9} _{-1.9}	133	¹ ABAZOV	16E D0	$p\bar{p} \rightarrow B_s\pi^\pm X$
¹ Assumes $X(5568)^\pm \rightarrow B_s\pi^\pm$ decay. If $X(5568)^\pm \rightarrow B_s^*\pi^\pm$ decay is assumed, the mass shifts upward by 49 MeV.				

NODE=M232M

NODE=M232M;LINKAGE=A

X(5568)[±] WIDTH

NODE=M232W

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
21.9±6.4 ^{+5.0} _{-2.5}	133	ABAZOV	16E D0	$p\bar{p} \rightarrow B_s\pi^\pm X$

NODE=M232W

X(5568)[±] DECAY MODES

NODE=M232215;NODE=M232

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad B_s\pi^\pm$	seen

DESIG=1

X(5568)[±] BRANCHING RATIOS

NODE=M232220

$\Gamma(B_s\pi^\pm)/\Gamma_{\text{total}}$				Γ_1/Γ
VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
not seen		¹ AAIJ	16AI LHCB	$pp \rightarrow B_s^0\pi^\pm X$
seen	133	² ABAZOV	16E D0	$p\bar{p} \rightarrow B_s\pi^\pm X$
¹ Not seen in 3 fb ⁻¹ of pp collision data at $\sqrt{s} = 7$ and 8 TeV in a scan over the $X(5568)$ mass and width, with B_s mesons reconstructed in decays to $D_s^-\pi^+$ or $J/\psi\phi$.				
² Seen in $p\bar{p}$ collisions at 1.96 TeV at a rate of $(8.6 \pm 1.9 \pm 1.4)\%$ relative to inclusive B_s production in the kinematic region $10 < p_T(B_s) < 30$ GeV/c. An alternative possibility, $X(5568)^\pm \rightarrow B_s^*\pi^\pm$ with a missing γ , could not be ruled out.				

NODE=M232R01
NODE=M232R01

NODE=M232R01;LINKAGE=B

NODE=M232R01;LINKAGE=A

X(5568)[±] REFERENCES

NODE=M232

AAIJ	16AI	PRL 117 152003	R. Aaij <i>et al.</i>	(LHCb Collab.)
ABAZOV	16E	PRL 117 022003	V.M. Abazov <i>et al.</i>	(D0 Collab.)

REFID=57549
REFID=57453

$B_{s1}(5830)^0$
 $I(J^P) = 0(1^+)$ Status: ***
 I, J, P need confirmation.

Quantum numbers shown are quark-model predictions.

NODE=M187

NODE=M187

NODE=M187M

NODE=M187M
NEWNODE=M187M;LINKAGE=AI
NODE=M187M;LINKAGE=AA

NODE=M187DM

NODE=M187DM

NODE=M187DM;LINKAGE=AL

NODE=M187DM;LINKAGE=AA

NODE=M187W

NODE=M187W

NODE=M187215;NODE=M187

DESIG=1

NODE=M187220

NODE=M187R01
NODE=M187R01

NODE=M187

REFID=56029
REFID=54968
REFID=52235 **$B_{s1}(5830)^0$ MASS**

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
5828.64±0.27 OUR FIT			
[5828.63 ± 0.27 MeV OUR 2016 FIT]			
5828.40±0.04±0.41	¹ AAIJ	130 LHCb	$p\bar{p}$ at 7 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •			
5829.4 ± 0.7	² AALTONEN	08K CDF	Repl. by AALTONEN 14I
¹ Uses $B_{s1}(5830)^0 \rightarrow B^{*+} K^-$ decay.			
² Uses two-body decays into K^- and B^+ mesons reconstructed as $B^+ \rightarrow J/\psi K^+$, $J/\psi \rightarrow \mu^+ \mu^-$ or $B^+ \rightarrow \bar{D}^0 \pi^+$, $\bar{D}^0 \rightarrow K^+ \pi^-$.			

 $m_{B_{s1}^0} - m_{B^{*+}}$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
503.98±0.18 OUR FIT			
504.03±0.12±0.15	³ AALTONEN	14I CDF	$p\bar{p}$ at 1.96 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •			
504.41±0.21±0.14	⁴ AALTONEN	08K CDF	Repl. by AALTONEN 14I
³ AALTONEN 14I reports $m_{B_{s1}(5830)^0} - m_{B^{*+}} - m_{K^-} = 10.35 \pm 0.12 \pm 0.15$ MeV which we adjusted by the K^- mass.			
⁴ Uses two-body decays into K^- and B^+ mesons reconstructed as $B^+ \rightarrow J/\psi K^+$, $J/\psi \rightarrow \mu^+ \mu^-$ or $B^+ \rightarrow \bar{D}^0 \pi^+$, $\bar{D}^0 \rightarrow K^+ \pi^-$.			

 $B_{s1}(5830)^0$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
0.5±0.3±0.3	AALTONEN	14I CDF	$p\bar{p}$ at 1.96 TeV

 $B_{s1}(5830)^0$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad B^{*+} K^-$	dominant

 $B_{s1}(5830)^0$ BRANCHING RATIOS

$\Gamma(B^{*+} K^-)/\Gamma_{\text{total}}$				Γ_1/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
dominant	AALTONEN	08K	CDF	$p\bar{p}$ at 1.96 TeV

 $B_{s1}(5830)^0$ REFERENCES

AALTONEN	14I	PR D90 012013	T. Aaltonen <i>et al.</i>	(CDF Collab.)
AAIJ	130	PRL 110 151803	R. Aaij <i>et al.</i>	(LHCb Collab.)
AALTONEN	08K	PRL 100 082001	T. Aaltonen <i>et al.</i>	(CDF Collab.)

$$B_{s2}^*(5840)^0$$

$$I(J^P) = 0(2^+) \text{ Status: } ***$$

I, J, P need confirmation.

Quantum numbers shown are quark-model predictions.

NODE=M186

NODE=M186

NODE=M186M

NODE=M186M

NEW

NODE=M186M;LINKAGE=AB

NODE=M186M;LINKAGE=AA

$B_{s2}^*(5840)^0$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
5839.85±0.17 OUR FIT	Error includes scale factor of 1.1. [5839.84 ± 0.18 MeV OUR 2016 FIT Scale factor = 1.1]		
5839.98±0.20 OUR AVERAGE			
5839.99±0.05±0.20	AAIJ	130 LHCb	$p\bar{p}$ at 7 TeV
5839.6 ±1.1 ±0.7	¹ ABAZOV	08E D0	$p\bar{p}$ at 1.96 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •			
5839.7 ±0.7	² AALTONEN	08K CDF	Repl. by AALTONEN 14I
¹ Observed in $B_{s2}^{*0} \rightarrow B^+ K^-$. Measured production rate of B_{s2}^{*0} relative to B^+ to be $(1.15 \pm 0.23 \pm 0.13)\%$.			
² Uses two-body decays into K^- and B^+ mesons reconstructed as $B^+ \rightarrow J/\psi K^+$, $J/\psi \rightarrow \mu^+ \mu^-$ or $B^+ \rightarrow \bar{D}^0 \pi^+$, $\bar{D}^0 \rightarrow K^+ \pi^-$.			

$m_{B_{s2}^{*0}} - m_{B_{s1}^0}$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
10.5±0.6	³ AALTONEN	08K CDF	Repl. by AALTONEN 14I
³ Uses two-body decays into K^- and B^+ mesons reconstructed as $B^+ \rightarrow J/\psi K^+$, $J/\psi \rightarrow \mu^+ \mu^-$ or $B^+ \rightarrow \bar{D}^0 \pi^+$, $\bar{D}^0 \rightarrow K^+ \pi^-$.			

$m_{B_{s2}^{*0}} - m_{B^+}$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
560.53±0.16 OUR FIT	Error includes scale factor of 1.1. [560.53 ± 0.18 MeV OUR 2016 FIT Scale factor = 1.1]		
560.41±0.13±0.14	⁴ AALTONEN	14I CDF	$p\bar{p}$ at 1.96 TeV
⁴ AALTONEN 14I reports $m_{B_{s2}^*(5840)^0} - m_{B^+} - m_{K^-} = 66.73 \pm 0.13 \pm 0.14$ MeV which we adjusted by the K^- mass.			

$B_{s2}^*(5840)^0$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
1.47±0.33 OUR AVERAGE			
1.4 ±0.4 ±0.2	AALTONEN	14I CDF	$p\bar{p}$ at 1.96 TeV
1.56±0.13±0.47	⁵ AAIJ	130 LHCb	$p\bar{p}$ at 7 TeV
⁵ Uses $B_{s2}^*(5840)^0 \rightarrow B^{*+} K^-$ decays.			

$B_{s2}^*(5840)^0$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad B^+ K^-$	dominant
$\Gamma_2 \quad B^{*+} K^-$	

$B_{s2}^*(5840)^0$ BRANCHING RATIOS

$\Gamma(B^+ K^-)/\Gamma_{\text{total}}$				Γ_1/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
dominant	AALTONEN	08K	CDF	$p\bar{p}$ at 1.96 TeV
dominant	⁶ ABAZOV	08E	D0	$p\bar{p}$ at 1.96 TeV
⁶ Measured production rate of B_{s2}^{*0} relative to B^+ to be $(1.15 \pm 0.23 \pm 0.13)\%$.				

NODE=M186220

NODE=M186R01

NODE=M186R01

NODE=M186R01;LINKAGE=AB

$\Gamma(B^{*+}K^-)/\Gamma(B^+K^-)$

VALUE	DOCUMENT ID	TECN	COMMENT
0.093±0.013±0.012	AAIJ	130 LHCb	pp at 7 TeV

 Γ_2/Γ_1

NODE=M186R02
 NODE=M186R02

 $B_{s2}^*(5840)^0$ REFERENCES

AALTONEN	14I	PR D90 012013	T. Aaltonen <i>et al.</i>	(CDF Collab.)
AAIJ	13O	PRL 110 151803	R. Aaij <i>et al.</i>	(LHCb Collab.)
AALTONEN	08K	PRL 100 082001	T. Aaltonen <i>et al.</i>	(CDF Collab.)
ABAZOV	08E	PRL 100 082002	V.M. Abazov <i>et al.</i>	(D0 Collab.)

NODE=M186

REFID=56029
 REFID=54968
 REFID=52235
 REFID=52232

 $B_{sJ}^*(5850)$

$I(J^P) = ?(??)$
 I, J, P need confirmation.

OMITTED FROM SUMMARY TABLE

Signal can be interpreted as coming from $\bar{b}s$ states. Needs confirmation.

NODE=M153

NODE=M153

 $B_{sJ}^*(5850)$ MASS

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
5853±15	141	AKERS	95E OPAL	$E_{cm}^{ee} = 88-94$ GeV

NODE=M153M

NODE=M153M

 $B_{sJ}^*(5850)$ WIDTH

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
47±22	141	AKERS	95E OPAL	$E_{cm}^{ee} = 88-94$ GeV

NODE=M153W

NODE=M153W

 $B_{sJ}^*(5850)$ REFERENCES

AKERS	95E	ZPHY C66 19	R. Akers <i>et al.</i>	(OPAL Collab.)

NODE=M153

REFID=44182

BOTTOM, CHARMED MESONS
 $(B = C = \pm 1)$

$B_c^+ = c\bar{b}, B_c^- = \bar{c}b$, similarly for B_c^{*} 's

NODE=MXXX049

NODE=MXXX049

 $B_c(2S)^\pm$ $I(J^P) = 0(0^-)$

OMITTED FROM SUMMARY TABLE

Quantum numbers neither measured nor confirmed.

NODE=M217

NODE=M217

 $B_c(2S)^\pm$ MASS

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
6842±4±5	57	¹ AAD	14AQ ATLS	pp at 7, 8 TeV

NODE=M217M

NODE=M217M

¹ Observed in the decay mode $B_c(2S)^+ \rightarrow B_c^+ \pi^+ \pi^-$ ($B_c^+ \rightarrow J/\psi \pi^+$) with 5.2 standard deviations significance.

NODE=M217M;LINKAGE=AA

 $B_c(2S)^\pm$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $B_c^+ \pi^+ \pi^-$	seen

NODE=M217215;NODE=M217

DESIG=1

$B_c(2S)^\pm$ BRANCHING RATIOS $\Gamma(B_c^+ \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_1/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
seen	57	¹ AAD	14AQ ATLS	pp at 7, 8 TeV

¹ Observed with 5.2 standard deviations significance.

NODE=M217225

NODE=M217R01
NODE=M217R01

NODE=M217R01;LINKAGE=AA

 $B_c(2S)^\pm$ REFERENCESAAD 14AQ PRL 113 212004 G. Aad *et al.* (ATLAS Collab.)

NODE=M217

REFID=56117

A REVIEW GOES HERE – Check our WWW List of Reviews

NODE=M209

 $c\bar{c}$ MESONS

NODE=MXXX025

A REVIEW GOES HERE – Check our WWW List of Reviews
Reviews

NODE=M826

NODE=M026

 $\eta_c(1S)$

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

 $\eta_c(1S)$ MASS

NODE=M026M

NODE=M026M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2983.4 ± 0.5 OUR AVERAGE		Error includes scale factor of 1.2.		
2982.2 ± 1.5 ± 0.1	2.0k	¹ AAIJ	15BI LHCb	$pp \rightarrow \eta_c(1S) X$
2983.5 ± 1.4 $^{+1.6}_{-3.6}$		² ANASHIN	14 KEDR	$J/\psi \rightarrow \gamma \eta_c$
2979.8 ± 0.8 ± 3.5	4.5k	^{3,4} LEES	14E BABR	$\gamma\gamma \rightarrow K^+ K^- \pi^0$
2984.1 ± 1.1 ± 2.1	900	^{3,4,5} LEES	14E BABR	$\gamma\gamma \rightarrow K^+ K^- \eta$
2984.3 ± 0.6 ± 0.6		^{6,7} ABLIKIM	12F BES3	$\psi(2S) \rightarrow \gamma \eta_c$
2984.49 ± 1.16 ± 0.52	832	³ ABLIKIM	12N BES3	$\psi(2S) \rightarrow \pi^0 \gamma \text{ hadrons}$
2982.7 ± 1.8 ± 2.2	486	ZHANG	12A BELL	$e^+ e^- \rightarrow \eta' \pi^+ \pi^-$
2984.5 ± 0.8 ± 3.1	11k	DEL-AMO-SA..11M	BABR	$\gamma\gamma \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$
2985.4 ± 1.5 $^{+0.5}_{-2.0}$	920	⁷ VINOKUROVA	11 BELL	$B^\pm \rightarrow K^\pm (K_S^0 K^\pm \pi^\mp)$
2982.2 ± 0.4 ± 1.6	14k	⁸ LEES	10 BABR	$10.6 e^+ e^- \rightarrow K_S^0 K^\pm \pi^\mp$
2985.8 ± 1.5 ± 3.1	0.9k	AUBERT	08AB BABR	$B \rightarrow \eta_c(1S) K^{(*)} \rightarrow K \bar{K} \pi K^{(*)}$
2986.1 ± 1.0 ± 2.5	7.5k	UEHARA	08 BELL	$\gamma\gamma \rightarrow \eta_c \rightarrow \text{hadrons}$
2970 ± 5 ± 6	501	⁹ 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	¹⁰ 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	¹¹ DEL-AMO-SA..11M	BABR	$\gamma\gamma \rightarrow K_S^0 K^\pm \pi^\mp$
2982.2 ± 0.6		¹² MITCHELL	09 CLEO	$e^+ e^- \rightarrow \gamma X$
2982 ± 5	270	¹³ AUBERT	06E BABR	$B^\pm \rightarrow K^\pm X_{c\bar{c}}$
2982.5 ± 1.1 ± 0.9	2.5k	¹⁴ AUBERT	04D BABR	$\gamma\gamma \rightarrow \eta_c(1S) \rightarrow K \bar{K} \pi$
2977.5 ± 1.0 ± 1.2		^{12,15} BAI	03 BES	$J/\psi \rightarrow \gamma \eta_c$
2979.6 ± 2.3 ± 1.6	180	¹⁶ FANG	03 BELL	$B \rightarrow \eta_c K$
2976.3 ± 2.3 ± 1.2		^{12,17} BAI	00F BES	$J/\psi, \psi(2S) \rightarrow \gamma \eta_c$

OCCUR=2

OCCUR=2

OCCUR=2

2976.6 ± 2.9 ± 1.3	140 ^{12,18}	BAI	00F	BES	$J/\psi \rightarrow \gamma \eta_c$	OCCUR=2
2980.4 ± 2.3 ± 0.6	19	BRANDENB...	00B	CLE2	$\gamma\gamma \rightarrow \eta_c \rightarrow K^\pm K_S^0 \pi^\mp$	
2975.8 ± 3.9 ± 1.2	18	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	12,20	BISELLO	91	DM2	$J/\psi \rightarrow \eta_c \gamma$	
2969 ± 4 ± 4	80	12 BAI	90B	MRK3	$J/\psi \rightarrow \gamma K^+ K^- K^+ K^-$	OCCUR=3
2956 ± 12 ± 12	12	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	12,20	BALTRUSAIT..86	MRK3		$J/\psi \rightarrow \eta_c \gamma$	
2984 ± 2.3 ± 4.0	12	GAISER	86	CBAL	$J/\psi \rightarrow \gamma X, \psi(2S) \rightarrow \gamma X$	
2976 ± 8	12,21	BALTRUSAIT..84	MRK3		$J/\psi \rightarrow 2\phi\gamma$	
2982 ± 8	18	22 HIMEL	80B	MRK2	$e^+ e^-$	
2980 ± 9	22	PARTRIDGE	80B	CBAL	$e^+ e^-$	

¹ AAIJ 15BI reports $m_{J/\psi} - m_{\eta_c(1S)} = 114.7 \pm 1.5 \pm 0.1$ MeV from a sample of $\eta_c(1S)$ and J/ψ produced in b -hadron decays. We have used current value of $m_{J/\psi} = 3096.900 \pm 0.006$ MeV to arrive at the quoted $m_{\eta_c(1S)}$ result.

² Taking into account an asymmetric photon lineshape.

³ With floating width.

⁴ Ignoring possible interference with the non-resonant 0^- amplitude.

⁵ Using both, $\eta \rightarrow \gamma\gamma$ and $\eta \rightarrow \pi^+ \pi^- \pi^0$ decays.

⁶ From a simultaneous fit to six decay modes of the η_c .

⁷ Accounts for interference with non-resonant continuum.

⁸ Taking into account interference with the non-resonant $J^P = 0^-$ amplitude.

⁹ From a fit of the J/ψ recoil mass spectrum. Supersedes ABE,K 02 and ABE 04G.

¹⁰ Using mass of $\psi(2S) = 3686.00$ MeV.

¹¹ Not independent from the measurements reported by LEES 10.

¹² 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.

¹³ From the fit of the kaon momentum spectrum. Systematic errors not evaluated.

¹⁴ Superseded by LEES 10.

¹⁵ From a simultaneous fit of five decay modes of the η_c .

¹⁶ Superseded by VINOKUROVA 11.

¹⁷ Weighted average of the $\psi(2S)$ and $J/\psi(1S)$ samples. Using an η_c width of 13.2 MeV.

¹⁸ Average of several decay modes. Using an η_c width of 13.2 MeV.

¹⁹ Superseded by ASNER 04.

²⁰ Average of several decay modes.

²¹ $\eta_c \rightarrow \phi\phi$.

²² Mass adjusted by us to correspond to $J/\psi(1S)$ mass = 3097 MeV.

NODE=M026M;LINKAGE=D

NODE=M026M;LINKAGE=E

NODE=M026M;LINKAGE=AL

NODE=M026M;LINKAGE=LS

NODE=M026M;LINKAGE=EL

NODE=M026M;LINKAGE=BL

NODE=M026M;LINKAGE=VA

NODE=M026M;LINKAGE=LE

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NODE=M026M;LINKAGE=MI

NODE=M026M;LINKAGE=AU

NODE=M026M;LINKAGE=UB

NODE=M026M;LINKAGE=AK

NODE=M026M;LINKAGE=FA

NODE=M026M;LINKAGE=KZ

NODE=M026M;LINKAGE=C1

NODE=M026M;LINKAGE=NN

NODE=M026M;LINKAGE=A

NODE=M026M;LINKAGE=B

NODE=M026M;LINKAGE=M

$\eta_c(1S)$ WIDTH

NODE=M026W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
31.8 ± 0.8 OUR FIT				
31.9 ± 1.0 OUR AVERAGE				Error includes scale factor of 1.2.
27.2 ± 3.1 ^{+5.4} _{-2.6}		¹ ANASHIN	14	KEDR $J/\psi \rightarrow \gamma \eta_c$
25.2 ± 2.6 ± 2.4	4.5k	^{2,3} LEES	14E	BABR $\gamma\gamma \rightarrow K^+ K^- \pi^0$
34.8 ± 3.1 ± 4.0	900	^{2,3,4} LEES	14E	BABR $\gamma\gamma \rightarrow K^+ K^- \eta$
32.0 ± 1.2 ± 1.0		^{5,6} ABLIKIM	12F	BES3 $\psi(2S) \rightarrow \gamma \eta_c$
36.4 ± 3.2 ± 1.7	832	² ABLIKIM	12N	BES3 $\psi(2S) \rightarrow \pi^0 \gamma \text{ hadrons}$
37.8 ^{+5.8} _{-5.3} ± 3.1	486	ZHANG	12A	BELL $e^+ e^- \rightarrow e^+ e^- \eta' \pi^+ \pi^-$
36.2 ± 2.8 ± 3.0	11k	DEL-AMO-SA..11M	BABR	$\gamma\gamma \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$
35.1 ± 3.1 ^{+1.0} _{-1.6}	920	⁶ VINOKUROVA	11	BELL $B^\pm \rightarrow K^\pm (K_S^0 K^\pm \pi^\mp)$
31.7 ± 1.2 ± 0.8	14k	⁷ LEES	10	BABR $10.6 e^+ e^- \rightarrow e^+ e^- K_S^0 K^\pm \pi^\mp$

NODE=M026W

OCCUR=2

$36.3^{+3.7}_{-3.6} \pm 4.4$	0.9k	AUBERT	08AB BABR	$B \rightarrow \eta_c(1S) K^{(*)} \rightarrow K \bar{K} \pi K^{(*)}$	
$28.1 \pm 3.2 \pm 2.2$	7.5k	UEHARA	08 BELL	$\gamma\gamma \rightarrow \eta_c \rightarrow \text{hadrons}$	
$48^{+8}_{-7} \pm 5$	195	WU	06 BELL	$B^+ \rightarrow p \bar{p} K^+$	
$40 \pm 19 \pm 5$	20	WU	06 BELL	$B^+ \rightarrow \Lambda \bar{\Lambda} K^+$	OCCUR=2
$24.8 \pm 3.4 \pm 3.5$	592	ASNER	04 CLEO	$\gamma\gamma \rightarrow \eta_c \rightarrow K_S^0 K^\pm \pi^\mp$	
$20.4^{+7.7}_{-6.7} \pm 2.0$	190	AMBROGIANI	03 E835	$\bar{p} p \rightarrow \eta_c \rightarrow \gamma\gamma$	
$23.9^{+12.6}_{-7.1}$		ARMSTRONG	95F E760	$\bar{p} p \rightarrow \gamma\gamma$	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$32.1 \pm 1.1 \pm 1.3$	12k	⁸ DEL-AMO-SA..11M	BABR	$\gamma\gamma \rightarrow K_S^0 K^\pm \pi^\mp$	OCCUR=2
$34.3 \pm 2.3 \pm 0.9$	2.5k	⁹ AUBERT	04D BABR	$\gamma\gamma \rightarrow \eta_c(1S) \rightarrow K \bar{K} \pi$	
$17.0 \pm 3.7 \pm 7.4$		¹⁰ BAI	03 BES	$J/\psi \rightarrow \gamma \eta_c$	
$29 \pm 8 \pm 6$	180	¹¹ FANG	03 BELL	$B \rightarrow \eta_c K$	
$11.0 \pm 8.1 \pm 4.1$		¹² BAI	00F BES	$J/\psi \rightarrow \gamma \eta_c \text{ and } \psi(2S) \rightarrow \gamma \eta_c$	
$27.0 \pm 5.8 \pm 1.4$		¹³ BRANDENB...	00B CLE2	$\gamma\gamma \rightarrow \eta_c \rightarrow K^\pm K_S^0 \pi^\mp$	
$7.0^{+7.5}_{-7.0}$	12	BAGLIN	87B SPEC	$\bar{p} p \rightarrow \gamma\gamma$	
$10.1^{+33.0}_{-8.2}$	23	¹⁴ 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 Taking into account an asymmetric photon lineshape.

² With floating mass.

³ Ignoring possible interference with the non-resonant 0^- amplitude.

⁴ Using both, $\eta \rightarrow \gamma\gamma$ and $\eta \rightarrow \pi^+ \pi^- \pi^0$ decays.

⁵ From a simultaneous fit to six decay modes of the η_c .

⁶ Accounts for interference with non-resonant continuum.

⁷ Taking into account interference with the non-resonant $J^P = 0^-$ amplitude.

⁸ Not independent from the measurements reported by LEES 10.

⁹ Superseded by LEES 10.

¹⁰ From a simultaneous fit of five decay modes of the η_c .

¹¹ Superseded by VINOKUROVA 11.

¹² 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.

¹³ Superseded by ASNER 04.

¹⁴ Positive and negative errors correspond to 90% confidence level.

NODE=M026W;LINKAGE=A
 NODE=M026W;LINKAGE=AL
 NODE=M026W;LINKAGE=LS
 NODE=M026W;LINKAGE=EL
 NODE=M026W;LINKAGE=BL
 NODE=M026W;LINKAGE=VA
 NODE=M026W;LINKAGE=LE
 NODE=M026W;LINKAGE=DE
 NODE=M026W;LINKAGE=UB
 NODE=M026W;LINKAGE=AK
 NODE=M026W;LINKAGE=FA
 NODE=M026W;LINKAGE=KZ
 NODE=M026W;LINKAGE=NN
 NODE=M026W;LINKAGE=L

$\eta_c(1S)$ DECAY MODES

NODE=M026215;NODE=M026

Mode	Fraction (Γ_i/Γ)	Confidence level
Decays involving hadronic resonances		
$\Gamma_1 \quad \eta'(958) \pi \pi$	(4.1 $\pm$ 1.7) %	
$\Gamma_2 \quad \rho \rho$	(1.8 $\pm$ 0.5) %	
$\Gamma_3 \quad K^*(892)^0 K^- \pi^+ + \text{c.c.}$	(2.0 $\pm$ 0.7) %	
$\Gamma_4 \quad K^*(892) \bar{K}^*(892)$	(7.0 $\pm$ 1.3) $\times 10^{-3}$	
$\Gamma_5 \quad K^*(892)^0 \bar{K}^*(892)^0 \pi^+ \pi^-$	(1.1 $\pm$ 0.5) %	
$\Gamma_6 \quad \phi K^+ K^-$	(2.9 $\pm$ 1.4) $\times 10^{-3}$	
$\Gamma_7 \quad \phi \phi$	(1.75 $\pm$ 0.20) $\times 10^{-3}$	
$\Gamma_8 \quad \phi 2(\pi^+ \pi^-)$	< 4 $\times 10^{-3}$	90%
$\Gamma_9 \quad a_0(980) \pi$	< 2 %	90%
$\Gamma_{10} \quad a_2(1320) \pi$	< 2 %	90%
$\Gamma_{11} \quad K^*(892) \bar{K} + \text{c.c.}$	< 1.28 %	90%
$\Gamma_{12} \quad f_2(1270) \eta$	< 1.1 %	90%
$\Gamma_{13} \quad \omega \omega$	< 3.1 $\times 10^{-3}$	90%
$\Gamma_{14} \quad \omega \phi$	< 1.7 $\times 10^{-3}$	90%
$\Gamma_{15} \quad f_2(1270) f_2(1270)$	(9.8 $\pm$ 2.5) $\times 10^{-3}$	
$\Gamma_{16} \quad f_2(1270) f_2'(1525)$	(9.7 $\pm$ 3.2) $\times 10^{-3}$	
$\Gamma_{17} \quad f_0(980) \eta$	seen	

NODE=M026;CLUMP=A
 DESIG=24
 DESIG=19
 DESIG=26
 DESIG=18
 DESIG=57
 DESIG=28
 DESIG=17
 DESIG=58
 DESIG=21
 DESIG=22
 DESIG=40
 DESIG=23
 DESIG=20
 DESIG=47
 DESIG=46
 DESIG=59
 DESIG=70

Γ_{18}	$f_0(1500)\eta$	seen	DESIG=71
Γ_{19}	$f_0(2200)\eta$	seen	DESIG=72
Γ_{20}	$a_0(980)\pi$	seen	DESIG=73
Γ_{21}	$a_0(1320)\pi$	seen	DESIG=74
Γ_{22}	$a_0(1450)\pi$	seen	DESIG=75
Γ_{23}	$a_0(1950)\pi$	seen	DESIG=79
Γ_{24}	$a_2(1950)\pi$	not seen	DESIG=80
Γ_{25}	$K_0^*(1430)\bar{K}$	seen	DESIG=76
Γ_{26}	$K_2^*(1430)\bar{K}$	seen	DESIG=77
Γ_{27}	$K_0^*(1950)\bar{K}$	seen	DESIG=78

Decays into stable hadrons

Γ_{28}	$K\bar{K}\pi$	(7.3 $\pm$ 0.5) %	DESIG=14
Γ_{29}	$K\bar{K}\eta$	(1.35 $\pm$ 0.16) %	DESIG=25
Γ_{30}	$\eta\pi^+\pi^-$	(1.7 $\pm$ 0.5) %	DESIG=16
Γ_{31}	$\eta 2(\pi^+\pi^-)$	(4.4 $\pm$ 1.3) %	DESIG=61
Γ_{32}	$K^+K^-\pi^+\pi^-$	(6.9 $\pm$ 1.1) $\times 10^{-3}$	DESIG=15
Γ_{33}	$K^+K^-\pi^+\pi^-\pi^0$	(3.5 $\pm$ 0.6) %	DESIG=60
Γ_{34}	$K^0K^-\pi^+\pi^-\pi^++c.c.$	(5.6 $\pm$ 1.5) %	DESIG=62
Γ_{35}	$K^+K^-2(\pi^+\pi^-)$	(7.5 $\pm$ 2.4) $\times 10^{-3}$	DESIG=55
Γ_{36}	$2(K^+K^-)$	(1.46 $\pm$ 0.30) $\times 10^{-3}$	DESIG=27
Γ_{37}	$\pi^+\pi^-\pi^0\pi^0$	(4.7 $\pm$ 1.0) %	DESIG=63
Γ_{38}	$2(\pi^+\pi^-)$	(9.7 $\pm$ 1.2) $\times 10^{-3}$	DESIG=11
Γ_{39}	$2(\pi^+\pi^-\pi^0)$	(17.4 $\pm$ 3.3) %	DESIG=64
Γ_{40}	$3(\pi^+\pi^-)$	(1.8 $\pm$ 0.4) %	DESIG=56
Γ_{41}	$\rho\bar{\rho}$	(1.50 $\pm$ 0.16) $\times 10^{-3}$	DESIG=12
Γ_{42}	$\rho\bar{\rho}\pi^0$	(3.6 $\pm$ 1.3) $\times 10^{-3}$	DESIG=65
Γ_{43}	$\Lambda\bar{\Lambda}$	(1.09 $\pm$ 0.24) $\times 10^{-3}$	DESIG=45
Γ_{44}	$\Sigma^+\bar{\Sigma}^-$	(2.1 $\pm$ 0.6) $\times 10^{-3}$	DESIG=66
Γ_{45}	$\Xi^-\bar{\Xi}^+$	(8.9 $\pm$ 2.7) $\times 10^{-4}$	DESIG=67
Γ_{46}	$\pi^+\pi^-\rho\bar{\rho}$	(5.3 $\pm$ 1.8) $\times 10^{-3}$	DESIG=13

Radiative decays

Γ_{47}	$\gamma\gamma$	(1.59 $\pm$ 0.13) $\times 10^{-4}$	DESIG=31

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

Γ_{48}	$\pi^+\pi^-$	P, CP	< 1.1	$\times 10^{-4}$	90%	DESIG=51
Γ_{49}	$\pi^0\pi^0$	P, CP	< 4	$\times 10^{-5}$	90%	DESIG=52
Γ_{50}	K^+K^-	P, CP	< 6	$\times 10^{-4}$	90%	DESIG=53
Γ_{51}	$K_S^0K_S^0$	P, CP	< 3.1	$\times 10^{-4}$	90%	DESIG=54

CONSTRAINED FIT INFORMATION

An overall fit to the total width, 8 combinations of partial widths obtained from integrated cross section, and 19 branching ratios uses 85 measurements and one constraint to determine 13 parameters. The overall fit has a $\chi^2 = 118.3$ for 73 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_{28}	22	41	7							
x_{29}	12	22	4	54						
x_{32}	11	21	4	25	13					
x_{36}	9	16	3	25	14	10				
x_{38}	14	25	5	30	16	16	12			
x_{41}	14	26	5	36	19	16	13	20		
x_{43}	3	6	1	9	5	4	3	5	25	
x_{47}	-29	-54	-10	-66	-35	-34	-27	-41	-46	-11
Γ	-2	-3	-1	-4	-2	-2	-1	-2	7	2
	x_4	x_7	x_{15}	x_{28}	x_{29}	x_{32}	x_{36}	x_{38}	x_{41}	x_{43}
Γ	-28									
	x_{47}									

	Mode	Rate (MeV)	
Γ_4	$K^*(892) \bar{K}^*(892)$	0.22 $\pm$ 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_{28}	$K \bar{K} \pi$	2.31 $\pm$ 0.16	DESIG=14
Γ_{29}	$K \bar{K} \eta$	0.43 $\pm$ 0.05	DESIG=25
Γ_{32}	$K^+ K^- \pi^+ \pi^-$	0.219 $\pm$ 0.034	DESIG=15
Γ_{36}	$2(K^+ K^-)$	0.046 $\pm$ 0.010	DESIG=27
Γ_{38}	$2(\pi^+ \pi^-)$	0.31 $\pm$ 0.04	DESIG=11
Γ_{41}	$\rho \bar{\rho}$	0.048 $\pm$ 0.005	DESIG=12
Γ_{43}	$\Lambda \bar{\Lambda}$	0.034 $\pm$ 0.008	DESIG=45
Γ_{47}	$\gamma \gamma$	0.0051 $\pm$ 0.0004	DESIG=31

$\eta_c(1S)$ PARTIAL WIDTHS

NODE=M026217

$\Gamma(\gamma\gamma)$

Γ_{47}

VALUE (keV) EVTS DOCUMENT ID TECN COMMENT

5.1 $\pm$ 0.4 OUR FIT

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

5.8 $\pm$ 1.1	486	¹ ZHANG	12A BELL	$e^+ e^- \rightarrow e^+ e^- \eta' \pi^+ \pi^-$
5.2 $\pm$ 1.2	273 $\pm$ 43	^{2,3} AUBERT	06E BABR	$B^\pm \rightarrow K^\pm X_{c\bar{c}}$
5.5 $\pm$ 1.2 $\pm$ 1.8	157 $\pm$ 33	⁴ KUO	05 BELL	$\gamma\gamma \rightarrow \rho \bar{\rho}$
7.4 $\pm$ 0.4 $\pm$ 2.3		⁵ 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	⁶ ABDALLAH	03J DLPH	$\gamma\gamma \rightarrow \eta_c$
3.8 $\pm$ 1.1 $\pm$ 1.9	190	⁷ AMBROGIANI	03 E835	$\bar{p} p \rightarrow \eta_c \rightarrow \gamma\gamma$
7.6 $\pm$ 0.8 $\pm$ 2.3		^{5,8} 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	⁹ ACCIARRI	99T L3	$e^+ e^- \rightarrow e^+ e^- \eta_c$
27 $\pm$ 16 $\pm$ 10	5	⁵ SHIRAI	98 AMY	58 $e^+ e^-$
6.7 $\pm$ 2.4		⁴ ARMSTRONG	95F E760	$\bar{p} p \rightarrow \gamma\gamma$
11.3 $\pm$ 4.2		¹⁰ ALBRECHT	94H ARG	$e^+ e^- \rightarrow e^+ e^- \eta_c$

NODE=M026W1
NODE=M026W1

$8.0 \pm 2.3 \pm 2.4$	17	¹¹ ADRIANI	93N L3	$e^+e^- \rightarrow e^+e^-\eta_C$
$5.9^{+2.1}_{-1.8} \pm 1.9$		⁷ CHEN	90B CLEO	$e^+e^- \rightarrow e^+e^-\eta_C$
$6.4^{+5.0}_{-3.4}$		¹² AIHARA	88D TPC	$e^+e^- \rightarrow e^+e^-X$
$4.3^{+3.4}_{-3.7} \pm 2.4$		⁴ BAGLIN	87B SPEC	$\bar{p}p \rightarrow \gamma\gamma$
28 ± 15	^{5,13}	BERGER	86 PLUT	$\gamma\gamma \rightarrow K\bar{K}\pi$

¹ Assuming there is no interference with the non-resonant background.

² Calculated by us using $\Gamma(\eta_C \rightarrow K\bar{K}\pi) \times \Gamma(\eta_C \rightarrow \gamma\gamma) / \Gamma = 0.44 \pm 0.05$ keV from PDG 06 and $B(\eta_C \rightarrow K\bar{K}\pi) = (8.5 \pm 1.8)\%$ from AUBERT 06E.

³ Systematic errors not evaluated.

⁴ Normalized to $B(\eta_C \rightarrow \rho\bar{\rho}) = (1.3 \pm 0.4) \times 10^{-3}$.

⁵ Normalized to $B(\eta_C \rightarrow K^\pm K_S^0 \pi^\mp)$.

⁶ Average of $K_S^0 K^\pm \pi^\mp$, $\pi^+ \pi^- K^+ K^-$, and $2(K^+ K^-)$ decay modes.

⁷ Normalized to the sum of $B(\eta_C \rightarrow K^\pm K_S^0 \pi^\mp)$, $B(\eta_C \rightarrow K^+ K^- \pi^+ \pi^-)$, and $B(\eta_C \rightarrow 2\pi^+ 2\pi^-)$.

⁸ Superseded by ASNER 04.

⁹ Normalized to the sum of 9 branching ratios.

¹⁰ Normalized to the sum of $B(\eta_C \rightarrow K^\pm K_S^0 \pi^\mp)$, $B(\eta_C \rightarrow \phi\phi)$, $B(\eta_C \rightarrow K^+ K^- \pi^+ \pi^-)$, and $B(\eta_C \rightarrow 2\pi^+ 2\pi^-)$.

¹¹ Superseded by ACCIARRI 99T.

¹² Normalized to the sum of $B(\eta_C \rightarrow K^\pm K_S^0 \pi^\mp)$, $B(\eta_C \rightarrow 2K^+ 2K^-)$, $B(\eta_C \rightarrow K^+ K^- \pi^+ \pi^-)$, and $B(\eta_C \rightarrow 2\pi^+ 2\pi^-)$.

¹³ Re-evaluated by AIHARA 88D.

NODE=M026W1;LINKAGE=ZH
NODE=M026W1;LINKAGE=AU

NODE=M026W1;LINKAGE=NS
NODE=M026W1;LINKAGE=N3
NODE=M026W1;LINKAGE=N2
NODE=M026W;LINKAGE=FF
NODE=M026W1;LINKAGE=N6

NODE=M026W1;LINKAGE=NN
NODE=M026W1;LINKAGE=N1
NODE=M026W1;LINKAGE=N5

NODE=M026W1;LINKAGE=WD
NODE=M026W1;LINKAGE=N4

NODE=M026W1;LINKAGE=A

$\eta_C(1S) \Gamma(i) \Gamma(\gamma\gamma) / \Gamma(\text{total})$

$\Gamma(\eta'(958)\pi\pi) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$				$\Gamma_1 \Gamma_{47} / \Gamma$	
VALUE (keV)	EVTs	DOCUMENT ID	TECN	COMMENT	
$75.8^{+6.3}_{-6.2} \pm 8.4$	486	¹ ZHANG	12A BELL	$e^+e^- \rightarrow e^+e^-\eta' \pi^+ \pi^-$	

¹ Assuming there is no interference with the non-resonant background.

NODE=M026220

NODE=M026G10
NODE=M026G10

NODE=M026G10;LINKAGE=ZH

$\Gamma(\rho\rho) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$				$\Gamma_2 \Gamma_{47} / \Gamma$	
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

$\Gamma(K^*(892)\bar{K}^*(892)) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$				$\Gamma_4 \Gamma_{47} / \Gamma$	
VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT	
35 ± 6 OUR FIT					
32.4 $\pm 4.2 \pm 5.8$	882 ± 115	UEHARA	08	BELL	$\gamma\gamma \rightarrow \pi^+ \pi^- K^+ K^-$

NODE=M026G08
NODE=M026G08

$\Gamma(\phi\phi) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$				$\Gamma_7 \Gamma_{47} / \Gamma$	
VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT	
8.9 ± 0.8 OUR FIT					
7.75 $\pm 0.66 \pm 0.62$	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

NODE=M026G07;LINKAGE=LI

$\Gamma(\omega\omega) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$				$\Gamma_{13} \Gamma_{47} / \Gamma$	
VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT	
8.67 $\pm 2.86 \pm 0.96$	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

$\Gamma(\omega\phi) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$				$\Gamma_{14} \Gamma_{47} / \Gamma$	
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

$$\Gamma(f_2(1270)f_2(1270)) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{15}\Gamma_{47}/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
50±13 OUR FIT				
69±17±12	3182 ± 766	UEHARA	08 BELL	$\gamma\gamma \rightarrow 2(\pi^+\pi^-)$

NODE=M026G19
NODE=M026G19

$$\Gamma(f_2(1270)f_2'(1525)) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{16}\Gamma_{47}/\Gamma$$

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

$$\Gamma(K\bar{K}\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{28}\Gamma_{47}/\Gamma$$

VALUE (keV)	CL% EVTS	DOCUMENT ID	TECN	COMMENT
0.368±0.021 OUR FIT				
0.407±0.027 OUR AVERAGE				Error includes scale factor of 1.2.

NODE=M026G14
NODE=M026G14

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

$$\Gamma(K^+K^-\pi^+\pi^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{32}\Gamma_{47}/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
35 ± 5 OUR FIT				
27 ± 6 OUR AVERAGE				
25.7 ± 3.2 ± 4.9	2019 ± 248	UEHARA	08 BELL	$\gamma\gamma \rightarrow \pi^+\pi^-K^+K^-$
280 ± 100 ± 60	42	¹ ABDALLAH	03J DLPH	$\gamma\gamma \rightarrow \pi^+\pi^-K^+K^-$
170 ± 80 ± 20	13.9 ± 6.6	ALBRECHT	94H ARG	$\gamma\gamma \rightarrow \pi^+\pi^-K^+K^-$

NODE=M026G15
NODE=M026G15

¹ Calculated by us from the value reported in ABDALLAH 03J, which uses $B(\eta_c \rightarrow \pi^+\pi^-K^+K^-) = (2.0 \pm 0.7)\%$.

NODE=M026G;LINKAGE=CC

$$\Gamma(K^+K^-\pi^+\pi^-\pi^0) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{33}\Gamma_{47}/\Gamma$$

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT

NODE=M026G02
NODE=M026G02

• • • 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;LINKAGE=DE

$$\Gamma(2(K^+K^-)) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{36}\Gamma_{47}/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
7.4± 1.5 OUR FIT				
5.8± 1.9 OUR AVERAGE				

NODE=M026G27
NODE=M026G27

5.6 ± 1.1 ± 1.6	216 ± 42	UEHARA	08 BELL	$\gamma\gamma \rightarrow 2(K^+K^-)$
350 ± 90 ± 60	46	¹ ABDALLAH	03J DLPH	$\gamma\gamma \rightarrow 2(K^+K^-)$
231 ± 90 ± 23	9.1 ± 3.3	² ALBRECHT	94H ARG	$\gamma\gamma \rightarrow 2(K^+K^-)$

¹ Calculated by us from the value reported in ABDALLAH 03J, which uses $B(\eta_c \rightarrow 2(K^+K^-)) = (2.1 \pm 1.2)\%$.

NODE=M026G;LINKAGE=DD

² Includes all topological modes except $\eta_c \rightarrow \phi\phi$.

NODE=M026G;LINKAGE=EE

$$\Gamma(2(\pi^+\pi^-)) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$$

$$\Gamma_{38}\Gamma_{47}/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
49 ± 6 OUR FIT				
42 ± 6 OUR AVERAGE				
40.7 ± 3.7 ± 5.3	5381 ± 492	UEHARA	08 BELL	$\gamma\gamma \rightarrow 2(\pi^+\pi^-)$
180 ± 70 ± 20	21.4 ± 8.6	ALBRECHT	94H ARG	$\gamma\gamma \rightarrow 2(\pi^+\pi^-)$

NODE=M026G11
NODE=M026G11

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

$$\Gamma_{41}\Gamma_{47}/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
7.6 ± 0.7 OUR FIT				
7.20 ± 1.53^{+0.67}_{-0.75}	157 ± 33	¹ KUO	05 BELL	$\gamma\gamma \rightarrow p\bar{p}$

NODE=M026G01
NODE=M026G01

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

4.6 ^{+1.3} _{-1.1} ± 0.4	190	¹ AMBROGIANI 03	E835	$\bar{p}p \rightarrow \gamma\gamma$
8.1 ^{+2.9} _{-2.0}		¹ ARMSTRONG 95F	E760	$\bar{p}p \rightarrow \gamma\gamma$

¹ Not independent from the $\Gamma_{\gamma\gamma}$ reported by the same experiment.

NODE=M026G01;LINKAGE=GG

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

$$\Gamma_{51}\Gamma_{47}/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<1.6	90	¹ UEHARA 13	BELL	$\gamma\gamma \rightarrow K_S^0 K_S^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.29	90	² UEHARA 13	BELL	$\gamma\gamma \rightarrow K_S^0 K_S^0$

NODE=M026G05
NODE=M026G05

¹ Taking into account interference with the non-resonant continuum.

² Neglecting interference with the non-resonant continuum.

OCCUR=2

NODE=M026G05;LINKAGE=U1
NODE=M026G05;LINKAGE=U2

$\eta_c(1S)$ BRANCHING RATIOS

NODE=M026225

HADRONIC DECAYS

NODE=M026305

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

$$\Gamma_1/\Gamma$$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.041 ± 0.017	14	¹ BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \eta_c \gamma$

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

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

$$\Gamma_2/\Gamma$$

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
18 ± 5 OUR AVERAGE					
12.6± 3.8±5.1	72	¹ ABLIKIM	05L BES2	$J/\psi \rightarrow \pi^+\pi^-\pi^+\pi^-\gamma$	
26.0± 2.4±8.8	113	¹ BISELLO	91 DM2	$J/\psi \rightarrow \gamma\rho^0\rho^0$	
23.6±10.6±8.2	32	¹ BISELLO	91 DM2	$J/\psi \rightarrow \gamma\rho^+\rho^-$	
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
<14	90	¹ BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \eta_c\gamma$	

NODE=M026R9
NODE=M026R9

OCCUR=2

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=M026R9;LINKAGE=E

$$\Gamma(K^*(892)^0 K^- \pi^+ + \text{c.c.})/\Gamma_{\text{total}}$$

$$\Gamma_3/\Gamma$$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.02 ± 0.007	63	^{1,2} BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \eta_c \gamma$

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

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

$$\Gamma_4/\Gamma$$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
70 ± 13 OUR FIT				
91 ± 26 OUR AVERAGE				
108 ± 25 ± 44	60	¹ ABLIKIM	05L BES2	$J/\psi \rightarrow K^+K^-\pi^+\pi^-\gamma$
82 ± 28 ± 27	14	¹ BISELLO	91 DM2	$e^+e^- \rightarrow \gamma K^+K^-\pi^+\pi^-$
90 ± 50	9	¹ BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \eta_c \gamma$

NODE=M026R8
NODE=M026R8

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;LINKAGE=E

$$\Gamma(K^*(892)^0 \bar{K}^*(892)^0 \pi^+ \pi^-) / \Gamma_{\text{total}} \quad \Gamma_5 / \Gamma$$

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
113 ± 47 ± 25	45	¹ ABLIKIM	06A BES2	$J/\psi \rightarrow K^{*0} \bar{K}^{*0} \pi^+ \pi^- \gamma$
¹ ABLIKIM 06A reports $[\Gamma(\eta_c(1S) \rightarrow K^*(892)^0 \bar{K}^*(892)^0 \pi^+ \pi^-) / \Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma \eta_c(1S))] = (1.91 \pm 0.64 \pm 0.48) \times 10^{-4}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = (1.7 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M026R25
NODE=M026R25

NODE=M026R25;LINKAGE=AB

$$\Gamma(\phi K^+ K^-) / \Gamma_{\text{total}} \quad \Gamma_6 / \Gamma$$

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
2.9^{+0.9}_{-0.8} ± 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

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

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
17.5 ± 2.0 OUR FIT				
30 ± 5 OUR AVERAGE				
25.3 ± 5.1 ± 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 ± 7 ± 10	19	¹ BISELLO	91 DM2	$J/\psi \rightarrow \gamma K^+ K^- K^+ K^-$
30 ⁺¹⁸ ₋₁₂ ± 10	5	¹ BISELLO	91 DM2	$J/\psi \rightarrow \gamma K^+ K^- K_S^0 K_L^0$
74 ± 18 ± 24	80	¹ BAI	90B MRK3	$J/\psi \rightarrow \gamma K^+ K^- K^+ K^-$
67 ± 21 ± 24		¹ BAI	90B MRK3	$J/\psi \rightarrow \gamma K^+ K^- K_S^0 K_L^0$

NODE=M026R7
NODE=M026R7

OCCUR=2

OCCUR=3

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

18 ⁺⁸ ₋₆ ± 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=M026R;LINKAGE=E

NODE=M026R7;LINKAGE=BB

$$\Gamma(\phi\phi) / \Gamma(K \bar{K} \pi) \quad \Gamma_7 / \Gamma_{28}$$

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
0.0240 ± 0.0026 OUR FIT				
0.044^{+0.012}_{-0.010} OUR AVERAGE				
0.055 ± 0.014 ± 0.005		AUBERT,B	04B BABR	$B^\pm \rightarrow K^\pm \eta_c$
0.032 ^{+0.014} _{-0.010} ± 0.009	7	¹ HUANG	03 BELL	$B^\pm \rightarrow K^\pm \phi\phi$

NODE=M026R39
NODE=M026R39

NODE=M026R39;LINKAGE=BB

$$\Gamma(\phi 2(\pi^+ \pi^-)) / \Gamma_{\text{total}} \quad \Gamma_8 / \Gamma$$

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 40	90	¹ ABLIKIM	06A BES2	$J/\psi \rightarrow \phi 2(\pi^+ \pi^-) \gamma$
¹ ABLIKIM 06A reports $[\Gamma(\eta_c(1S) \rightarrow \phi 2(\pi^+ \pi^-)) / \Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma \eta_c(1S))] < 0.603 \times 10^{-4}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = 1.7 \times 10^{-2}$.				

NODE=M026R26
NODE=M026R26

NODE=M026R26;LINKAGE=AB

$$\Gamma(a_0(980) \pi) / \Gamma_{\text{total}} \quad \Gamma_9 / \Gamma$$

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

$$\Gamma(a_2(1320) \pi) / \Gamma_{\text{total}} \quad \Gamma_{10} / \Gamma$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
< 0.02	90	¹ BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \eta_c \gamma$
¹ The quoted branching ratios use $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = 0.0127 \pm 0.0036$.				

NODE=M026R12
NODE=M026R12

NODE=M026R12;LINKAGE=E

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

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 $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = 0.0127 \pm 0.0036$.

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 $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = 0.0127 \pm 0.0036$.

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				
$0.77^{+0.25}_{-0.30} \pm 0.17$	91.2 ± 19.8	¹ ABLIKIM 04M	BES	$J/\psi \rightarrow \gamma 2\pi^+ 2\pi^-$

¹ ABLIKIM 04M reports $[\Gamma(\eta_c(1S) \rightarrow f_2(1270)f_2(1270))/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma \eta_c(1S))] = (1.3 \pm 0.3^{+0.3}_{-0.4}) \times 10^{-4}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = (1.7 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R19
NODE=M026R19

NODE=M026R19;LINKAGE=AB

 $\Gamma(f_0(980)\eta)/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT
seen	LEES 14E	BABR	Dalitz anal. of $\eta_c \rightarrow K^+ K^- \eta$

NODE=M026R41
NODE=M026R41

 $\Gamma(f_0(1500)\eta)/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT
seen	LEES 14E	BABR	Dalitz anal. of $\eta_c \rightarrow K^+ K^- \eta$

NODE=M026R42
NODE=M026R42

 $\Gamma(f_0(2200)\eta)/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT
seen	LEES 14E	BABR	Dalitz anal. of $\eta_c \rightarrow K^+ K^- \eta$

NODE=M026R43
NODE=M026R43

 $\Gamma(a_0(980)\pi)/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT
seen	LEES 14E	BABR	Dalitz anal. of $\eta_c \rightarrow K^+ K^- \pi^0$

NODE=M026R44
NODE=M026R44

 $\Gamma(a_0(1320)\pi)/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT
seen	LEES 14E	BABR	Dalitz anal. of $\eta_c \rightarrow K^+ K^- \pi^0$

NODE=M026R45
NODE=M026R45

 $\Gamma(a_0(1450)\pi)/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT
seen	LEES 14E	BABR	Dalitz anal. of $\eta_c \rightarrow K^+ K^- \pi^0$

NODE=M026R46
NODE=M026R46

 $\Gamma(a_0(1950)\pi)/\Gamma_{\text{total}}$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
seen	12k	¹ LEES 16A	BABR	$\gamma \gamma \rightarrow \eta_c(1S) \rightarrow K \bar{K} \pi$

¹ From a model-independant partial wave analysis.

NODE=M026R00
NODE=M026R00

NODE=M026R00;LINKAGE=A

$\Gamma(a_2(1950)\pi)/\Gamma_{\text{total}}$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
not seen	12k	¹ LEES	16A BABR	$\gamma\gamma \rightarrow \eta_c(1S) \rightarrow K\bar{K}\pi$

¹ From a model-independent partial wave analysis assuming the existence of a hypothetical tensor isovector $a_2(1950)$.

NODE=M026R50
NODE=M026R50

NODE=M026R50;LINKAGE=A

 $\Gamma(K_0^*(1430)\bar{K})/\Gamma_{\text{total}}$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
seen	12k	¹ LEES	16A BABR	$\gamma\gamma \rightarrow \eta_c(1S) \rightarrow K\bar{K}\pi$
seen		LEES	14E BABR	Dalitz anal. of $\eta_c \rightarrow K^+K^-\eta/\pi^0$

¹ From a model-independent partial wave analysis.

NODE=M026R47
NODE=M026R47

NODE=M026R47;LINKAGE=A

 $\Gamma(K_2^*(1430)\bar{K})/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT
seen	LEES	14E BABR	Dalitz anal. of $\eta_c \rightarrow K^+K^-\pi^0$

NODE=M026R48
NODE=M026R48

 $\Gamma(K_0^*(1950)\bar{K})/\Gamma_{\text{total}}$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
seen	12K	¹ LEES	16A BABR	$\gamma\gamma \rightarrow \eta_c(1S) \rightarrow K\bar{K}\pi$
seen		LEES	14E BABR	Dalitz anal. of $\eta_c \rightarrow K^+K^-\eta/\pi^0$

¹ From a Dalitz plot analysis using an isobar model.

NODE=M026R49
NODE=M026R49

NODE=M026R49;LINKAGE=A

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

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
7.3 ± 0.5 OUR FIT				
6.5 ± 0.6 OUR 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	$\psi(2S) \rightarrow \pi^0\gamma K_S^0 K^\pm\pi^\pm$
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.

OCCUR=2

² ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow K\bar{K}\pi)/\Gamma_{\text{total}}] \times [\Gamma(h_c(1P) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}}] = (27.24 \pm 4.56 \pm 2.88) \times 10^{-6}$ which we divide by our best value $\Gamma(h_c(1P) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}} = (4.3 \pm 0.4) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

³ ABLIKIM 12N quotes $B(\psi(2S) \rightarrow \pi^0 h_c) \cdot B(h_c \rightarrow \gamma\eta_c) \cdot B(\eta_c \rightarrow K_S^0 K^\pm\pi^\mp) = (11.35 \pm 1.25 \pm 1.50) \times 10^{-6}$ which we multiply by 3 to account for isospin symmetry.

NODE=M026R4;LINKAGE=BK

⁴ ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow K\bar{K}\pi)/\Gamma_{\text{total}}] \times [\Gamma(h_c(1P) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}}] = (34.05 \pm 3.75 \pm 4.50) \times 10^{-6}$ which we divide by our best value $\Gamma(h_c(1P) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}} = (4.3 \pm 0.4) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R4;LINKAGE=CK

⁵ Determined from the ratio of $B(B^\pm \rightarrow K^\pm\eta_c) \cdot B(\eta_c \rightarrow K\bar{K}\pi) = (7.4 \pm 0.5 \pm 0.7) \times 10^{-5}$ 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.

NODE=M026R4;LINKAGE=BL

NODE=M026R4;LINKAGE=CL

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.

NODE=M026R4;LINKAGE=AB

NODE=M026R4;LINKAGE=E

⁷ Average from $K^+K^-\pi^0$ and $K^\pm K_S^0\pi^\mp$ decay channels.

NODE=M026R4;LINKAGE=D

⁸ $K^\pm K_S^0\pi^\mp$ corrected to $K\bar{K}\pi$ by factor 3. KS, MR.

NODE=M026R4;LINKAGE=01

⁹ Estimated using $B(\psi(2S) \rightarrow \gamma\eta_c(1S)) = 0.0028 \pm 0.0006$.

NODE=M026R4;LINKAGE=A

¹⁰ $K^+K^-\pi^0$ corrected to $K\bar{K}\pi$ by factor 6. KS, MR

NODE=M026R4;LINKAGE=02

$\Gamma(\phi K^+ K^-)/\Gamma(K \bar{K} \pi)$ Γ_6/Γ_{28}

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
$0.052^{+0.016}_{-0.014} \pm 0.014$	7	¹ HUANG	03	BELL $B^\pm \rightarrow K^\pm \phi \phi$

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

 $\Gamma(K \bar{K} \eta)/\Gamma_{\text{total}}$ Γ_{29}/Γ

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

1.35 $\pm$ 0.16 OUR FIT**1.0 $\pm$ 0.5 $\pm$ 0.2** 7 ^{1,2} ABLIKIM 12N BES3 $\psi(2S) \rightarrow \pi^0 \gamma \eta K^+ K^-$

NODE=M026R15
 NODE=M026R15

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

<3.1 90 ³ BALTRUSAIT..86 MRK3 $J/\psi \rightarrow \eta_c \gamma$

OCCUR=2

¹ ABLIKIM 12N quotes $B(\psi(2S) \rightarrow \pi^0 h_c) \cdot B(h_c \rightarrow \gamma \eta_c) \cdot B(\eta_c \rightarrow K^+ K^- \eta) = (2.11 \pm 1.01 \pm 0.32) \times 10^{-6}$ which we multiply by 2 to account for isospin symmetry.

NODE=M026R15;LINKAGE=AK

² ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow K \bar{K} \eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \pi^0 h_c(1P))] \times [B(h_c(1P) \rightarrow \gamma \eta_c(1S))] = (4.22 \pm 2.02 \pm 0.64) \times 10^{-6}$ which we divide by our best values $B(\psi(2S) \rightarrow \pi^0 h_c(1P)) = (8.6 \pm 1.3) \times 10^{-4}$, $B(h_c(1P) \rightarrow \gamma \eta_c(1S)) = (51 \pm 6) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best values.

NODE=M026R15;LINKAGE=AM

³ The quoted branching ratios use $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = 0.0127 \pm 0.0036$.

NODE=M026R15;LINKAGE=E

 $\Gamma(K \bar{K} \eta)/\Gamma(K \bar{K} \pi)$ Γ_{29}/Γ_{28}

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

0.186 $\pm$ 0.018 OUR FIT**0.190 $\pm$ 0.008 $\pm$ 0.017** 5.4k ¹ LEES 14E BABR $\gamma \gamma \rightarrow K^+ K^- \eta/\pi^0$

NODE=M026R40
 NODE=M026R40

¹ LEES 14E reports $B(\eta_c(1S) \rightarrow K^+ K^- \eta)/B(\eta_c(1S) \rightarrow K^+ K^- \pi^0) = 0.571 \pm 0.025 \pm 0.051$, which we divide by 3 to account for isospin symmetry. It uses both $\eta \rightarrow \gamma \gamma$ and $\eta \rightarrow \pi^+ \pi^- \pi^0$ decays.

NODE=M026R40;LINKAGE=LE

 $\Gamma(\eta \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{30}/Γ

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

1.7 $\pm$ 0.4 $\pm$ 0.1

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

5.4 $\pm$ 2.0 75 ² BALTRUSAIT..86 MRK3 $J/\psi \rightarrow \eta_c \gamma$ 3.7 $\pm$ 1.3 $\pm$ 2.0 18 ² PARTRIDGE 80B CBAL $J/\psi \rightarrow \eta \pi^+ \pi^- \gamma$

NODE=M026R6
 NODE=M026R6

¹ ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow \eta \pi^+ \pi^-)/\Gamma_{\text{total}}] \times [\Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}}] = (7.22 \pm 1.47 \pm 1.11) \times 10^{-6}$ which we divide by our best value $\Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}} = (4.3 \pm 0.4) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

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_{31}/Γ

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

4.4 $\pm$ 1.2 $\pm$ 0.4**4.4 $\pm$ 1.2 $\pm$ 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 $[\Gamma(\eta_c(1S) \rightarrow \eta 2(\pi^+ \pi^-))/\Gamma_{\text{total}}] \times [\Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}}] = (19.17 \pm 3.77 \pm 3.72) \times 10^{-6}$ which we divide by our best value $\Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}} = (4.3 \pm 0.4) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R05;LINKAGE=AB

 $\Gamma(K^+ K^- \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{32}/Γ

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

6.9 $\pm$ 1.1 OUR FIT**11.2 $\pm$ 1.9 OUR AVERAGE**9.7 $\pm$ 2.2 $\pm$ 0.9 38 ¹ ABLIKIM 12N BES3 $\psi(2S) \rightarrow \pi^0 \gamma K^+ K^- \pi^+ \pi^-$ 12 $\pm$ 4 0.4k ² BAI 04 BES $J/\psi \rightarrow \gamma K^+ K^- \pi^+ \pi^-$ 21 $\pm$ 7 110 ² BALTRUSAIT..86 MRK3 $J/\psi \rightarrow \eta_c \gamma$ 14 $\pm$ 22 ³ HIMEL 80B MRK2 $\psi(2S) \rightarrow \eta_c \gamma$

NODE=M026R5
 NODE=M026R5

- ¹ ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow K^+ K^- \pi^+ \pi^-)/\Gamma_{\text{total}}] \times [\Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}}] = (4.16 \pm 0.76 \pm 0.59) \times 10^{-6}$ which we divide by our best value $\Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}} = (4.3 \pm 0.4) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.
- ² The quoted branching ratios use $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = 0.0127 \pm 0.0036$. Where relevant, the error in this branching ratio is treated as a common systematic in computing averages.
- ³ Estimated using $B(\psi(2S) \rightarrow \gamma \eta_c(1S)) = 0.0028 \pm 0.0006$.

NODE=M026R5;LINKAGE=AB

NODE=M026R5;LINKAGE=E

NODE=M026R5;LINKAGE=A

 $\Gamma(K^+ K^- \pi^+ \pi^- \pi^0)/\Gamma(K \bar{K} \pi)$ **Γ_{33}/Γ_{28}**

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 $\Gamma(K^+ K^- \pi^+ \pi^- \pi^0)/\Gamma(K_S^0 K^\pm \pi^\mp)$ reported in DEL-AMO-SANCHEZ 11M by a factor 1/3 to obtain $\Gamma(K^+ K^- \pi^+ \pi^- \pi^0)/\Gamma(K \bar{K} \pi)$. Not independent from other measurements reported in DEL-AMO-SANCHEZ 11M.

NODE=M026R01;LINKAGE=DE

 $\Gamma(K^0 K^- \pi^+ \pi^- \pi^+ + \text{c.c.})/\Gamma_{\text{total}}$ **Γ_{34}/Γ**

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
5.6±1.4±0.5	43	^{1,2} ABLIKIM	12N BES3	$\psi(2S) \rightarrow \pi^0 \gamma K_S^0 K^\mp \pi^\mp 2\pi^\pm$

NODE=M026R06
NODE=M026R06

- ¹ ABLIKIM 12N quotes $B(\psi(2S) \rightarrow \pi^0 h_c) \cdot B(h_c \rightarrow \gamma \eta_c) \cdot B(\eta_c \rightarrow K_S^0 K^- \pi^- 2\pi^+)$ = $(12.01 \pm 2.22 \pm 2.04) \times 10^{-6}$ which we multiply by 2 to take c.c. into account.
- ² ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow K^0 K^- \pi^+ \pi^- \pi^+ + \text{c.c.})/\Gamma_{\text{total}}] \times [\Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}}] = (24.02 \pm 4.44 \pm 4.08) \times 10^{-6}$ which we divide by our best value $\Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}} = (4.3 \pm 0.4) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R06;LINKAGE=AA

NODE=M026R06;LINKAGE=AB

 $\Gamma(K^+ K^- 2(\pi^+ \pi^-))/\Gamma_{\text{total}}$ **Γ_{35}/Γ**

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
7.5±2.4 OUR AVERAGE				
8 ±4 ±1	10	¹ ABLIKIM	12N BES3	$\psi(2S) \rightarrow \pi^0 \gamma K^+ K^- 2(\pi^+ \pi^-)$
7.2±2.4±1.6	100	² ABLIKIM	06A BES2	$J/\psi \rightarrow K^+ K^- 2(\pi^+ \pi^-) \gamma$

NODE=M026R23
NODE=M026R23

- ¹ ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow K^+ K^- 2(\pi^+ \pi^-))/\Gamma_{\text{total}}] \times [\Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}}] = (3.60 \pm 1.71 \pm 0.64) \times 10^{-6}$ which we divide by our best value $\Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}} = (4.3 \pm 0.4) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.
- ² ABLIKIM 06A reports $[\Gamma(\eta_c(1S) \rightarrow K^+ K^- 2(\pi^+ \pi^-))/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma \eta_c(1S))] = (1.21 \pm 0.32 \pm 0.24) \times 10^{-4}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = (1.7 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R23;LINKAGE=AL

NODE=M026R23;LINKAGE=AB

 $\Gamma(2(K^+ K^-))/\Gamma_{\text{total}}$ **Γ_{36}/Γ**

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.46± 0.30 OUR FIT				
2.2 ± 0.9 ± 0.2	7	¹ ABLIKIM	12N BES3	$\psi(2S) \rightarrow \pi^0 \gamma 2(K^+ K^-)$

NODE=M026R20
NODE=M026R20

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

1.4 $\pm$ 0.5 $\pm$ 0.6	14.5 $\pm$ 4.6 $\pm$ 3.0	² HUANG	03 BELL	$B^+ \rightarrow 2(K^+ K^-) K^+$
21 ±10 ±6		³ ALBRECHT	94H ARG	$\gamma\gamma \rightarrow K^+ K^- K^+ K^-$

- ¹ ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow 2(K^+ K^-))/\Gamma_{\text{total}}] \times [\Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}}] = (0.94 \pm 0.37 \pm 0.14) \times 10^{-6}$ which we divide by our best value $\Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}} = (4.3 \pm 0.4) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R20;LINKAGE=AB

- ² Using $B(B^+ \rightarrow \eta_c K^+) = (1.25 \pm 0.12^{+0.10}_{-0.12}) \times 10^{-3}$ from FANG 03 and $B(\eta_c \rightarrow K \bar{K} \pi) = (5.5 \pm 1.7) \times 10^{-2}$.

NODE=M026R20;LINKAGE=BB

- ³ Normalized to the sum of $B(\eta_c \rightarrow K^\pm K_S^0 \pi^\mp)$, $B(\eta_c \rightarrow \phi\phi)$, $B(\eta_c \rightarrow K^+ K^- \pi^+ \pi^-)$, and $B(\eta_c \rightarrow 2\pi^+ 2\pi^-)$.

NODE=M026R20;LINKAGE=AL

$\Gamma(2(K^+ K^-))/\Gamma(K \bar{K} \pi)$ Γ_{36}/Γ_{28}

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
0.020±0.004 OUR 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 $B^\pm \rightarrow K^\pm(2K^+ 2K^-)$

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
NODE=M026R38

NODE=M026R38;LINKAGE=BB

 $\Gamma(\pi^+ \pi^- \pi^0 \pi^0)/\Gamma_{\text{total}}$ Γ_{37}/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 $[\Gamma(\eta_c(1S) \rightarrow \pi^+ \pi^- \pi^0 \pi^0)/\Gamma_{\text{total}}] \times [\Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}}] = (20.31 \pm 2.20 \pm 3.33) \times 10^{-6}$ which we divide by our best value $\Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}} = (4.3 \pm 0.4) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R07
NODE=M026R07

NODE=M026R07;LINKAGE=AB

 $\Gamma(2(\pi^+ \pi^-))/\Gamma_{\text{total}}$ Γ_{38}/Γ

VALUE (units 10^{-2})	EVTs	DOCUMENT ID	TECN	COMMENT
0.97±0.12 OUR FIT				
1.35±0.21 OUR AVERAGE				
1.74±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 $[\Gamma(\eta_c(1S) \rightarrow 2(\pi^+ \pi^-))/\Gamma_{\text{total}}] \times [\Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}}] = (7.51 \pm 0.85 \pm 1.11) \times 10^{-6}$ which we divide by our best value $\Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}} = (4.3 \pm 0.4) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² The quoted branching ratios use $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = 0.0127 \pm 0.0036$. Where relevant, the error in this branching ratio is treated as a common systematic in computing averages.

³ Estimated using $B(\psi(2S) \rightarrow \gamma \eta_c(1S)) = 0.0028 \pm 0.0006$.

NODE=M026R1
NODE=M026R1

NODE=M026R1;LINKAGE=AB

NODE=M026R1;LINKAGE=E

NODE=M026R1;LINKAGE=A

 $\Gamma(2(\pi^+ \pi^- \pi^0))/\Gamma_{\text{total}}$ Γ_{39}/Γ

VALUE (units 10^{-2})	EVTs	DOCUMENT ID	TECN	COMMENT
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 $[\Gamma(\eta_c(1S) \rightarrow 2(\pi^+ \pi^- \pi^0))/\Gamma_{\text{total}}] \times [\Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}}] = (75.13 \pm 7.42 \pm 9.99) \times 10^{-6}$ which we divide by our best value $\Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}} = (4.3 \pm 0.4) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R08
NODE=M026R08

NODE=M026R08;LINKAGE=AB

 $\Gamma(3(\pi^+ \pi^-))/\Gamma_{\text{total}}$ Γ_{40}/Γ

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
18 ±4 OUR AVERAGE				
20 ±5 ±2	51	¹ ABLIKIM	12N	BES3 $\psi(2S) \rightarrow \pi^0 \gamma 3(\pi^+ \pi^-)$
15.3±3.4±3.3	479	² ABLIKIM	06A	BES2 $J/\psi \rightarrow 3(\pi^+ \pi^-) \gamma$

¹ ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow 3(\pi^+ \pi^-))/\Gamma_{\text{total}}] \times [\Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}}] = (8.82 \pm 1.57 \pm 1.59) \times 10^{-6}$ which we divide by our best value $\Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}} = (4.3 \pm 0.4) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² ABLIKIM 06A reports $[\Gamma(\eta_c(1S) \rightarrow 3(\pi^+ \pi^-))/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma \eta_c(1S))] = (2.59 \pm 0.32 \pm 0.47) \times 10^{-4}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = (1.7 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R24
NODE=M026R24

NODE=M026R24;LINKAGE=AL

NODE=M026R24;LINKAGE=AB

$\Gamma(p\bar{p})/\Gamma_{\text{total}}$ Γ_{41}/Γ

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

15.0 ± 1.6 OUR FIT**13.2 ± 2.7 OUR AVERAGE**

15 ± 5 ± 1	15	¹ ABLIKIM	12N BES3	$\psi(2S) \rightarrow \pi^0 \gamma p \bar{p}$
15 ± 6	213 ± 33	² BAI	04 BES	$J/\psi \rightarrow \gamma p \bar{p}$
10 ± 3 ± 4	18	² BISELLO	91 DM2	$J/\psi \rightarrow \gamma p \bar{p}$
11 ± 6	23	² BALTRUSAIT..	86 MRK3	$J/\psi \rightarrow \eta_c \gamma$
29 ⁺²⁹ ₋₁₅		³ HIMEL	80B MRK2	$\psi(2S) \rightarrow \eta_c \gamma$

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

14.8 ^{+2.0+1.7} _{-2.4-1.8}	195	⁴ WU	06 BELL	$B^+ \rightarrow p \bar{p} K^+$

¹ ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow p \bar{p})/\Gamma_{\text{total}}] \times [\Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S))/\Gamma_{\text{total}}] \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}} = (0.65 \pm 0.19 \pm 0.10) \times 10^{-6}$ which we divide by our best value $\Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}} = (4.3 \pm 0.4) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² The quoted branching ratios use $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = 0.0127 \pm 0.0036$. Where relevant, the error in this branching ratio is treated as a common systematic in computing averages.

³ Estimated using $B(\psi(2S) \rightarrow \gamma \eta_c(1S)) = 0.0028 \pm 0.0006$.

⁴ WU 06 reports $[\Gamma(\eta_c(1S) \rightarrow p \bar{p})/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \eta_c K^+)] = (1.42 \pm 0.11^{+0.16}_{-0.20}) \times 10^{-6}$ which we divide by our best value $B(B^+ \rightarrow \eta_c K^+) = (9.6 \pm 1.1) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R2
NODE=M026R2

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_{41}/Γ_{28}

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

0.0207 ± 0.0021 OUR FIT

0.021 ± 0.002 ^{+0.004} _{-0.006}	195	¹ WU	06 BELL	$B^\pm \rightarrow K^\pm p \bar{p}$

¹ Using $B(B^+ \rightarrow \eta_c K^+) = (1.25 \pm 0.12^{+0.10}_{-0.12}) \times 10^{-3}$ from FANG 03 and $B(\eta_c \rightarrow K \bar{K} \pi) = (5.5 \pm 1.7) \times 10^{-2}$.

NODE=M026R03
NODE=M026R03

NODE=M026R03;LINKAGE=BB

$\Gamma(p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\phi\phi)/\Gamma_{\text{total}}$ $\Gamma_{41}/\Gamma \times \Gamma_7/\Gamma$

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

0.26 ± 0.05 OUR FIT

4.0 ^{+3.5} _{-3.2}	BAGLIN	89 SPEC	$\bar{p} p \rightarrow K^+ K^- K^+ K^-$

NODE=M026R33
NODE=M026R33

$\Gamma(p\bar{p}\pi^0)/\Gamma_{\text{total}}$ Γ_{42}/Γ

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

0.36 ± 0.13 ± 0.03	14	¹ ABLIKIM	12N BES3	$\psi(2S) \rightarrow \pi^0 \gamma p \bar{p} \pi^0$

¹ ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow p \bar{p} \pi^0)/\Gamma_{\text{total}}] \times [\Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S))/\Gamma_{\text{total}}] \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}} = (1.53 \pm 0.49 \pm 0.23) \times 10^{-6}$ which we divide by our best value $\Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}} = (4.3 \pm 0.4) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R09
NODE=M026R09

NODE=M026R09;LINKAGE=AB

$\Gamma(\Lambda\bar{\Lambda})/\Gamma_{\text{total}}$ Γ_{43}/Γ

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

10.9 ± 2.4 OUR FIT**11.7 ± 2.3 ± 2.6**

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

9.9 ^{+2.7} _{-2.6} ± 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 $[\Gamma(\eta_c(1S) \rightarrow \Lambda \bar{\Lambda})/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \eta_c K^+)] = (0.95^{+0.25+0.08}_{-0.22-0.11}) \times 10^{-6}$ 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

NODE=M026R18;LINKAGE=AB

NODE=M026R18;LINKAGE=WU

NODE=M026R18;LINKAGE=E

$\Gamma(\Lambda\bar{\Lambda})/\Gamma(p\bar{p})$ Γ_{43}/Γ_{41}

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

 $\Gamma(\Sigma^+\bar{\Sigma}^-)/\Gamma_{\text{total}}$ Γ_{44}/Γ

VALUE (units 10 ⁻³)	EVTS	DOCUMENT ID	TECN	COMMENT
2.1±0.3±0.5	112	¹ ABLIKIM	13C BES3	$J/\psi \rightarrow \gamma p\bar{p}\pi^0\pi^0$

¹ ABLIKIM 13C reports $[\Gamma(\eta_c(1S) \rightarrow \Sigma^+\bar{\Sigma}^-)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta_c(1S))] = (3.60 \pm 0.48 \pm 0.31) \times 10^{-5}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = (1.7 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.NODE=M026R28
NODE=M026R28

NODE=M026R28;LINKAGE=AB

 $\Gamma(\Xi^-\bar{\Xi}^+)/\Gamma_{\text{total}}$ Γ_{45}/Γ

VALUE (units 10 ⁻³)	EVTS	DOCUMENT ID	TECN	COMMENT
0.89±0.18±0.19	78	¹ ABLIKIM	13C BES3	$J/\psi \rightarrow \gamma \Lambda\bar{\Lambda}\pi^+\pi^-$

¹ ABLIKIM 13C reports $[\Gamma(\eta_c(1S) \rightarrow \Xi^-\bar{\Xi}^+)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta_c(1S))] = (1.51 \pm 0.27 \pm 0.14) \times 10^{-5}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = (1.7 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.NODE=M026R29
NODE=M026R29

NODE=M026R29;LINKAGE=AB

 $\Gamma(\pi^+\pi^-\rho\bar{\rho})/\Gamma_{\text{total}}$ Γ_{46}/Γ

VALUE (units 10 ⁻³)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
5.3±1.7±0.5		19	¹ ABLIKIM	12N BES3	$\psi(2S) \rightarrow \pi^0\gamma p\bar{p}\pi^+\pi^-$

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

<12	90	HIMEL	80B MRK2	$\psi(2S) \rightarrow \eta_c\gamma$

¹ ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow \pi^+\pi^-\rho\bar{\rho})/\Gamma_{\text{total}}] \times [\Gamma(h_c(1P) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}}] = (2.30 \pm 0.65 \pm 0.36) \times 10^{-6}$ which we divide by our best value $\Gamma(h_c(1P) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}} = (4.3 \pm 0.4) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.NODE=M026R3
NODE=M026R3

NODE=M026R3;LINKAGE=AB

RADIATIVE DECAYS

 $\Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ Γ_{47}/Γ

VALUE (units 10 ⁻⁴)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
1.59±0.13 OUR FIT					

1.9^{+0.7}_{-0.6} OUR AVERAGE

2.7 ±0.8 ±0.6			¹ ABLIKIM	13i	BES3
1.4 ^{+0.7} _{-0.5} ±0.3	1.2 ^{+2.8} _{-1.1}		² ADAMS	08	CLEO $\psi(2S) \rightarrow \pi^+\pi^- J/\psi$

• • • 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.

NODE=M026310

NODE=M026R31
NODE=M026R31

NODE=M026R31;LINKAGE=AL

² ADAMS 08 reports $[\Gamma(\eta_c(1S) \rightarrow \gamma\gamma)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta_c(1S))] = (2.4^{+1.1}_{-0.8} ±0.3) \times 10^{-6}$ 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.

NODE=M026R31;LINKAGE=AD

³ WICHT 08 reports $[\Gamma(\eta_c(1S) \rightarrow \gamma\gamma)/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \eta_c K^+)] = (2.2^{+0.9+0.4}_{-0.7-0.2}) \times 10^{-7}$ which we divide by our best value $B(B^+ \rightarrow \eta_c K^+) = (9.6 \pm 1.1) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R31;LINKAGE=WI

⁴ Not independent from the values of the total and two-photon width quoted by the same experiment.

NODE=M026R31;LINKAGE=AB

⁵ The quoted branching ratios use $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = 0.0127 \pm 0.0036$.

NODE=M026R31;LINKAGE=E

⁶ Using $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = 0.0127 \pm 0.0036$.

NODE=M026R31;LINKAGE=C

$\Gamma(\gamma\gamma)/\Gamma(K\bar{K}\pi)$ Γ_{47}/Γ_{28}

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
2.19±0.29 OUR FIT				
3.2 $^{+1.3}_{-1.0}$ $^{+0.8}_{-0.6}$	13	¹ WICHT	08 BELL	$B^\pm \rightarrow K^\pm \gamma\gamma$

¹ Using $B(B^+ \rightarrow \eta_c K^+) = (1.25 \pm 0.12^{+0.10}_{-0.12}) \times 10^{-3}$ from FANG 03 and $B(\eta_c \rightarrow K\bar{K}\pi) = (5.5 \pm 1.7) \times 10^{-2}$.

NODE=M026R04
NODE=M026R04

NODE=M026R04;LINKAGE=BB

 $\Gamma(p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_{41}/\Gamma \times \Gamma_{47}/\Gamma$

VALUE (units 10^{-6})	EVTs	DOCUMENT ID	TECN	COMMENT
0.240±0.024 OUR FIT				
0.26 ±0.05 OUR AVERAGE		Error includes scale factor of 1.4.		
$0.224^{+0.038}_{-0.037} \pm 0.020$	190	AMBROGIANI 03	E835	$\bar{p}p \rightarrow \eta_c \rightarrow \gamma\gamma$
$0.336^{+0.080}_{-0.070}$		ARMSTRONG 95F	E760	$\bar{p}p \rightarrow \gamma\gamma$
$0.68^{+0.42}_{-0.31}$	12	BAGLIN	87B SPEC	$\bar{p}p \rightarrow \gamma\gamma$

NODE=M026R32
NODE=M026R32

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

NODE=M026320

 $\Gamma(\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{48}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<11	90	¹ ABLIKIM	11G BES3	$J/\psi \rightarrow \gamma\pi^+\pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<70	90	² ABLIKIM	06B BES2	$J/\psi \rightarrow \pi^+\pi^-\gamma$
¹ ABLIKIM 11G reports $[\Gamma(\eta_c(1S) \rightarrow \pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta_c(1S))] < 1.82 \times 10^{-6}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = 1.7 \times 10^{-2}$.				
² ABLIKIM 06B reports $[\Gamma(\eta_c(1S) \rightarrow \pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta_c(1S))] < 1.1 \times 10^{-5}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = 1.7 \times 10^{-2}$.				

NODE=M026R34
NODE=M026R34

NODE=M026R34;LINKAGE=AL

NODE=M026R34;LINKAGE=AB

 $\Gamma(\pi^0\pi^0)/\Gamma_{\text{total}}$ Γ_{49}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
< 4	90	¹ ABLIKIM	11G BES3	$J/\psi \rightarrow \gamma\pi^0\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<40	90	² ABLIKIM	06B BES2	$J/\psi \rightarrow \pi^0\pi^0\gamma$
¹ ABLIKIM 11G reports $[\Gamma(\eta_c(1S) \rightarrow \pi^0\pi^0)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta_c(1S))] < 6.0 \times 10^{-7}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = 1.7 \times 10^{-2}$.				
² ABLIKIM 06B reports $[\Gamma(\eta_c(1S) \rightarrow \pi^0\pi^0)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta_c(1S))] < 0.71 \times 10^{-5}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = 1.7 \times 10^{-2}$.				

NODE=M026R35
NODE=M026R35

NODE=M026R35;LINKAGE=AL

NODE=M026R35;LINKAGE=AB

 $\Gamma(K^+K^-)/\Gamma_{\text{total}}$ Γ_{50}/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 $[\Gamma(\eta_c(1S) \rightarrow K^+K^-)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta_c(1S))] < 0.96 \times 10^{-5}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = 1.7 \times 10^{-2}$.				

NODE=M026R36
NODE=M026R36

NODE=M026R36;LINKAGE=AB

 $\Gamma(K_S^0 K_S^0)/\Gamma_{\text{total}}$ Γ_{51}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<31	90	¹ ABLIKIM	06B BES2	$J/\psi \rightarrow K_S^0 K_S^0 \gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<32	90	² UEHARA	13 BELL	$\gamma\gamma \rightarrow K_S^0 K_S^0$
< 5.6	90	³ UEHARA	13 BELL	$\gamma\gamma \rightarrow K_S^0 K_S^0$
¹ ABLIKIM 06B reports $[\Gamma(\eta_c(1S) \rightarrow K_S^0 K_S^0)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta_c(1S))] < 0.53 \times 10^{-5}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = 1.7 \times 10^{-2}$.				
² Taking into account interference with the non-resonant continuum.				
³ Neglecting interference with the non-resonant continuum.				

NODE=M026R37
NODE=M026R37

OCCUR=2

NODE=M026R37;LINKAGE=AB

NODE=M026R37;LINKAGE=U1

NODE=M026R37;LINKAGE=U2

$\eta_c(1S)$ REFERENCES

NODE=M026

LEES	16A	PR D93 012005	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=57125
AAIJ	15BI	EPJ C75 311	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=57147
ANASHIN	14	PL B738 391	V.V. Anashin <i>et al.</i>	(KEDR Collab.)	REFID=56130
LEES	14E	PR D89 112004	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=55937
ABLIKIM	13C	PR D87 012003	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=54878
ABLIKIM	13I	PR D87 032003	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=54954
UEHARA	13	PTEP 2013 123C01	S. Uehara <i>et al.</i>	(BELLE Collab.)	REFID=55592
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
ZHANG	12A	PR D86 052002	C.C. Zhang <i>et al.</i>	(BELLE Collab.)	REFID=54763
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	JP G33 1	W.-M. Yao <i>et al.</i>	(PDG Collab.)	REFID=51004
WU	06	PRL 97 162003	C.-H. Wu <i>et al.</i>	(BELLE Collab.)	REFID=51472
ABLIKIM	05L	PR D72 072005	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50837
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+)	REFID=22006
BLOOM	83	ARNS 33 143	E.D. Bloom, C. Peck	(SLAC, CIT)	REFID=21682
HIMEL	80B	PRL 45 1146	T.M. Himel <i>et al.</i>	(SLAC, LBL, UCB)	REFID=22003
PARTRIDGE	80B	PRL 45 1150	R. Partridge <i>et al.</i>	(CIT, HARV, PRIN+)	REFID=22004

$J/\psi(1S)$

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

NODE=M070

 $J/\psi(1S)$ MASS

NODE=M070M

NODE=M070M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
3096.900±0.006 OUR AVERAGE				
3096.66 ±0.19 ±0.02	6.1k	¹ AAIJ	15BI LHCB	$p p \rightarrow J/\psi X$
3096.900±0.002±0.006		² ANASHIN	15 KEDR	$e^+e^- \rightarrow \text{hadrons}$
3096.89 ±0.09	502	³ ARTAMONOV	00 OLYA	$e^+e^- \rightarrow \text{hadrons}$
3096.91 ±0.03 ±0.01		⁴ ARMSTRONG	93B E760	$\bar{p} p \rightarrow e^+e^-$
3096.95 ±0.1 ±0.3	193	BAGLIN	87 SPEC	$\bar{p} p \rightarrow e^+e^- X$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
3096.917±0.010±0.007		AULCHENKO	03 KEDR	$e^+e^- \rightarrow \text{hadrons}$
3097.5 ±0.3		GRIBUSHIN	96 FMPS	$515 \pi^- \text{Be} \rightarrow 2\mu X$
3098.4 ±2.0	38k	LEMOIGNE	82 GOLI	$185 \pi^- \text{Be} \rightarrow \gamma \mu^+ \mu^- A$
3096.93 ±0.09	502	⁵ ZHOLENTZ	80 REDE	e^+e^-
3097.0 ±1		⁶ BRANDELIK	79C DASP	e^+e^-

¹ From a sample of $\eta_c(1S)$ and J/ψ produced in b -hadron decays.² Supersedes AULCHENKO 03.³ Reanalysis of ZHOLENTZ 80 using new electron mass (COHEN 87) and radiative corrections (KURAEV 85).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 03.⁵ Superseded by ARTAMONOV 00.⁶ From a simultaneous fit to e^+e^- , $\mu^+\mu^-$ and hadronic channels assuming $\Gamma(e^+e^-) = \Gamma(\mu^+\mu^-)$.

NODE=M070M;LINKAGE=B

NODE=M070M;LINKAGE=A

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

$$\frac{\Gamma(J/\psi(1S) \rightarrow \pi^+\pi^-K_S^0K_L^0)}{\Gamma_{\text{total}}(e^+e^-)} \times \frac{\Gamma(J/\psi(1S) \rightarrow \pi^+\pi^-K_S^0K_L^0)}{\Gamma_{\text{total}}(e^+e^-)} \rightarrow \frac{\Gamma_{\text{DESIG=X1}} \Gamma_{\text{DESIG=1}}}{\Gamma}$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
20.8±2.3±2.1	248	LEES	14H BABR	$e^+e^- \rightarrow \pi^+\pi^-K_S^0K_L^0\gamma$

NODE=M070GY1

NODE=M070GY1

$$\frac{\Gamma(J/\psi(1S) \rightarrow \pi^+\pi^-K_S^0K_S^0)}{\Gamma_{\text{total}}(e^+e^-)} \times \frac{\Gamma(J/\psi(1S) \rightarrow \pi^+\pi^-K_S^0K_S^0)}{\Gamma_{\text{total}}(e^+e^-)} \rightarrow \frac{\Gamma_{\text{DESIG=X2}} \Gamma_{\text{DESIG=1}}}{\Gamma}$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
9.3±0.9±0.5	133	LEES	14H BABR	$e^+e^- \rightarrow \pi^+\pi^-K_S^0K_S^0\gamma$

NODE=M070GY2

NODE=M070GY2

$$\frac{\Gamma(J/\psi(1S) \rightarrow K^+K^-K_S^0K_S^0)}{\Gamma_{\text{total}}(e^+e^-)} \times \frac{\Gamma(J/\psi(1S) \rightarrow K^+K^-K_S^0K_S^0)}{\Gamma_{\text{total}}(e^+e^-)} \rightarrow \frac{\Gamma_{\text{DESIG=X3}} \Gamma_{\text{DESIG=1}}}{\Gamma}$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
2.3±0.4±0.1	29	LEES	14H BABR	$e^+e^- \rightarrow K_S^0K_S^0K^+K^-\gamma$

NODE=M070GY3

NODE=M070GY3

$$\Gamma(J/\psi(1S) \rightarrow K_S^0 \pi^- K^*(892)^+ + c.c.) \times \Gamma(J/\psi(1S) \rightarrow e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{\text{DESIG}=X4} \Gamma_{\text{DESIG}=1} / \Gamma$$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT
14.8 ± 4.8 ± 1.2	53	¹ LEES	14H BABR	$e^+ e^- \rightarrow \pi^+ \pi^- K_S^0 K_S^0 \gamma$

NODE=M070GY4
NODE=M070GY4

¹ Dividing by 1/4 to take into account $B(K^*(892) \rightarrow K_S^0 \pi) = 1/4$.

NODE=M070GY4;LINKAGE=A

$$\Gamma(J/\psi(1S) \rightarrow K_S^0 \pi^- K^*(892)^+ + c.c. \rightarrow K_S^0 K_S^0 \pi^+ \pi^-) \times \Gamma(J/\psi(1S) \rightarrow e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{\text{DESIG}=X5} \Gamma_{\text{DESIG}=1} / \Gamma$$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT
3.7 ± 1.2 ± 0.3	53	LEES	14H BABR	$e^+ e^- \rightarrow \pi^+ \pi^- K_S^0 K_S^0 \gamma$

NODE=M070GY5
NODE=M070GY5

$$\Gamma(J/\psi(1S) \rightarrow K_S^0 \pi^- K_2^*(1430)^+ + c.c.) \times \Gamma(J/\psi(1S) \rightarrow e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{\text{DESIG}=X6} \Gamma_{\text{DESIG}=1} / \Gamma$$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT
20.1 ± 9.8 ± 0.5	35	^{1,2} LEES	14H BABR	$e^+ e^- \rightarrow \pi^+ \pi^- K_S^0 K_S^0 \gamma$

NODE=M070GY6
NODE=M070GY6

¹ Dividing by 1/4 to take into account $B(K^*(1430) \rightarrow K_S^0 \pi) = 1/4 B(K^*(1430) \rightarrow K \pi)$

NODE=M070GY6;LINKAGE=A

² LEES 14H reports $[\Gamma(J/\psi(1S) \rightarrow K_S^0 \pi^- K_2^*(1430)^+ + c.c.) \times \Gamma(J/\psi(1S) \rightarrow e^+ e^-) / \Gamma_{\text{total}}] \Gamma_{\text{DESIG}=X6} \Gamma_{\text{DESIG}=1} / \Gamma \times [B(K_2^*(1430) \rightarrow K \pi)] = 10.0 \pm 4.8 \pm 0.8$ eV which we divide by our best value $B(K_2^*(1430) \rightarrow K \pi) = (49.9 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070GY6;LINKAGE=B

$$\Gamma(J/\psi(1S) \rightarrow K_S^0 \pi^- K_2^*(1430)^+ + c.c. \rightarrow K_S^0 K_S^0 \pi^+ \pi^-) \times \Gamma(J/\psi(1S) \rightarrow e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{\text{DESIG}=X7} \Gamma_{\text{DESIG}=1} / \Gamma$$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT
2.5 ± 1.2 ± 0.2	35	LEES	14H BABR	$e^+ e^- \rightarrow \pi^+ \pi^- K_S^0 K_S^0 \gamma$

NODE=M070GY7
NODE=M070GY7

$$\Gamma(J/\psi(1S) \rightarrow K^*(892)^\pm K^*(892)^\mp) \times \Gamma(J/\psi(1S) \rightarrow e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{\text{DESIG}=256} \Gamma_{\text{DESIG}=1} / \Gamma$$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT
0.80 ± 0.48 ± 0.32	1+5	¹ LEES	14H BABR	$e^+ e^- \rightarrow \pi^+ \pi^- K_S^0 K_S^0 \gamma$

NODE=M070GY8
NODE=M070GY8

¹ Dividing by $(1/4)^2$ to take twice into account $B(K^*(892) \rightarrow K_S^0 \pi) = 1/4$.

NODE=M070GY8;LINKAGE=A

$$\Gamma(J/\psi(1S) \rightarrow K^*(892)^+ K_2^*(1430)^- + c.c.) \times \Gamma(J/\psi(1S) \rightarrow e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{\text{DESIG}=X9} \Gamma_{\text{DESIG}=1} / \Gamma$$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT
18.6 ± 16.1 ± 0.4	8+8	^{1,2} LEES	14H BABR	$e^+ e^- \rightarrow \pi^+ \pi^- K_S^0 K_S^0 \gamma$

NODE=M070GY9
NODE=M070GY9

¹ Dividing by 1/16 to take into account $B(K^*(892) \rightarrow K_S^0 \pi) = 1/4$ and $B(K^*(1430) \rightarrow K_S^0 \pi) = 1/4 B(K^*(1430) \rightarrow K \pi)$.

NODE=M070GY9;LINKAGE=A

² LEES 14H reports $[\Gamma(J/\psi(1S) \rightarrow K^*(892)^+ K_2^*(1430)^- + c.c.) \times \Gamma(J/\psi(1S) \rightarrow e^+ e^-) / \Gamma_{\text{total}}] \Gamma_{\text{DESIG}=X9} \Gamma_{\text{DESIG}=1} / \Gamma \times [B(K_2^*(1430) \rightarrow K \pi)] = 9.28 \pm 8.0 \pm 0.32$ eV which we divide by our best value $B(K_2^*(1430) \rightarrow K \pi) = (49.9 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070GY9;LINKAGE=B

$$\Gamma(J/\psi(1S) \rightarrow K^*(892)^+ K_2^*(1430)^- + c.c. \rightarrow K^*(892)^+ K_S^0 \pi^- + c.c.) \times \Gamma(J/\psi(1S) \rightarrow e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{\text{DESIG}=X10} \Gamma_{\text{DESIG}=1} / \Gamma$$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT
2.32 ± 2.00 ± 0.08	8+8	¹ LEES	14H BABR	$e^+ e^- \rightarrow \pi^+ \pi^- K_S^0 K_S^0 \gamma$

NODE=M070GZ0
NODE=M070GZ0

¹ Dividing by 1/4 to take into account $B(K^*(892) \rightarrow K_S^0 \pi) = 1/4$.

NODE=M070GZ0;LINKAGE=A

$$\Gamma(J/\psi(1S) \rightarrow \phi(1020) K_S^0 K_S^0) \times \Gamma(J/\psi(1S) \rightarrow e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{\text{DESIG}=X11} \Gamma_{\text{DESIG}=1} / \Gamma$$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT
3.27 ± 0.84 ± 0.03	29	¹ LEES	14H BABR	$e^+ e^- \rightarrow K_S^0 K_S^0 K^+ K^- \gamma$

NODE=M070GZ1
NODE=M070GZ1

¹LEES 14H reports $[\Gamma(J/\psi(1S) \rightarrow \phi(1020)K_S^0 K_S^0) \times \Gamma(J/\psi(1S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \Gamma_{\text{DESIG}=X11} \Gamma_{\text{DESIG}=1}/\Gamma \times [B(\phi(1020) \rightarrow K^+K^-)] = 1.6 \pm 0.4 \pm 0.1 \text{ eV}$ which we divide by our best value $B(\phi(1020) \rightarrow K^+K^-) = (49.0 \pm 0.5) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070GZ1;LINKAGE=A

$$\frac{\Gamma(J/\psi(1S) \rightarrow \phi(1020)f_2'(1525)) \times \Gamma(J/\psi(1S) \rightarrow e^+e^-)/\Gamma_{\text{total}}}{\Gamma_{\text{DESIG}=40} \Gamma_{\text{DESIG}=1}/\Gamma}$$

NODE=M070GZ2
NODE=M070GZ2

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
8.1±3.2±0.2	11	1,2 LEES	14H BABR	$e^+e^- \rightarrow K_S^0 K_S^0 K^+ K^- \gamma$

¹Dividing by 1/4 to take into account $B(f_2'(1525) \rightarrow K_S^0 K_S^0) = 1/4 B(f_2'(1525) \rightarrow K\bar{K})$ and using $B(\phi(1020) \rightarrow K^+K^-) = (48.9 \pm 0.5)\%$.

NODE=M070GZ2;LINKAGE=A

²LEES 14H reports $[\Gamma(J/\psi(1S) \rightarrow \phi(1020)f_2'(1525)) \times \Gamma(J/\psi(1S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \Gamma_{\text{DESIG}=40} \Gamma_{\text{DESIG}=1}/\Gamma \times [B(f_2'(1525) \rightarrow K\bar{K})] = 7.2 \pm 2.8 \pm 0.3 \text{ eV}$ which we divide by 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.

NODE=M070GZ2;LINKAGE=B

$$\frac{\Gamma(J/\psi(1S) \rightarrow \phi(1020)f_2'(1525) \rightarrow \phi(1020)K_S^0 K_S^0) \times \Gamma(J/\psi(1S) \rightarrow e^+e^-)/\Gamma_{\text{total}}}{\Gamma_{\text{DESIG}=X13} \Gamma_{\text{DESIG}=1}/\Gamma}$$

NODE=M070GZ3
NODE=M070GZ3
NODE=M070GZ3

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
1.80±0.70±0.08	11	1 LEES	14H BABR	$e^+e^- \rightarrow K_S^0 K_S^0 K^+ K^- \gamma$

¹Using $B(\phi(1020) \rightarrow K^+K^-) = (48.9 \pm 0.5)\%$.

NODE=M070GZ3;LINKAGE=A

$$\frac{\Gamma(J/\psi(1S) \rightarrow K^+K^- f_2'(1525)) \times \Gamma(J/\psi(1S) \rightarrow e^+e^-)/\Gamma_{\text{total}}}{\Gamma_{\text{DESIG}=X14} \Gamma_{\text{DESIG}=1}/\Gamma}$$

NODE=M070GZ4
NODE=M070GZ4
NODE=M070GZ4

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
5.8±1.9±0.1	16	1,2 LEES	14H BABR	$e^+e^- \rightarrow K_S^0 K_S^0 K^+ K^- \gamma$

¹Dividing by 1/4 to take into account $B(f_2'(1525) \rightarrow K_S^0 K_S^0) = 1/4 B(f_2'(1525) \rightarrow K\bar{K})$.

NODE=M070GZ4;LINKAGE=A

²LEES 14H reports $[\Gamma(J/\psi(1S) \rightarrow K^+K^- f_2'(1525)) \times \Gamma(J/\psi(1S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \Gamma_{\text{DESIG}=X14} \Gamma_{\text{DESIG}=1}/\Gamma \times [B(f_2'(1525) \rightarrow K\bar{K})] = 5.12 \pm 1.68 \pm 0.20 \text{ eV}$ which we divide by 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.

NODE=M070GZ4;LINKAGE=B

$$\frac{\Gamma(J/\psi(1S) \rightarrow K^+K^- f_2'(1525) \rightarrow K^+K^- K_S^0 K_S^0) \times \Gamma(J/\psi(1S) \rightarrow e^+e^-)/\Gamma_{\text{total}}}{\Gamma_{\text{DESIG}=X15} \Gamma_{\text{DESIG}=1}/\Gamma}$$

NODE=M070GZ5
NODE=M070GZ5

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
1.28±0.42±0.05	16	LEES	14H BABR	$e^+e^- \rightarrow K_S^0 K_S^0 K^+ K^- \gamma$

$J/\psi(1S)$ 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 $\gamma \rightarrow$ hadrons	(13.50 ± 0.30) %	DESIG=4
Γ_3 ggg	(64.1 ± 1.0) %	DESIG=249
Γ_4 γgg	(8.8 ± 1.1) %	DESIG=250
Γ_5 e^+e^-	(5.971 ± 0.032) %	DESIG=1
Γ_6 $e^+e^- \gamma$	[a] (8.8 ± 1.4) $\times 10^{-3}$	DESIG=5
Γ_7 $\mu^+\mu^-$	(5.961 ± 0.033) %	DESIG=2

Decays involving hadronic resonances

NODE=M070;CLUMP=A

Г ₈	$\rho\pi$	(1.69 ± 0.15) %	S=2.4	DESIG=20
Г ₉	$\rho^0\pi^0$	(5.6 ± 0.7) × 10 ⁻³		DESIG=21
Г ₁₀	$a_2(1320)\rho$	(1.09 ± 0.22) %		DESIG=43
Г ₁₁	$\omega\pi^+\pi^+\pi^-\pi^-$	(8.5 ± 3.4) × 10 ⁻³		DESIG=26
Г ₁₂	$\omega\pi^+\pi^-\pi^0$	(4.0 ± 0.7) × 10 ⁻³		DESIG=211
Г ₁₃	$\omega\pi^+\pi^-$	(8.6 ± 0.7) × 10 ⁻³	S=1.1	DESIG=24
Г ₁₄	$\omega f_2(1270)$	(4.3 ± 0.6) × 10 ⁻³		DESIG=28
Г ₁₅	$K^*(892)^0\bar{K}^*(892)^0$			DESIG=46
Г ₁₆	$K^*(892)^\pm K^*(892)^\mp$	(1.00 ± 0.22 / 0.40) × 10 ⁻³		DESIG=256
Г ₁₇	$K^*(892)^\pm K^*(800)^\mp$	(1.1 ± 1.0 / 0.6) × 10 ⁻³		DESIG=257
Г ₁₈	$K_S^0\pi^- K^*(892)^+ + \text{c.c.}$	(267 ± 90) %		DESIG=299
Г ₁₉	$K_S^0\pi^- K^*(892)^+ + \text{c.c.} \rightarrow K_S^0 K_S^0\pi^+\pi^-$	(67 ± 22) %		DESIG=300
Г ₂₀	$\eta K^*(892)^0\bar{K}^*(892)^0$	(1.15 ± 0.26) × 10 ⁻³		DESIG=252
Г ₂₁	$K^*(892)^0\bar{K}_2^*(1430)^0 + \text{c.c.}$			DESIG=48
Г ₂₂	$K^*(892)^+ K_2^*(1430)^- + \text{c.c.}$			DESIG=303
Г ₂₃	$K^*(892)^+ K_2^*(1430)^- + \text{c.c.} \rightarrow K^*(892)^+ K_S^0\pi^- + \text{c.c.}$	(42 ± 40) %		DESIG=304
Г ₂₄	$K^*(892)^0\bar{K}_2^*(1770)^0 + \text{c.c.} \rightarrow K^*(892)^0 K^-\pi^+ + \text{c.c.}$			DESIG=235
Г ₂₅	$\omega K^*(892)\bar{K} + \text{c.c.}$	(6.1 ± 0.9) × 10 ⁻³		DESIG=102
Г ₂₆	$K^+ K^*(892)^- + \text{c.c.}$	(5.12 ± 0.30) × 10 ⁻³		DESIG=121
Г ₂₇	$K^+ K^*(892)^- + \text{c.c.} \rightarrow K^+ K^-\pi^0$	(1.97 ± 0.20) × 10 ⁻³		DESIG=231
Г ₂₈	$K^+ K^*(892)^- + \text{c.c.} \rightarrow K^0 K^\pm\pi^\mp + \text{c.c.}$	(3.0 ± 0.4) × 10 ⁻³		DESIG=232
Г ₂₉	$K^0\bar{K}^*(892)^0 + \text{c.c.}$	(4.39 ± 0.31) × 10 ⁻³		DESIG=122
Г ₃₀	$K^0\bar{K}^*(892)^0 + \text{c.c.} \rightarrow K^0 K^\pm\pi^\mp + \text{c.c.}$	(3.2 ± 0.4) × 10 ⁻³		DESIG=233
Г ₃₁	$K_1(1400)^\pm K^\mp$	(3.8 ± 1.4) × 10 ⁻³		DESIG=132
Г ₃₂	$\bar{K}^*(892)^0 K^+\pi^- + \text{c.c.}$	seen		DESIG=214
Г ₃₃	$\omega\pi^0\pi^0$	(3.4 ± 0.8) × 10 ⁻³		DESIG=140
Г ₃₄	$b_1(1235)^\pm\pi^\mp$	[b] (3.0 ± 0.5) × 10 ⁻³		DESIG=49
Г ₃₅	$\omega K^\pm K_S^0\pi^\mp$	[b] (3.4 ± 0.5) × 10 ⁻³		DESIG=101
Г ₃₆	$b_1(1235)^0\pi^0$	(2.3 ± 0.6) × 10 ⁻³		DESIG=160
Г ₃₇	$\eta K^\pm K_S^0\pi^\mp$	[b] (2.2 ± 0.4) × 10 ⁻³		DESIG=230
Г ₃₈	$\phi K^*(892)\bar{K} + \text{c.c.}$	(2.18 ± 0.23) × 10 ⁻³		DESIG=104
Г ₃₉	$\omega K\bar{K}$	(1.70 ± 0.32) × 10 ⁻³		DESIG=27
Г ₄₀	$\omega f_0(1710) \rightarrow \omega K\bar{K}$	(4.8 ± 1.1) × 10 ⁻⁴		DESIG=130
Г ₄₁	$\phi 2(\pi^+\pi^-)$	(1.66 ± 0.23) × 10 ⁻³		DESIG=35
Г ₄₂	$\Delta(1232)^{++}\bar{p}\pi^-$	(1.6 ± 0.5) × 10 ⁻³		DESIG=70
Г ₄₃	$\omega\eta$	(1.74 ± 0.20) × 10 ⁻³	S=1.6	DESIG=30
Г ₄₄	$\phi K\bar{K}$	(1.77 ± 0.16) × 10 ⁻³	S=1.3	DESIG=36
Г ₄₅	$\phi K_S^0 K_S^0$	(59 ± 15) %		DESIG=305
Г ₄₆	$\phi f_0(1710) \rightarrow \phi K\bar{K}$	(3.6 ± 0.6) × 10 ⁻⁴		DESIG=129
Г ₄₇	$\phi K^+ K^-$			DESIG=295
Г ₄₈	$\phi f_2(1270)$			DESIG=39
Г ₄₉	$\Delta(1232)^{++}\bar{\Delta}(1232)^{--}$	(1.10 ± 0.29) × 10 ⁻³		DESIG=66
Г ₅₀	$\Sigma(1385)^-\bar{\Sigma}(1385)^+ (\text{or c.c.})$	[b] (1.16 ± 0.05) × 10 ⁻³		DESIG=67
Г ₅₁	$K^+ K^- f_2'(1525)$	(104 ± 34) %		DESIG=308
Г ₅₂	$K^+ K^- f_2'(1525) \rightarrow K^+ K^- K_S^0 K_S^0$	(23 ± 8) %		DESIG=307
Г ₅₃	$\phi f_2'(1525)$	(8 ± 4) × 10 ⁻⁴	S=2.7	DESIG=40
Г ₅₄	$\phi f_2'(1525) \rightarrow \phi K_S^0 K_S^0$	(32 ± 13) %		DESIG=306
Г ₅₅	$\phi\pi^+\pi^-$	(8.7 ± 0.9) × 10 ⁻⁴	S=1.4	DESIG=34
Г ₅₆	$\phi\pi^0\pi^0$			DESIG=76

Г ₅₇	$\phi K^\pm K_S^0 \pi^\mp$	[b] (7.2 ± 0.8) × 10 ⁻⁴	DESIG=103
Г ₅₈	$\omega f_1(1420)$	(6.8 ± 2.4) × 10 ⁻⁴	DESIG=105
Г ₅₉	$\phi \eta$	(7.5 ± 0.8) × 10 ⁻⁴ S=1.5	DESIG=37
Г ₆₀	$\Xi^0 \Xi^0$	(1.20 ± 0.24) × 10 ⁻³	DESIG=248
Г ₆₁	$\Xi(1530)^- \Xi^+$	(5.9 ± 1.5) × 10 ⁻⁴	DESIG=107
Г ₆₂	$p K^- \bar{\Sigma}(1385)^0$	(5.1 ± 3.2) × 10 ⁻⁴	DESIG=74
Г ₆₃	$\omega \pi^0$	(4.5 ± 0.5) × 10 ⁻⁴ S=1.4	DESIG=32
Г ₆₄	$\phi \eta'(958)$	(4.6 ± 0.5) × 10 ⁻⁴ S=2.2	DESIG=38
Г ₆₅	$\phi f_0(980)$	(3.2 ± 0.9) × 10 ⁻⁴ S=1.9	DESIG=41
Г ₆₆	$\phi f_0(980) \rightarrow \phi \pi^+ \pi^-$		DESIG=236
Г ₆₇	$\phi f_0(980) \rightarrow \phi \pi^0 \pi^0$		DESIG=237
Г ₆₈	$\phi \pi^0 f_0(980) \rightarrow \phi \pi^0 \pi^+ \pi^-$	(4.5 ± 1.0) × 10 ⁻⁶	DESIG=278
Г ₆₉	$\phi \pi^0 f_0(980) \rightarrow \phi \pi^0 p^0 \pi^0$	(1.7 ± 0.6) × 10 ⁻⁶	DESIG=279
Г ₇₀	$\eta \phi f_0(980) \rightarrow \eta \phi \pi^+ \pi^-$	(3.2 ± 1.0) × 10 ⁻⁴	DESIG=229
Г ₇₁	$\phi a_0(980)^0 \rightarrow \phi \eta \pi^0$	(5 ± 4) × 10 ⁻⁶	DESIG=258
Г ₇₂	$\Xi(1530)^0 \Xi^0$	(3.2 ± 1.4) × 10 ⁻⁴	DESIG=108
Г ₇₃	$\Sigma(1385)^- \bar{\Sigma}^+ \text{ (or c.c.)}$	[b] (3.1 ± 0.5) × 10 ⁻⁴	DESIG=68
Г ₇₄	$\phi f_1(1285)$	(2.6 ± 0.5) × 10 ⁻⁴	DESIG=106
Г ₇₅	$\phi f_1(1285) \rightarrow \phi \pi^0 f_0(980) \rightarrow \phi \pi^0 \pi^+ \pi^-$	(9.4 ± 2.8) × 10 ⁻⁷	DESIG=280
Г ₇₆	$\phi f_1(1285) \rightarrow \phi \pi^0 f_0(980) \rightarrow \phi \pi^0 \pi^0 \pi^0$	(2.1 ± 2.2) × 10 ⁻⁷	DESIG=281
Г ₇₇	$\eta \pi^+ \pi^-$	(4.0 ± 1.7) × 10 ⁻⁴	DESIG=239
Г ₇₈	$\eta \rho$	(1.93 ± 0.23) × 10 ⁻⁴	DESIG=22
Г ₇₉	$\omega \eta'(958)$	(1.82 ± 0.21) × 10 ⁻⁴	DESIG=31
Г ₈₀	$\omega f_0(980)$	(1.4 ± 0.5) × 10 ⁻⁴	DESIG=150
Г ₈₁	$\rho \eta'(958)$	(1.05 ± 0.18) × 10 ⁻⁴	DESIG=23
Г ₈₂	$a_2(1320)^\pm \pi^\mp$	[b] < 4.3 × 10 ⁻³ CL=90%	DESIG=42
Г ₈₃	$K \bar{K}_2^*(1430) + \text{c.c.}$	< 4.0 × 10 ⁻³ CL=90%	DESIG=45
Г ₈₄	$K_1(1270)^\pm K^\mp$	< 3.0 × 10 ⁻³ CL=90%	DESIG=131
Г ₈₅	$K_S^0 \pi^- K_2^*(1430)^+ + \text{c.c.}$	(360 ± 180) %	DESIG=301
Г ₈₆	$K_S^0 \pi^- K_2^*(1430)^+ + \text{c.c.} \rightarrow K_S^0 K_S^0 \pi^+ \pi^-$	(45 ± 22) %	DESIG=302
Г ₈₇	$K_2^*(1430)^0 \bar{K}_2^*(1430)^0$	< 2.9 × 10 ⁻³ CL=90%	DESIG=47
Г ₈₈	$\phi \pi^0$	3 × 10 ⁻⁶ or 1 × 10 ⁻⁷	DESIG=33; OUR EVAL; → UNCHECKED ←
Г ₈₉	$\phi \eta(1405) \rightarrow \phi \eta \pi^+ \pi^-$	(2.0 ± 1.0) × 10 ⁻⁵	DESIG=128
Г ₉₀	$\omega f_2'(1525)$	< 2.2 × 10 ⁻⁴ CL=90%	DESIG=29
Г ₉₁	$\omega X(1835) \rightarrow \omega p \bar{p}$	< 3.9 × 10 ⁻⁶ CL=95%	DESIG=263
Г ₉₂	$\phi X(1835) \rightarrow \phi p \bar{p}$	< 2.1 × 10 ⁻⁷ CL=90%	DESIG=291
Г ₉₃	$\phi X(1835) \rightarrow \phi \eta \pi^+ \pi^-$	< 2.8 × 10 ⁻⁴ CL=90%	DESIG=288
Г ₉₄	$\phi X(1870) \rightarrow \phi \eta \pi^+ \pi^-$	< 6.13 × 10 ⁻⁵ CL=90%	DESIG=289
Г ₉₅	$\eta \phi(2170) \rightarrow \eta \phi f_0(980) \rightarrow \eta \phi \pi^+ \pi^-$	(1.2 ± 0.4) × 10 ⁻⁴	DESIG=287
Г ₉₆	$\eta \phi(2170) \rightarrow \eta K^*(892)^0 \bar{K}^*(892)^0$	< 2.52 × 10 ⁻⁴ CL=90%	DESIG=253
Г ₉₇	$\Sigma(1385)^0 \bar{\Lambda} + \text{c.c.}$	< 8.2 × 10 ⁻⁶ CL=90%	DESIG=111
Г ₉₈	$\Delta(1232)^+ \bar{p}$	< 1 × 10 ⁻⁴ CL=90%	DESIG=112
Г ₉₉	$\Lambda(1520) \bar{\Lambda} + \text{c.c.} \rightarrow \gamma \Lambda \bar{\Lambda}$	< 4.1 × 10 ⁻⁶ CL=90%	DESIG=260
Г ₁₀₀	$\Theta(1540) \bar{\Theta}(1540) \rightarrow K_S^0 p K^- \bar{n} + \text{c.c.}$	< 1.1 × 10 ⁻⁵ CL=90%	DESIG=205
Г ₁₀₁	$\Theta(1540) K^- \bar{n} \rightarrow K_S^0 p K^- \bar{n}$	< 2.1 × 10 ⁻⁵ CL=90%	DESIG=206
Г ₁₀₂	$\Theta(1540) K_S^0 \bar{p} \rightarrow K_S^0 \bar{p} K^+ n$	< 1.6 × 10 ⁻⁵ CL=90%	DESIG=207
Г ₁₀₃	$\bar{\Theta}(1540) K^+ n \rightarrow K_S^0 \bar{p} K^+ n$	< 5.6 × 10 ⁻⁵ CL=90%	DESIG=208
Г ₁₀₄	$\bar{\Theta}(1540) K_S^0 p \rightarrow K_S^0 p K^- \bar{n}$	< 1.1 × 10 ⁻⁵ CL=90%	DESIG=209
Г ₁₀₅	$\Sigma^0 \bar{\Lambda}$	< 9 × 10 ⁻⁵ CL=90%	DESIG=110

Decays into stable hadrons

NODE=M070;CLUMP=B

Γ ₁₀₆	$2(\pi^+\pi^-)\pi^0$	(4.1 ± 0.5) %	S=2.4	DESIG=9
Γ ₁₀₇	$3(\pi^+\pi^-)\pi^0$	(2.9 ± 0.6) %		DESIG=11
Γ ₁₀₈	$\pi^+\pi^-\pi^0$	(2.11 ± 0.07) %	S=1.5	DESIG=7
Γ ₁₀₉	$\pi^+\pi^-\pi^0 K^+ K^-$	(1.79 ± 0.29) %	S=2.2	DESIG=18
Γ ₁₁₀	$4(\pi^+\pi^-)\pi^0$	(9.0 ± 3.0) × 10 ⁻³		DESIG=12
Γ ₁₁₁	$\pi^+\pi^- K^+ K^-$			DESIG=16
Γ ₁₁₂	$\pi^+\pi^- K_S^0 K_L^0$	(375 ± 60) %		DESIG=296
Γ ₁₁₃	$\pi^+\pi^- K_S^0 K_S^0$	(168 ± 19) %		DESIG=297
Γ ₁₁₄	$K^+ K^- K_S^0 K_S^0$	(41 ± 8) %		DESIG=298
Γ ₁₁₅	$\pi^+\pi^- K^+ K^- \eta$	(1.84 ± 0.28) × 10 ⁻³		DESIG=238
Γ ₁₁₆	$\pi^0 \pi^0 K^+ K^-$			DESIG=234
Γ ₁₁₇	$K \bar{K} \pi$	(6.1 ± 1.0) × 10 ⁻³		DESIG=15
Γ ₁₁₈	$2(\pi^+\pi^-)$	(3.57 ± 0.30) × 10 ⁻³		DESIG=8
Γ ₁₁₉	$3(\pi^+\pi^-)$	(4.3 ± 0.4) × 10 ⁻³		DESIG=10
Γ ₁₂₀	$2(\pi^+\pi^-\pi^0)$	(1.62 ± 0.21) %		DESIG=210
Γ ₁₂₁	$2(\pi^+\pi^-)\eta$	(2.29 ± 0.24) × 10 ⁻³		DESIG=201
Γ ₁₂₂	$3(\pi^+\pi^-)\eta$	(7.2 ± 1.5) × 10 ⁻⁴		DESIG=202
Γ ₁₂₃	$p \bar{p}$	(2.120 ± 0.029) × 10 ⁻³		DESIG=50
Γ ₁₂₄	$p \bar{p} \pi^0$	(1.19 ± 0.08) × 10 ⁻³	S=1.1	DESIG=52
Γ ₁₂₅	$p \bar{p} \pi^+ \pi^-$	(6.0 ± 0.5) × 10 ⁻³	S=1.3	DESIG=54
Γ ₁₂₆	$p \bar{p} \pi^+ \pi^- \pi^0$	[c] (2.3 ± 0.9) × 10 ⁻³	S=1.9	DESIG=55
Γ ₁₂₇	$p \bar{p} \eta$	(2.00 ± 0.12) × 10 ⁻³		DESIG=56
Γ ₁₂₈	$p \bar{p} \rho$	< 3.1 × 10 ⁻⁴	CL=90%	DESIG=57
Γ ₁₂₉	$p \bar{p} \omega$	(9.8 ± 1.0) × 10 ⁻⁴	S=1.3	DESIG=58
Γ ₁₃₀	$p \bar{p} \eta'(958)$	(2.1 ± 0.4) × 10 ⁻⁴		DESIG=59
Γ ₁₃₁	$p \bar{p} a_0(980) \rightarrow p \bar{p} \pi^0 \eta$	(6.8 ± 1.8) × 10 ⁻⁵		DESIG=276
Γ ₁₃₂	$p \bar{p} \phi$	(5.19 ± 0.33) × 10 ⁻⁵		DESIG=127
Γ ₁₃₃	$n \bar{n}$	(2.09 ± 0.16) × 10 ⁻³		DESIG=64
Γ ₁₃₄	$n \bar{n} \pi^+ \pi^-$	(4 ± 4) × 10 ⁻³		DESIG=65
Γ ₁₃₅	$\Sigma^+ \bar{\Sigma}^-$	(1.50 ± 0.24) × 10 ⁻³		DESIG=247
Γ ₁₃₆	$\Sigma^0 \bar{\Sigma}^0$	(1.29 ± 0.09) × 10 ⁻³		DESIG=63
Γ ₁₃₇	$2(\pi^+\pi^-) K^+ K^-$	(4.7 ± 0.7) × 10 ⁻³	S=1.3	DESIG=17
Γ ₁₃₈	$p \bar{n} \pi^-$	(2.12 ± 0.09) × 10 ⁻³		DESIG=53
Γ ₁₃₉	$n N(1440)$	seen		DESIG=215;OUR EST;→ UNCHECKED ←
Γ ₁₄₀	$n N(1520)$	seen		DESIG=216;OUR EST;→ UNCHECKED ←
Γ ₁₄₁	$n N(1535)$	seen		DESIG=217;OUR EST;→ UNCHECKED ←
Γ ₁₄₂	$\Xi^- \bar{\Xi}^+$	(9.7 ± 0.8) × 10 ⁻⁴	S=1.4	DESIG=62
Γ ₁₄₃	$\Lambda \bar{\Lambda}$	(1.61 ± 0.15) × 10 ⁻³	S=1.9	DESIG=60
Γ ₁₄₄	$\Lambda \bar{\Sigma}^- \pi^+$ (or c.c.)	[b] (8.3 ± 0.7) × 10 ⁻⁴	S=1.2	DESIG=71
Γ ₁₄₅	$p K^- \bar{\Lambda}$	(8.9 ± 1.6) × 10 ⁻⁴		DESIG=72
Γ ₁₄₆	$2(K^+ K^-)$	(7.4 ± 0.7) × 10 ⁻⁴		DESIG=19
Γ ₁₄₇	$p K^- \bar{\Sigma}^0$	(2.9 ± 0.8) × 10 ⁻⁴		DESIG=73
Γ ₁₄₈	$K^+ K^-$	(2.86 ± 0.21) × 10 ⁻⁴		DESIG=13
Γ ₁₄₉	$K_S^0 K_L^0$	(2.1 ± 0.4) × 10 ⁻⁴	S=3.2	DESIG=75
Γ ₁₅₀	$\Lambda \bar{\Lambda} \pi^+ \pi^-$	(4.3 ± 1.0) × 10 ⁻³		DESIG=261
Γ ₁₅₁	$\Lambda \bar{\Lambda} \eta$	(1.62 ± 0.17) × 10 ⁻⁴		DESIG=228
Γ ₁₅₂	$\Lambda \bar{\Lambda} \pi^0$	(3.8 ± 0.4) × 10 ⁻⁵		DESIG=109
Γ ₁₅₃	$\bar{\Lambda} n K_S^0 + \text{c.c.}$	(6.5 ± 1.1) × 10 ⁻⁴		DESIG=225
Γ ₁₅₄	$\pi^+ \pi^-$	(1.47 ± 0.14) × 10 ⁻⁴		DESIG=6
Γ ₁₅₅	$\Lambda \bar{\Sigma}^+ + \text{c.c.}$	(2.83 ± 0.23) × 10 ⁻⁵		DESIG=61
Γ ₁₅₆	$K_S^0 K_S^0$	< 1 × 10 ⁻⁶	CL=95%	DESIG=14

Radiative decays

NODE=M070;CLUMP=C

Γ ₁₅₇	3γ	(1.16 ± 0.22) × 10 ⁻⁵		DESIG=81
Γ ₁₅₈	4γ	< 9	× 10 ⁻⁶ CL=90%	DESIG=244
Γ ₁₅₉	5γ	< 1.5	× 10 ⁻⁵ CL=90%	DESIG=245
Γ ₁₆₀	γπ ⁰ π ⁰	(1.15 ± 0.05) × 10 ⁻³		DESIG=283
Γ ₁₆₁	γηπ ⁰	(2.14 ± 0.31) × 10 ⁻⁵		DESIG=292
Γ ₁₆₂	γa ₀ (980) ⁰ → γηπ ⁰	< 2.5	× 10 ⁻⁶ CL=95%	DESIG=293
Γ ₁₆₃	γa ₂ (1320) ⁰ → γηπ ⁰	< 6.6	× 10 ⁻⁶ CL=95%	DESIG=294
Γ ₁₆₄	γη _c (1S)	(1.7 ± 0.4) %	S=1.5	DESIG=85
Γ ₁₆₅	γη _c (1S) → 3γ	(3.8 ⁺ ₋ 1.3 _{1.0}) × 10 ⁻⁶	S=1.1	DESIG=246
Γ ₁₆₆	γπ ⁺ π ⁻ 2π ⁰	(8.3 ± 3.1) × 10 ⁻³		DESIG=99
Γ ₁₆₇	γηππ	(6.1 ± 1.0) × 10 ⁻³		DESIG=96
Γ ₁₆₈	γη ₂ (1870) → γηπ ⁺ π ⁻	(6.2 ± 2.4) × 10 ⁻⁴		DESIG=142
Γ ₁₆₉	γη(1405/1475) → γK ⁻ $\bar{K}$ ⁺ π	[d] (2.8 ± 0.6) × 10 ⁻³	S=1.6	DESIG=89
Γ ₁₇₀	γη(1405/1475) → γγρ ⁰	(7.8 ± 2.0) × 10 ⁻⁵	S=1.8	DESIG=171
Γ ₁₇₁	γη(1405/1475) → γηπ ⁺ π ⁻	(3.0 ± 0.5) × 10 ⁻⁴		DESIG=170
Γ ₁₇₂	γη(1405/1475) → γγφ	< 8.2	× 10 ⁻⁵ CL=95%	DESIG=212
Γ ₁₇₃	γρρ	(4.5 ± 0.8) × 10 ⁻³		DESIG=94
Γ ₁₇₄	γρω	< 5.4	× 10 ⁻⁴ CL=90%	DESIG=226
Γ ₁₇₅	γρφ	< 8.8	× 10 ⁻⁵ CL=90%	DESIG=227
Γ ₁₇₆	γη'(958)	(5.13 ± 0.17) × 10 ⁻³	S=1.3	DESIG=84
Γ ₁₇₇	γ2π ⁺ 2π ⁻	(2.8 ± 0.5) × 10 ⁻³	S=1.9	DESIG=95
Γ ₁₇₈	γf ₂ (1270)f ₂ (1270)	(9.5 ± 1.7) × 10 ⁻⁴		DESIG=203
Γ ₁₇₉	γf ₂ (1270)f ₂ (1270)(non resonant)	(8.2 ± 1.9) × 10 ⁻⁴		DESIG=204
Γ ₁₈₀	γK ⁺ K ⁻ π ⁺ π ⁻	(2.1 ± 0.6) × 10 ⁻³		DESIG=143
Γ ₁₈₁	γf ₄ (2050)	(2.7 ± 0.7) × 10 ⁻³		DESIG=100
Γ ₁₈₂	γωω	(1.61 ± 0.33) × 10 ⁻³		DESIG=97
Γ ₁₈₃	γη(1405/1475) → γρ ⁰ ρ ⁰	(1.7 ± 0.4) × 10 ⁻³	S=1.3	DESIG=124
Γ ₁₈₄	γf ₂ (1270)	(1.64 ± 0.12) × 10 ⁻³	S=1.3	DESIG=86
Γ ₁₈₅	γf ₀ (1370) → γK ⁻ $\bar{K}$ ⁺	(4.2 ± 1.5) × 10 ⁻⁴		DESIG=284
Γ ₁₈₆	γf ₀ (1710) → γK ⁻ $\bar{K}$ ⁺	(1.00 ⁺ ₋ 0.11 _{0.09}) × 10 ⁻³	S=1.5	DESIG=91
Γ ₁₈₇	γf ₀ (1710) → γππ	(3.8 ± 0.5) × 10 ⁻⁴		DESIG=135
Γ ₁₈₈	γf ₀ (1710) → γωω	(3.1 ± 1.0) × 10 ⁻⁴		DESIG=221
Γ ₁₈₉	γf ₀ (1710) → γηη	(2.4 ⁺ ₋ 1.2 _{0.7}) × 10 ⁻⁴		DESIG=266
Γ ₁₉₀	γη	(1.104 ± 0.034) × 10 ⁻³		DESIG=83
Γ ₁₉₁	γf ₁ (1420) → γK ⁻ $\bar{K}$ ⁺ π	(7.9 ± 1.3) × 10 ⁻⁴		DESIG=175
Γ ₁₉₂	γf ₁ (1285)	(6.1 ± 0.8) × 10 ⁻⁴		DESIG=88
Γ ₁₉₃	γf ₁ (1510) → γηπ ⁺ π ⁻	(4.5 ± 1.2) × 10 ⁻⁴		DESIG=141
Γ ₁₉₄	γf' ₂ (1525)	(5.7 ⁺ ₋ 0.8 _{0.5}) × 10 ⁻⁴	S=1.5	DESIG=87
Γ ₁₉₅	γf' ₂ (1525) → γηη	(3.4 ± 1.4) × 10 ⁻⁵		DESIG=268
Γ ₁₉₆	γf ₂ (1640) → γωω	(2.8 ± 1.8) × 10 ⁻⁴		DESIG=222
Γ ₁₉₇	γf ₂ (1910) → γωω	(2.0 ± 1.4) × 10 ⁻⁴		DESIG=223
Γ ₁₉₈	γf ₀ (1800) → γωφ	(2.5 ± 0.6) × 10 ⁻⁴		DESIG=262
Γ ₁₉₉	γf ₂ (1810) → γηη	(5.4 ⁺ ₋ 3.5 _{2.4}) × 10 ⁻⁵		DESIG=269
Γ ₂₀₀	γf ₂ (1950) → γK ⁺ (892) $\bar{K}$ ⁺ (892)	(7.0 ± 2.2) × 10 ⁻⁴		DESIG=144
Γ ₂₀₁	γK ⁺ (892) $\bar{K}$ ⁺ (892)	(4.0 ± 1.3) × 10 ⁻³		DESIG=145
Γ ₂₀₂	γφφ	(4.0 ± 1.2) × 10 ⁻⁴	S=2.1	DESIG=98
Γ ₂₀₃	γρ $\bar{\rho}$	(3.8 ± 1.0) × 10 ⁻⁴		DESIG=90
Γ ₂₀₄	γη(2225)	(3.14 ⁺ ₋ 0.50 _{0.19}) × 10 ⁻⁴		DESIG=126
Γ ₂₀₅	γη(1760) → γρ ⁰ ρ ⁰	(1.3 ± 0.9) × 10 ⁻⁴		DESIG=125
Γ ₂₀₆	γη(1760) → γωω	(1.98 ± 0.33) × 10 ⁻³		DESIG=224
Γ ₂₀₇	γX(1835) → γπ ⁺ π ⁻ η'	(2.77 ⁺ ₋ 0.34 _{0.40}) × 10 ⁻⁴	S=1.1	DESIG=213
Γ ₂₀₈	γX(1835) → γρ $\bar{\rho}$	(7.7 ⁺ ₋ 1.5 _{0.9}) × 10 ⁻⁵		DESIG=254

Γ_{209}	$\gamma X(1835) \rightarrow \gamma K_S^0 K_S^0 \eta$	$(3.3 \pm 2.0_{-1.3}) \times 10^{-5}$	DESIG=282
Γ_{210}	$\gamma X(1840) \rightarrow \gamma 3(\pi^+ \pi^-)$	$(2.4 \pm 0.7_{-0.8}) \times 10^{-5}$	DESIG=264
Γ_{211}	$\gamma(K \bar{K} \pi) [J^{PC} = 0^{-+}]$	$(7 \pm 4) \times 10^{-4}$ S=2.1	DESIG=176
Γ_{212}	$\gamma \pi^0$	$(3.49 \pm 0.33_{-0.30}) \times 10^{-5}$	DESIG=82
Γ_{213}	$\gamma p \bar{p} \pi^+ \pi^-$	$< 7.9 \times 10^{-4}$ CL=90%	DESIG=93
Γ_{214}	$\gamma \Lambda \bar{\Lambda}$	$< 1.3 \times 10^{-4}$ CL=90%	DESIG=200
Γ_{215}	$\gamma f_0(2100) \rightarrow \gamma \eta \eta$	$(1.13 \pm 0.60_{-0.30}) \times 10^{-4}$	DESIG=267
Γ_{216}	$\gamma f_0(2100) \rightarrow \gamma \pi \pi$	$(6.2 \pm 1.0) \times 10^{-4}$	DESIG=286
Γ_{217}	$\gamma f_0(2200)$		DESIG=123
Γ_{218}	$\gamma f_0(2200) \rightarrow \gamma K \bar{K}$	$(5.9 \pm 1.3) \times 10^{-4}$	DESIG=285
Γ_{219}	$\gamma f_J(2220)$		DESIG=92
Γ_{220}	$\gamma f_J(2220) \rightarrow \gamma \pi \pi$	$< 3.9 \times 10^{-5}$ CL=90%	DESIG=136
Γ_{221}	$\gamma f_J(2220) \rightarrow \gamma K \bar{K}$	$< 4.1 \times 10^{-5}$ CL=90%	DESIG=137
Γ_{222}	$\gamma f_J(2220) \rightarrow \gamma p \bar{p}$	$(1.5 \pm 0.8) \times 10^{-5}$	DESIG=138
Γ_{223}	$\gamma f_2(2340) \rightarrow \gamma \eta \eta$	$(5.6 \pm 2.4_{-2.2}) \times 10^{-5}$	DESIG=270
Γ_{224}	$\gamma f_0(1500) \rightarrow \gamma \pi \pi$	$(1.09 \pm 0.24) \times 10^{-4}$	DESIG=172
Γ_{225}	$\gamma f_0(1500) \rightarrow \gamma \eta \eta$	$(1.7 \pm 0.6_{-1.4}) \times 10^{-5}$	DESIG=265
Γ_{226}	$\gamma A \rightarrow \gamma \text{invisible}$	[e] $< 6.3 \times 10^{-6}$ CL=90%	DESIG=251
Γ_{227}	$\gamma A^0 \rightarrow \gamma \mu^+ \mu^-$	[f] $< 5 \times 10^{-6}$ CL=90%	DESIG=259
Dalitz decays			
Γ_{228}	$\pi^0 e^+ e^-$	$(7.6 \pm 1.4) \times 10^{-7}$	NODE=M070;CLUMP=G DESIG=271
Γ_{229}	$\eta e^+ e^-$	$(1.16 \pm 0.09) \times 10^{-5}$	DESIG=272
Γ_{230}	$\eta'(958) e^+ e^-$	$(5.81 \pm 0.35) \times 10^{-5}$	DESIG=273
Weak decays			
Γ_{231}	$D^- e^+ \nu_e + \text{c.c.}$	$< 1.2 \times 10^{-5}$ CL=90%	NODE=M070;CLUMP=E DESIG=218
Γ_{232}	$\bar{D}^0 e^+ e^- + \text{c.c.}$	$< 1.1 \times 10^{-5}$ CL=90%	DESIG=219
Γ_{233}	$D_s^- e^+ \nu_e + \text{c.c.}$	$< 1.3 \times 10^{-6}$ CL=90%	DESIG=220
Γ_{234}	$D_s^{*-} e^+ \nu_e + \text{c.c.}$	$< 1.8 \times 10^{-6}$ CL=90%	DESIG=290
Γ_{235}	$D^- \pi^+ + \text{c.c.}$	$< 7.5 \times 10^{-5}$ CL=90%	DESIG=241
Γ_{236}	$\bar{D}^0 \bar{K}^0 + \text{c.c.}$	$< 1.7 \times 10^{-4}$ CL=90%	DESIG=242
Γ_{237}	$\bar{D}^0 \bar{K}^{*0} + \text{c.c.}$	$< 2.5 \times 10^{-6}$ CL=90%	DESIG=275
Γ_{238}	$D_s^- \pi^+ + \text{c.c.}$	$< 1.3 \times 10^{-4}$ CL=90%	DESIG=243
Γ_{239}	$D_s^- \rho^+ + \text{c.c.}$	$< 1.3 \times 10^{-5}$ CL=90%	DESIG=274
Charge conjugation (C), Parity (P), Lepton Family number (LF) violating modes			
Γ_{240}	$\gamma \gamma$	C $< 2.7 \times 10^{-7}$ CL=90%	DESIG=80
Γ_{241}	$\gamma \phi$	C $< 1.4 \times 10^{-6}$ CL=90%	DESIG=277
Γ_{242}	$e^\pm \mu^\mp$	LF $< 1.6 \times 10^{-7}$ CL=90%	DESIG=177
Γ_{243}	$e^\pm \tau^\mp$	LF $< 8.3 \times 10^{-6}$ CL=90%	DESIG=178
Γ_{244}	$\mu^\pm \tau^\mp$	LF $< 2.0 \times 10^{-6}$ CL=90%	DESIG=179
Other decays			
Γ_{245}	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=NAO

$J/\psi(1S)$ 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. • • •				
5.58 ± 0.05 ± 0.08		¹ ABLIKIM	16Q	BES3 $e^+e^- \rightarrow \mu^+\mu^-\gamma$
5.71 ± 0.16	13k	² ADAMS	06A	CLEO $e^+e^- \rightarrow \mu^+\mu^-\gamma$
5.57 ± 0.19	7.8k	² AUBERT	04	BABR $e^+e^- \rightarrow \mu^+\mu^-\gamma$
5.14 ± 0.39		BAI	95B	BES e^+e^-
5.36 ^{+0.29} _{-0.28}		³ HSUEH	92	RVUE See Υ mini-review
4.72 ± 0.35		ALEXANDER	89	RVUE See Υ mini-review
4.4 ± 0.6		³ BRANDELIK	79C	DASP e^+e^-
4.6 ± 0.8		⁴ BALDINI-...	75	FRAG e^+e^-
4.8 ± 0.6		BOYARSKI	75	MRK1 e^+e^-
4.6 ± 1.0		ESPOSITO	75B	FRAM e^+e^-

NODE=M070W1
NODE=M070W1
→ UNCHECKED ←¹ Using $B(J/\psi \rightarrow \mu^+\mu^-) = (5.973 \pm 0.007 \pm 0.037)\%$ from ABLIKIM 13R.² Calculated by us from the reported values of $\Gamma(e^+e^-) \times B(\mu^+\mu^-)$ using $B(\mu^+\mu^-) = (5.93 \pm 0.06)\%$.³ From a simultaneous fit to e^+e^- , $\mu^+\mu^-$, and hadronic channels assuming $\Gamma(e^+e^-) = \Gamma(\mu^+\mu^-)$.⁴ Assuming equal partial widths for e^+e^- and $\mu^+\mu^-$.NODE=M070W1;LINKAGE=A
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_{240}**

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<5.4	90	BRANDELIK	79C	DASP e^+e^-

NODE=M070W70
NODE=M070W70 **$J/\psi(1S) \Gamma(i) \Gamma(e^+e^-) / \Gamma(\text{total})$**

NODE=M070225

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

 $\Gamma(\text{hadrons}) \times \Gamma(e^+e^-) / \Gamma_{\text{total}}$ **$\Gamma_1 \Gamma_5 / \Gamma$**

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 $e^+e^- \rightarrow e^+e^-$
• • • 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

$$\Gamma(\mu^+\mu^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_7\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
333 ± 4 OUR AVERAGE [334 ± 5 eV OUR 2016 AVERAGE]				
333.4 ± 2.5 ± 4.4		ABLIKIM	16Q BES3	3.773 $e^+e^- \rightarrow \mu^+\mu^-\gamma$
331.8 ± 5.2 ± 6.3		ANASHIN	10 KEDR	3.097 $e^+e^- \rightarrow \mu^+\mu^-$
338.4 ± 5.8 ± 7.1	13k	ADAMS	06A CLEO	$e^+e^- \rightarrow \mu^+\mu^-\gamma$
330.1 ± 7.7 ± 7.3	7.8k	AUBERT	04 BABR	$e^+e^- \rightarrow \mu^+\mu^-\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
510 ± 90		DASP	75 DASP	e^+e^-
380 ± 50		¹ ESPOSITO	75B FRAM	e^+e^-

¹ Data redundant with branching ratios or partial widths above.

NODE=M070G2
NODE=M070G2
NEW

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

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

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
NODE=M070G24

NODE=M070G24;LINKAGE=AU

$$\Gamma(K^*(892)^0\bar{K}_2^*(1430)^0 + \text{c.c.}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{21}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
25.8 ± 1.5 OUR AVERAGE [33 ± 4 eV OUR 2016 AVERAGE]				
25.8 ± 1.4 ± 0.6	710	^{1,2,3} LEES	12F BABR	10.6 $e^+e^- \rightarrow \pi^+\pi^-K^+K^-\gamma$

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

33 ± 4 ± 1	317	^{2,4} AUBERT	07AK BABR	10.6 $e^+e^- \rightarrow \pi^+\pi^-K^+K^-\gamma$

¹ LEES 12F reports $[\Gamma(J/\psi(1S) \rightarrow K^*(892)^0\bar{K}_2^*(1430)^0 + \text{c.c.}) \times \Gamma(J/\psi(1S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(K_2^*(1430) \rightarrow K\pi)] = 12.89 \pm 0.54 \pm 0.41$ eV which we divide by our best value $B(K_2^*(1430) \rightarrow K\pi) = (49.9 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² Dividing by 2/3 to take into account that $B(K^{*0} \rightarrow K^+\pi^-) = 2/3 B(K^{*0} \rightarrow K\pi)$.

³ The $K_2^*(1430)$ cannot be distinguished from the $K_0^*(1430)$.

⁴ Superseded by LEES 12F. AUBERT 07AK reports $[\Gamma(J/\psi(1S) \rightarrow K^*(892)^0\bar{K}_2^*(1430)^0 + \text{c.c.}) \times \Gamma(J/\psi(1S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(K_2^*(1430) \rightarrow K\pi)] = 16.4 \pm 1.1 \pm 1.4$ eV which we divide by our best value $B(K_2^*(1430) \rightarrow K\pi) = (49.9 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070G02
NODE=M070G02
NEW

NODE=M070G02;LINKAGE=A

NODE=M070G02;LINKAGE=AE

NODE=M070G02;LINKAGE=B

NODE=M070G02;LINKAGE=UB

$$\Gamma(K^*(892)^0\bar{K}_2(1770)^0 + \text{c.c.} \rightarrow K^*(892)^0 K^- \pi^+ + \text{c.c.}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{24}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
3.8 ± 0.4 ± 0.3	110 ± 14	¹ AUBERT	07AK BABR	10.6 $e^+e^- \rightarrow \pi^+\pi^-K^+K^-\gamma$

¹ Dividing by 2/3 to take into account that $B(K^{*0} \rightarrow K^+\pi^-) = 2/3$.

NODE=M070G03
NODE=M070G03

NODE=M070G03;LINKAGE=AE

$$\Gamma(K^+K^*(892)^- + \text{c.c.}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{26}\Gamma_5/\Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
29.0 ± 1.7 ± 1.3	AUBERT	08S BABR	10.6 $e^+e^- \rightarrow K^+K^*(892)^-\gamma$

NODE=M070G18
NODE=M070G18

$$\Gamma(K^+K^*(892)^- + \text{c.c.} \rightarrow K^+K^-\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{27}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
10.96 ± 0.85 ± 0.70	155	AUBERT	08S BABR	10.6 $e^+e^- \rightarrow K^+K^-\pi^0\gamma$

NODE=M070G20
NODE=M070G20

$$\Gamma(K^+K^*(892)^- + \text{c.c.} \rightarrow K^0K^\pm\pi^\mp + \text{c.c.}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{28}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
16.76 ± 1.70 ± 1.00	89	AUBERT	08S BABR	10.6 $e^+e^- \rightarrow K_S^0K^\pm\pi^\mp\gamma$

NODE=M070G21
NODE=M070G21

$$\Gamma(K^0 \bar{K}^*(892)^0 + \text{c.c.}) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{29} \Gamma_5 / \Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
26.6 ± 2.5 ± 1.5	AUBERT	08S BABR	10.6 e ⁺ e ⁻ → K ⁰ $\bar{K}^*(892)^0 \gamma$

NODE=M070G19
NODE=M070G19

$$\Gamma(K^0 \bar{K}^*(892)^0 + \text{c.c.} \rightarrow K^0 K^\pm \pi^\mp + \text{c.c.}) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{30} \Gamma_5 / \Gamma$$

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

$$\Gamma(\omega K \bar{K}) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{39} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
3.70 ± 1.98 ± 0.03	24	¹ AUBERT	07AU BABR	10.6 e ⁺ e ⁻ → ω K ⁺ K ⁻ γ

NODE=M070G29
NODE=M070G29

¹ AUBERT 07AU reports $[\Gamma(J/\psi(1S) \rightarrow \omega K \bar{K}) \times \Gamma(J/\psi(1S) \rightarrow e^+ e^-) / \Gamma_{\text{total}}] \times [B(\omega(782) \rightarrow \pi^+ \pi^- \pi^0)] = 3.3 \pm 1.3 \pm 1.2 \text{ eV}$ 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

$$\Gamma(\phi 2(\pi^+ \pi^-)) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{41} \Gamma_5 / \Gamma$$

VALUE (10 ⁻² keV)	EVTS	DOCUMENT ID	TECN	COMMENT
0.96 ± 0.19 ± 0.01	35	¹ AUBERT	06D BABR	10.6 e ⁺ e ⁻ → φ 2(π ⁺ π ⁻) γ

NODE=M070G10
NODE=M070G10

¹ AUBERT 06D reports $[\Gamma(J/\psi(1S) \rightarrow \phi 2(\pi^+ \pi^-)) \times \Gamma(J/\psi(1S) \rightarrow e^+ e^-) / \Gamma_{\text{total}}] \times [B(\phi(1020) \rightarrow K^+ K^-)] = (0.47 \pm 0.09 \pm 0.03) \times 10^{-2} \text{ keV}$ which we divide by our best value $B(\phi(1020) \rightarrow K^+ K^-) = (49.0 \pm 0.5) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070G10;LINKAGE=AU

$$\Gamma(\phi K^+ K^-) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{47} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
4.61 ± 0.62 ± 0.05	163 ± 19	¹ LEES	12F BABR	BABR 10.6 e ⁺ e ⁻ → K ⁺ K ⁻ K ⁺ K ⁻ γ

NODE=M070G09
NODE=M070G09

¹ LEES 12F reports $[\Gamma(J/\psi(1S) \rightarrow \phi K^+ K^-) \times \Gamma(J/\psi(1S) \rightarrow e^+ e^-) / \Gamma_{\text{total}}] \times [B(\phi(1020) \rightarrow K^+ K^-)] = 2.26 \pm 0.26 \pm 0.16 \text{ eV}$ which we divide by our best value $B(\phi(1020) \rightarrow K^+ K^-) = (49.0 \pm 0.5) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070G09;LINKAGE=A

$$\Gamma(\phi \pi^+ \pi^-) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{55} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
4.49 ± 0.35 OUR AVERAGE				

NODE=M070G14
NODE=M070G14
NEW

4.47 ± 0.49 ± 0.04	181 ± 19	¹ LEES	12F BABR	10.6 e ⁺ e ⁻ → K ⁺ K ⁻ π ⁺ π ⁻ γ
4.52 ± 0.48 ± 0.04	254 ± 23	² SHEN	09 BELL	10.6 e ⁺ e ⁻ → K ⁺ K ⁻ π ⁺ π ⁻ γ

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

5.3 ± 0.7 ± 0.1	103	³ AUBERT, BE 06D	BABR	10.6 e ⁺ e ⁻ → K ⁺ K ⁻ π ⁺ π ⁻ γ

¹ LEES 12F reports $[\Gamma(J/\psi(1S) \rightarrow \phi \pi^+ \pi^-) \times \Gamma(J/\psi(1S) \rightarrow e^+ e^-) / \Gamma_{\text{total}}] \times [B(\phi(1020) \rightarrow K^+ K^-)] = 2.19 \pm 0.23 \pm 0.07 \text{ eV}$ which we divide by our best value $B(\phi(1020) \rightarrow K^+ K^-) = (49.0 \pm 0.5) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070G14;LINKAGE=B

² SHEN 09 reports 4.50 ± 0.41 ± 0.26 eV from a measurement of $[\Gamma(J/\psi(1S) \rightarrow \phi \pi^+ \pi^-) \times \Gamma(J/\psi(1S) \rightarrow e^+ e^-) / \Gamma_{\text{total}}] \times [B(\phi(1020) \rightarrow K^+ K^-)]$ assuming $B(\phi(1020) \rightarrow K^+ K^-) = (49.2 \pm 0.6) \times 10^{-2}$, which we rescale to our best value $B(\phi(1020) \rightarrow K^+ K^-) = (49.0 \pm 0.5) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070G14;LINKAGE=SH

³ Superseded by LEES 12F. AUBERT, BE 06D reports $[\Gamma(J/\psi(1S) \rightarrow \phi \pi^+ \pi^-) \times \Gamma(J/\psi(1S) \rightarrow e^+ e^-) / \Gamma_{\text{total}}] \times [B(\phi(1020) \rightarrow K^+ K^-)] = 2.61 \pm 0.30 \pm 0.18 \text{ eV}$ which we divide by our best value $B(\phi(1020) \rightarrow K^+ K^-) = (49.0 \pm 0.5) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070G14;LINKAGE=AU

$$\Gamma(\phi \pi^0 \pi^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{56} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
2.8 ± 0.6 OUR AVERAGE				[3.1 ± 0.9 eV OUR 2016 AVERAGE]

NODE=M070G15
NODE=M070G15

2.78 ± 0.57 ± 0.03	45 ± 9	¹ LEES	12F BABR	10.6 e ⁺ e ⁻ → K ⁺ K ⁻ π ⁰ π ⁰ γ

NEW

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

3.14 ± 0.88 ± 0.03	23	² AUBERT, BE 06D	BABR	10.6 e ⁺ e ⁻ → K ⁺ K ⁻ π ⁰ π ⁰ γ

¹ LEES 12F reports $[\Gamma(J/\psi(1S) \rightarrow \phi\pi^0\pi^0) \times \Gamma(J/\psi(1S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\phi(1020) \rightarrow K^+K^-)] = 1.36 \pm 0.27 \pm 0.07 \text{ eV}$ which we divide by our best value $B(\phi(1020) \rightarrow K^+K^-) = (49.0 \pm 0.5) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070G15;LINKAGE=A

² Superseded by LEES 12F. AUBERT, BE 06D reports $[\Gamma(J/\psi(1S) \rightarrow \phi\pi^0\pi^0) \times \Gamma(J/\psi(1S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\phi(1020) \rightarrow K^+K^-)] = 1.54 \pm 0.40 \pm 0.16 \text{ eV}$ which we divide by our best value $B(\phi(1020) \rightarrow K^+K^-) = (49.0 \pm 0.5) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070G15;LINKAGE=AU

$\Gamma(\phi\eta) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$		$\Gamma_{59}\Gamma_5/\Gamma$		
VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
6.1±2.7±0.4	6	¹ AUBERT	07AU BABR	10.6 $e^+e^- \rightarrow \phi\eta\gamma$

NODE=M070G28
NODE=M070G28

¹ AUBERT 07AU quotes $\Gamma_{ee}^{J/\psi} \cdot B(J/\psi \rightarrow \phi\eta) \cdot B(\phi \rightarrow K^+K^-) \cdot B(\eta \rightarrow 3\pi) = 0.84 \pm 0.37 \pm 0.05 \text{ eV}$.

NODE=M070G28;LINKAGE=AU

$\Gamma(\phi f_0(980) \rightarrow \phi\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$		$\Gamma_{66}\Gamma_5/\Gamma$		
VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
1.44±0.19 OUR AVERAGE				

NODE=M070G05
NODE=M070G05
NEW

[1.21 ± 0.23 eV OUR 2016 AVERAGE Scale factor = 1.2]

1.41±0.25±0.01 57 ± 9 ¹ LEES 12F BABR 10.6 $e^+e^- \rightarrow \pi^+\pi^-K^+K^-\gamma$
1.48±0.27±0.09 60 ± 11 ² SHEN 09 BELL 10.6 $e^+e^- \rightarrow K^+K^-\pi^+\pi^-\gamma$

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

1.02±0.24±0.01 20 ± 5 ³ AUBERT 07AK BABR 10.6 $e^+e^- \rightarrow \pi^+\pi^-K^+K^-\gamma$

NODE=M070G05;LINKAGE=A

¹ LEES 12F reports $[\Gamma(J/\psi(1S) \rightarrow \phi f_0(980) \rightarrow \phi\pi^+\pi^-) \times \Gamma(J/\psi(1S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\phi(1020) \rightarrow K^+K^-)] = 0.69 \pm 0.11 \pm 0.05 \text{ eV}$ which we divide by our best value $B(\phi(1020) \rightarrow K^+K^-) = (49.0 \pm 0.5) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² Multiplied by 2/3 to take into account the $\phi\pi^+\pi^-$ mode only. Using $B(\phi \rightarrow K^+K^-) = (49.2 \pm 0.6)\%$.

NODE=M070G05;LINKAGE=SH

³ Superseded by LEES 12F. AUBERT 07AK reports $[\Gamma(J/\psi(1S) \rightarrow \phi f_0(980) \rightarrow \phi\pi^+\pi^-) \times \Gamma(J/\psi(1S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\phi(1020) \rightarrow K^+K^-)] = 0.50 \pm 0.11 \pm 0.04 \text{ eV}$ which we divide by our best value $B(\phi(1020) \rightarrow K^+K^-) = (49.0 \pm 0.5) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070G05;LINKAGE=UB

$\Gamma(\phi f_0(980) \rightarrow \phi\pi^0\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$		$\Gamma_{67}\Gamma_5/\Gamma$		
VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
0.98±0.27 OUR AVERAGE				

NODE=M070G06
NODE=M070G06
NEW

0.98±0.27±0.01 16 ± 4 ¹ LEES 12F BABR 10.6 $e^+e^- \rightarrow \pi^0\pi^0K^+K^-\gamma$

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

0.96±0.40±0.01 7.0 ± 2.8 ² AUBERT 07AK BABR 10.6 $e^+e^- \rightarrow \pi^0\pi^0K^+K^-\gamma$

NODE=M070G06;LINKAGE=A

¹ LEES 12F reports $[\Gamma(J/\psi(1S) \rightarrow \phi f_0(980) \rightarrow \phi\pi^0\pi^0) \times \Gamma(J/\psi(1S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\phi(1020) \rightarrow K^+K^-)] = 0.48 \pm 0.12 \pm 0.05 \text{ eV}$ which we divide by our best value $B(\phi(1020) \rightarrow K^+K^-) = (49.0 \pm 0.5) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² Superseded by LEES 12F. AUBERT 07AK reports $[\Gamma(J/\psi(1S) \rightarrow \phi f_0(980) \rightarrow \phi\pi^0\pi^0) \times \Gamma(J/\psi(1S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\phi(1020) \rightarrow K^+K^-)] = 0.47 \pm 0.19 \pm 0.05 \text{ eV}$ which we divide by our best value $B(\phi(1020) \rightarrow K^+K^-) = (49.0 \pm 0.5) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070G06;LINKAGE=UB

$\Gamma(\eta\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$		$\Gamma_{77}\Gamma_5/\Gamma$		
VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
2.23±0.97±0.03	9	¹ AUBERT	07AU BABR	10.6 $e^+e^- \rightarrow \eta\pi^+\pi^-\gamma$

NODE=M070G25
NODE=M070G25

¹ AUBERT 07AU reports $[\Gamma(J/\psi(1S) \rightarrow \eta\pi^+\pi^-) \times \Gamma(J/\psi(1S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\eta \rightarrow \pi^+\pi^-\pi^0)] = 0.51 \pm 0.22 \pm 0.03 \text{ eV}$ 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

$\Gamma(K^*(892)^0\bar{K}^*(892)^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$		$\Gamma_{15}\Gamma_5/\Gamma$		
VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
1.28±0.35 OUR AVERAGE				

NODE=M070G01
NODE=M070G01
NEW

1.28±0.34±0.07 47 ± 12 ¹ LEES 12F BABR 10.6 $e^+e^- \rightarrow \pi^+\pi^-K^+K^-\gamma$

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

1.28±0.40±0.11 25 ± 8 ^{1,2} AUBERT 07AK BABR 10.6 $e^+e^- \rightarrow \pi^+\pi^-K^+K^-\gamma$

¹ Dividing by $(2/3)^2$ to take twice into account that $B(K^{*0} \rightarrow K^+ \pi^-) = 2/3 B(K^{*0} \rightarrow K \pi)$.

² Superseded by LEES 12F.

$\Gamma(\phi f_2(1270)) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}}$ $\Gamma_{48}\Gamma_5/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
1.79±0.32 OUR AVERAGE		[4.0 ± 0.7 eV OUR 2016 AVERAGE]		

1.79±0.32^{+0.02}_{-0.06}	61 ± 10	^{1,2,3} LEES	12F BABR	10.6 $e^+ e^- \rightarrow \pi^+ \pi^- K^+ K^- \gamma$

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

4.08±0.73 ^{+0.04} _{-0.14}	44 ± 7	^{2,4} AUBERT	07AK BABR	10.6 $e^+ e^- \rightarrow \pi^+ \pi^- K^+ K^- \gamma$

¹ LEES 12F reports $[\Gamma(J/\psi(1S) \rightarrow \phi f_2(1270)) \times \Gamma(J/\psi(1S) \rightarrow e^+ e^-)/\Gamma_{\text{total}}] \times [B(f_2(1270) \rightarrow \pi\pi)] = 1.51 \pm 0.25 \pm 0.10$ eV which we divide by our best value $B(f_2(1270) \rightarrow \pi\pi) = (84.2^{+2.9}_{-0.9}) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² Using $B(\phi \rightarrow K^+ K^-) = (48.9 \pm 0.5)\%$.

³ Using $\pi^+ \pi^-$ invariant mass between 1.1 and 1.5 GeV. May include other sources such as $f_0(1370)$.

⁴ Superseded by LEES 12F. AUBERT 07AK reports $[\Gamma(J/\psi(1S) \rightarrow \phi f_2(1270)) \times \Gamma(J/\psi(1S) \rightarrow e^+ e^-)/\Gamma_{\text{total}}] \times [B(f_2(1270) \rightarrow \pi\pi)] = 3.44 \pm 0.55 \pm 0.28$ eV which we divide by our best value $B(f_2(1270) \rightarrow \pi\pi) = (84.2^{+2.9}_{-0.9}) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(2(\pi^+ \pi^-) \pi^0) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}}$ $\Gamma_{106}\Gamma_5/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
303±5±18	4990	AUBERT	07AU BABR	10.6 $e^+ e^- \rightarrow 2(\pi^+ \pi^-) \pi^0 \gamma$

$\Gamma(\pi^+ \pi^- \pi^0) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}}$ $\Gamma_{108}\Gamma_5/\Gamma$

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
0.122±0.005±0.008	AUBERT,B	04N BABR	10.6 $e^+ e^- \rightarrow \pi^+ \pi^- \pi^0 \gamma$

$\Gamma(\pi^+ \pi^- \pi^0 K^+ K^-) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}}$ $\Gamma_{109}\Gamma_5/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
107.0±4.3±6.4	768	AUBERT	07AU BABR	10.6 $e^+ e^- \rightarrow K^+ K^- \pi^+ \pi^- \pi^0 \gamma$

$\Gamma(\pi^+ \pi^- K^+ K^-) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}}$ $\Gamma_{111}\Gamma_5/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
37.9 ±1.4 OUR AVERAGE		[36.3 ± 2.5 eV OUR 2016 AVERAGE]		

37.94±0.81±1.10	3.1k	LEES	12F BABR	10.6 $e^+ e^- \rightarrow \pi^+ \pi^- K^+ K^- \gamma$

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

36.3 ±1.3 ±2.1	1.5k	¹ AUBERT	07AK BABR	10.6 $e^+ e^- \rightarrow \pi^+ \pi^- K^+ K^- \gamma$

33.6 ±2.7 ±2.7	233	² AUBERT	05D BABR	10.6 $e^+ e^- \rightarrow K^+ K^- \pi^+ \pi^- \gamma$

¹ Superseded by LEES 12F.

² Superseded by AUBERT 07AK.

$\Gamma(\pi^+ \pi^- K^+ K^- \eta) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}}$ $\Gamma_{115}\Gamma_5/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
25.9±3.9±0.1	73	¹ AUBERT	07AU BABR	10.6 $e^+ e^- \rightarrow K^+ K^- \pi^+ \pi^- \eta \gamma$

¹ AUBERT 07AU reports $[\Gamma(J/\psi(1S) \rightarrow \pi^+ \pi^- K^+ K^- \eta) \times \Gamma(J/\psi(1S) \rightarrow e^+ e^-)/\Gamma_{\text{total}}] \times [B(\eta \rightarrow 2\gamma)] = 10.2 \pm 1.3 \pm 0.8$ eV which we divide by our best value $B(\eta \rightarrow 2\gamma) = (39.41 \pm 0.20) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(\pi^0 \pi^0 K^+ K^-) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}}$ $\Gamma_{116}\Gamma_5/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
11.8 ±1.2 OUR AVERAGE		[13.6 ± 1.7 eV OUR 2016 AVERAGE]		

11.75±0.81±0.90	388	LEES	12F BABR	10.6 $e^+ e^- \rightarrow \pi^0 \pi^0 K^+ K^- \gamma$

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

13.6 ±1.1 ±1.3	203	¹ AUBERT	07AK BABR	10.6 $e^+ e^- \rightarrow \pi^0 \pi^0 K^+ K^- \gamma$

¹ Superseded by LEES 12F.

NODE=M070G01;LINKAGE=AE

NODE=M070G01;LINKAGE=A

NODE=M070G07

NODE=M070G07

NEW

NODE=M070G07;LINKAGE=A

NODE=M070G07;LINKAGE=AE

NODE=M070G07;LINKAGE=B

NODE=M070G07;LINKAGE=UB

NODE=M070G23

NODE=M070G23

NODE=M070G5

NODE=M070G5

NODE=M070G27

NODE=M070G27

NODE=M070G12

NODE=M070G12

NEW

OCCUR=2

NODE=M070G12;LINKAGE=B

NODE=M070G12;LINKAGE=AU

NODE=M070G30

NODE=M070G30

NODE=M070G30;LINKAGE=AU

NODE=M070G04

NODE=M070G04

NEW

NODE=M070G04;LINKAGE=A

$$\Gamma(2(\pi^+\pi^-)) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{118}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
20.4±0.9±0.4		LEES	12E	BABR 10.6 $e^+e^- \rightarrow 2\pi^+2\pi^-\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
19.5±1.4±1.3	270	¹ AUBERT	05D	BABR 10.6 $e^+e^- \rightarrow 2(\pi^+\pi^-)\gamma$
¹ Superseded by LEES 12E.				

NODE=M070G11
NODE=M070G11

NODE=M070G11;LINKAGE=AU

$$\Gamma(3(\pi^+\pi^-)) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{119}\Gamma_5/\Gamma$$

VALUE (10 ⁻² keV)	EVTS	DOCUMENT ID	TECN	COMMENT
2.37±0.16±0.14	496	AUBERT	06D	BABR 10.6 $e^+e^- \rightarrow 3(\pi^+\pi^-)\gamma$

NODE=M070G6
NODE=M070G6

$$\Gamma(2(\pi^+\pi^-\pi^0)) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{120}\Gamma_5/\Gamma$$

VALUE (10 ⁻² keV)	EVTS	DOCUMENT ID	TECN	COMMENT
8.9±0.5±1.0	761	AUBERT	06D	BABR 10.6 $e^+e^- \rightarrow 2(\pi^+\pi^-\pi^0)\gamma$

NODE=M070G7
NODE=M070G7

$$\Gamma(2(\pi^+\pi^-\eta)) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{121}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
13.1±2.4±0.1	85	¹ AUBERT	07AU	BABR 10.6 $e^+e^- \rightarrow 2(\pi^+\pi^-\eta)\gamma$

NODE=M070G26
NODE=M070G26

¹ AUBERT 07AU reports $[\Gamma(J/\psi(1S) \rightarrow 2(\pi^+\pi^-\eta)) \times \Gamma(J/\psi(1S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\eta \rightarrow 2\gamma)] = 5.16 \pm 0.85 \pm 0.39$ eV which we divide by our best value $B(\eta \rightarrow 2\gamma) = (39.41 \pm 0.20) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070G26;LINKAGE=AU

$$\Gamma(p\bar{p}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{123}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
11.9±0.6 OUR AVERAGE		Error includes scale factor of 1.8. See the ideogram below. [11.9 ± 0.5 eV OUR 2016 AVERAGE Scale factor = 1.4]		

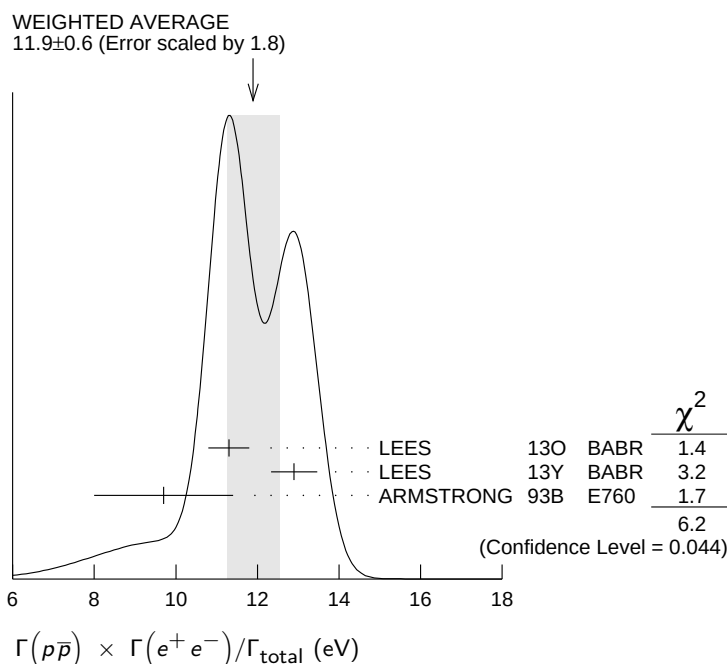
NODE=M070G4
NODE=M070G4
NEW

11.3±0.4±0.3	821	¹ LEES	13O	BABR $e^+e^- \rightarrow p\bar{p}\gamma$
12.9±0.4±0.4	918	² LEES	13Y	BABR $e^+e^- \rightarrow p\bar{p}\gamma$
9.7±1.7		³ ARMSTRONG	93B	E760 $\bar{p}p \rightarrow e^+e^-$
12.0±0.6±0.5	438	⁴ AUBERT	06B	BABR $e^+e^- \rightarrow p\bar{p}\gamma$

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

- ¹ ISR photon reconstructed in the detector
² ISR photon undetected
³ Using $\Gamma_{\text{total}} = 85.5^{+6.1}_{-5.8}$ MeV.
⁴ Superseded by LEES 13O

NODE=M070G4;LINKAGE=B
 NODE=M070G4;LINKAGE=C
 NODE=M070G;LINKAGE=A
 NODE=M070G4;LINKAGE=A



$$\Gamma(\Sigma^0\bar{\Sigma}^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{136}\Gamma_5/\Gamma$$

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

$$\Gamma(2(\pi^+\pi^-)K^+K^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{137}\Gamma_5/\Gamma$$

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

$$\Gamma(\Lambda\bar{\Lambda}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{143}\Gamma_5/\Gamma$$

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

$$\Gamma(2(K^+K^-)) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{146}\Gamma_5/\Gamma$$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT
4.0 ±0.4 OUR AVERAGE				[4.1 ± 0.5 eV OUR 2016 AVERAGE]

NODE=M070G13
NODE=M070G13
NEW

4.00±0.33±0.29 287 ± 24 LEES 12F BABR 10.6 $e^+e^- \rightarrow 2(K^+K^-)\gamma$

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

4.11±0.39±0.30 156 ± 15 ¹ AUBERT 07AK BABR 10.6 $e^+e^- \rightarrow 2(K^+K^-)\gamma$

4.0 ±0.7 ±0.6 38 ² AUBERT 05D BABR 10.6 $e^+e^- \rightarrow 2(K^+K^-)\gamma$

¹ Superseded by LEES 12F.

² Superseded by AUBERT 07AK.

NODE=M070G13;LINKAGE=A
NODE=M070G13;LINKAGE=AU

$$\Gamma(K^+K^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{148}\Gamma_5/\Gamma$$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT

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

1.78±0.11±0.05 462 ¹ LEES 15J BABR $e^+e^- \rightarrow K^+K^-\gamma$

1.94±0.11±0.05 462 ² LEES 15J BABR $e^+e^- \rightarrow K^+K^-\gamma$

1.42±0.23±0.08 51 ³ LEES 13Q BABR $e^+e^- \rightarrow K^+K^-\gamma$

¹ $\sin\phi > 0$.

² $\sin\phi < 0$.

³ Interference with non-resonant K^+K^- production not taken into account.

NODE=M070G08
NODE=M070G08

OCCUR=2

NODE=M070G08;LINKAGE=A
NODE=M070G08;LINKAGE=B
NODE=M070G08;LINKAGE=BA

$J/\psi(1S)$ BRANCHING RATIOS

NODE=M070230

For the first four branching ratios, see also the partial widths, and (partial widths) $\times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ above.

NODE=M070300

$$\Gamma(\text{hadrons})/\Gamma_{\text{total}} \quad \Gamma_1/\Gamma$$

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 $\psi(2S) \rightarrow \pi^+\pi^-\gamma + \text{hadrons}$

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 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	BESSON	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
5.971±0.032 OUR AVERAGE				
5.983±0.007±0.037	720k	ABLIKIM	13R	BES3 $\psi(2S) \rightarrow J/\psi \pi^+ \pi^-$
5.945±0.067±0.042	15k	LI	05C	CLEO $\psi(2S) \rightarrow J/\psi \pi^+ \pi^-$
5.90 ±0.05 ±0.10		BAI	98D	BES $\psi(2S) \rightarrow J/\psi \pi^+ \pi^-$
6.09 ±0.33		BAI	95B	BES $e^+ e^-$
5.92 ±0.15 ±0.20		COFFMAN	92	MRK3 $\psi(2S) \rightarrow J/\psi \pi^+ \pi^-$
6.9 ±0.9		BOYARSKI	75	MRK1 $e^+ e^-$

 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
5.961±0.033 OUR AVERAGE				
5.973±0.007±0.038	770k	ABLIKIM	13R	BES3 $\psi(2S) \rightarrow J/\psi \pi^+ \pi^-$
5.960±0.065±0.050	17k	LI	05C	CLEO $\psi(2S) \rightarrow J/\psi \pi^+ \pi^-$
5.84 ±0.06 ±0.10		BAI	98D	BES $\psi(2S) \rightarrow J/\psi \pi^+ \pi^-$
6.08 ±0.33		BAI	95B	BES $e^+ e^-$
5.90 ±0.15 ±0.19		COFFMAN	92	MRK3 $\psi(2S) \rightarrow J/\psi \pi^+ \pi^-$
6.9 ±0.9		BOYARSKI	75	MRK1 $e^+ e^-$

 Γ_7/Γ

NODE=M070R2
 NODE=M070R2

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

VALUE	DOCUMENT ID	TECN	COMMENT
1.0016±0.0031 OUR AVERAGE			
1.0022±0.0044±0.0048	¹ AULCHENKO 14	KEDR	3.097 $e^+ e^- \rightarrow e^+ e^-, \mu^+ \mu^-$
1.0017±0.0017±0.0033	² ABLIKIM 13R	BES3	$\psi(2S) \rightarrow J/\psi \pi^+ \pi^-$
1.002 ±0.021 ±0.013	³ ANASHIN 10	KEDR	3.097 $e^+ e^- \rightarrow e^+ e^-, \mu^+ \mu^-$
0.997 ±0.012 ±0.006	LI 05C	CLEO	$\psi(2S) \rightarrow J/\psi \pi^+ \pi^-$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
1.011 ±0.013 ±0.016	BAI 98D	BES	$\psi(2S) \rightarrow J/\psi \pi^+ \pi^-$
1.00 ±0.07	BAI 95B	BES	$e^+ e^-$
1.00 ±0.05	BOYARSKI 75	MRK1	$e^+ e^-$
0.91 ±0.15	ESPOSITO 75B	FRAM	$e^+ e^-$
0.93 ±0.10	FORD 75	SPEC	$e^+ e^-$

 Γ_5/Γ_7

NODE=M070R5
 NODE=M070R5

¹ From 235.3k $J/\psi \rightarrow e^+ e^-$ and 156.6k $J/\psi \rightarrow \mu^+ \mu^-$ observed events.

² Not independent of the corresponding measurements of $\Gamma(e^+ e^-)/\Gamma_{\text{total}}$ and $\Gamma(\mu^+ \mu^-)/\Gamma_{\text{total}}$.

³ Not independent of the corresponding measurements of $\Gamma(e^+ e^-) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}}$ and $\Gamma(\mu^+ \mu^-) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}}$.

NODE=M070R5;LINKAGE=A
 NODE=M070R5;LINKAGE=AB

NODE=M070R5;LINKAGE=AN

HADRONS 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

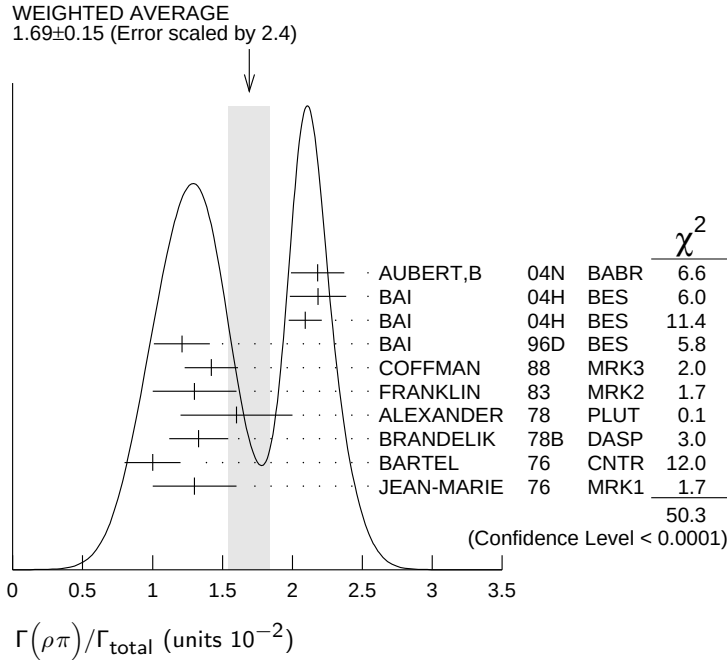
NODE=M070R20
 NODE=M070R20

OCCUR=2

NODE=M070305

- 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



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

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_9/Γ_8
$0.328 \pm 0.005 \pm 0.027$	COFFMAN	88	MRK3 e^+e^-	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.35 ± 0.08	ALEXANDER	78	PLUT e^+e^-	
0.32 ± 0.08	BRANDELIK	78B	DASP e^+e^-	
0.39 ± 0.11	BARTEL	76	CNTR e^+e^-	
0.37 ± 0.09	JEAN-MARIE	76	MRK1 e^+e^-	

NODE=M070R21
 NODE=M070R21

$\Gamma(a_2(1320)\rho)/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_{10}/Γ
10.9 ± 2.2 OUR AVERAGE					
$11.7 \pm 0.7 \pm 2.5$	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
$0.40 \pm 0.06 \pm 0.04$	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.	
$9.7 \pm 0.6 \pm 0.6$	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

$\Gamma(\omega f_2(1270))/\Gamma_{\text{total}}$ Γ_{14}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
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 $e^+e^- \rightarrow \pi^+\pi^- K^+ K^- \gamma$
<5	90		VANNUCCI	77 MRK1	$e^+e^- \rightarrow \pi^+\pi^- K^+ K^-$

NODE=M070R46
NODE=M070R46

¹ Superseded by LEES 12F. 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

 $\Gamma(K^*(892)^\pm K^*(892)^\mp)/\Gamma_{\text{total}}$ Γ_{16}/Γ

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<1700	90	0.7±5	1	LEES	14H BABR $e^+e^- \rightarrow \pi^+\pi^- K_S^0 K_S^0 \gamma$
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

¹ Using $\Gamma(J/\psi(1S) \rightarrow e^+e^-) = 5.5 \pm 0.14 \pm 0.02$ keV.

NODE=M070S73;LINKAGE=A

 $\Gamma(K^*(892)^\pm K^*(800)^\mp)/\Gamma_{\text{total}}$ 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_{20}/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_{21}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
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 $e^+e^- \rightarrow \pi^+\pi^- K^+ K^-$

NODE=M070R48
NODE=M070R48

¹ Using $B(K_2^*(1430)^0 \rightarrow K\pi) = (49.9 \pm 1.2)\%$.

² Superseded by LEES 12F. 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=A
NODE=M070R48;LINKAGE=BE

 $\Gamma(K^*(892)^+ K_2^*(1430)^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{22}/Γ

VALUE	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<7.8	90	8±8	1	LEES	14H BABR $e^+e^- \rightarrow \pi^+\pi^- K_S^0 K_S^0 \gamma$

NODE=M070P11
NODE=M070P11

¹ Using $\Gamma(J/\psi(1S) \rightarrow e^+e^-) = 5.5 \pm 0.14 \pm 0.02$ keV.

NODE=M070P11;LINKAGE=A

 $\Gamma(K^*(892)^+ K_2^*(1430)^- + \text{c.c.} \rightarrow K^*(892)^+ K_S^0 \pi^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{23}/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.42±0.36±0.01	8	1,2	LEES	14H BABR $e^+e^- \rightarrow \pi^+\pi^- K_S^0 K_S^0 \gamma$

NODE=M070P12
NODE=M070P12

¹ Dividing by 1/4 to take into account $B(K^*(892) \rightarrow K_S^0 \pi) = 1/4$.

² LEES 14H reports $[\Gamma(J/\psi(1S) \rightarrow K^*(892)^+ K_2^*(1430)^- + \text{c.c.} \rightarrow K^*(892)^+ K_S^0 \pi^- + \text{c.c.})/\Gamma_{\text{total}}] \times [\Gamma(J/\psi(1S) \rightarrow e^+e^-)] = 2.32 \pm 2.00 \pm 0.08$ 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=M070P12;LINKAGE=A
NODE=M070P12;LINKAGE=B

$\Gamma(\omega K^*(892) \bar{K} + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{25}/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

 $\Gamma(K^+ K^*(892)^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{26}/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 $[\Gamma(J/\psi(1S) \rightarrow K^+ K^*(892)^- + \text{c.c.})/\Gamma_{\text{total}}] \times [\Gamma(J/\psi(1S) \rightarrow e^+ e^-)] = (29.0 \pm 1.7 \pm 1.3) \times 10^{-3}$ 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

 $\Gamma(K^+ K^*(892)^- + \text{c.c.} \rightarrow K^+ K^- \pi^0)/\Gamma_{\text{total}}$ Γ_{27}/Γ

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
1.97 ± 0.20 ± 0.05	155	¹ AUBERT	08S BABR	$10.6 e^+ e^- \rightarrow K^+ K^- \pi^0 \gamma$

NODE=M070R09
 NODE=M070R09

¹ AUBERT 08S reports $[\Gamma(J/\psi(1S) \rightarrow K^+ K^*(892)^- + \text{c.c.} \rightarrow K^+ K^- \pi^0)/\Gamma_{\text{total}}] \times [\Gamma(J/\psi(1S) \rightarrow e^+ e^-)] = (10.96 \pm 0.85 \pm 0.70) \times 10^{-3}$ 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;LINKAGE=AU

 $\Gamma(K^+ K^*(892)^- + \text{c.c.} \rightarrow K^0 K^\pm \pi^\mp + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{28}/Γ

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
3.0 ± 0.4 ± 0.1	89	¹ AUBERT	08S BABR	$10.6 e^+ e^- \rightarrow K_S^0 K^\pm \pi^\mp \gamma$

NODE=M070S58
 NODE=M070S58

¹ AUBERT 08S reports $[\Gamma(J/\psi(1S) \rightarrow K^+ K^*(892)^- + \text{c.c.} \rightarrow K^0 K^\pm \pi^\mp + \text{c.c.})/\Gamma_{\text{total}}] \times [\Gamma(J/\psi(1S) \rightarrow e^+ e^-)] = (16.76 \pm 1.70 \pm 1.00) \times 10^{-3}$ 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;LINKAGE=AU

 $\Gamma(K_S^0 \pi^- K^*(892)^+ + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{18}/Γ

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
2.7 ± 0.9 ± 0.1	53	^{1,2} LEES	14H BABR	$e^+ e^- \rightarrow \pi^+ \pi^- K_S^0 K_S^0 \gamma$

NODE=M070P07
 NODE=M070P07

¹ Dividing by 1/4 to take into account $B(K^*(892) \rightarrow K_S^0 \pi) = 1/4$.

² LEES 14H reports $[\Gamma(J/\psi(1S) \rightarrow K_S^0 \pi^- K^*(892)^+ + \text{c.c.})/\Gamma_{\text{total}}] \times [\Gamma(J/\psi(1S) \rightarrow e^+ e^-)] = 14.8 \pm 4.8 \pm 1.2$ 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=M070P07;LINKAGE=A

NODE=M070P07;LINKAGE=B

 $\Gamma(K_S^0 \pi^- K^*(892)^+ + \text{c.c.} \rightarrow K_S^0 K_S^0 \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{19}/Γ

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
0.67 ± 0.22 ± 0.02	53	¹ LEES	14H BABR	$e^+ e^- \rightarrow \pi^+ \pi^- K_S^0 K_S^0 \gamma$

NODE=M070P08
 NODE=M070P08

¹ LEES 14H reports $[\Gamma(J/\psi(1S) \rightarrow K_S^0 \pi^- K^*(892)^+ + \text{c.c.} \rightarrow K_S^0 K_S^0 \pi^+ \pi^-)/\Gamma_{\text{total}}] \times [\Gamma(J/\psi(1S) \rightarrow e^+ e^-)] = 3.7 \pm 1.2 \pm 0.3$ 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=M070P08;LINKAGE=A

$\Gamma(K^0 \bar{K}^*(892)^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{29}/Γ

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

 $\Gamma(K^0 \bar{K}^*(892)^0 + \text{c.c.})/\Gamma(K^+ K^*(892)^- + \text{c.c.})$ Γ_{29}/Γ_{26}

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

 $\Gamma(K^0 \bar{K}^*(892)^0 + \text{c.c.} \rightarrow K^0 K^\pm \pi^\mp + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{30}/Γ

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 $[\Gamma(J/\psi(1S) \rightarrow K^0 \bar{K}^*(892)^0 + \text{c.c.} \rightarrow K^0 K^\pm \pi^\mp + \text{c.c.})/\Gamma_{\text{total}}] \times [\Gamma(J/\psi(1S) \rightarrow e^+ e^-)] = (17.70 \pm 1.70 \pm 1.00) \times 10^{-3}$ 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

 $\Gamma(K_1(1400)^\pm K^\mp)/\Gamma_{\text{total}}$ Γ_{31}/Γ

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

 $\Gamma(\bar{K}^*(892)^0 K^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{32}/Γ

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

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

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

 $\Gamma(b_1(1235)^\pm \pi^\mp)/\Gamma_{\text{total}}$ Γ_{34}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
30±5 OUR AVERAGE				
31±6	4600	AUGUSTIN	89 DM2	$J/\psi \rightarrow 2(\pi^+ \pi^-) \pi^0$
29±7	87	BURMESTER	77D PLUT	$e^+ e^-$

NODE=M070R49
NODE=M070R49

 $\Gamma(\omega K^\pm K_S^0 \pi^\mp)/\Gamma_{\text{total}}$ Γ_{35}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
34 ±5 OUR AVERAGE				
37.7±0.8±5.8	1972 ± 41	ABLIKIM	08E BES2	$e^+ e^- \rightarrow J/\psi$
29.5±1.4±7.0	879 ± 41	BECKER	87 MRK3	$e^+ e^- \rightarrow \text{hadrons}$

NODE=M070S1
NODE=M070S1

 $\Gamma(b_1(1235)^0 \pi^0)/\Gamma_{\text{total}}$ Γ_{36}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
23±3±5	229	AUGUSTIN	89 DM2	$e^+ e^-$

NODE=M070S28
NODE=M070S28

 $\Gamma(\eta K^\pm K_S^0 \pi^\mp)/\Gamma_{\text{total}}$ Γ_{37}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
21.8±2.2±3.4	232 ± 23	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_{38}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
21.8±2.3 OUR AVERAGE				
20.8±2.7±3.9	195 ± 25	ABLIKIM	08E BES2	$J/\psi \rightarrow \phi K_S^0 K^\pm \pi^\mp$
29.6±3.7±4.7	238 ± 30	ABLIKIM	08E BES2	$J/\psi \rightarrow \phi K^+ K^- \pi^0$
20.7±2.4±3.0		FALVARD	88 DM2	$J/\psi \rightarrow \text{hadrons}$
20 ±3 ±3	155 ± 20	BECKER	87 MRK3	$e^+ e^- \rightarrow \text{hadrons}$

NODE=M070S4
 NODE=M070S4

OCCUR=2

 $\Gamma(\omega K \bar{K})/\Gamma_{\text{total}}$ Γ_{39}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
17.0± 3.2 OUR AVERAGE				
13.6± 5.0±1.0	24	¹ AUBERT	07AU BABR	10.6 $e^+ e^- \rightarrow \omega K^+ K^- \gamma$
19.8± 2.1±3.9		² FALVARD	88 DM2	$J/\psi \rightarrow \text{hadrons}$
16 ±10	22	FELDMAN	77 MRK1	$e^+ e^-$

NODE=M070R27
 NODE=M070R27

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;LINKAGE=AU
 NODE=M070R27;LINKAGE=B

 $\Gamma(\omega f_0(1710) \rightarrow \omega K \bar{K})/\Gamma_{\text{total}}$ Γ_{40}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
4.8±1.1±0.3	^{1,2} FALVARD	88 DM2	$J/\psi \rightarrow \text{hadrons}$

NODE=M070S25
 NODE=M070S25

¹ Includes unknown branching fraction $f_0(1710) \rightarrow K \bar{K}$.

² Addition of $f_0(1710) \rightarrow K^+ K^-$ and $f_0(1710) \rightarrow K^0 \bar{K}^0$ branching ratios.

NODE=M070S25;LINKAGE=F
 NODE=M070S25;LINKAGE=G

 $\Gamma(\phi 2(\pi^+ \pi^-))/\Gamma_{\text{total}}$ Γ_{41}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
16.6±2.3 OUR AVERAGE				
17.3±3.3±1.2	35	¹ AUBERT	06D BABR	10.6 $e^+ e^- \rightarrow \phi 2(\pi^+ \pi^-) \gamma$
16.0±1.0±3.0		FALVARD	88 DM2	$J/\psi \rightarrow \text{hadrons}$

NODE=M070R35
 NODE=M070R35

¹ Using $\Gamma(J/\psi \rightarrow e^+ e^-) = 5.52 \pm 0.14 \pm 0.04 \text{ keV}$.

NODE=M070R35;LINKAGE=EE

 $\Gamma(\Delta(1232)^{++} \bar{p} \pi^-)/\Gamma_{\text{total}}$ Γ_{42}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.58±0.23±0.40	332	EATON	84 MRK2	$e^+ e^-$

NODE=M070R70
 NODE=M070R70

 $\Gamma(\omega \eta)/\Gamma_{\text{total}}$ Γ_{43}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.74 ±0.20 OUR AVERAGE				
2.352±0.273	5k	Error includes scale factor of 1.6. See the ideogram below.		
1.44 ±0.40 ±0.14	13	¹ ABLIKIM	06F BES2	$J/\psi \rightarrow \omega \eta$
1.43 ±0.10 ±0.21	378	² AUBERT	06D BABR	10.6 $e^+ e^- \rightarrow \omega \eta \gamma$
		JOUSSET	90 DM2	$J/\psi \rightarrow \text{hadrons}$
1.71 ±0.08 ±0.20		COFFMAN	88 MRK3	$e^+ e^- \rightarrow 3\pi \eta$

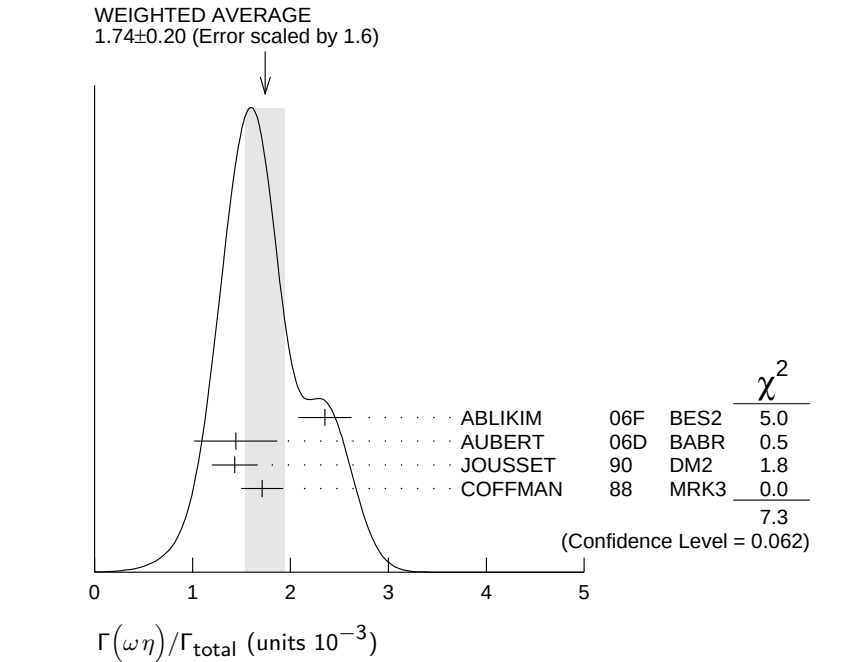
NODE=M070R30
 NODE=M070R30

¹ Using $B(\eta \rightarrow 2\gamma) = (39.43 \pm 0.26)\%$, $B(\eta \rightarrow \pi^+ \pi^- \pi^0) = 22.6 \pm 0.4\%$, $B(\eta \rightarrow \pi^+ \pi^- \gamma) = 4.68 \pm 0.11\%$, and $B(\omega \rightarrow \pi^+ \pi^- \pi^0) = (89.1 \pm 0.7)\%$.

NODE=M070R30;LINKAGE=BL

² Using $\Gamma(J/\psi \rightarrow e^+ e^-) = 5.52 \pm 0.14 \pm 0.04 \text{ keV}$.

NODE=M070R30;LINKAGE=EE

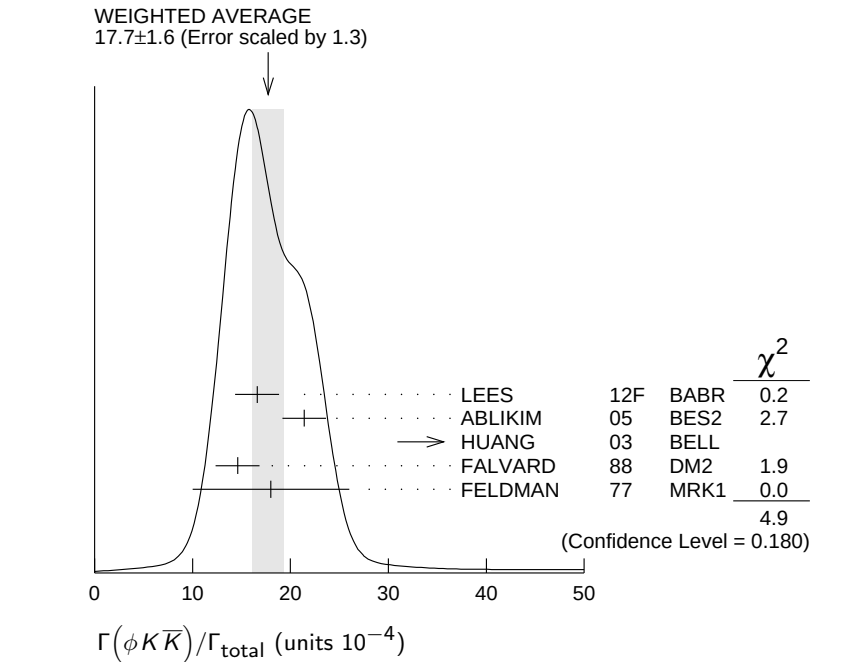


$\Gamma(\phi K \bar{K})/\Gamma_{\text{total}}$					Γ_{44}/Γ
VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT	
17.7± 1.6 OUR AVERAGE Error includes scale factor of 1.3. See the ideogram below. [(18.3 ± 2.4) × 10 ⁻⁴ OUR 2016 AVERAGE Scale factor = 1.5]					
16.6 ± 1.9 ± 1.2	163 ± 19	LEES	12F BABR	10.6 e ⁺ e ⁻ → 2(K ⁺ K ⁻)γ	
21.4 ± 0.4 ± 2.2		ABLIKIM	05 BES2	J/ψ → φπ ⁺ π ⁻	
48 ⁺²⁰ ₋₁₆ ± 6	9.0 ^{+3.7} _{-3.0}	1,2 HUANG	03 BELL	B ⁺ → (φK ⁺ K ⁻) K ⁺	
14.6 ± 0.8 ± 2.1		3 FALVARD	88 DM2	J/ψ → hadrons	
18 ± 8	14	FELDMAN	77 MRK1	e ⁺ e ⁻	

¹We have multiplied K⁺K⁻ measurement by 2 to obtain K⁰ $\bar{K}^0$.
²Using B(B⁺ → J/ψ K⁺) = (1.01 ± 0.05) × 10⁻³.
³Addition of φK⁺K⁻ and φK⁰ $\bar{K}^0$ branching ratios.

NODE=M070R36
NODE=M070R36
NEW

NODE=M070R36;LINKAGE=AA
NODE=M070R36;LINKAGE=CC
NODE=M070R36;LINKAGE=A



$\Gamma(\phi K_S^0 K_S^0)/\Gamma_{\text{total}}$				Γ_{45}/Γ	
VALUE	EVTs	DOCUMENT ID	TECN	COMMENT	
0.59±0.15±0.02	29	1,2 LEES	14H BABR	e ⁺ e ⁻ → π ⁺ π ⁻ K _S ⁰ K _S ⁰ γ	

NODE=M070P13
NODE=M070P13

¹ Using $B(\phi(1020) \rightarrow K^+ K^-) = (48.9 \pm 0.5)\%$.

² LEES 14H reports $[\Gamma(J/\psi(1S) \rightarrow \phi K_S^0 K_S^0)/\Gamma_{\text{total}}] \times [\Gamma(J/\psi(1S) \rightarrow e^+ e^-)] = 3.27 \pm 0.82 \pm 0.20$ 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.

$\Gamma(\phi f_0(1710) \rightarrow \phi K \bar{K})/\Gamma_{\text{total}}$ Γ_{46}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
3.6 ± 0.2 ± 0.6	^{1,2} FALVARD	88 DM2	$J/\psi \rightarrow \text{hadrons}$

¹ Including interference with $f_2'(1525)$.

² Includes unknown branching fraction $f_0(1710) \rightarrow K \bar{K}$.

NODE=M070P13;LINKAGE=A

NODE=M070P13;LINKAGE=B

NODE=M070S24

NODE=M070S24

NODE=M070S24;LINKAGE=D

NODE=M070S24;LINKAGE=E

$\Gamma(\phi f_2(1270))/\Gamma_{\text{total}}$ Γ_{48}/Γ

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

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

$0.72 \pm 0.13 \pm 0.02$	44 ± 7	^{1,2} AUBERT	07AK BABR	10.6	$e^+ e^- \rightarrow \pi^+ \pi^- K^+ K^- \gamma$
< 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 Superseded by LEES 12F. 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_{49}/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_{50}/Γ

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

1.16 ± 0.05 OUR AVERAGE

$[(1.10 \pm 0.12) \times 10^{-3}]$ OUR 2016 AVERAGE]

$1.096 \pm 0.012 \pm 0.071$	43K	ABLIKIM	16L BES3	$J/\psi \rightarrow \Sigma(1385)^- \bar{\Sigma}(1385)^+$
$1.258 \pm 0.014 \pm 0.078$	53k	ABLIKIM	16L BES3	$J/\psi \rightarrow \Sigma(1385)^+ \bar{\Sigma}(1385)^-$
$1.23 \pm 0.07 \pm 0.30$	0.8k	ABLIKIM	12P BES2	$J/\psi \rightarrow \Sigma(1385)^- \bar{\Sigma}(1385)^+$
$1.50 \pm 0.08 \pm 0.38$	1k	ABLIKIM	12P BES2	$J/\psi \rightarrow \Sigma(1385)^+ \bar{\Sigma}(1385)^-$
$1.00 \pm 0.04 \pm 0.21$	0.6k	HENRARD	87 DM2	$e^+ e^- \rightarrow \Sigma^{*-}$
$1.19 \pm 0.04 \pm 0.25$	0.7k	HENRARD	87 DM2	$e^+ e^- \rightarrow \Sigma^{*+}$
$0.86 \pm 0.18 \pm 0.22$	56	EATON	84 MRK2	$e^+ e^- \rightarrow \Sigma^{*-}$
$1.03 \pm 0.24 \pm 0.25$	68	EATON	84 MRK2	$e^+ e^- \rightarrow \Sigma^{*+}$

NODE=M070R67

NODE=M070R67

NEW

OCCUR=2

OCCUR=2

OCCUR=2

OCCUR=2

$\Gamma(\phi f_2'(1525))/\Gamma_{\text{total}}$ Γ_{53}/Γ

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

8 ± 4 OUR AVERAGE Error includes scale factor of 2.7.

14631 ± 5679 ± 373	11	^{1,2} LEES	14H BABR	$e^+ e^- \rightarrow K_S^0 K_S^0 K^+ K^- \gamma$
$12.3 \pm 0.6 \pm 2.0$	2.0	^{3,4} FALVARD	88 DM2	$J/\psi \rightarrow \text{hadrons}$
4.8 ± 1.8	46	³ GIDAL	81 MRK2	$J/\psi \rightarrow K^+ K^- K^+ K^-$

¹ Dividing by 1/4 to take into account $B(f_2'(1525) \rightarrow K_S^0 K_S^0) = 1/4 B(f_2'(1525) \rightarrow K \bar{K})$ and using $B(\phi(1020) \rightarrow K^+ K^-) = (48.9 \pm 0.5)\%$ and $B(f_2'(1525) \rightarrow K \bar{K}) = (88.7 \pm 2.2)\%$.

² LEES 14H reports $[\Gamma(J/\psi(1S) \rightarrow \phi f_2'(1525))/\Gamma_{\text{total}}] \times [\Gamma(J/\psi(1S) \rightarrow e^+ e^-)] = 8.12 \pm 3.13 \pm 0.37$ 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.

³ Re-evaluated using $B(f_2'(1525) \rightarrow K \bar{K}) = 0.713$.

⁴ Including interference with $f_0(1710)$.

NODE=M070R40

NODE=M070R40

NODE=M070R40;LINKAGE=A

NODE=M070R40;LINKAGE=E

NODE=M070R40;LINKAGE=B

NODE=M070R40;LINKAGE=C

$\Gamma(\phi f_2'(1525) \rightarrow \phi K_S^0 K_S^0)/\Gamma_{\text{total}}$ Γ_{54}/Γ

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
0.32±0.13±0.01	11	1,2 LEES	14H BABR	$e^+e^- \rightarrow K_S^0 K_S^0 K^+ K^- \gamma$

NODE=M070P14
 NODE=M070P14

¹ Using $B(\phi(1020) \rightarrow K^+ K^-) = (48.9 \pm 0.5)\%$.

² LEES 14H reports $[\Gamma(J/\psi(1S) \rightarrow \phi f_2'(1525) \rightarrow \phi K_S^0 K_S^0)/\Gamma_{\text{total}}] \times [\Gamma(J/\psi(1S) \rightarrow e^+ e^-)] = 1.80 \pm 0.70 \pm 0.08$ 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=M070P14;LINKAGE=A
 NODE=M070P14;LINKAGE=B

 $\Gamma(\phi \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{55}/Γ

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
0.87±0.09 OUR AVERAGE		Error includes scale factor of 1.4. See the ideogram below. $[(0.94 \pm 0.09) \times 10^{-3}]$ OUR 2016 AVERAGE Scale factor = 1.2		

NODE=M070R34
 NODE=M070R34

NEW

0.81±0.08±0.03	181±19	LEES	12F 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^-

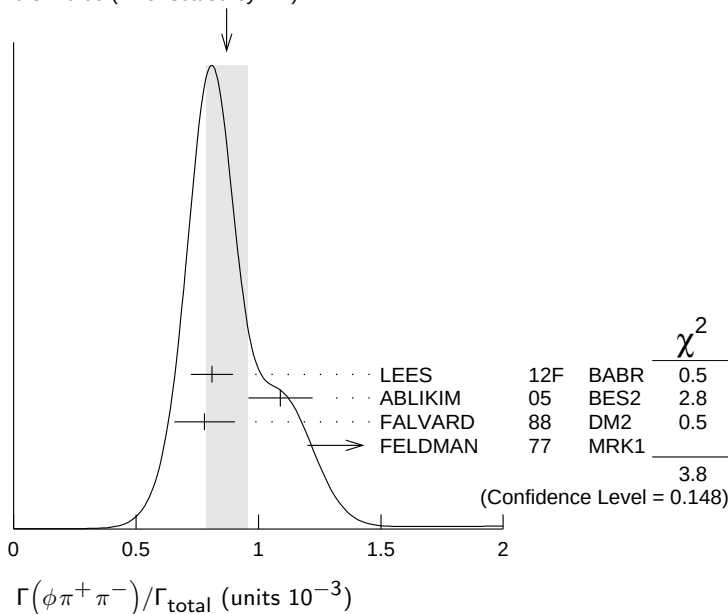
• • • We do not use the following data for averages, fits, limits, etc. • • •

0.96±0.13	103	¹ AUBERT,BE	06D BABR	10.6 $e^+e^- \rightarrow K^+ K^- \pi^+ \pi^- \gamma$

¹ Superseded by LEES 12F. 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;LINKAGE=AU

WEIGHTED AVERAGE
 0.87±0.09 (Error scaled by 1.4)

 $\Gamma(\phi \pi^0 \pi^0)/\Gamma_{\text{total}}$ Γ_{56}/Γ

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

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

0.56±0.16	23	¹ AUBERT,BE	06D BABR	10.6 $e^+e^- \rightarrow K^+ K^- \pi^0 \pi^0 \gamma$

¹ Superseded by LEES 12F. 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_{57}/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_{58}/Γ

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

6.8^{+1.9}_{-1.6}±1.7	111 ⁺³¹ ₋₂₆	BECKER	87 MRK3	$e^+e^- \rightarrow \text{hadrons}$

NODE=M070S5
 NODE=M070S5

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

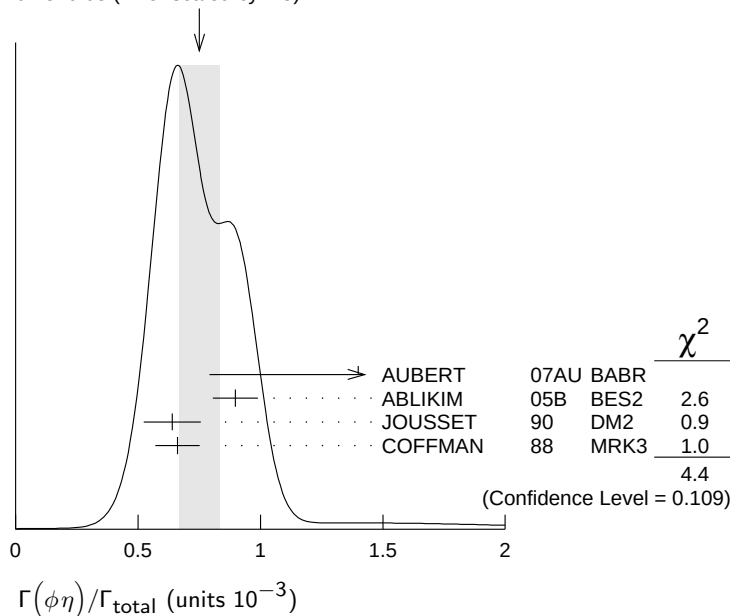
MRK3

 $e^+e^- \rightarrow K^+K^-\eta$
¹ AUBERT 07AU quotes $\Gamma_{ee}^{J/\psi} \cdot B(J/\psi \rightarrow \phi\eta) \cdot B(\phi \rightarrow K^+K^-) \cdot B(\eta \rightarrow \gamma\gamma) = 0.84 \pm 0.37 \pm 0.05 \text{ eV}$.
 Γ_{59}/Γ

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_{60}/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_{61}/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_{62}/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

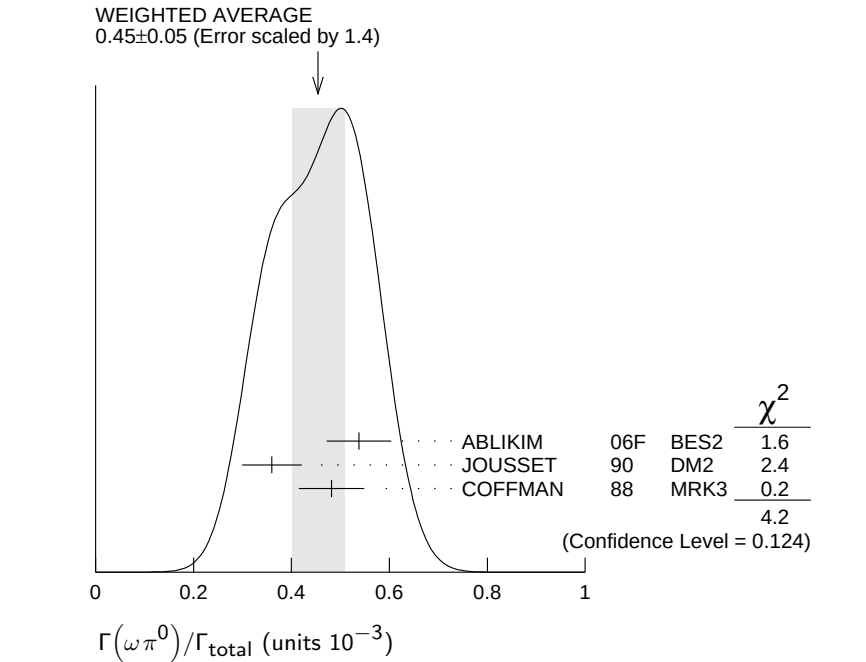
MRK3

 $e^+e^- \rightarrow \pi^0\pi^+\pi^-\pi^0$
¹ Using $B(\omega \rightarrow \pi^+\pi^-\pi^0) = (89.1 \pm 0.7)\%$.
 Γ_{63}/Γ

NODE=M070R32

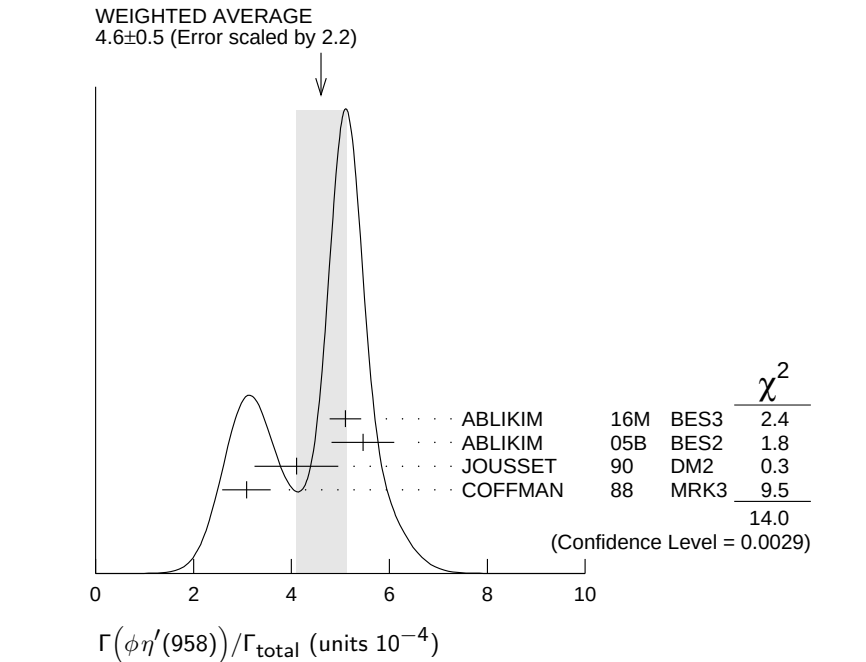
NODE=M070R32

NODE=M070R32;LINKAGE=BL



$\Gamma(\phi\eta'(958))/\Gamma_{\text{total}}$						Γ_{64}/Γ
<u>VALUE (units 10^{-4})</u>	<u>CL%</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
4.6 $\pm$0.5 OUR AVERAGE Error includes scale factor of 2.2. See the ideogram below.						
[(0.40 $\pm$ 0.07) $\times 10^{-3}$ OUR 2016 AVERAGE Scale factor = 2.1]						
5.10 $\pm$ 0.03 $\pm$ 0.32		31k	ABLIKIM	16M	BES3	$e^+e^- \rightarrow J/\psi \rightarrow \text{hadrons}$
5.46 $\pm$ 0.31 $\pm$ 0.56			ABLIKIM	05B	BES2	$e^+e^- \rightarrow J/\psi \rightarrow \text{hadrons}$
4.1 $\pm$ 0.3 $\pm$ 0.8		167	JOUSSET	90	DM2	$J/\psi \rightarrow \text{hadrons}$
3.08 $\pm$ 0.34 $\pm$ 0.36			COFFMAN	88	MRK3	$e^+e^- \rightarrow K^+K^-\eta'$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●						
< 13		90	VANNUCCI	77	MRK1	e^+e^-

NODE=M070R38
NODE=M070R38
NEW



$\Gamma(\phi f_0(980))/\Gamma_{\text{total}}$					Γ_{65}/Γ
<i>VALUE (units 10^{-4})</i>	<i>EVTS</i>	<i>DOCUMENT ID</i>	<i>TECN</i>	<i>COMMENT</i>	
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

$\Gamma(\phi f_0(980) \rightarrow \phi \pi^+ \pi^-) / \Gamma_{\text{total}}$ Γ_{66} / Γ

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

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

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 Superseded by LEES 12F. 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_{67} / Γ

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

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

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 Superseded by LEES 12F. 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

$\Gamma(\phi \pi^0 f_0(980) \rightarrow \phi \pi^0 \pi^+ \pi^-) / \Gamma_{\text{total}}$ Γ_{68} / Γ

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

4.50 ± 0.80 ± 0.61 355 ABLIKIM 15P BES3 $J/\psi \rightarrow K^+ K^- 3\pi$

NODE=M070S97
NODE=M070S97

$\Gamma(\phi \pi^0 f_0(980) \rightarrow \phi \pi^0 \rho^0 \pi^0) / \Gamma_{\text{total}}$ Γ_{69} / Γ

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

1.67 ± 0.50 ± 0.24 70 ABLIKIM 15P BESE $J/\psi \rightarrow K^+ K^- 3\pi$

NODE=M070S98
NODE=M070S98

$\Gamma(\eta \phi f_0(980) \rightarrow \eta \phi \pi^+ \pi^-) / \Gamma_{\text{total}}$ Γ_{70} / 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_{71} / 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_{72} / 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_{73} / 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_{74} / Γ

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

2.6 ± 0.5 OUR AVERAGE

3.4 ± 1.8 ± 1.5 1.1k ¹ ABLIKIM 15H BES3 $e^+ e^- \rightarrow J/\psi \rightarrow \phi \eta \pi^+ \pi^-$

3.2 ± 0.6 ± 0.4 JOUSSET 90 DM2 $J/\psi \rightarrow \phi 2(\pi^+ \pi^-)$

2.1 ± 0.5 ± 0.4 25 ² JOUSSET 90 DM2 $J/\psi \rightarrow \phi \eta \pi^+ \pi^-$

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

0.6 ± 0.2 ± 0.1 16 BECKER 87 MRK3 $J/\psi \rightarrow \phi K \bar{K} \pi$

NODE=M070S6
NODE=M070S6

OCCUR=2

¹ ABLIKIM 15H reports $[\Gamma(J/\psi(1S) \rightarrow \phi f_1(1285))/\Gamma_{\text{total}}] \times [B(f_1(1285) \rightarrow \eta \pi^+ \pi^-)] = (1.20 \pm 0.6 \pm 0.14) \times 10^{-4}$ which we divide by our best value $B(f_1(1285) \rightarrow \eta \pi^+ \pi^-) = (35 \pm 15) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² We attribute to the $f_1(1285)$ the signal observed in the $\pi^+ \pi^- \eta$ invariant mass distribution at 1297 MeV.

$\Gamma(\phi f_1(1285) \rightarrow \phi \pi^0 f_0(980) \rightarrow \phi \pi^0 \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{75}/Γ

VALUE (units 10^{-7})	EVTs	DOCUMENT ID	TECN	COMMENT
9.36 ± 2.31 ± 1.54	78	ABLIKIM	15P BES3	$J/\psi \rightarrow K^+ K^- 3\pi$

NODE=M070S6;LINKAGE=A

NODE=M070S6;LINKAGE=Q

NODE=M070S99
NODE=M070S99

$\Gamma(\phi f_1(1285) \rightarrow \phi \pi^0 f_0(980) \rightarrow \phi \pi^0 \pi^0 \pi^0)/\Gamma_{\text{total}}$ Γ_{76}/Γ

VALUE (units 10^{-7})	EVTs	DOCUMENT ID	TECN	COMMENT
2.08 ± 1.63 ± 1.47	9	ABLIKIM	15P BES3	$J/\psi \rightarrow K^+ K^- 3\pi$

NODE=M070S00
NODE=M070S00

$\Gamma(\eta \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{77}/Γ

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
0.40 ± 0.17 ± 0.03	9	¹ AUBERT	07AU BABR	$10.6 e^+ e^- \rightarrow \eta \pi^+ \pi^- \gamma$

NODE=M070S05
NODE=M070S05

¹ AUBERT 07AU quotes $\Gamma_{ee}^{J/\psi} \cdot B(J/\psi \rightarrow \eta \pi^+ \pi^-) \cdot B(\eta \rightarrow 3\pi) = 0.51 \pm 0.22 \pm 0.03 \text{ eV}$.

NODE=M070S05;LINKAGE=AU

$\Gamma(\eta \rho)/\Gamma_{\text{total}}$ Γ_{78}/Γ

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
0.193 ± 0.023 OUR AVERAGE				
0.194 ± 0.017 ± 0.029	299	JOUSSET	90 DM2	$J/\psi \rightarrow \text{hadrons}$
0.193 ± 0.013 ± 0.029		COFFMAN	88 MRK3	$e^+ e^- \rightarrow \pi^+ \pi^- \eta$

NODE=M070R22
NODE=M070R22

$\Gamma(\omega \eta'(958))/\Gamma_{\text{total}}$ Γ_{79}/Γ

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 $^{+0.10}_{-0.08} \pm 0.03$	6	JOUSSET	90 DM2	$J/\psi \rightarrow \text{hadrons}$
0.166 ± 0.017 ± 0.019		COFFMAN	88 MRK3	$e^+ e^- \rightarrow 3\pi \eta'$

NODE=M070R31
NODE=M070R31

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;LINKAGE=BL

$\Gamma(\omega f_0(980))/\Gamma_{\text{total}}$ Γ_{80}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
1.41 ± 0.27 ± 0.47	¹ AUGUSTIN	89 DM2	$J/\psi \rightarrow 2(\pi^+ \pi^-) \pi^0$

NODE=M070S27
NODE=M070S27

¹ Assuming $B(f_0(980) \rightarrow \pi\pi) = 0.78$.

NODE=M070S27;LINKAGE=K

$\Gamma(\rho \eta'(958))/\Gamma_{\text{total}}$ Γ_{81}/Γ

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

$\Gamma(a_2(1320)^\pm \pi^\mp)/\Gamma_{\text{total}}$ Γ_{82}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<43	90	BRAUNSCH...	76 DASP	$e^+ e^-$

NODE=M070R42
NODE=M070R42

$\Gamma(K_S^0 \pi^- K_2^*(1430)^+ + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{85}/Γ

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
3.6 ± 1.8 ± 0.1	35	^{1,2} LEES	14H BABR	$e^+ e^- \rightarrow \pi^+ \pi^- K_S^0 K_S^0 \gamma$

NODE=M070P09
NODE=M070P09

¹ Dividing by 1/4 to take into account $B(K^*(1430) \rightarrow K_S^0 \pi) = 1/4 B(K_2^*(1430) \rightarrow K\pi)$ and using $B(K_2^*(1430) \rightarrow K\pi) = (49.9 \pm 1.2)\%$.

NODE=M070P09;LINKAGE=A

² LEES 14H reports $[\Gamma(J/\psi(1S) \rightarrow K_S^0 \pi^- K_2^*(1430)^+ + \text{c.c.})/\Gamma_{\text{total}}] \times [\Gamma(J/\psi(1S) \rightarrow e^+ e^-)] = 20 \pm 9.6 \pm 1.7 \text{ keV}$ 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=M070P09;LINKAGE=B

$$\Gamma(K_S^0 \pi^- K_2^*(1430)^+ + \text{c.c.} \rightarrow K_S^0 K_S^0 \pi^+ \pi^-) / \Gamma_{\text{total}} \quad \Gamma_{86}/\Gamma$$

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
0.45±0.22±0.01	35	¹ LEES	14H BABR	$e^+e^- \rightarrow \pi^+\pi^- K_S^0 K_S^0 \gamma$

NODE=M070P10
NODE=M070P10

¹ LEES 14H reports $[\Gamma(J/\psi(1S) \rightarrow K_S^0 \pi^- K_2^*(1430)^+ + \text{c.c.} \rightarrow K_S^0 K_S^0 \pi^+ \pi^-) / \Gamma_{\text{total}}] \times [\Gamma(J/\psi(1S) \rightarrow e^+e^-)] = 2.5 \pm 1.2 \pm 0.2 \text{ keV}$ 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=M070P10;LINKAGE=A

$$\Gamma(K \bar{K}_2^*(1430) + \text{c.c.}) / \Gamma_{\text{total}} \quad \Gamma_{83}/\Gamma$$

VALUE (units 10 ⁻⁴)	CL%	DOCUMENT ID	TECN	COMMENT
<40	90	VANNUCCI	77 MRK1	$e^+e^- \rightarrow K^0 \bar{K}_2^{*0}$

NODE=M070R45
NODE=M070R45

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

<66	90	BRAUNSCH...	76 DASP	$e^+e^- \rightarrow K^\pm \bar{K}_2^{*\mp}$

$$\Gamma(K_1(1270)^\pm K^\mp) / \Gamma_{\text{total}} \quad \Gamma_{84}/\Gamma$$

VALUE (units 10 ⁻³)	CL%	DOCUMENT ID	TECN	COMMENT
<3.0	90	¹ BAI	99C BES	e^+e^-

NODE=M070S34
NODE=M070S34

¹ Assuming $B(K_1(1270) \rightarrow K \rho) = 0.42 \pm 0.06$

NODE=M070S34;LINKAGE=M2

$$\Gamma(K_2^*(1430)^0 \bar{K}_2^*(1430)^0) / \Gamma_{\text{total}} \quad \Gamma_{87}/\Gamma$$

VALUE (units 10 ⁻⁴)	CL%	DOCUMENT ID	TECN	COMMENT
<29	90	VANNUCCI	77 MRK1	$e^+e^- \rightarrow \pi^+\pi^- K^+ K^-$

NODE=M070R47
NODE=M070R47

$$\Gamma(\phi \pi^0) / \Gamma_{\text{total}} \quad \Gamma_{88}/\Gamma$$

The two different fit values of ABLIKIM 15K below have the same statistical significance of 6.4 σ and cannot be distinguished at this moment.

VALUE (units 10 ⁻⁶)	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
2.94 ± 0.16 ± 0.16		0.8k	¹ ABLIKIM	15K BES3	$e^+e^- \rightarrow J/\psi \rightarrow K^+ K^- \gamma \gamma$
0.124 ± 0.033 ± 0.030		35 ± 9	² ABLIKIM	15K BES3	$e^+e^- \rightarrow J/\psi \rightarrow K^+ K^- \gamma \gamma$

NODE=M070R33
NODE=M070R33

NODE=M070R33

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

<6.4	90	³ ABLIKIM	05B BES2	$e^+e^- \rightarrow J/\psi \rightarrow \phi \gamma \gamma$
<6.8	90	COFFMAN	88 MRK3	$e^+e^- \rightarrow K^+ K^- \pi^0$

OCCUR=2

¹ Corresponding to one of the two fit solutions with $\delta = (-95.9 \pm 1.5)^\circ$ for the phase angle between the resonant $J/\psi \rightarrow \phi \pi^0$ and non-phi $J/\psi \rightarrow K^+ K^- \pi^0$ contributions.

NODE=M070R33;LINKAGE=A

² Corresponding to one of the two fit solutions with $\delta = (-152.1 \pm 7.7)^\circ$ for the phase angle between the resonant $J/\psi \rightarrow \phi \pi^0$ and non-phi $J/\psi \rightarrow K^+ K^- \pi^0$ contributions.

NODE=M070R33;LINKAGE=C

³ Superseded by ABLIKIM 15K.

NODE=M070R33;LINKAGE=B

$$\Gamma(\phi \eta(1405) \rightarrow \phi \eta \pi^+ \pi^-) / \Gamma_{\text{total}} \quad \Gamma_{89}/\Gamma$$

VALUE (units 10 ⁻⁵)	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
2.01±0.58±0.82	172		¹ ABLIKIM	15H BES3	$e^+e^- \rightarrow J/\psi \rightarrow \phi \eta \pi^+ \pi^-$

NODE=M070S23
NODE=M070S23

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

< 17	90	² FALVARD	88 DM2	$J/\psi \rightarrow \text{hadrons}$

¹ With 3.6 σ significance.

² Includes unknown branching fraction $\eta(1405) \rightarrow \eta \pi \pi$.

NODE=M070S23;LINKAGE=B
NODE=M070S23;LINKAGE=A

$$\Gamma(\omega f_2'(1525)) / \Gamma_{\text{total}} \quad \Gamma_{90}/\Gamma$$

VALUE (units 10 ⁻⁴)	CL%	DOCUMENT ID	TECN	COMMENT
<2.2	90	¹ VANNUCCI	77 MRK1	$e^+e^- \rightarrow \pi^+\pi^-\pi^0 K^+ K^-$

NODE=M070R29
NODE=M070R29

• • • 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;LINKAGE=C

$$\Gamma(\omega X(1835) \rightarrow \omega p \bar{p}) / \Gamma_{\text{total}} \quad \Gamma_{91}/\Gamma$$

VALUE (units 10 ⁻⁶)	CL%	DOCUMENT ID	TECN	COMMENT
<3.9	95	ABLIKIM	13P BES3	$J/\psi \rightarrow \gamma \pi^0 p \bar{p}$

NODE=M070S81
NODE=M070S81

$\Gamma(\phi X(1835) \rightarrow \phi p \bar{p})/\Gamma_{\text{total}}$
 Γ_{92}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<2.1 \times 10^{-7}$	90	¹ ABLIKIM	16K BES3	$J/\psi \rightarrow p \bar{p} K_S^0 K_L^0,$ $p \bar{p} K^+ K^-$

NODE=M070P00
NODE=M070P00
OCCUR=2

¹ Upper limit applies to any $p \bar{p}$ mass enhancement near threshold.

NODE=M070P00;LINKAGE=A

 $\Gamma(\phi X(1835) \rightarrow \phi \eta \pi^+ \pi^-)/\Gamma_{\text{total}}$
 Γ_{93}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<2.8 \times 10^{-4}$	90	ABLIKIM	15H BES3	$e^+ e^- \rightarrow J/\psi \rightarrow \phi \eta \pi^+ \pi^-$

NODE=M070B10
NODE=M070B10

 $\Gamma(\phi X(1870) \rightarrow \phi \eta \pi^+ \pi^-)/\Gamma_{\text{total}}$
 Γ_{94}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<6.13 \times 10^{-5}$	90	ABLIKIM	15H BES3	$e^+ e^- \rightarrow J/\psi \rightarrow \phi \eta \pi^+ \pi^-$

NODE=M070B11
NODE=M070B11

 $\Gamma(\eta \phi(2170) \rightarrow \eta \phi f_0(980) \rightarrow \eta \phi \pi^+ \pi^-)/\Gamma_{\text{total}}$
 Γ_{95}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.20 \pm 0.14 \pm 0.37$	471	ABLIKIM	15H BES3	$e^+ e^- \rightarrow J/\psi \rightarrow \phi \eta \pi^+ \pi^-$

NODE=M070B12
NODE=M070B12

 $\Gamma(\eta \phi(2170) \rightarrow \eta K^*(892)^0 \bar{K}^*(892)^0)/\Gamma_{\text{total}}$
 Γ_{96}/Γ

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_{97}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
< 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	$e^+ e^-$

NODE=M070S13
NODE=M070S13

 $\Gamma(\Delta(1232)^+ \bar{p})/\Gamma_{\text{total}}$
 Γ_{98}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<0.1	90	HENRARD	87 DM2	$e^+ e^-$

NODE=M070S14
NODE=M070S14

 $\Gamma(\Lambda(1520) \bar{\Lambda} + \text{c.c.} \rightarrow \gamma \Lambda \bar{\Lambda})/\Gamma_{\text{total}}$
 Γ_{99}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<4.1	90	ABLIKIM	12B BES3	$J/\psi \rightarrow \Lambda \bar{\Lambda} \gamma$

NODE=M070S77
NODE=M070S77

 $\Gamma(\Theta(1540) \bar{\Theta}(1540) \rightarrow K_S^0 p K^- \bar{n} + \text{c.c.})/\Gamma_{\text{total}}$
 Γ_{100}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<1.1	90	BAI	04G BES2	$e^+ e^-$

NODE=M070S47
NODE=M070S47

 $\Gamma(\Theta(1540) K^- \bar{n} \rightarrow K_S^0 p K^- \bar{n})/\Gamma_{\text{total}}$
 Γ_{101}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<2.1	90	BAI	04G BES2	$e^+ e^-$

NODE=M070S48
NODE=M070S48

 $\Gamma(\Theta(1540) K_S^0 \bar{p} \rightarrow K_S^0 \bar{p} K^+ n)/\Gamma_{\text{total}}$
 Γ_{102}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<1.6	90	BAI	04G BES2	$e^+ e^-$

NODE=M070S49
NODE=M070S49

 $\Gamma(\bar{\Theta}(1540) K^+ n \rightarrow K_S^0 \bar{p} K^+ n)/\Gamma_{\text{total}}$
 Γ_{103}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<5.6	90	BAI	04G BES2	$e^+ e^-$

NODE=M070S50
NODE=M070S50

 $\Gamma(\bar{\Theta}(1540) K_S^0 p \rightarrow K_S^0 p K^- \bar{n})/\Gamma_{\text{total}}$
 Γ_{104}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<1.1	90	BAI	04G BES2	$e^+ e^-$

NODE=M070S51
NODE=M070S51

 $\Gamma(\Sigma^0 \bar{\Lambda})/\Gamma_{\text{total}}$
 Γ_{105}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<0.9	90	HENRARD	87 DM2	$e^+ e^-$

NODE=M070S12
NODE=M070S12

STABLE HADRONS

NODE=M070307

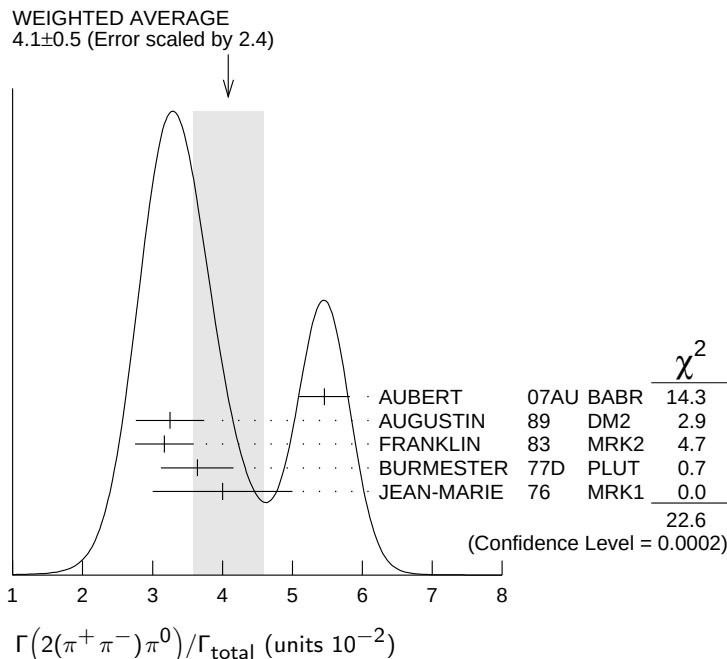
 $\Gamma(2(\pi^+\pi^-)\pi^0)/\Gamma_{\text{total}}$
 Γ_{106}/Γ

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 ± 0.34 ± 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^-

NODE=M070R9
NODE=M070R9

¹ AUBERT 07AU reports $[\Gamma(J/\psi(1S) \rightarrow 2(\pi^+\pi^-)\pi^0)/\Gamma_{\text{total}}] \times [\Gamma(J/\psi(1S) \rightarrow e^+e^-)] = 0.303 \pm 0.005 \pm 0.018$ 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=M070R9;LINKAGE=AU


 $\Gamma(\omega\pi^+\pi^-)/\Gamma(2(\pi^+\pi^-)\pi^0)$
 Γ_{13}/Γ_{106}

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_{107}/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_{108}/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.		
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

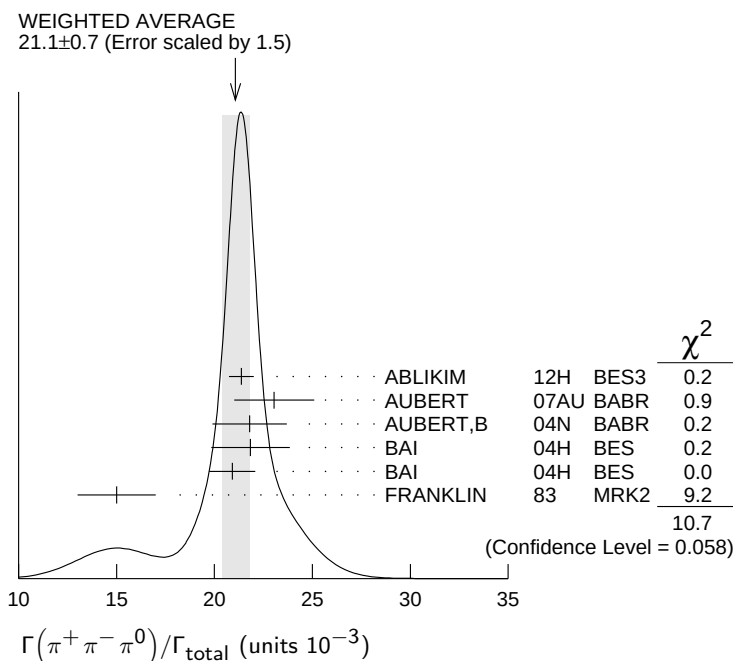
OCCUR=2

- 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 $\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) \times \Gamma(\psi(2S) \rightarrow e^+e^-)/\Gamma_{\text{total}} = 0.807 \pm 0.013$ 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



$\Gamma(\pi^+\pi^-\pi^0 K^+ K^-)/\Gamma_{\text{total}}$ Γ_{109}/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^-

NODE=M070R18
NODE=M070R18

- 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;LINKAGE=AU

$\Gamma(4(\pi^+\pi^-\pi^0))/\Gamma_{\text{total}}$ Γ_{110}/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_{111}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
6.5±0.4±0.2	1.6k	¹ AUBERT	07AK BABR	10.6 $e^+e^- \rightarrow \pi^+\pi^- K^+ K^- \gamma$
6.1±0.7±0.2	233	² AUBERT	05D BABR	10.6 $e^+e^- \rightarrow K^+ K^- \pi^+\pi^- \gamma$
7.2±2.3	205	VANNUCCI	77 MRK1	e^+e^-

NODE=M070R16
NODE=M070R16

- ¹ Superseded by LEES 12F. 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;LINKAGE=BE

NODE=M070R16;LINKAGE=AU

$$\Gamma(\pi^+\pi^-K_S^0K_L^0)/\Gamma_{\text{total}} \quad \Gamma_{112}/\Gamma$$

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
3.7±0.6±0.1	248	¹ LEES	14H BABR	$e^+e^- \rightarrow \pi^+\pi^-K_S^0K_L^0\gamma$

NODE=M070P04
NODE=M070P04

¹ LEES 14H reports $[\Gamma(J/\psi(1S) \rightarrow \pi^+\pi^-K_S^0K_L^0)/\Gamma_{\text{total}}] \times [\Gamma(J/\psi(1S) \rightarrow e^+e^-)] = 20.8 \pm 2.3 \pm 2.1$ 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=M070P04;LINKAGE=A

$$\Gamma(\pi^+\pi^-K_S^0K_S^0)/\Gamma_{\text{total}} \quad \Gamma_{113}/\Gamma$$

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
1.68±0.19±0.04	133	¹ LEES	14H BABR	$e^+e^- \rightarrow \pi^+\pi^-K_S^0K_S^0\gamma$

NODE=M070P05
NODE=M070P05

¹ LEES 14H reports $[\Gamma(J/\psi(1S) \rightarrow \pi^+\pi^-K_S^0K_S^0)/\Gamma_{\text{total}}] \times [\Gamma(J/\psi(1S) \rightarrow e^+e^-)] = 9.3 \pm 0.9 \pm 0.5$ 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=M070P05;LINKAGE=A

$$\Gamma(K^+K^-K_S^0K_S^0)/\Gamma_{\text{total}} \quad \Gamma_{114}/\Gamma$$

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
0.41±0.07±0.01	29	¹ LEES	14H BABR	$e^+e^- \rightarrow K_S^0K_S^0K^+K^-\gamma$

NODE=M070P06
NODE=M070P06

¹ LEES 14H reports $[\Gamma(J/\psi(1S) \rightarrow K^+K^-K_S^0K_S^0)/\Gamma_{\text{total}}] \times [\Gamma(J/\psi(1S) \rightarrow e^+e^-)] = 2.3 \pm 0.4 \pm 0.1$ 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=M070P06;LINKAGE=A

$$\Gamma(\pi^+\pi^-K^+K^-\eta)/\Gamma_{\text{total}} \quad \Gamma_{115}/\Gamma$$

VALUE (units 10 ⁻³)	EVTs	DOCUMENT ID	TECN	COMMENT
1.84±0.28±0.05	73	¹ AUBERT	07AU BABR	$10.6 e^+e^- \rightarrow K^+K^-\pi^+\pi^-\eta\gamma$

NODE=M070S04
NODE=M070S04

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;LINKAGE=AU

$$\Gamma(\pi^0\pi^0K^+K^-)/\Gamma_{\text{total}} \quad \Gamma_{116}/\Gamma$$

VALUE (units 10 ⁻³)	EVTs	DOCUMENT ID	TECN	COMMENT

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

2.45±0.31±0.06 203 ± 16 ¹ AUBERT 07AK BABR 10.6 $e^+e^- \rightarrow \pi^0\pi^0K^+K^-\gamma$

¹ Superseded by LEES 12F. AUBERT 07AK reports $[\Gamma(J/\psi(1S) \rightarrow \pi^0\pi^0K^+K^-)/\Gamma_{\text{total}}] \times [\Gamma(J/\psi(1S) \rightarrow e^+e^-)] = (13.6 \pm 1.1 \pm 1.3) \times 10^{-3}$ 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

$$\Gamma(K\bar{K}\pi)/\Gamma_{\text{total}} \quad \Gamma_{117}/\Gamma$$

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	$e^+e^- \rightarrow K_S^0K^\pm\pi^\mp$

NODE=M070R15
NODE=M070R15

$$\Gamma(2(\pi^+\pi^-))/\Gamma_{\text{total}} \quad \Gamma_{118}/\Gamma$$

VALUE (units 10 ⁻³)	EVTs	DOCUMENT ID	TECN	COMMENT
3.57±0.30 OUR AVERAGE				

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
NODE=M070R8

NODE=M070R8;LINKAGE=AB

NODE=M070R8;LINKAGE=AU

$\Gamma(3(\pi^+\pi^-))/\Gamma_{\text{total}}$ Γ_{119}/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_{120}/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_{121}/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_{122}/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_{123}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
2.120 ± 0.029 OUR 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^-
2.16 ± 0.07 ± 0.15	1420	EATON	84 MRK2	e^+e^-
2.5 ± 0.4	133	BRANDELIK	79C DASP	e^+e^-
2.0 ± 0.5		BESCH	78 BONA	e^+e^-
2.2 ± 0.2	331	² PERUZZI	78 MRK1	e^+e^-

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

2.0 ± 0.3 48 ANTONELLI 93 SPEC e^+e^-

¹ WU 06 reports $[\Gamma(J/\psi(1S) \rightarrow p\bar{p})/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow J/\psi(1S)K^+)] = (2.21 \pm 0.13 \pm 0.10) \times 10^{-6}$ which we divide by our best value $B(B^+ \rightarrow J/\psi(1S)K^+) = (1.026 \pm 0.031) \times 10^{-3}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² Assuming angular distribution $(1+\cos^2\theta)$.

NODE=M070R50
NODE=M070R50

NODE=M070R50;LINKAGE=WU

NODE=M070R50;LINKAGE=A

 $\Gamma(p\bar{p}\pi^0)/\Gamma_{\text{total}}$ Γ_{124}/Γ

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

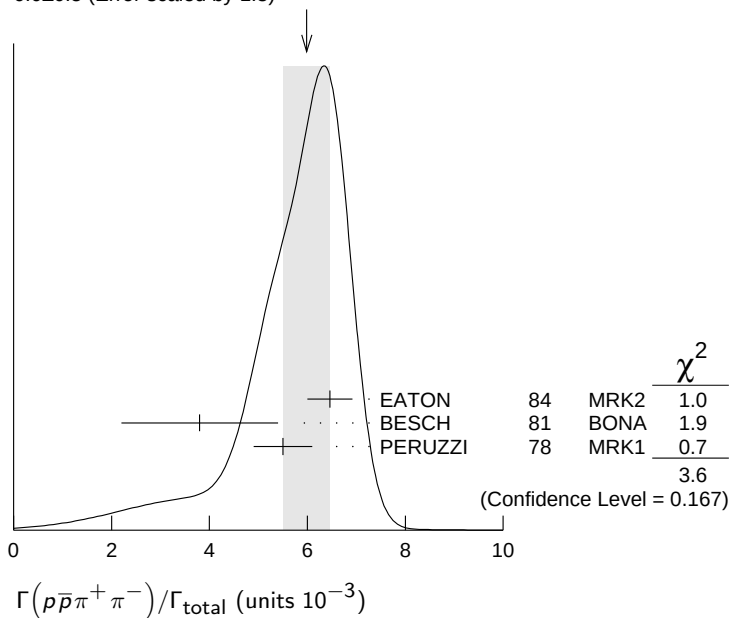
NODE=M070R52
NODE=M070R52

 $\Gamma(p\bar{p}\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{125}/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_{126}/Γ

NODE=M070R55
 NODE=M070R55
 NODE=M070R55

Including $p\bar{p}\pi^+\pi^-\gamma$ and excluding ω, η, η'

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
2.3 ± 0.9 OUR AVERAGE	Error includes scale factor of 1.9.			
$3.36 \pm 0.65 \pm 0.28$	364	EATON	84	MRK2 e^+e^-
1.6 ± 0.6	39	PERUZZI	78	MRK1 e^+e^-

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

Γ_{127}/Γ

NODE=M070R56
 NODE=M070R56

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
2.00 ± 0.12 OUR AVERAGE				
$1.91 \pm 0.02 \pm 0.17$	13k	¹ ABLIKIM	09	BES2 e^+e^-
$2.03 \pm 0.13 \pm 0.15$	826	EATON	84	MRK2 e^+e^-
2.5 ± 1.2		BRANDELIK	79C	DASP e^+e^-
2.3 ± 0.4	197	PERUZZI	78	MRK1 e^+e^-

¹ From the combination of $p\bar{p}\eta \rightarrow p\bar{p}\gamma\gamma$ and $p\bar{p}\eta \rightarrow p\bar{p}\pi^+\pi^-\pi^0$ channels.

NODE=M070R56;LINKAGE=AB

$\Gamma(p\bar{p}\rho)/\Gamma_{\text{total}}$

Γ_{128}/Γ

NODE=M070R57
 NODE=M070R57

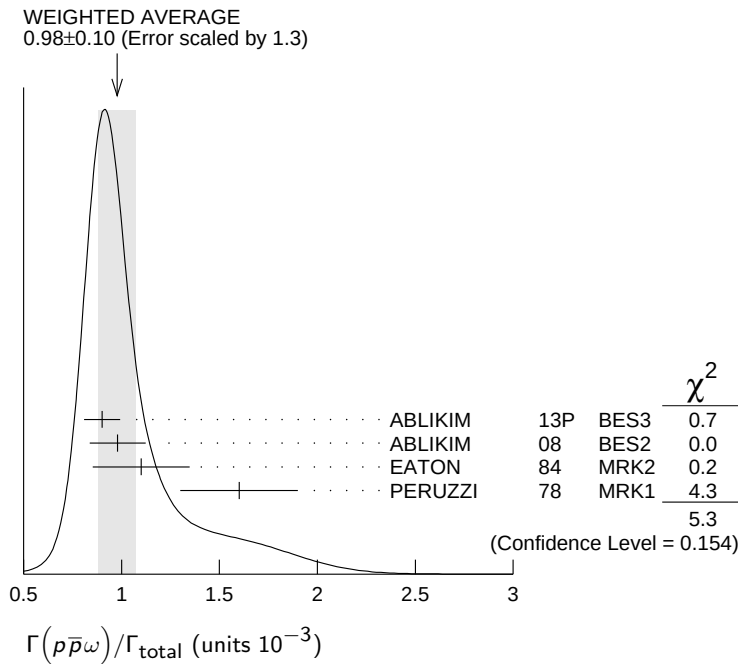
VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<0.31	90	EATON	84	MRK2 $e^+e^- \rightarrow \text{hadrons}\gamma$

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

Γ_{129}/Γ

NODE=M070R58
 NODE=M070R58

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
0.98 ± 0.10 OUR AVERAGE	Error includes scale factor of 1.3. See the ideogram below.			
$0.90 \pm 0.02 \pm 0.09$	2670	ABLIKIM	13P	BES3 e^+e^-
$0.98 \pm 0.03 \pm 0.14$	2449	ABLIKIM	08	BES2 e^+e^-
$1.10 \pm 0.17 \pm 0.18$	486	EATON	84	MRK2 e^+e^-
1.6 ± 0.3	77	PERUZZI	78	MRK1 e^+e^-



$\Gamma(p\bar{p}\eta(958))/\Gamma_{\text{total}}$ Γ_{130}/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^-

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
 NODE=M070R59

NODE=M070R59;LINKAGE=AB

$\Gamma(p\bar{p}a_0(980) \rightarrow p\bar{p}\pi^0\eta)/\Gamma_{\text{total}}$ Γ_{131}/Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
$6.8 \pm 1.2 \pm 1.3$	ABLIKIM	14N BES3	$e^+e^- \rightarrow J/\psi$

NODE=M070S94
 NODE=M070S94

$\Gamma(p\bar{p}\phi)/\Gamma_{\text{total}}$ Γ_{132}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
0.519 ± 0.033 OUR AVERAGE				
$[(0.45 \pm 0.15) \times 10^{-4}]$				OUR 2016 AVERAGE]
$0.523 \pm 0.006 \pm 0.033$	14K	ABLIKIM	16K BES3	$J/\psi \rightarrow p\bar{p}K_S^0 K_L^0$
				$p\bar{p}K^+K^-$
$0.45 \pm 0.13 \pm 0.07$		FALVARD	88 DM2	$J/\psi \rightarrow \text{hadrons}$

NODE=M070S22
 NODE=M070S22
 NEW

$\Gamma(n\bar{n})/\Gamma_{\text{total}}$ Γ_{133}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
2.09 ± 0.16 OUR 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^-

NODE=M070R64
 NODE=M070R64

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

1.90 ± 0.55	40	ANTONELLI	93 SPEC	e^+e^-

$\Gamma(n\bar{n}\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{134}/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_{135}/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_{136}/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_{137}/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_{138}/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_{142}/Γ VALUE (units 10^{-3}) EVTS

DOCUMENT ID

TECN

COMMENT

0.97 ± 0.08 OUR AVERAGE

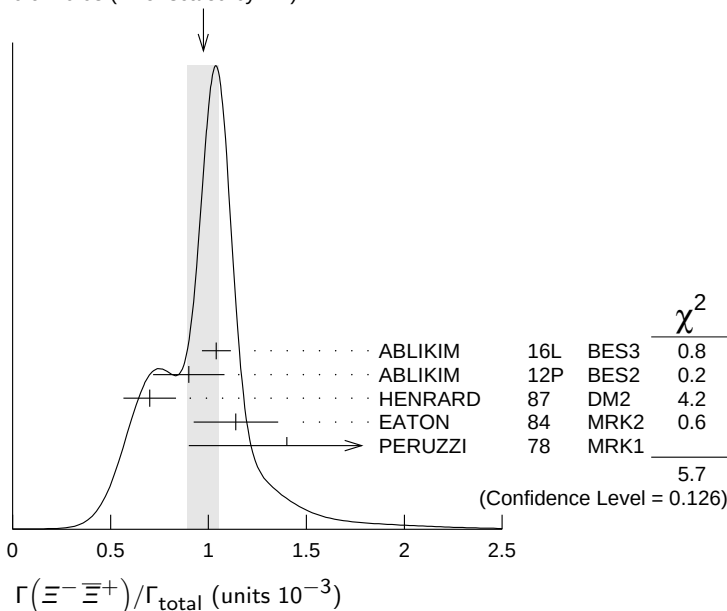
Error includes scale factor of 1.4. See the ideogram below.

[(0.86 ± 0.11) × 10⁻³ OUR 2016 AVERAGE Scale factor = 1.2]

1.040 ± 0.006 ± 0.074	43k	ABLIKIM	16L	BES3	$J/\psi \rightarrow \Xi^- \bar{\Xi}^+$
0.90 ± 0.03 ± 0.18	961	ABLIKIM	12P	BES2	$J/\psi \rightarrow \Xi^- \bar{\Xi}^+$
0.70 ± 0.06 ± 0.12	132	HENRARD	87	DM2	$e^+e^- \rightarrow \Xi^- \bar{\Xi}^+$
1.14 ± 0.08 ± 0.20	194	EATON	84	MRK2	$e^+e^- \rightarrow \Xi^- \bar{\Xi}^+$
1.4 ± 0.5	51	PERUZZI	78	MRK1	$e^+e^- \rightarrow \Xi^- \bar{\Xi}^+$

NODE=M070R62
NODE=M070R62

NEW

WEIGHTED AVERAGE
0.97 ± 0.08 (Error scaled by 1.4)

$\Gamma(\Lambda\bar{\Lambda})/\Gamma_{\text{total}}$				Γ_{143}/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.		
$1.93 \pm 0.21 \pm 0.05$		¹ AUBERT	07BD BABR	$10.6 e^+ e^- \rightarrow \Lambda\bar{\Lambda}\gamma$
$2.03 \pm 0.03 \pm 0.15$	8887	ABLIKIM	06 BES2	$J/\psi \rightarrow \Lambda\bar{\Lambda}$
$1.9^{+0.5}_{-0.4} \pm 0.1$	46	² WU	06 BELL	$B^+ \rightarrow \Lambda\bar{\Lambda}K^+$
$1.08 \pm 0.06 \pm 0.24$	631	BAI	98G BES	$e^+ e^-$
$1.38 \pm 0.05 \pm 0.20$	1847	PALLIN	87 DM2	$e^+ e^-$
$1.58 \pm 0.08 \pm 0.19$	365	EATON	84 MRK2	$e^+ e^-$
2.6 ± 1.6	5	BESCH	81 BONA	$e^+ e^-$
1.1 ± 0.2	196	PERUZZI	78 MRK1	$e^+ e^-$

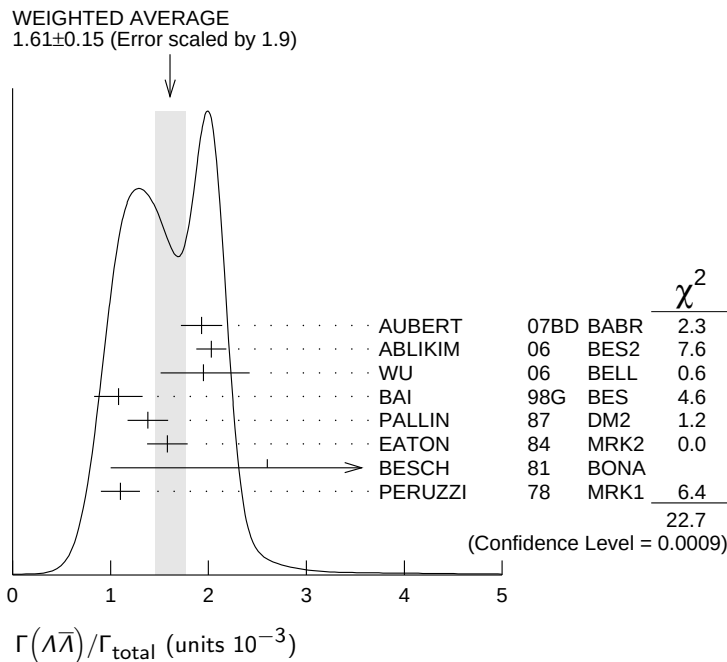
¹ AUBERT 07BD reports $[\Gamma(J/\psi(1S) \rightarrow \Lambda\bar{\Lambda})/\Gamma_{\text{total}}] \times [\Gamma(J/\psi(1S) \rightarrow e^+ e^-)] = (10.7 \pm 0.9 \pm 0.7) \times 10^{-3}$ keV which we divide by our best value $\Gamma(J/\psi(1S) \rightarrow e^+ e^-) = 5.55 \pm 0.14 \pm 0.02$ keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² WU 06 reports $[\Gamma(J/\psi(1S) \rightarrow \Lambda\bar{\Lambda})/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow J/\psi(1S)K^+)] = (2.00^{+0.34}_{-0.29} \pm 0.34) \times 10^{-6}$ which we divide by our best value $B(B^+ \rightarrow J/\psi(1S)K^+) = (1.026 \pm 0.031) \times 10^{-3}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070R60
NODE=M070R60

NODE=M070R60;LINKAGE=AU

NODE=M070R60;LINKAGE=WU



$\Gamma(\Lambda\bar{\Lambda})/\Gamma(p\bar{p})$				$\Gamma_{143}/\Gamma_{123}$
VALUE	DOCUMENT ID	TECN	COMMENT	
$0.90^{+0.15}_{-0.14} \pm 0.10$	¹ WU	06 BELL	$B^+ \rightarrow p\bar{p}K^+, \Lambda\bar{\Lambda}K^+$	

¹ Not independent of other $J/\psi \rightarrow \Lambda\bar{\Lambda}, p\bar{p}$ branching ratios reported by WU 06.

NODE=M070R79
NODE=M070R79

NODE=M070R79;LINKAGE=WU

$\Gamma(\Lambda\bar{\Sigma}^- \pi^+ (\text{or c.c.}))/\Gamma_{\text{total}}$				Γ_{144}/Γ
VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
0.83 ± 0.07 OUR AVERAGE		Error includes scale factor of 1.2.		
$0.770 \pm 0.051 \pm 0.083$	335	¹ ABLIKIM	07H BES2	$e^+ e^- \rightarrow \Lambda\bar{\Sigma}^+ \pi^-$
$0.747 \pm 0.056 \pm 0.076$	254	¹ ABLIKIM	07H BES2	$e^+ e^- \rightarrow \Lambda\bar{\Sigma}^- \pi^+$
$0.90 \pm 0.06 \pm 0.16$	225 ± 15	HENRARD	87 DM2	$e^+ e^- \rightarrow \Lambda\bar{\Sigma}^+ \pi^-$
$1.11 \pm 0.06 \pm 0.20$	342 ± 18	HENRARD	87 DM2	$e^+ e^- \rightarrow \Lambda\bar{\Sigma}^- \pi^+$
$1.53 \pm 0.17 \pm 0.38$	135	EATON	84 MRK2	$e^+ e^- \rightarrow \Lambda\bar{\Sigma}^+ \pi^-$
$1.38 \pm 0.21 \pm 0.35$	118	EATON	84 MRK2	$e^+ e^- \rightarrow \Lambda\bar{\Sigma}^- \pi^+$

¹ Using $B(\Lambda \rightarrow \pi^- p) = 63.9\%$ and $B(\Sigma^+ \rightarrow \pi^0 p) = 51.6\%$.

NODE=M070R71
NODE=M070R71

OCCUR=2

OCCUR=2

OCCUR=2

NODE=M070R71;LINKAGE=AB

$\Gamma(pK^-\bar{\Lambda})/\Gamma_{\text{total}}$				Γ_{145}/Γ
VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$0.89 \pm 0.07 \pm 0.14$	307	EATON	84 MRK2	$e^+ e^-$

NODE=M070R72
NODE=M070R72

$\Gamma(2(K^+ K^-))/\Gamma_{\text{total}}$ Γ_{146}/Γ

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

0.74±0.07 OUR AVERAGE[(0.76 ± 0.09) × 10⁻³ OUR 2016 AVERAGE]0.72±0.06±0.05 287 ± 24 LEES 12F BABR 10.6 e⁺e⁻ → 2(K⁺K⁻)γ1.4 ^{+0.5}_{-0.4} ±0.2 11.0 ^{+4.3}_{-3.5} ¹ HUANG 03 BELL B⁺ → 2(K⁺K⁻) K⁺0.7 ± 0.3 VANNUCCI 77 MRK1 e⁺e⁻

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

0.74±0.09±0.02 156 ± 15 ² AUBERT 07AK BABR 10.6 e⁺e⁻ → 2(K⁺K⁻)γ0.72±0.17±0.02 38 ³ AUBERT 05D BABR 10.6 e⁺e⁻ → 2(K⁺K⁻)γ¹ Using B(B⁺ → J/ψ K⁺) = (1.01 ± 0.05) × 10⁻³.² Superseded by LEES 12F. AUBERT 07AK reports [Γ(J/ψ(1S) → 2(K⁺K⁻))/Γ_{total}] × [Γ(J/ψ(1S) → e⁺e⁻)] = (4.11 ± 0.39 ± 0.30) × 10⁻³ keV which we divide by our best value Γ(J/ψ(1S) → e⁺e⁻) = 5.55 ± 0.14 ± 0.02 keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.³ Superseded by AUBERT 07AK. AUBERT 05D reports [Γ(J/ψ(1S) → 2(K⁺K⁻))/Γ_{total}] × [Γ(J/ψ(1S) → e⁺e⁻)] = (4.0 ± 0.7 ± 0.6) × 10⁻³ keV which we divide by our best value Γ(J/ψ(1S) → e⁺e⁻) = 5.55 ± 0.14 ± 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=M070R19

NODE=M070R19

NEW

NODE=M070R19;LINKAGE=CC

NODE=M070R19;LINKAGE=BE

NODE=M070R19;LINKAGE=AU

 $\Gamma(pK^- \bar{\Sigma}^0)/\Gamma_{\text{total}}$ Γ_{147}/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_{148}/Γ

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

2.86±0.09±0.19

1k

¹ METREVELI 12ψ(2S) → π⁺π⁻K⁺K⁻

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

3.22±0.20±0.12 462 ^{2,3} LEES 15J BABR e⁺e⁻ → K⁺K⁻γ3.50±0.20±0.12 462 ^{3,4} LEES 15J BABR e⁺e⁻ → K⁺K⁻γ2.39±0.24±0.22 107 ⁵ BALTRUSAIT..85D MRK3 e⁺e⁻2.2 ± 0.9 6 ⁵ BRANDELIK 79C DASP e⁺e⁻¹ Obtained by analyzing CLEO-c data but not authored by the CLEO Collaboration.² sin φ > 0.³ Using Γ(J/ψ → e⁺e⁻) = (5.55 ± 0.14) keV.⁴ sin φ < 0.⁵ Interference with non-resonant K⁺K⁻ production not taken into account.

NODE=M070R13

NODE=M070R13

OCCUR=2

NODE=M070R13;LINKAGE=ME

NODE=M070R13;LINKAGE=A

NODE=M070R13;LINKAGE=B

NODE=M070R13;LINKAGE=C

NODE=M070R13;LINKAGE=BA

 $\Gamma(K^+ K^- f'_2(1525))/\Gamma_{\text{total}}$ Γ_{51}/Γ

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT

1.04±0.34±0.03

16

^{1,2} LEES

14H

BABR

e⁺e⁻ → K_S⁰K_S⁰K⁺K⁻γ¹ Dividing by 1/4 to take into account B(f'₂(1525) → K_S⁰K_S⁰) = 1/4 B(f'₂(1525) → K⁺K⁻) and using B(f'₂(1525) → K⁺K⁻) = (88.7 ± 2.2)%.² LEES 14H reports [Γ(J/ψ(1S) → K⁺K⁻f'₂(1525))/Γ_{total}] × [Γ(J/ψ(1S) → e⁺e⁻)] = 5.77 ± 1.89 ± 0.23 keV which we divide by our best value Γ(J/ψ(1S) → e⁺e⁻) = 5.55 ± 0.14 ± 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=M070P15

NODE=M070P15

NODE=M070P15;LINKAGE=A

NODE=M070P15;LINKAGE=B

 $\Gamma(K^+ K^- f'_2(1525) \rightarrow K^+ K^- K_S^0 K_S^0)/\Gamma_{\text{total}}$ Γ_{52}/Γ

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT

0.23±0.08±0.01

16

¹ LEES

14H

BABR

e⁺e⁻ → K_S⁰K_S⁰K⁺K⁻γ¹ LEES 14H reports [Γ(J/ψ(1S) → K⁺K⁻f'₂(1525) → K⁺K⁻K_S⁰K_S⁰)/Γ_{total}] × [Γ(J/ψ(1S) → e⁺e⁻)] = 1.28 ± 0.42 ± 0.05 keV which we divide by our best value Γ(J/ψ(1S) → e⁺e⁻) = 5.55 ± 0.14 ± 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=M070P16

NODE=M070P16

NODE=M070P16;LINKAGE=A

$\Gamma(K_S^0 K_L^0)/\Gamma_{\text{total}}$ Γ_{149}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.1 ± 0.4 OUR AVERAGE		Error includes scale factor of 3.2.		
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

NODE=M070R75;LINKAGE=ME

NODE=M070R;LINKAGE=HZ

 $\Gamma(\Lambda \bar{\Lambda} \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{150}/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_{151}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
16.2 ± 1.7 OUR AVERAGE				
15.7 ± 0.80 ± 1.54	454	¹ ABLIKIM	13F BES3	$J/\psi \rightarrow p \bar{p} \pi^+ \pi^- \gamma \gamma$
26.2 ± 6.0 ± 4.4	44	² ABLIKIM	07H BES2	$e^+ e^- \rightarrow \psi(2S)$

¹ Using $B(\Lambda \rightarrow \pi^- p) = 63.9\%$ and $B(\eta \rightarrow \gamma \gamma) = 39.31\%$.² Using $B(\Lambda \rightarrow \pi^- p) = 63.9\%$ and $B(\eta \rightarrow \gamma \gamma) = 39.4\%$.NODE=M070R07
NODE=M070R07

NODE=M070R07;LINKAGE=AL

NODE=M070R07;LINKAGE=AB

 $\Gamma(\Lambda \bar{\Lambda} \pi^0)/\Gamma_{\text{total}}$ Γ_{152}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
3.78 ± 0.27 ± 0.30		323	¹ ABLIKIM	13F BES3	$J/\psi \rightarrow p \bar{p} \pi^+ \pi^- \gamma \gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 6.4		90	² ABLIKIM	07H BES2	$e^+ e^- \rightarrow \psi(2S)$
23 ± 7 ± 8		11	BAI	98G BES	$e^+ e^-$
22 ± 5 ± 5		19	HENRARD	87 DM2	$e^+ e^-$

¹ Using $B(\Lambda \rightarrow \pi^- p) = 63.9\%$ and $B(\pi^0 \rightarrow \gamma \gamma) = 98.8\%$.² Using $B(\Lambda \rightarrow \pi^- p) = 63.9\%$.NODE=M070S11
NODE=M070S11

NODE=M070S11;LINKAGE=AL

NODE=M070S11;LINKAGE=AB

 $\Gamma(\bar{\Lambda} n K_S^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{153}/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_{154}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.47 ± 0.14 OUR AVERAGE				
1.47 ± 0.13 ± 0.13	140	¹ METREVELI	12	$\psi(2S) \rightarrow 2(\pi^+ \pi^-)$
1.58 ± 0.20 ± 0.15	84	BALTRUSAIT..85D	MRK3	$e^+ e^-$
1.0 ± 0.5	5	BRANDELIK	78B DASP	$e^+ e^-$
1.6 ± 1.6	1	VANNUCCI	77 MRK1	$e^+ e^-$

¹ Obtained by analyzing CLEO-c data but not authored by the CLEO Collaboration.NODE=M070R6
NODE=M070R6

NODE=M070R6;LINKAGE=ME

 $\Gamma(\Lambda \bar{\Sigma} + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{155}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
2.83 ± 0.23 OUR AVERAGE					
2.74 ± 0.24 ± 0.22		234 ± 21	¹ ABLIKIM	12B BES3	$J/\psi \rightarrow \Lambda \bar{\Sigma}^0$
2.92 ± 0.22 ± 0.24		308 ± 24	² ABLIKIM	12B BES3	$J/\psi \rightarrow \bar{\Lambda} \Sigma^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 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_{156}/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

RADIATIVE DECAYS

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

VALUE (units 10^{-6})	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
11.6$\pm$2.2 OUR AVERAGE					
11.3 $\pm$ 1.8 $\pm$ 2.0		113 $\pm$ 18	ABLIKIM	13i	BES3 $\psi(2S) \rightarrow \pi^+ \pi^- J/\psi$
12 $\pm$ 3 $\pm$ 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 $e^+ e^-$

Γ_{157}/Γ

NODE=M070310

NODE=M070R81
NODE=M070R81

$\Gamma(4\gamma)/\Gamma_{\text{total}}$

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<9	90	ADAMS	08	CLEO $\psi(2S) \rightarrow \pi^+ \pi^- J/\psi$

Γ_{158}/Γ

NODE=M070S06
NODE=M070S06

$\Gamma(5\gamma)/\Gamma_{\text{total}}$

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<15	90	ADAMS	08	CLEO $\psi(2S) \rightarrow \pi^+ \pi^- J/\psi$

Γ_{159}/Γ

NODE=M070S07
NODE=M070S07

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

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
1.15$\pm$0.05	¹ ABLIKIM	15AE BES3	$J/\psi \rightarrow \gamma\pi^0\pi^0$

Γ_{160}/Γ

NODE=M070B00
NODE=M070B00¹ The uncertainty is systematic as statistical is negligible.

NODE=M070B00;LINKAGE=A

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

VALUE (units 10^{-6})	EVTs	DOCUMENT ID	TECN	COMMENT
21.4$\pm$1.8$\pm$2.5	596	ABLIKIM	16P	BES3 $J/\psi \rightarrow 5\gamma$

Γ_{161}/Γ

NODE=M070P01
NODE=M070P01

$\Gamma(\gamma a_0(980)^0 \rightarrow \gamma\eta\pi^0)/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<2.5 $\times 10^{-6}$	95	ABLIKIM	16P	BES3 $J/\psi \rightarrow 5\gamma$

Γ_{162}/Γ

NODE=M070P02
NODE=M070P02

$\Gamma(\gamma a_2(1320)^0 \rightarrow \gamma\eta\pi^0)/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<6.6 $\times 10^{-6}$	95	ABLIKIM	16P	BES3 $J/\psi \rightarrow 5\gamma$

Γ_{163}/Γ

NODE=M070P03
NODE=M070P03

$\Gamma(\gamma\eta_c(1S))/\Gamma_{\text{total}}$

VALUE (units 10^{-2})	EVTs	DOCUMENT ID	TECN	COMMENT
1.7 $\pm$0.4 OUR AVERAGE Error includes scale factor of 1.5.				
2.01 $\pm$ 0.32 $\pm$ 0.02		¹ MITCHELL	09	CLEO $e^+ e^- \rightarrow \gamma X$
1.27 $\pm$ 0.36		GAISER	86	CBAL $J/\psi \rightarrow \gamma X$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
seen		ANASHIN	14	KEDR $J/\psi \rightarrow \gamma\eta_c$
0.79 $\pm$ 0.20	273 $\pm$ 43	² AUBERT	06E	BABR $B^\pm \rightarrow K^\pm X_{c\bar{c}}$
seen	16	BALTRUSAITIS	84	MRK3 $J/\psi \rightarrow 2\phi\gamma$

Γ_{164}/Γ

NODE=M070R85
NODE=M070R85

¹ MITCHELL 09 reports $(1.98 \pm 0.09 \pm 0.30) \times 10^{-2}$ from a measurement of $[\Gamma(J/\psi(1S) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)]$ assuming $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (35.04 \pm 0.07 \pm 0.77) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (34.49 \pm 0.30) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070R85;LINKAGE=MI

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

$\Gamma(\gamma\eta_c(1S) \rightarrow 3\gamma)/\Gamma_{\text{total}}$

VALUE (units 10^{-6})	EVTs	DOCUMENT ID	TECN	COMMENT
3.8$^{+1.3}_{-1.0}$ OUR AVERAGE Error includes scale factor of 1.1.				
4.5 $\pm$ 1.2 $\pm$ 0.6	33 $\pm$ 9	ABLIKIM	13i	BES3 $\psi(2S) \rightarrow \pi^+ \pi^- J/\psi$
1.2 $^{+2.7}_{-1.1}$ $\pm$ 0.3	1.2 $^{+2.8}_{-1.1}$	ADAMS	08	CLEO $\psi(2S) \rightarrow \pi^+ \pi^- J/\psi$

Γ_{165}/Γ

NODE=M070S08
NODE=M070S08

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

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
8.3$\pm$0.2$\pm$3.1	¹ BALTRUSAITIS	86B	MRK3 $J/\psi \rightarrow 4\pi\gamma$

Γ_{166}/Γ

NODE=M070R99
NODE=M070R99¹ 4π mass less than 2.0 GeV.

NODE=M070R99;LINKAGE=M

$\Gamma(\gamma\eta\pi\pi)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})**6.1 ± 1.0 OUR AVERAGE**5.85 $\pm 0.3 \pm 1.05$ 7.8 $\pm 1.2 \pm 2.4$ ¹ Broad enhancement at 1700 MeV.

DOCUMENT ID	TECN	COMMENT
¹ EDWARDS 83B CBAL		$J/\psi \rightarrow \eta\pi^+\pi^-$
¹ EDWARDS 83B CBAL		$J/\psi \rightarrow \eta 2\pi^0$

 Γ_{167}/Γ NODE=M070R96
NODE=M070R96

OCCUR=2

NODE=M070R96;LINKAGE=M

 $\Gamma(\gamma\eta_2(1870) \rightarrow \gamma\eta\pi^+\pi^-)/\Gamma_{\text{total}}$ VALUE (units 10^{-4})**6.2 $\pm 2.2 \pm 0.9$**

DOCUMENT ID	TECN	COMMENT
BAI 99 BES		$J/\psi \rightarrow \gamma\eta\pi^+\pi^-$

 Γ_{168}/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 $\pm 0.1 \pm 0.58$ 3.8 $\pm 0.3 \pm 0.6$ 4.0 $\pm 0.7 \pm 1.0$ 4.3 ± 1.7

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

1.78 $\pm 0.21 \pm 0.33$ 0.83 $\pm 0.13 \pm 0.18$ 0.66 $^{+0.17}_{-0.16} \pm 0.24$ 1.03 $^{+0.21}_{-0.18} \pm 0.26$ -0.18 -0.19

DOCUMENT ID	TECN	COMMENT
^{1,2} BAI 00D BES		$J/\psi \rightarrow \gamma K^\pm K_S^0 \pi^\mp$
³ AUGUSTIN 90 DM2		$J/\psi \rightarrow \gamma K \bar{K} \pi$
³ EDWARDS 82E CBAL		$J/\psi \rightarrow K^+ K^- \pi^0 \gamma$
^{3,4} SCHARRE 80 MRK2		$e^+ e^-$
^{3,5,6} AUGUSTIN 92 DM2		$J/\psi \rightarrow \gamma K \bar{K} \pi$
^{3,7,8} AUGUSTIN 92 DM2		$J/\psi \rightarrow \gamma K \bar{K} \pi$
^{3,6,9} BAI 90C MRK3		$J/\psi \rightarrow \gamma K_S^0 K^\pm \pi^\mp$
^{3,8,10} BAI 90C MRK3		$J/\psi \rightarrow \gamma K_S^0 K^\pm \pi^\mp$

 Γ_{169}/Γ NODE=M070R89
NODE=M070R89

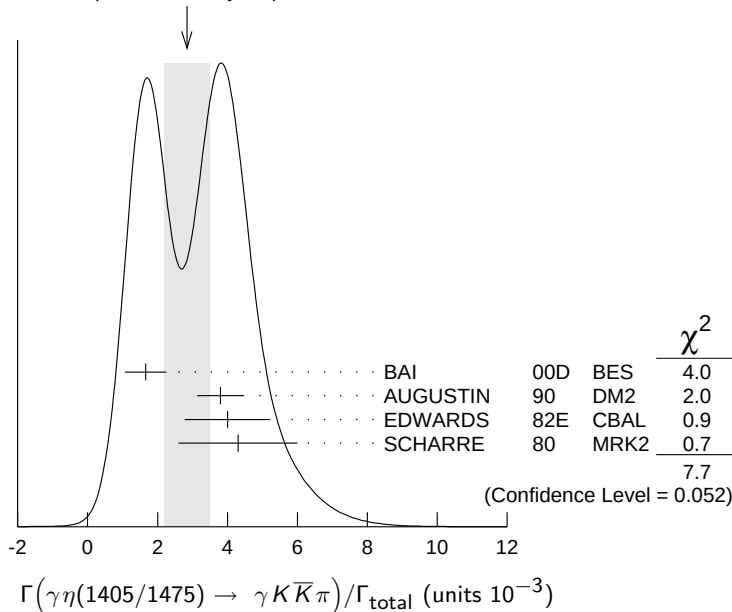
OCCUR=2

OCCUR=2

NODE=M070R89;LINKAGE=BD

NODE=M070R89;LINKAGE=BE
 NODE=M070R89;LINKAGE=B
 NODE=M070R89;LINKAGE=C
 NODE=M070R89;LINKAGE=H
 NODE=M070R89;LINKAGE=K9
 NODE=M070R89;LINKAGE=J
 NODE=M070R89;LINKAGE=K8
 NODE=M070R89;LINKAGE=D
 NODE=M070R89;LINKAGE=E

- ¹ Interference with the $J/\psi(1S)$ radiative transition to the broad $K \bar{K} \pi$ pseudoscalar state around 1800 is $(0.15 \pm 0.01 \pm 0.05) \times 10^{-3}$.
² Interference with $J/\psi \rightarrow \gamma f_1(1420)$ is $(-0.03 \pm 0.01 \pm 0.01) \times 10^{-3}$.
³ Includes unknown branching fraction $\eta(1405) \rightarrow K \bar{K} \pi$.
⁴ Corrected for spin-zero hypothesis for $\eta(1405)$.
⁵ From fit to the $a_0(980)\pi 0^-+$ partial wave.
⁶ $a_0(980)\pi$ mode.
⁷ From fit to the $K^*(892)K 0^-+$ partial wave.
⁸ $K^* K$ mode.
⁹ From $a_0(980)\pi$ final state.
¹⁰ From $K^*(890)K$ final state.

WEIGHTED AVERAGE
2.8 ± 0.6 (Error scaled by 1.6) $\Gamma(\gamma\eta(1405/1475) \rightarrow \gamma\gamma\rho^0)/\Gamma_{\text{total}}$ VALUE (units 10^{-4})**0.78 ± 0.20 OUR AVERAGE** Error includes scale factor of 1.8.1.07 $\pm 0.17 \pm 0.11$ 0.64 $\pm 0.12 \pm 0.07$ ¹ Includes unknown branching fraction $\eta(1405) \rightarrow \gamma\rho^0$.

DOCUMENT ID	TECN	COMMENT
¹ BAI 04J BES2		$J/\psi \rightarrow \gamma\gamma\pi^+\pi^-$
¹ COFFMAN 90 MRK3		$J/\psi \rightarrow \gamma\gamma\pi^+\pi^-$

 Γ_{170}/Γ NODE=M070S30
NODE=M070S30

NODE=M070S30;LINKAGE=C

$\Gamma(\gamma\eta(1405/1475) \rightarrow \gamma\eta\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{171}/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=M070S29

NODE=M070S29;LINKAGE=RR
NODE=M070S29;LINKAGE=R

 $\Gamma(\gamma\eta(1405/1475) \rightarrow \gamma\gamma\phi)/\Gamma_{\text{total}}$ Γ_{172}/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_{173}/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=M070R94

NODE=M070R94;LINKAGE=N
NODE=M070R94;LINKAGE=M
NODE=M070R94;LINKAGE=A

 $\Gamma(\gamma\rho\omega)/\Gamma_{\text{total}}$ Γ_{174}/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_{175}/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

 $\Gamma(\gamma\eta'(958))/\Gamma_{\text{total}}$ Γ_{176}/Γ

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
5.13 ± 0.17 OUR AVERAGE Error includes scale factor of 1.3. See the ideogram below. [(5.15 ± 0.16) × 10 ⁻³ OUR 2016 AVERAGE Scale factor = 1.2]				
4.78 ± 0.22 ± 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 $J/\psi \rightarrow \gamma\pi^+\pi^-\eta, \eta \rightarrow \pi^+\pi^-\pi^0$

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

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 $B(\eta'(958) \rightarrow \pi^+\pi^-\eta) = (42.6 \pm 0.7) \times 10^{-2}$, $B(\eta \rightarrow 2\gamma) = (39.41 \pm 0.20) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best values.

NODE=M070R84
NODE=M070R84

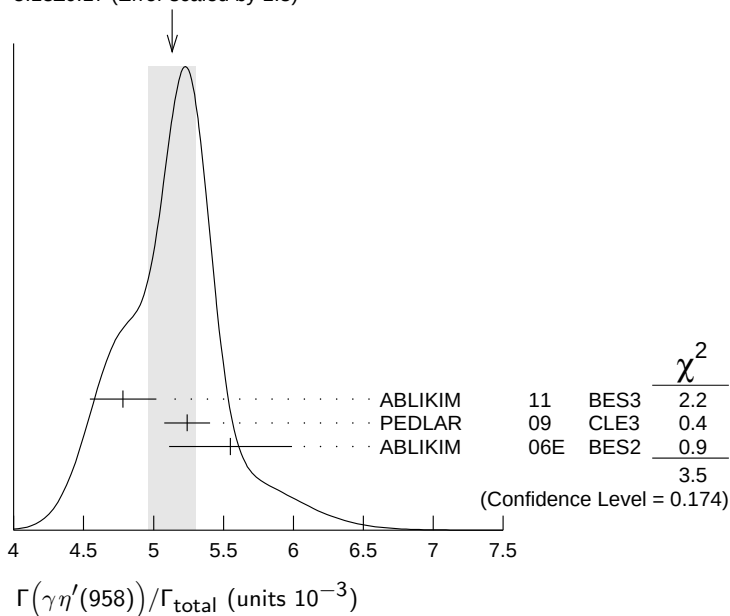
NEW

OCCUR=2

OCCUR=2

NODE=M070R84;LINKAGE=AB

WEIGHTED AVERAGE
5.13±0.17 (Error scaled by 1.3)



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

Γ_{177}/Γ

VALUE (units 10^{-3}) DOCUMENT ID TECN COMMENT
2.8 ±0.5 OUR AVERAGE Error includes scale factor of 1.9. See the ideogram below.

4.32±0.14±0.73	¹ BISELLO	89B	DM2	$J/\psi \rightarrow 4\pi\gamma$
2.08±0.13±0.35	² BISELLO	89B	DM2	$J/\psi \rightarrow 4\pi\gamma$
3.05±0.08±0.45	² BALTRUSAIT...	86B	MRK3	$J/\psi \rightarrow 4\pi\gamma$
4.85±0.45±1.20	³ BURKE	82	MRK2	e^+e^-

¹ 4π mass less than 3.0 GeV.

² 4π mass less than 2.0 GeV.

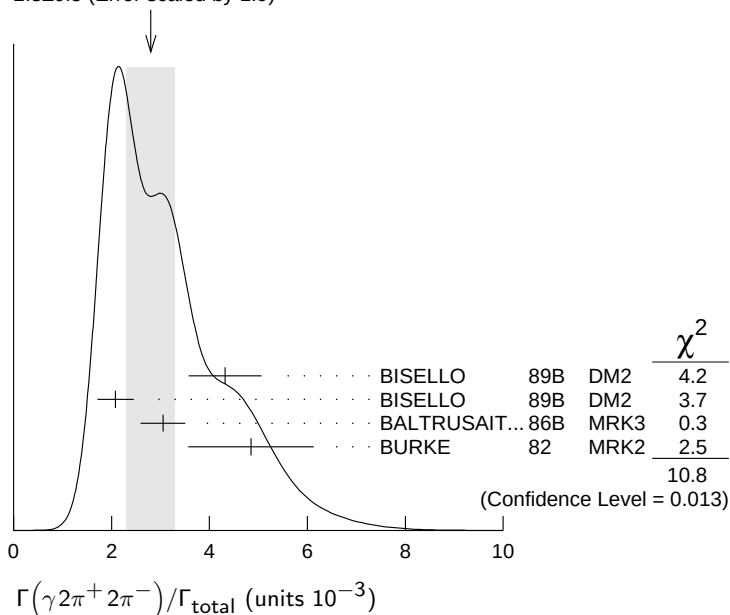
³ 4π mass less than 2.5 GeV.

NODE=M070R95
 NODE=M070R95

OCCUR=2

NODE=M070R95;LINKAGE=A
 NODE=M070R95;LINKAGE=B
 NODE=M070R95;LINKAGE=M

WEIGHTED AVERAGE
2.8±0.5 (Error scaled by 1.9)



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

Γ_{178}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
9.5±0.7±1.6	646 ± 45	ABLIKIM	04M BES	$J/\psi \rightarrow \gamma 2\pi^+ 2\pi^-$

NODE=M070S45
 NODE=M070S45

$\Gamma(\gamma f_2(1270) f_2(1270) (\text{non resonant}))/\Gamma_{\text{total}}$

Γ_{179}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
8.2±0.8±1.7	¹ ABLIKIM	04M BES	$J/\psi \rightarrow \gamma 2\pi^+ 2\pi^-$

NODE=M070S46
 NODE=M070S46

¹ Subtracting contribution from intermediate $\eta_c(1S)$ decays.

NODE=M070S46;LINKAGE=AB

$\Gamma(\gamma K^+ K^- \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{180}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
2.1$\pm$0.1$\pm$0.6	1516	BAI	00B BES	$J/\psi \rightarrow \gamma K^+ K^0 \pi^+ \pi^-$

NODE=M070B05
NODE=M070B05

 $\Gamma(\gamma f_4(2050))/\Gamma_{\text{total}}$ Γ_{181}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
2.7$\pm$0.5$\pm$0.5	¹ BALTRUSAIT..87	MRK3	$J/\psi \rightarrow \gamma \pi^+ \pi^-$

NODE=M070S7
NODE=M070S7

¹ Assuming branching fraction $f_4(2050) \rightarrow \pi\pi/\text{total} = 0.167$.

NODE=M070S7;LINKAGE=V

 $\Gamma(\gamma \omega \omega)/\Gamma_{\text{total}}$ Γ_{182}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.61$\pm$0.33 OUR AVERAGE				
6.0 $\pm$ 4.8 $\pm$ 1.8		ABLIKIM	08A BES2	$J/\psi \rightarrow \gamma \omega \pi^+ \pi^-$
1.41 $\pm$ 0.2 $\pm$ 0.42	120 $\pm$ 17	BISELLO	87 SPEC	$e^+ e^-$, hadrons γ
1.76 $\pm$ 0.09 $\pm$ 0.45		BALTRUSAIT..85C	MRK3	$e^+ e^- \rightarrow \text{hadrons } \gamma$

NODE=M070R97
NODE=M070R97

 $\Gamma(\gamma \eta(1405/1475) \rightarrow \gamma \rho^0 \rho^0)/\Gamma_{\text{total}}$ Γ_{183}/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	$J/\psi \rightarrow 4\pi \gamma$

NODE=M070S19
NODE=M070S19

¹ Estimated by us from various fits.

² Includes unknown branching fraction to $\rho^0 \rho^0$.

NODE=M070S19;LINKAGE=A
NODE=M070S19;LINKAGE=B

 $\Gamma(\gamma f_2(1270))/\Gamma_{\text{total}}$ Γ_{184}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.64$\pm$0.12 OUR AVERAGE	Error includes scale factor of 1.3. See the ideogram below.			
2.07 $\pm$ 0.16 $^{+0.02}_{-0.07}$	2.4k	^{1,2} DOBBS	15	$J/\psi \rightarrow \gamma \pi \pi$
1.63 $\pm$ 0.26 $^{+0.02}_{-0.06}$		³ ABLIKIM	06V BES2	$e^+ e^- \rightarrow J/\psi \rightarrow \gamma \pi^+ \pi^-$
1.42 $\pm$ 0.21 $^{+0.01}_{-0.05}$		⁴ ABLIKIM	06V BES2	$e^+ e^- \rightarrow J/\psi \rightarrow \gamma \pi^0 \pi^0$
1.33 $\pm$ 0.05 $\pm$ 0.20		⁵ AUGUSTIN	87 DM2	$J/\psi \rightarrow \gamma \pi^+ \pi^-$
1.36 $\pm$ 0.09 $\pm$ 0.23		⁵ BALTRUSAIT..87	MRK3	$J/\psi \rightarrow \gamma \pi^+ \pi^-$
1.48 $\pm$ 0.25 $\pm$ 0.30	178	EDWARDS	82B CBAL	$e^+ e^- \rightarrow 2\pi^0 \gamma$
2.0 $\pm$ 0.7	35	ALEXANDER	78 PLUT	$e^+ e^-$
1.2 $\pm$ 0.6	30	⁶ BRANDELIK	78B DASP	$e^+ e^- \rightarrow \pi^+ \pi^- \gamma$

NODE=M070R86
NODE=M070R86

OCCUR=2

¹ Using CLEO-c data but not authored by the CLEO Collaboration.

² DOBBS 15 reports $[\Gamma(J/\psi(1S) \rightarrow \gamma f_2(1270))/\Gamma_{\text{total}}] \times [B(f_2(1270) \rightarrow \pi\pi)] = (1.744 \pm 0.052 \pm 0.122) \times 10^{-3}$ which we divide by our best value $B(f_2(1270) \rightarrow \pi\pi) = (84.2^{+2.9}_{-0.9}) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

³ ABLIKIM 06V reports $[\Gamma(J/\psi(1S) \rightarrow \gamma f_2(1270))/\Gamma_{\text{total}}] \times [B(f_2(1270) \rightarrow \pi\pi)] = (1.371 \pm 0.010 \pm 0.222) \times 10^{-3}$ which we divide by our best value $B(f_2(1270) \rightarrow \pi\pi) = (84.2^{+2.9}_{-0.9}) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

⁴ ABLIKIM 06V reports $[\Gamma(J/\psi(1S) \rightarrow \gamma f_2(1270))/\Gamma_{\text{total}}] \times [B(f_2(1270) \rightarrow \pi\pi)] = (1.200 \pm 0.027 \pm 0.174) \times 10^{-3}$ which we divide by our best value $B(f_2(1270) \rightarrow \pi\pi) = (84.2^{+2.9}_{-0.9}) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

⁵ Estimated using $B(f_2(1270) \rightarrow \pi\pi) = 0.843 \pm 0.012$. The errors do not contain the uncertainty in the $f_2(1270)$ decay.

⁶ Restated by us to take account of spread of E1, M2, E3 transitions.

NODE=M070R86;LINKAGE=A
NODE=M070R86;LINKAGE=DO

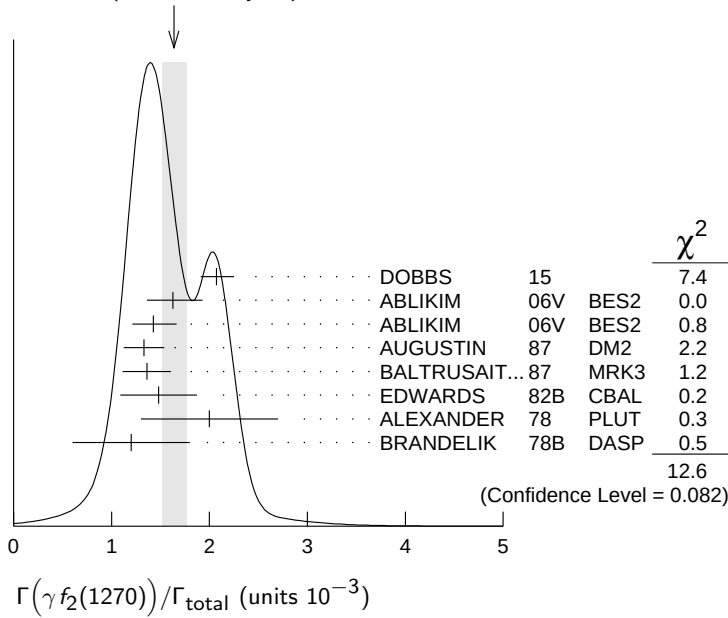
NODE=M070R86;LINKAGE=AI

NODE=M070R86;LINKAGE=AL

NODE=M070R86;LINKAGE=X

NODE=M070R86;LINKAGE=T

WEIGHTED AVERAGE
 1.64 ± 0.12 (Error scaled by 1.3)



$\Gamma(\gamma f_0(1370) \rightarrow \gamma K \bar{K}) / \Gamma_{\text{total}}$

Γ_{185} / Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	COMMENT
$4.19 \pm 0.73 \pm 1.34$	478	¹ DOBBS 15	$J/\psi \rightarrow \gamma K \bar{K}$

¹ Using CLEO-c data but not authored by the CLEO Collaboration.

NODE=M070R00
 NODE=M070R00

NODE=M070R00;LINKAGE=A

$\Gamma(\gamma f_0(1710) \rightarrow \gamma K \bar{K}) / \Gamma_{\text{total}}$

Γ_{186} / Γ

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

10.0 ± 1.1 **OUR AVERAGE** Error includes scale factor of 1.5. See the ideogram

below.

$11.76 \pm 0.54 \pm 0.94$	1.2k	¹ DOBBS 15	$J/\psi \rightarrow \gamma K \bar{K}$
$9.62 \pm 0.29 \pm 3.51$ -1.86		² BAI 03G BES	$J/\psi \rightarrow \gamma K \bar{K}$
$5.0 \pm 0.8 \pm 1.8$ -0.4		^{3,4} BAI 96C BES	$J/\psi \rightarrow \gamma K^+ K^-$
$9.2 \pm 1.4 \pm 1.4$		⁴ AUGUSTIN 88 DM2	$J/\psi \rightarrow \gamma K^+ K^-$
$10.4 \pm 1.2 \pm 1.6$		⁴ AUGUSTIN 88 DM2	$J/\psi \rightarrow \gamma K_S^0 K_S^0$
$9.6 \pm 1.2 \pm 1.8$		⁴ BALTRUSAIT..87 MRK3	$J/\psi \rightarrow \gamma K^+ K^-$

OCCUR=2

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

$1.6 \pm 0.2 \pm 0.6$ -0.2		^{4,5} BAI 96C BES	$J/\psi \rightarrow \gamma K^+ K^-$
< 0.8	90	⁶ BISELLO 89B	$J/\psi \rightarrow 4\pi\gamma$
$1.6 \pm 0.4 \pm 0.3$		⁷ BALTRUSAIT..87 MRK3	$J/\psi \rightarrow \gamma \pi^+ \pi^-$
3.8 ± 1.6		⁸ EDWARDS 82D CBAL	$e^+ e^- \rightarrow \eta \eta \gamma$

OCCUR=2

OCCUR=2

¹ Using CLEO-c data but not authored by the CLEO Collaboration.

² Includes unknown branching ratio to $K^+ K^-$ or $K_S^0 K_S^0$.

³ Assuming $J^P = 2^+$ for $f_0(1710)$.

⁴ 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.

⁵ Assuming $J^P = 0^+$ for $f_0(1710)$.

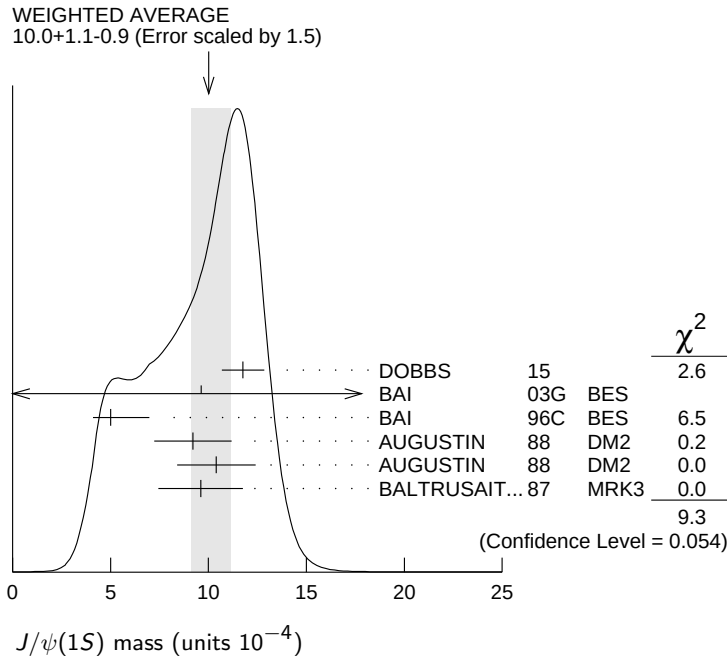
⁶ Includes unknown branching fraction to $\rho^0 \rho^0$.

⁷ Includes unknown branching fraction to $\pi^+ \pi^-$.

⁸ Includes unknown branching fraction to $\eta \eta$.

NODE=M070R91;LINKAGE=D
 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_{187}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
3.8 ± 0.5 OUR AVERAGE				
3.72 ± 0.30 ± 0.43	483	¹ DOBBS 15		$J/\psi \rightarrow \gamma \pi \pi$
3.96 ± 0.06 ± 1.12		² ABLIKIM 06V BES2		$e^+ e^- \rightarrow J/\psi \rightarrow \gamma \pi^+ \pi^-$
3.99 ± 0.15 ± 2.64		² ABLIKIM 06V BES2		$e^+ e^- \rightarrow J/\psi \rightarrow \gamma \pi^0 \pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2.5 ± 1.6 ± 0.8		BAI 98H BES		$J/\psi \rightarrow \gamma \pi^0 \pi^0$

NODE=M070B01
NODE=M070B01

OCCUR=2

¹ Using CLEO-c data but not authored by the CLEO Collaboration.

² Including unknown branching fraction to $\pi \pi$.

NODE=M070B01;LINKAGE=A
NODE=M070B01;LINKAGE=AB

$\Gamma(\gamma f_0(1710) \rightarrow \gamma \omega \omega) / \Gamma_{\text{total}}$

Γ_{188}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
0.31 ± 0.06 ± 0.08	180	ABLIKIM 06H BES		$J/\psi \rightarrow \gamma \omega \omega$

NODE=M070R01
NODE=M070R01

$\Gamma(\gamma f_0(1710) \rightarrow \gamma \eta \eta) / \Gamma_{\text{total}}$

Γ_{189}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.35^{+0.13+1.24}_{-0.11-0.74}	5.5k	¹ ABLIKIM 13N BES3		$J/\psi \rightarrow \gamma \eta \eta$

NODE=M070S84
NODE=M070S84

¹ From partial wave analysis including all possible combinations of 0^{++} , 2^{++} , and 4^{++} resonances.

NODE=M070S84;LINKAGE=A

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

Γ_{190}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.104 ± 0.034 OUR AVERAGE				
1.101 ± 0.029 ± 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 ± 0.08 ± 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_{191}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
0.79 ± 0.13 OUR AVERAGE			
0.68 ± 0.04 ± 0.24	BAI 00D BES		$J/\psi \rightarrow \gamma K^\pm K_S^0 \pi^\mp$
0.76 ± 0.15 ± 0.21	^{1,2} AUGUSTIN 92 DM2		$J/\psi \rightarrow \gamma K \bar{K} \pi$
0.87 ± 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

$\Gamma(\gamma f_1(1285))/\Gamma_{\text{total}}$ VALUE (units 10^{-3})**0.61 $\pm$ 0.08 OUR AVERAGE**0.69 $\pm$ 0.16 $\pm$ 0.200.61 $\pm$ 0.04 $\pm$ 0.210.45 $\pm$ 0.09 $\pm$ 0.170.625 $\pm$ 0.063 $\pm$ 0.1030.70 $\pm$ 0.08 $\pm$ 0.16

DOCUMENT ID

TECN

COMMENT

1 BAI

04J

BES2

 $J/\psi \rightarrow \gamma \gamma \rho^0$

2 BAI

00D

BES

 $J/\psi \rightarrow \gamma K^\pm K_S^0 \pi^\mp$

3 BAI

99

BES

 $J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$

4 BOLTON

92

MRK3

 $J/\psi \rightarrow \gamma f_1(1285)$

5 BOLTON

92B

MRK3

 $J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$ 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 $a_0(980) \rightarrow \eta \pi$. Γ_{192}/Γ

NODE=M070R88

NODE=M070R88

NODE=M070R88;LINKAGE=BI

NODE=M070R88;LINKAGE=BD

NODE=M070R88;LINKAGE=BA

NODE=M070R88;LINKAGE=B

NODE=M070R88;LINKAGE=A

 $\Gamma(\gamma f_1(1510) \rightarrow \gamma \eta \pi^+ \pi^-)/\Gamma_{\text{total}}$ VALUE (units 10^{-4})**4.5 $\pm$ 1.0 $\pm$ 0.7**

DOCUMENT ID

TECN

COMMENT

BAI

99

BES

 $J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$ Γ_{193}/Γ

NODE=M070S36

NODE=M070S36

 $\Gamma(\gamma f'_2(1525))/\Gamma_{\text{total}}$ VALUE (units 10^{-4})**5.7 $^{+0.8}_{-0.5}$** **OUR AVERAGE**

Error includes scale factor of 1.5. See the ideogram

below.

8.0 $\pm$ 0.9 $\pm$ 0.2

750

1,2 DOBBS

15

 $J/\psi \rightarrow \gamma K \bar{K}$ 3.85 $\pm$ 0.17 $^{+1.91}_{-0.73}$

3 BAI

03G

BES

 $J/\psi \rightarrow \gamma K \bar{K}$ 3.6 $\pm$ 0.4 $^{+1.4}_{-0.4}$

3 BAI

96C

BES

 $J/\psi \rightarrow \gamma K^+ K^-$ 5.6 $\pm$ 1.4 $\pm$ 0.9

3 AUGUSTIN

88

DM2

 $J/\psi \rightarrow \gamma K^+ K^-$ 4.5 $\pm$ 0.4 $\pm$ 0.9

3 AUGUSTIN

88

DM2

 $J/\psi \rightarrow \gamma K_S^0 K_S^0$ 6.8 $\pm$ 1.6 $\pm$ 1.4

3 BALTRUSAIT..87

MRK3

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

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

<3.4

90

4

4 BRANDELIK

79C

DASP

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

<2.3

90

3

ALEXANDER

78

PLUT

 $e^+ e^- \rightarrow K^+ K^- \gamma$ ¹ Using CLEO-c data but not authored by the CLEO Collaboration.² DOBBS 15 reports $[\Gamma(J/\psi(1S) \rightarrow \gamma f'_2(1525))/\Gamma_{\text{total}}] \times [B(f'_2(1525) \rightarrow K \bar{K})] = (7.09 \pm 0.46 \pm 0.67) \times 10^{-4}$ which we divide by our best value $B(f'_2(1525) \rightarrow K \bar{K}) = (88.7 \pm 2.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.³ Using $B(f'_2(1525) \rightarrow K \bar{K}) = 0.888$.⁴ Assuming isotropic production and decay of the $f'_2(1525)$ and isospin. Γ_{194}/Γ

NODE=M070R87

NODE=M070R87

OCCUR=3

OCCUR=4

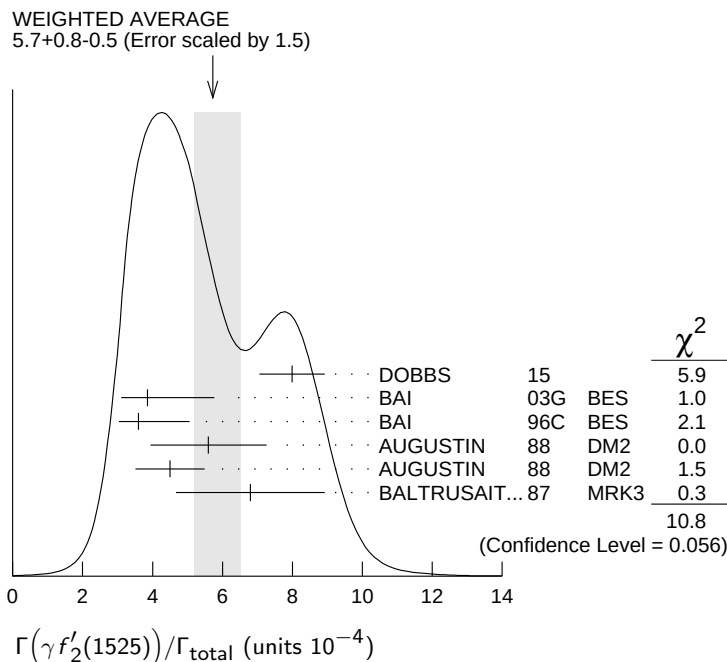
OCCUR=2

NODE=M070R87;LINKAGE=B

NODE=M070R87;LINKAGE=DO

NODE=M070R87;LINKAGE=A1

NODE=M070R87;LINKAGE=I



$\Gamma(\gamma f'_2(1525) \rightarrow \gamma \eta \eta)/\Gamma_{\text{total}}$

Γ_{195}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
3.42^{+0.43+1.37}_{-0.51-1.30}	5.5k	¹ ABLIKIM	13N	BES3 $J/\psi \rightarrow \gamma \eta \eta$

NODE=M070S86
NODE=M070S86

¹ From partial wave analysis including all possible combinations of 0^{++} , 2^{++} , and 4^{++} resonances.

NODE=M070S86;LINKAGE=A

$\Gamma(\gamma f_2(1640) \rightarrow \gamma \omega \omega)/\Gamma_{\text{total}}$

Γ_{196}/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_{197}/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_{198}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.5 $\pm$ 0.6 OUR AVERAGE				
2.00 $\pm$ 0.08 ^{+1.38} _{-1.64}	1.3k	ABLIKIM	13J	BES3 $J/\psi \rightarrow \gamma \omega \phi$
2.61 $\pm$ 0.27 $\pm$ 0.65	95	ABLIKIM	06J	BES2 $J/\psi \rightarrow \gamma \omega \phi$

NODE=M070S79
NODE=M070S79

$\Gamma(\gamma f_2(1810) \rightarrow \gamma \eta \eta)/\Gamma_{\text{total}}$

Γ_{199}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	COMMENT
5.40^{+0.60+3.42}_{-0.67-2.35}	5.5k	¹ ABLIKIM	13N $J/\psi \rightarrow \gamma \eta \eta$

NODE=M070S87
NODE=M070S87

¹ From partial wave analysis including all possible combinations of 0^{++} , 2^{++} , and 4^{++} resonances.

NODE=M070S87;LINKAGE=A

$\Gamma(\gamma f_2(1950) \rightarrow \gamma K^*(892) \bar{K}^*(892))/\Gamma_{\text{total}}$

Γ_{200}/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_{201}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
4.0$\pm$0.3$\pm$1.3	320	¹ BAI	00B	BES $J/\psi \rightarrow \gamma K^+ K^0 \pi^+ \pi^-$

NODE=M070B07
NODE=M070B07

¹ Summed over all charges.

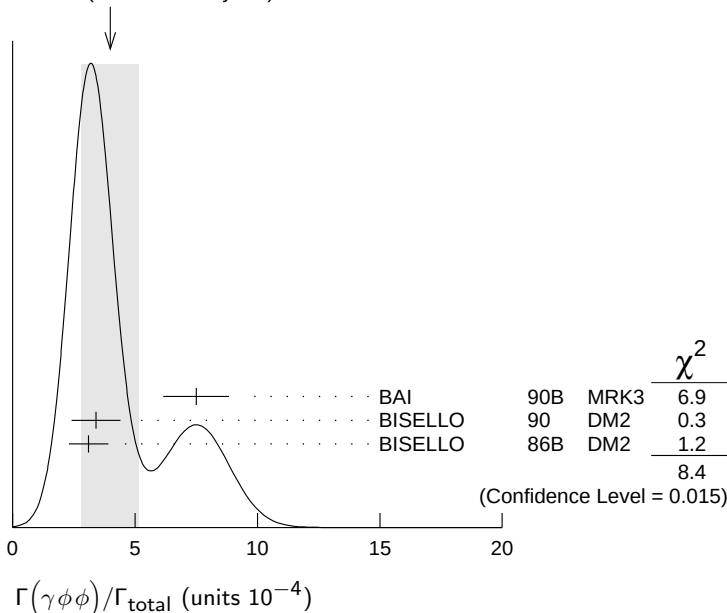
NODE=M070R;LINKAGE=B7

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

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.

WEIGHTED AVERAGE
 4.0 ± 1.2 (Error scaled by 2.1)



NODE=M070R98
NODE=M070R98

NODE=M070R98;LINKAGE=C

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

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 $e^+ e^-$

 $\Gamma(\gamma\eta(2225))/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$3.14^{+0.50}_{-0.19}$ OUR AVERAGE				

[(0.33 ± 0.05) $\times 10^{-3}$ OUR 2016 AVERAGE]

$2.40 \pm 0.10^{+2.47}_{-0.18}$	^{1,2}	ABLIKIM	16N	BES3	$J/\psi \rightarrow \gamma K^+ K^- K^+ K^-$
$4.4 \pm 0.4 \pm 0.8$	²	ABLIKIM	08I	BES	$J/\psi \rightarrow \gamma K^+ K^- K_S^0 K_L^0$
$3.3 \pm 0.8 \pm 0.5$	²	BAI	90B	MRK3	$J/\psi \rightarrow \gamma K^+ K^- K^+ K^-$
$2.7 \pm 0.6 \pm 0.6$	²	BAI	90B	MRK3	$J/\psi \rightarrow \gamma K^+ K^- K_S^0 K_L^0$
$2.4^{+1.5}_{-1.0}$	^{3,4}	BISELLO	89B	DM2	$J/\psi \rightarrow 4\pi\gamma$

¹ From a partial wave analysis of $J/\psi \rightarrow \gamma\phi\phi$ that also finds significant signals for for $\eta(2100)$, $0^- +$ phase space, $f_0(2100)$, $f_2(2010)$, $f_2(2300)$, $f_2(2340)$, and a previously unseen $0^- +$ state $X(2500)$ ($M = 2470^{+15+101}_{-19-23}$ MeV, $\Gamma = 230^{+64+56}_{-35-33}$ MeV).

² Includes unknown branching fraction to $\phi\phi$.

³ Estimated by us from various fits.

⁴ Includes unknown branching fraction to $\rho^0 \rho^0$.

 $\Gamma(\gamma\eta(1760) \rightarrow \gamma\rho^0\rho^0)/\Gamma_{\text{total}}$

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=M070R90
NODE=M070R90

NODE=M070S21
NODE=M070S21

NEW

OCCUR=2

NODE=M070S21;LINKAGE=C

NODE=M070S21;LINKAGE=U
NODE=M070S21;LINKAGE=A
NODE=M070S21;LINKAGE=B

NODE=M070S20
NODE=M070S20

NODE=M070S20;LINKAGE=A
NODE=M070S20;LINKAGE=B

$\Gamma(\gamma\eta(1760) \rightarrow \gamma\omega\omega)/\Gamma_{\text{total}}$ Γ_{206}/Γ

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
$1.98 \pm 0.08 \pm 0.32$	1045	ABLIKIM	06H	BES $J/\psi \rightarrow \gamma\omega\omega$

NODE=M070R04
 NODE=M070R04

 $\Gamma(\gamma X(1835) \rightarrow \gamma\pi^+\pi^-\eta')/\Gamma_{\text{total}}$ Γ_{207}/Γ

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

$2.77^{+0.34}_{-0.40}$ OUR AVERAGE Error includes scale factor of 1.1. $[(2.6 \pm 0.4) \times 10^{-4}]$ OUR 2016 AVERAGE]

NODE=M070R78
 NODE=M070R78

NEW

$3.93 \pm 0.38^{+0.31}_{-0.84}$		¹ ABLIKIM	16J	BES3	$J/\psi \rightarrow \gamma\pi^+\pi^-\eta'$
$2.87 \pm 0.09^{+0.49}_{-0.52}$	4265	² ABLIKIM	11C	BES3	$J/\psi \rightarrow \gamma\pi^+\pi^-\eta'$
$2.2 \pm 0.4 \pm 0.4$	264	ABLIKIM	05R	BES2	$J/\psi \rightarrow \gamma\pi^+\pi^-\eta'$

¹ From a fit of the measured $\pi^+\pi^-\eta'$ lineshape that accounts for the abrupt distortion observed at the $p\bar{p}$ threshold with a Flatte formula in addition to known backgrounds and contributors, as well as an *ad hoc* Breit-Wigner ($M \approx 1919$ MeV; $\Gamma \approx 51$ MeV) that is required for a good fit. Another explanation for the distortion provided by ABLIKIM 16J is that a second resonance near 1870 MeV interferes with the $X(1835)$; fits to this possibility yield product branching fraction values compatible with that shown within the respective systematic uncertainties.

NODE=M070R78;LINKAGE=A

² From a fit of the $\pi^+\pi^-\eta'$ mass distribution to a combination of $\gamma f_1(1510)$, $\gamma X(1835)$, and two 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;LINKAGE=AI

 $\Gamma(\gamma X(1835) \rightarrow \gamma p\bar{p})/\Gamma_{\text{total}}$ Γ_{208}/Γ

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

$0.77^{+0.15}_{-0.09}$ OUR AVERAGE

$0.90^{+0.04+0.27}_{-0.11-0.55}$		¹ ABLIKIM	12D	BES3	$J/\psi \rightarrow \gamma p\bar{p}$
$1.14^{+0.43+0.42}_{-0.30-0.26}$	231	² ALEXANDER	10	CLEO	$J/\psi \rightarrow \gamma p\bar{p}$
$0.70 \pm 0.04^{+0.19}_{-0.08}$		BAI	03F	BES2	$J/\psi \rightarrow \gamma p\bar{p}$

¹ From the fit including final state interaction effects in isospin 0 S -wave according to SIBIRTSEV 05A.

NODE=M070S71;LINKAGE=AK

² From a fit of the $p\bar{p}$ mass distribution to a combination of $\gamma X(1835)$, γR with $M(R) = 2100$ MeV and $\Gamma(R) = 160$ MeV, and $\gamma p\bar{p}$ phase space, for $M(p\bar{p}) < 2.85$ GeV.

NODE=M070S71;LINKAGE=AL

 $\Gamma(\gamma X(1835) \rightarrow \gamma K_S^0 K_S^0 \eta)/\Gamma_{\text{total}}$ Γ_{209}/Γ

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

$3.31^{+0.33+1.96}_{-0.30-1.29}$ ABLIKIM 15T BES3 $J/\psi \rightarrow \gamma K_S^0 K_S^0 \eta$

NODE=M070S96
 NODE=M070S96

 $\Gamma(\gamma X(1840) \rightarrow \gamma 3(\pi^+\pi^-))/\Gamma_{\text{total}}$ Γ_{210}/Γ

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT

$2.44 \pm 0.36^{+0.60}_{-0.74}$ 0.6k ABLIKIM 13U BES3 $J/\psi \rightarrow \gamma 3(\pi^+\pi^-)$

NODE=M070S82
 NODE=M070S82

 $\Gamma(\gamma(K\bar{K}\pi)[J^{PC}=0^{-+}])/ \Gamma_{\text{total}}$ Γ_{211}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT

0.7 ± 0.4 OUR AVERAGE Error includes scale factor of 2.1.

$0.58 \pm 0.03 \pm 0.20$	¹ BAI	00D	BES	$J/\psi \rightarrow \gamma K^\pm K_S^0 \pi^\mp$
$2.1 \pm 0.1 \pm 0.7$	² BAI	00D	BES	$J/\psi \rightarrow \gamma K^\pm K_S^0 \pi^\mp$

OCCUR=2

¹ For a broad structure around 1800 MeV.

NODE=M070S38;LINKAGE=BD
 NODE=M070S38;LINKAGE=BE

² For a broad structure around 2040 MeV.

 $\Gamma(\gamma\pi^0)/\Gamma_{\text{total}}$ Γ_{212}/Γ

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT

$3.49^{+0.33}_{-0.30}$ OUR AVERAGE

$3.63 \pm 0.36 \pm 0.13$		PEDLAR	09	CLE3	$J/\psi \rightarrow \pi^0 \gamma$
$3.13^{+0.65}_{-0.47}$	586	ABLIKIM	06E	BES2	$J/\psi \rightarrow \pi^0 \gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

$3.6 \pm 1.1 \pm 0.7$		BLOOM	83	CBAL	e^+e^-
7.3 ± 4.7	10	BRANDELIK	79C	DASP	e^+e^-

NODE=M070R82
 NODE=M070R82

$\Gamma(\gamma\rho\bar{\rho}\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{213}/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_{214}/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

 $\Gamma(\gamma f_0(2100) \rightarrow \gamma\eta\eta)/\Gamma_{\text{total}}$ Γ_{215}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.13^{+0.09+0.64}_{-0.10-0.28}$	5.5k	¹ ABLIKIM	13N	BES3 $J/\psi \rightarrow \gamma\eta\eta$

NODE=M070S85
 NODE=M070S85

¹ From partial wave analysis including all possible combinations of 0^{++} , 2^{++} , and 4^{++} resonances.

NODE=M070S85;LINKAGE=A

 $\Gamma(\gamma f_0(2100) \rightarrow \gamma\pi\pi)/\Gamma_{\text{total}}$ Γ_{216}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$6.24 \pm 0.48 \pm 0.87$	744	¹ DOBBS	15	$J/\psi \rightarrow \gamma\pi\pi$

NODE=M070B08
 NODE=M070B08

¹ Using CLEO-c data but not authored by the CLEO Collaboration.

NODE=M070B08;LINKAGE=A

 $\Gamma(\gamma f_0(2200))/\Gamma_{\text{total}}$ Γ_{217}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
1.5	¹ AUGUSTIN	88	DM2 $J/\psi \rightarrow \gamma K_S^0 K_S^0$

NODE=M070S18
 NODE=M070S18

¹ Includes unknown branching fraction to $K_S^0 K_S^0$.

NODE=M070S18;LINKAGE=A

 $\Gamma(\gamma f_0(2200) \rightarrow \gamma K\bar{K})/\Gamma_{\text{total}}$ Γ_{218}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	COMMENT
$5.86 \pm 0.49 \pm 1.20$	490	¹ DOBBS	15 $J/\psi \rightarrow \gamma K\bar{K}$

NODE=M070B09
 NODE=M070B09

¹ Using CLEO-c data but not authored by the CLEO Collaboration.

NODE=M070B09;LINKAGE=A

 $\Gamma(\gamma f_J(2220))/\Gamma_{\text{total}}$ Γ_{219}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
>300			¹ BAI	96B	BES $e^+e^- \rightarrow \gamma\bar{p}p, K\bar{K}$
>250	99.9		² HASAN	96	SPEC $\bar{p}p \rightarrow \pi^+\pi^-$
< 2.3	95		³ AUGUSTIN	88	DM2 $J/\psi \rightarrow \gamma K^+ K^-$
< 1.6	95		³ AUGUSTIN	88	DM2 $J/\psi \rightarrow \gamma K_S^0 K_S^0$
$12.4^{+6.4}_{-5.2} \pm 2.8$		23	³ BALTRUSAIT..86D	MRK3	$J/\psi \rightarrow \gamma K_S^0 K_S^0$
$8.4^{+3.4}_{-2.8} \pm 1.6$		93	³ BALTRUSAIT..86D	MRK3	$J/\psi \rightarrow \gamma K^+ K^-$

OCCUR=2

OCCUR=2

¹ Using BARNES 93.

² Using BAI 96B.

³ Includes unknown branching fraction to $K^+ K^-$ or $K_S^0 K_S^0$.

NODE=M070R92;LINKAGE=A
 NODE=M070R92;LINKAGE=M
 NODE=M070R92;LINKAGE=W

 $\Gamma(\gamma f_J(2220) \rightarrow \gamma\pi\pi)/\Gamma_{\text{total}}$ Γ_{220}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
< 3.9	90	^{1,2} DOBBS	15	$J/\psi \rightarrow \gamma\pi\pi$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$14 \pm 8 \pm 4$		BAI	98H	BES $J/\psi \rightarrow \gamma\pi^0\pi^0$
$8.4 \pm 2.6 \pm 3.0$		BAI	96B	BES $e^+e^- \rightarrow J/\psi \rightarrow \gamma\pi^+\pi^-$

NODE=M070B02
 NODE=M070B02

¹ Using CLEO-c data but not authored by the CLEO Collaboration.

² For $\Gamma = 20/50$ MeV, the 90% CL upper limits for $\pi^+\pi^-$ and $\pi^0\pi^0$ are $2.6/5.2 \times 10^{-5}$ and $1.3/1.9 \times 10^{-5}$, respectively.

NODE=M070B02;LINKAGE=A
 NODE=M070B02;LINKAGE=D0

$\Gamma(\gamma f_J(2220) \rightarrow \gamma K \bar{K})/\Gamma_{\text{total}}$ Γ_{221}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
< 4.1	90	^{1,2} DOBBS	15	$J/\psi \rightarrow \gamma K \bar{K}$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
< 3.6		³ DEL-AMO-SA..100	BABR	$e^+e^- \rightarrow J/\psi \rightarrow \gamma K^+ K^-$
< 2.9		³ DEL-AMO-SA..100	BABR	$e^+e^- \rightarrow J/\psi \rightarrow \gamma K_S^0 K_S^0$
$6.6 \pm 2.9 \pm 2.4$		BAI	96B BES	$e^+e^- \rightarrow J/\psi \rightarrow \gamma K^+ K^-$
$10.8 \pm 4.0 \pm 3.2$		BAI	96B BES	$e^+e^- \rightarrow J/\psi \rightarrow \gamma K_S^0 K_S^0$

¹ Using CLEO-c data but not authored by the CLEO Collaboration.² For $\Gamma = 20/50$ MeV, the 90% CL upper limits for $K^+ K^-$ and $K_S^0 K_S^0$ are $1.7/3.1 \times 10^{-5}$ and $1.2/2.0 \times 10^{-5}$, respectively.³ For spin 2 and helicity 0; other combinations lead to more stringent upper limits.NODE=M070B03
NODE=M070B03

OCCUR=2

OCCUR=2

NODE=M070B03;LINKAGE=A

NODE=M070B03;LINKAGE=DO

NODE=M070B03;LINKAGE=DE

 $\Gamma(\gamma f_J(2220) \rightarrow \gamma p \bar{p})/\Gamma_{\text{total}}$ Γ_{222}/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 $\Gamma(\gamma f_2(2340) \rightarrow \gamma \eta \eta)/\Gamma_{\text{total}}$ Γ_{223}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
$5.60^{+0.62+2.37}_{-0.65-2.07}$	5.5k	¹ ABLIKIM	13N BES3	$J/\psi \rightarrow \gamma \eta \eta$

NODE=M070S88
NODE=M070S88¹ From partial wave analysis including all possible combinations of 0^{++} , 2^{++} , and 4^{++} resonances.

NODE=M070S88;LINKAGE=A

 $\Gamma(\gamma f_0(1500) \rightarrow \gamma \pi \pi)/\Gamma_{\text{total}}$ Γ_{224}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.09 ± 0.24 OUR AVERAGE				
$1.21 \pm 0.29 \pm 0.24$	174	¹ DOBBS	15	$J/\psi \rightarrow \gamma \pi \pi$
$1.00 \pm 0.03 \pm 0.45$		² ABLIKIM	06V BES2	$e^+e^- \rightarrow J/\psi \rightarrow \gamma \pi^+ \pi^-$
$1.02 \pm 0.09 \pm 0.45$		² ABLIKIM	06V BES2	$e^+e^- \rightarrow J/\psi \rightarrow \gamma \pi^0 \pi^0$

• • • We do not use the following data for averages, fits, limits, etc. • • •

 5.7 ± 0.8 ^{3,4} BUGG 95 MRK3 $J/\psi \rightarrow \gamma \pi^+ \pi^- \pi^+ \pi^-$ ¹ Using CLEO-c data but not authored by the CLEO Collaboration.² Including unknown branching fraction to $\pi \pi$.³ Including unknown branching ratio for $f_0(1500) \rightarrow \pi^+ \pi^- \pi^+ \pi^-$.⁴ Assuming that $f_0(1500)$ decays only to two S-wave dipions.NODE=M070S32
NODE=M070S32

OCCUR=2

NODE=M070S32;LINKAGE=C
NODE=M070S32;LINKAGE=AB
NODE=M070S32;LINKAGE=A
NODE=M070S32;LINKAGE=B $\Gamma(\gamma f_0(1500) \rightarrow \gamma \eta \eta)/\Gamma_{\text{total}}$ Γ_{225}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.65^{+0.26+0.51}_{-0.31-1.40}$	5.5k	¹ ABLIKIM	13N BES3	$J/\psi \rightarrow \gamma \eta \eta$

¹ From partial wave analysis including all possible combinations of 0^{++} , 2^{++} , and 4^{++} resonances.NODE=M070S83
NODE=M070S83

NODE=M070S83;LINKAGE=A

 $\Gamma(\gamma A \rightarrow \gamma \text{invisible})/\Gamma_{\text{total}}$
(narrow state A with $m_A < 960$ MeV) Γ_{226}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
< 6.3	90	¹ INSLER	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_{227}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
< 0.5 (CL = 90%)	[< 2.1×10^{-5} (CL = 90%) OUR 2016 BEST LIMIT]			
< 0.5	90	¹ ABLIKIM	16E BES3	$J/\psi \rightarrow \gamma \mu^+ \mu^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 2.1 90 ² ABLIKIM 12 BES3 $J/\psi \rightarrow \gamma \mu^+ \mu^-$ ¹ For a narrow scalar or pseudoscalar, A^0 , with a mass in the range 0.212–3 GeV. The measured 90% CL limit as a function of m_{A^0} is in the range $(2.8\text{--}495.3) \times 10^{-8}$.² For a narrow scalar or pseudoscalar, A^0 , with a mass in the range 0.21–3.00 GeV. The measured 90% CL limit as a function of m_{A^0} ranges from 4×10^{-7} to 2.1×10^{-5} .NODE=M070S76
NODE=M070S76

NODE=M070S76;LINKAGE=A

NODE=M070S76;LINKAGE=AB

————— DALITZ DECAYS —————

$\Gamma(\pi^0 e^+ e^-)/\Gamma_{\text{total}}$					Γ_{228}/Γ
VALUE (units 10^{-7})	EVTS	DOCUMENT ID	TECN	COMMENT	
$7.56 \pm 1.32 \pm 0.50$	39	ABLIKIM	14I	BES3	$J/\psi \rightarrow \pi^0 e^+ e^-$

NODE=M070330

NODE=M070S89
NODE=M070S89

$\Gamma(\eta e^+ e^-)/\Gamma_{\text{total}}$					Γ_{229}/Γ
VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT	
$1.16 \pm 0.07 \pm 0.06$	320	¹ ABLIKIM	14I	BES3	$J/\psi \rightarrow \eta e^+ e^-$

NODE=M070S90
NODE=M070S90¹ Using both $\eta \rightarrow \gamma\gamma$ and $\eta \rightarrow \pi^+ \pi^- \pi^0$ decays.

NODE=M070S90;LINKAGE=A

$\Gamma(\eta'(958) e^+ e^-)/\Gamma_{\text{total}}$					Γ_{230}/Γ
VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT	
$5.81 \pm 0.16 \pm 0.31$	1.4k	¹ ABLIKIM	14I	BES3	$J/\psi \rightarrow \eta' e^+ e^-$

NODE=M070S91
NODE=M070S91¹ Using both $\eta' \rightarrow \gamma\pi^+ \pi^-$ and $\eta' \rightarrow \pi^+ \pi^- \eta$ decays.

NODE=M070S91;LINKAGE=A

————— WEAK DECAYS —————

$\Gamma(D^- e^+ \nu_e + \text{c.c.})/\Gamma_{\text{total}}$					Γ_{231}/Γ
VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT	
< 1.2	90	ABLIKIM	06M	BES2	$e^+ e^- \rightarrow J/\psi$

NODE=M070320

NODE=M070S53
NODE=M070S53

$\Gamma(\bar{D}^0 e^+ e^- + \text{c.c.})/\Gamma_{\text{total}}$					Γ_{232}/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_{233}/Γ
VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT	
< 1.3	90	ABLIKIM	14R	BES3	$e^+ e^- \rightarrow J/\psi$

NODE=M070S55
NODE=M070S55

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 36	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;LINKAGE=AB

$\Gamma(D_s^{*-} e^+ \nu_e + \text{c.c.})/\Gamma_{\text{total}}$					Γ_{234}/Γ
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
$< 1.8 \times 10^{-6}$	90	ABLIKIM	14R	BES3	$e^+ e^- \rightarrow J/\psi$

NODE=M070B13
NODE=M070B13

$\Gamma(D^- \pi^+ + \text{c.c.})/\Gamma_{\text{total}}$					Γ_{235}/Γ
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
$< 7.5 \times 10^{-5}$	90	ABLIKIM	08J	BES2	$e^+ e^- \rightarrow J/\psi$

NODE=M070S61
NODE=M070S61

$\Gamma(\bar{D}^0 \bar{K}^0 + \text{c.c.})/\Gamma_{\text{total}}$					Γ_{236}/Γ
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
$< 1.7 \times 10^{-4}$	90	ABLIKIM	08J	BES2	$e^+ e^- \rightarrow J/\psi$

NODE=M070S62
NODE=M070S62

$\Gamma(\bar{D}^0 \bar{K}^{*0} + \text{c.c.})/\Gamma_{\text{total}}$					Γ_{237}/Γ
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
$< 2.5 \times 10^{-6}$	90	ABLIKIM	14K	BES3	$e^+ e^- \rightarrow J/\psi$

NODE=M070S93
NODE=M070S93

$\Gamma(D_s^- \pi^+ + \text{c.c.})/\Gamma_{\text{total}}$					Γ_{238}/Γ
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
$< 1.3 \times 10^{-4}$	90	ABLIKIM	08J	BES2	$e^+ e^- \rightarrow J/\psi$

NODE=M070S63
NODE=M070S63

$\Gamma(D_s^- \rho^+ + \text{c.c.})/\Gamma_{\text{total}}$					Γ_{239}/Γ
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
$< 1.3 \times 10^{-5}$	90	ABLIKIM	14K	BES3	$e^+ e^- \rightarrow J/\psi$

NODE=M070S92
NODE=M070S92

————— CHARGE CONJUGATION (C), PARITY (P),
LEPTON FAMILY NUMBER (LF) VIOLATING MODES —————

NODE=M070315

$\Gamma(\gamma\gamma)/\Gamma_{\text{total}}$					Γ_{240}/Γ
VALUE (units 10^{-7})	CL%	DOCUMENT ID	TECN	COMMENT	
< 2.7	90	ABLIKIM	14Q	BES3	$\psi(2S) \rightarrow \pi^+ \pi^- J/\psi$

NODE=M070R80
NODE=M070R80

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 50	90	ADAMS	08	CLEO	$\psi(2S) \rightarrow \pi^+ \pi^- J/\psi$
<1600	90	¹ WICHT	08	BELL	$B^\pm \rightarrow K^\pm \gamma \gamma$
< 220	90	ABLIKIM	07J	BES2	$\psi(2S) \rightarrow J/\psi \pi^+ \pi^-$
<5000	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 $B(B^+ \rightarrow J/\psi(1S) K^+) = 1.026 \times 10^{-3}$.

NODE=M070R80;LINKAGE=W1

$\Gamma(\gamma\phi)/\Gamma_{\text{total}}$					Γ_{241}/Γ
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
<1.4 × 10 ⁻⁶	90	ABLIKIM	14Q	BES3	$\psi(2S) \rightarrow \pi^+ \pi^- J/\psi$

NODE=M070S95
NODE=M070S95

$\Gamma(e^\pm \mu^\mp)/\Gamma_{\text{total}}$					Γ_{242}/Γ
VALUE (units 10 ⁻⁷)	CL%	DOCUMENT ID	TECN	COMMENT	
< 1.6	90	ABLIKIM	13L	BES3	$e^+ e^- \rightarrow J/\psi$

NODE=M070S39
NODE=M070S39

• • • We do not use the following data for averages, fits, limits, etc. • • •

<11	90	BAI	03D	BES	$e^+ e^- \rightarrow J/\psi$

$\Gamma(e^\pm \tau^\mp)/\Gamma_{\text{total}}$					Γ_{243}/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

$\Gamma(\mu^\pm \tau^\mp)/\Gamma_{\text{total}}$					Γ_{244}/Γ
VALUE (units 10 ⁻⁶)	CL%	DOCUMENT ID	TECN	COMMENT	
<2.0	90	ABLIKIM	04	BES	$e^+ e^- \rightarrow J/\psi$

NODE=M070S41
NODE=M070S41

OTHER DECAYS

NODE=M070325

$\Gamma(\text{invisible})/\Gamma(e^+ e^-)$					Γ_{245}/Γ_5
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
<6.6 × 10 ⁻²	90	LEES	13I	BABR	$B \rightarrow K^{(*)} J/\psi$

NODE=M070S80
NODE=M070S80

$\Gamma(\text{invisible})/\Gamma(\mu^+ \mu^-)$					Γ_{245}/Γ_7
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
<1.2 × 10 ⁻²	90	ABLIKIM	08G	BES2	$\psi(2S) \rightarrow \pi^+ \pi^- J/\psi$

NODE=M070S60
NODE=M070S60

J/ψ(1S) REFERENCES

NODE=M070

ABLIKIM	16E	PR D93 052005	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=57265
ABLIKIM	16J	PRL 117 042002	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=57454
ABLIKIM	16K	PR D93 052010	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=57509
ABLIKIM	16L	PR D93 072003	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=57510
ABLIKIM	16M	PR D93 072008	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=57511
ABLIKIM	16N	PR D93 112011	M. Ablikim	(BES III Collab.)	REFID=57512
ABLIKIM	16P	PR D94 072005	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=57522
ABLIKIM	16Q	PL B761 98	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=57566
AAIJ	15BI	EPJ C75 311	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=57147
ABLIKIM	15AE	PR D92 052003	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=56984
ABLIKIM	15H	PR D91 052017	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=56773
ABLIKIM	15K	PR D91 112001	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=56776
ABLIKIM	15P	PR D92 012007	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=56781
ABLIKIM	15T	PRL 115 091803	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=56785
ANASHIN	15	PL B749 50	V.V. Anashin <i>et al.</i>	(KEDR Collab.)	REFID=56792
DOBBS	15	PR D91 052006	S. Dobbs <i>et al.</i>	(NWES)	REFID=56805
LEES	15J	PR D92 072008	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=56988
ABLIKIM	14I	PR D89 092008	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=55900
ABLIKIM	14K	PR D89 071101	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=55902
ABLIKIM	14N	PR D90 052009	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=55905
ABLIKIM	14Q	PR D90 092002	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=56238
ABLIKIM	14R	PR D90 112014	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=56388
ANASHIN	14	PL B738 391	V.V. Anashin <i>et al.</i>	(KEDR Collab.)	REFID=56130
AULCHENKO	14	PL B731 227	V.M. Aulchenko <i>et al.</i>	(KEDR Collab.)	REFID=55655
LEES	14H	PR D89 092002	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=55940
ABLIKIM	13F	PR D87 052007	M. Ablikim <i>et al.</i>	(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	13L	PR D87 112007	Ablikim M. <i>et al.</i>	(BES III Collab.)	REFID=55300
ABLIKIM	13N	PR D87 092009	Ablikim M. <i>et al.</i>	(BES III Collab.)	REFID=55387
ABLIKIM	13P	PR D87 112004	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=55392
ABLIKIM	13R	PR D88 032007	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=55402
ABLIKIM	13U	PR D88 091502	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=55582
LEES	13I	PR D87 112005	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=55161
LEES	13O	PR D87 092005	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=55293
LEES	13Q	PR D88 032013	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=55404
LEES	13Y	PR D88 072009	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=55589
ABLIKIM	12	PR D85 092012	M. Ablikim <i>et al.</i>	(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
LEES	12F	PR D86 012008	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=54298
METREVELI	12	PR D85 092007	Z. Metreveli <i>et al.</i>	(NWES, FLOR, WAYN+)	REFID=54304
ABLIKIM	11	PR D83 012003	M. Ablikim <i>et al.</i>	(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 (errat.)	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52266
AUBERT	07BD	PR D76 092006	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52050
ABLIKIM	06	PL B632 181	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50986
ABLIKIM	06C	PL B633 681	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51037
ABLIKIM	06E	PR D73 052008	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51057
ABLIKIM	06F	PR D73 052007	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51058
ABLIKIM	06H	PR D73 112007	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51125
ABLIKIM	06J	PRL 96 162002	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51127
ABLIKIM	06K	PRL 97 062001	M. Ablikim <i>et al.</i>	(BES II Collab.)	REFID=51128
ABLIKIM	06M	PL B639 418	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51130
ABLIKIM	06V	PL B642 441	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51507
ADAMS	06A	PR D73 051103	G.S. Adams <i>et al.</i>	(CLEO Collab.)	REFID=51036
AUBERT	06B	PR D73 012005	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51026
AUBERT	06D	PR D73 052003	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51047
AUBERT	06E	PRL 96 052002	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51059
AUBERT,BE	06D	PR D74 091103	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51511
WU	06	PRL 97 162003	C.-H. Wu <i>et al.</i>	(BELLE Collab.)	REFID=51472
ABLIKIM	05	PL B607 243	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50450
ABLIKIM	05B	PR D71 032003	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50496
ABLIKIM	05C	PL B610 192	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50507
ABLIKIM	05H	PR D72 012002	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50759
ABLIKIM	05R	PRL 95 262001	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50985
AUBERT	05D	PR D71 052001	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=50509
LI	05C	PR D71 111103	Z. Li <i>et al.</i>	(CLEO Collab.)	REFID=50802
SIBIRTSEV	05A	PR D71 054010	A. Sibirtsev, J. Haidenbauer		REFID=51038
ABLIKIM	04	PL B598 172	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=49739
ABLIKIM	04M	PR D70 112008	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50329
AUBERT	04	PR D69 011103	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=49611
AUBERT,B	04N	PR D70 072004	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=50184
BAI	04	PL B578 16	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49620
BAI	04A	PR D69 012003	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49607
BAI	04D	PL B589 7	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49750
BAI	04E	PL B591 42	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49751
BAI	04G	PR D70 012004	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49753
BAI	04H	PR D70 012005	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49754
BAI	04J	PL B594 47	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=50167
SETH	04	PR D69 097503	K.K. Seth		REFID=49779
AULCHENKO	03	PL B573 63	V.M. Aulchenko <i>et al.</i>	(KEDR Collab.)	REFID=49579
BAI	03D	PL B561 49	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49403
BAI	03F	PRL 91 022001	J.Z. Bai <i>et al.</i>	(BES II Collab.)	REFID=49473
BAI	03G	PR D68 052003	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49580
HUANG	03	PRL 91 241802	H.-C. Huang <i>et al.</i>	(BELLE Collab.)	REFID=49621
BAI	02C	PRL 88 101802	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=50506
ARTAMONOV	00	PL B474 427	A.S. Artamonov <i>et al.</i>		REFID=47424
BAI	00	PRL 84 594	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=50503
BAI	00B	PL B472 200	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=47427
BAI	00D	PL B476 25	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=47954
BAI	99	PL B446 356	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=46606
BAI	99C	PRL 83 1918	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=47420
BAI	98D	PR D58 092006	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=46338
BAI	98G	PL B424 213	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=46341
BAI	98H	PRL 81 1179	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=46342
BALDINI	98	PL B444 111	R. Baldini <i>et al.</i>	(FENICE Collab.)	REFID=46608
ARMSTRONG	96	PR D54 7067	T.A. Armstrong <i>et al.</i>	(E760 Collab.)	REFID=45146

BAI	96B	PRL 76 3502	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=44736
BAI	96C	PRL 77 3959	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=45169
BAI	96D	PR D54 1221	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=45198
GRIBUSHIN	96	PR D53 4723	A. Gribushin <i>et al.</i>	(E672 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
BALTRUSAIT...	87	PR D35 2077	R.M. Baltrusaitis <i>et al.</i>	(Mark III Collab.)	REFID=40010
BECKER	87	PRL 59 186	J.J. Becker <i>et al.</i>	(Mark III Collab.)	REFID=40015
BISELLO	87	PL B192 239	D. Bisello <i>et al.</i>	(PADO, CLER, FRAS+)	REFID=40012
COHEN	87	RMP 59 1121	E.R. Cohen, B.N. Taylor	(RISC, NBS)	REFID=11616
HENRARD	87	NP B292 670	P. Henrard <i>et al.</i>	(CLER, FRAS, LALO+)	REFID=40261
PALLIN	87	NP B292 653	D. Pallin <i>et al.</i>	(CLER, FRAS, LALO, PADO)	REFID=40243
BALTRUSAIT...	86	PR D33 629	R.M. Baltrusaitis <i>et al.</i>	(Mark III Collab.)	REFID=22009
BALTRUSAIT...	86B	PR D33 1222	R.M. Baltrusaitis <i>et al.</i>	(Mark III Collab.)	REFID=22100
BALTRUSAIT...	86D	PRL 56 107	R.M. Baltrusaitis <i>et al.</i>	(CIT, UCSC, ILL, SLAC+)	REFID=21865
BISELLO	86B	PL B179 294	D. Bisello <i>et al.</i>	(DM2 Collab.)	REFID=22101
GAISER	86	PR D34 711	J. Gaiser <i>et al.</i>	(Crystal Ball Collab.)	REFID=22012
BALTRUSAIT...	85C	PRL 55 1723	R.M. Baltrusaitis <i>et al.</i>	(CIT, UCSC+)	REFID=22095
BALTRUSAIT...	85D	PR D32 566	R.M. Baltrusaitis <i>et al.</i>	(CIT, UCSC+)	REFID=22097
KURAEV	85	SJNP 41 466	E.A. Kuraev, V.S. Fadin	(NOVO)	REFID=40033
Translated from YAF 41 733.					
BALTRUSAIT...	84	PRL 52 2126	R.M. Baltrusaitis <i>et al.</i>	(CIT, UCSC+)	REFID=22006
EATON	84	PR D29 804	M.W. Eaton <i>et al.</i>	(LBL, SLAC)	REFID=22092
BLOOM	83	ARNS 33 143	E.D. Bloom, C. Peck	(SLAC, CIT)	REFID=21682
EDWARDS	83B	PRL 51 859	C. Edwards <i>et al.</i>	(CIT, HARV, PRIN+)	REFID=21318
FRANKLIN	83	PRL 51 963	M.E.B. Franklin <i>et al.</i>	(LBL, SLAC)	REFID=22216
BURKE	82	PRL 49 632	D.L. Burke <i>et al.</i>	(LBL, SLAC)	REFID=21676
EDWARDS	82B	PR D25 3065	C. Edwards <i>et al.</i>	(CIT, HARV, PRIN+)	REFID=22080
EDWARDS	82D	PRL 48 458	C. Edwards <i>et al.</i>	(CIT, HARV, PRIN+)	REFID=21677
Also		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
BRAUNSCH...	76	PL 63B 487	W. Braunschweig <i>et al.</i>	(DASP Collab.)	REFID=22054
JEAN-MARIE	76	PRL 36 291	B. Jean-Marie <i>et al.</i>	(SLAC, LBL) IG	REFID=22056
BALDINI...	75	PL 58B 471	R. Baldini-Celio <i>et al.</i>	(FRAS, ROMA)	REFID=22026
BOYARSKI	75	PRL 34 1357	A.M. Boyarski <i>et al.</i>	(SLAC, LBL) JPC	REFID=22030
DASP	75	PL 56B 491	W. Braunschweig <i>et al.</i>	(DASP Collab.)	REFID=22036
ESPOSITO	75B	LNC 14 73	B. Esposito <i>et al.</i>	(FRAS, NAPL, PADO+)	REFID=22038
FORD	75	PRL 34 604	R.L. Ford <i>et al.</i>	(SLAC, PENN)	REFID=22039

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NODE=M870

$\chi_{c0}(1P)$

$$I^G(J^{PC}) = 0^+(0^{++})$$

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 $\begin{smallmatrix} + \\ - \end{smallmatrix} \begin{smallmatrix} 0.7 \\ 0.6 \end{smallmatrix} \pm 0.2$		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 $\begin{smallmatrix} + \\ - \end{smallmatrix} \begin{smallmatrix} 1.8 \\ 1.9 \end{smallmatrix} \pm 0.2$		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. • • •				
3414.6 ± 1.1	266	UEHARA	13	BELL $\gamma\gamma \rightarrow K_S^0 K_S^0$
3416.5 ± 3.0		EISENSTEIN	01	CLE2 $e^+e^- \rightarrow e^+e^-\chi_{c0}$
3422 ± 10		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

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
10.5 ± 0.6 OUR FIT				
10.5 ± 0.8 OUR AVERAGE Error includes scale factor of 1.1.				
10.6 ± 1.9 ± 2.6	5.4k	UEHARA	08	BELL $\gamma\gamma \rightarrow \chi_{c0} \rightarrow \text{hadrons}$
12.6 $\begin{smallmatrix} +1.5+0.9 \\ -1.6-1.1 \end{smallmatrix}$		ABLIKIM	05G	BES2 $\psi(2S) \rightarrow \gamma\chi_{c0}$
8.6 $\begin{smallmatrix} +1.7 \\ -1.3 \end{smallmatrix} \pm 0.1$		ANDREOTTI	03	E835 $\bar{p}p \rightarrow \chi_{c0} \rightarrow \pi^0\pi^0$
9.7 ± 1.0	392	¹ BAGNASCO	02	E835 $\bar{p}p \rightarrow \chi_{c0} \rightarrow J/\psi\gamma$
16.6 $\begin{smallmatrix} +5.2 \\ -3.7 \end{smallmatrix} \pm 0.1$		AMBROGIANI	99B	E835 $\bar{p}p \rightarrow e^+e^-\gamma$
14.3 ± 2.0 ± 3.0		BAI	98I	BES $\psi(2S) \rightarrow \gamma\pi^+\pi^-$
13.5 ± 3.3 ± 4.2		GAISER	86	CBAL $\psi(2S) \rightarrow \gamma X, \gamma\pi^0\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
13.2 ± 2.1	266	UEHARA	13	BELL $\gamma\gamma \rightarrow K_S^0 K_S^0$

¹ Recalculated by ANDREOTTI 05A.

NODE=M056W;LINKAGE=AN

 $\chi_{c0}(1P)$ DECAY MODES

NODE=M056215;NODE=M056

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
Hadronic decays		
Γ_1 $2(\pi^+\pi^-)$	(2.24 ± 0.18) %	
Γ_2 $\rho^0\pi^+\pi^-$	(8.7 ± 2.8) × 10 ⁻³	
Γ_3 $\rho^0\rho^0$		
Γ_4 $f_0(980)f_0(980)$	(6.5 ± 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 $4\pi^0$	(3.2 ± 0.4) × 10 ⁻³	
Γ_8 $\pi^+\pi^-K^+K^-$	(1.75 ± 0.14) %	
Γ_9 $K_0^*(1430)^0\bar{K}_0^*(1430)^0 \rightarrow \pi^+\pi^-K^+K^-$	(9.6 $\begin{smallmatrix} +3.5 \\ -2.8 \end{smallmatrix}$) × 10 ⁻⁴	

NODE=M056;CLUMP=A

DESIG=3

DESIG=9

DESIG=54

DESIG=20

DESIG=61

DESIG=62

DESIG=70

DESIG=5

DESIG=31

Γ_{10}	$K_0^*(1430)^0 \bar{K}_2^*(1430)^0 + \text{c.c.} \rightarrow \pi^+ \pi^- K^+ K^-$	$(7.8 \pm_{-2.4}^{+1.9}) \times 10^{-4}$		DESIG=32
Γ_{11}	$K_1(1270)^+ K^- + \text{c.c.} \rightarrow \pi^+ \pi^- K^+ K^-$	$(6.1 \pm 1.9) \times 10^{-3}$		DESIG=33
Γ_{12}	$K_1(1400)^+ K^- + \text{c.c.} \rightarrow \pi^+ \pi^- K^+ K^-$	$< 2.6 \times 10^{-3}$	CL=90%	DESIG=34
Γ_{13}	$f_0(980) f_0(980)$	$(1.6 \pm_{-0.9}^{+1.0}) \times 10^{-4}$		DESIG=23
Γ_{14}	$f_0(980) f_0(2200)$	$(7.8 \pm_{-2.5}^{+2.0}) \times 10^{-4}$		DESIG=24
Γ_{15}	$f_0(1370) f_0(1370)$	$< 2.7 \times 10^{-4}$	CL=90%	DESIG=25
Γ_{16}	$f_0(1370) f_0(1500)$	$< 1.7 \times 10^{-4}$	CL=90%	DESIG=26
Γ_{17}	$f_0(1370) f_0(1710)$	$(6.6 \pm_{-2.3}^{+3.5}) \times 10^{-4}$		DESIG=27
Γ_{18}	$f_0(1500) f_0(1370)$	$< 1.3 \times 10^{-4}$	CL=90%	DESIG=28
Γ_{19}	$f_0(1500) f_0(1500)$	$< 5 \times 10^{-5}$	CL=90%	DESIG=29
Γ_{20}	$f_0(1500) f_0(1710)$	$< 7 \times 10^{-5}$	CL=90%	DESIG=30
Γ_{21}	$K^+ K^- \pi^+ \pi^- \pi^0$	$(8.6 \pm 0.9) \times 10^{-3}$		DESIG=75
Γ_{22}	$K_S^0 K^\pm \pi^\mp \pi^+ \pi^-$	$(4.2 \pm 0.4) \times 10^{-3}$		DESIG=87
Γ_{23}	$K^+ K^- \pi^0 \pi^0$	$(5.4 \pm 0.9) \times 10^{-3}$		DESIG=63
Γ_{24}	$K^+ \pi^- \bar{K}^0 \pi^0 + \text{c.c.}$	$(2.44 \pm 0.33) \%$		DESIG=65
Γ_{25}	$\rho^+ K^- K^0 + \text{c.c.}$	$(1.18 \pm 0.21) \%$		DESIG=66
Γ_{26}	$K^*(892)^- K^+ \pi^0 \rightarrow K^+ \pi^- \bar{K}^0 \pi^0 + \text{c.c.}$	$(4.5 \pm 1.1) \times 10^{-3}$		DESIG=67
Γ_{27}	$K_S^0 K_S^0 \pi^+ \pi^-$	$(5.6 \pm 1.0) \times 10^{-3}$		DESIG=41
Γ_{28}	$K^+ K^- \eta \pi^0$	$(3.0 \pm 0.7) \times 10^{-3}$		DESIG=68
Γ_{29}	$3(\pi^+ \pi^-)$	$(1.20 \pm 0.18) \%$		DESIG=4
Γ_{30}	$K^+ \bar{K}^*(892)^0 \pi^- + \text{c.c.}$	$(7.2 \pm 1.6) \times 10^{-3}$		DESIG=10
Γ_{31}	$K^*(892)^0 \bar{K}^*(892)^0$	$(1.7 \pm 0.6) \times 10^{-3}$		DESIG=21
Γ_{32}	$\pi \pi$	$(8.33 \pm 0.35) \times 10^{-3}$		DESIG=18
Γ_{33}	$\pi^0 \eta$	$< 1.8 \times 10^{-4}$		DESIG=35
Γ_{34}	$\pi^0 \eta'$	$< 1.1 \times 10^{-3}$		DESIG=36
Γ_{35}	$\pi^0 \eta_c$	$< 1.6 \times 10^{-3}$	CL=90%	DESIG=86
Γ_{36}	$\eta \eta$	$(2.95 \pm 0.19) \times 10^{-3}$		DESIG=13
Γ_{37}	$\eta \eta'$	$< 2.3 \times 10^{-4}$	CL=90%	DESIG=37
Γ_{38}	$\eta' \eta'$	$(1.96 \pm 0.21) \times 10^{-3}$		DESIG=46
Γ_{39}	$\omega \omega$	$(9.5 \pm 1.1) \times 10^{-4}$		DESIG=22
Γ_{40}	$\omega \phi$	$(1.16 \pm 0.21) \times 10^{-4}$		DESIG=76
Γ_{41}	$\omega K^+ K^-$	$(1.94 \pm 0.21) \times 10^{-3}$		DESIG=88
Γ_{42}	$K^+ K^-$	$(5.91 \pm 0.32) \times 10^{-3}$		DESIG=2
Γ_{43}	$K_S^0 K_S^0$	$(3.10 \pm 0.18) \times 10^{-3}$		DESIG=15
Γ_{44}	$\pi^+ \pi^- \eta$	$< 1.9 \times 10^{-4}$	CL=90%	DESIG=50
Γ_{45}	$\pi^+ \pi^- \eta'$	$< 3.5 \times 10^{-4}$	CL=90%	DESIG=53
Γ_{46}	$\bar{K}^0 K^+ \pi^- + \text{c.c.}$	$< 9 \times 10^{-5}$	CL=90%	DESIG=17
Γ_{47}	$K^+ K^- \pi^0$	$< 6 \times 10^{-5}$	CL=90%	DESIG=47
Γ_{48}	$K^+ K^- \eta$	$< 2.2 \times 10^{-4}$	CL=90%	DESIG=51
Γ_{49}	$K^+ K^- K_S^0 K_S^0$	$(1.4 \pm 0.5) \times 10^{-3}$		DESIG=42
Γ_{50}	$K^+ K^- K^+ K^-$	$(2.75 \pm 0.28) \times 10^{-3}$		DESIG=14
Γ_{51}	$K^+ K^- \phi$	$(9.5 \pm 2.4) \times 10^{-4}$		DESIG=44
Γ_{52}	$\bar{K}^0 K^+ \pi^- \phi + \text{c.c.}$	$(3.7 \pm 0.6) \times 10^{-3}$		DESIG=91
Γ_{53}	$K^+ K^- \pi^0 \phi$	$(1.90 \pm 0.35) \times 10^{-3}$		DESIG=92
Γ_{54}	$\phi \pi^+ \pi^- \pi^0$	$(1.18 \pm 0.15) \times 10^{-3}$		DESIG=89
Γ_{55}	$\phi \phi$	$(7.7 \pm 0.7) \times 10^{-4}$		DESIG=16
Γ_{56}	$\rho \bar{\rho}$	$(2.25 \pm 0.09) \times 10^{-4}$		DESIG=11
Γ_{57}	$\rho \bar{\rho} \pi^0$	$(6.8 \pm 0.7) \times 10^{-4}$	S=1.3	DESIG=48
Γ_{58}	$\rho \bar{\rho} \eta$	$(3.5 \pm 0.4) \times 10^{-4}$		DESIG=52
Γ_{59}	$\rho \bar{\rho} \omega$	$(5.1 \pm 0.6) \times 10^{-4}$		DESIG=69
Γ_{60}	$\rho \bar{\rho} \phi$	$(5.9 \pm 1.4) \times 10^{-5}$		DESIG=74
Γ_{61}	$\rho \bar{\rho} \pi^+ \pi^-$	$(2.1 \pm 0.7) \times 10^{-3}$	S=1.4	DESIG=8

Γ ₆₂	$p\bar{p}\pi^0\pi^0$	$(1.02 \pm 0.27) \times 10^{-3}$		DESIG=64
Γ ₆₃	$p\bar{p}K^+K^-$ (non-resonant)	$(1.19 \pm 0.26) \times 10^{-4}$		DESIG=71
Γ ₆₄	$p\bar{p}K_S^0K_S^0$	$< 8.8 \times 10^{-4}$	CL=90%	DESIG=40
Γ ₆₅	$p\bar{n}\pi^-$	$(1.24 \pm 0.11) \times 10^{-3}$		DESIG=43
Γ ₆₆	$\bar{p}n\pi^+$	$(1.34 \pm 0.12) \times 10^{-3}$		DESIG=82
Γ ₆₇	$p\bar{n}\pi^-\pi^0$	$(2.29 \pm 0.21) \times 10^{-3}$		DESIG=83
Γ ₆₈	$\bar{p}n\pi^+\pi^0$	$(2.16 \pm 0.18) \times 10^{-3}$		DESIG=84
Γ ₆₉	$\Lambda\bar{\Lambda}$	$(3.21 \pm 0.25) \times 10^{-4}$		DESIG=19
Γ ₇₀	$\Lambda\bar{\Lambda}\pi^+\pi^-$	$(1.15 \pm 0.13) \times 10^{-3}$		DESIG=38
Γ ₇₁	$\Lambda\bar{\Lambda}\pi^+\pi^-$ (non-resonant)	$< 5 \times 10^{-4}$	CL=90%	DESIG=77
Γ ₇₂	$\Sigma(1385)^+\bar{\Lambda}\pi^- + \text{c.c.}$	$< 5 \times 10^{-4}$	CL=90%	DESIG=78
Γ ₇₃	$\Sigma(1385)^-\bar{\Lambda}\pi^+ + \text{c.c.}$	$< 5 \times 10^{-4}$	CL=90%	DESIG=79
Γ ₇₄	$K^+\bar{p}\Lambda + \text{c.c.}$	$(1.22 \pm 0.12) \times 10^{-3}$	S=1.3	DESIG=49
Γ ₇₅	$K^+\bar{p}\Lambda(1520) + \text{c.c.}$	$(2.9 \pm 0.7) \times 10^{-4}$		DESIG=72
Γ ₇₆	$\Lambda(1520)\bar{\Lambda}(1520)$	$(3.1 \pm 1.2) \times 10^{-4}$		DESIG=73
Γ ₇₇	$\Sigma^0\bar{\Sigma}^0$	$(4.4 \pm 0.4) \times 10^{-4}$		DESIG=58
Γ ₇₈	$\Sigma^+\bar{\Sigma}^-$	$(3.9 \pm 0.7) \times 10^{-4}$	S=1.7	DESIG=59
Γ ₇₉	$\Sigma(1385)^+\bar{\Sigma}(1385)^-$	$(1.6 \pm 0.6) \times 10^{-4}$		DESIG=80
Γ ₈₀	$\Sigma(1385)^-\bar{\Sigma}(1385)^+$	$(2.3 \pm 0.6) \times 10^{-4}$		DESIG=81
Γ ₈₁	$K^-\Lambda\Xi^+ + \text{c.c.}$	$(1.90 \pm 0.34) \times 10^{-4}$		DESIG=85
Γ ₈₂	$\Xi^0\bar{\Xi}^0$	$(3.1 \pm 0.8) \times 10^{-4}$		DESIG=60
Γ ₈₃	$\Xi^-\bar{\Xi}^+$	$(4.7 \pm 0.7) \times 10^{-4}$		DESIG=39
Γ ₈₄	$\eta_c\pi^+\pi^-$	$< 7 \times 10^{-4}$	CL=90%	DESIG=90

Radiative decays

Γ ₈₅	$\gamma J/\psi(1S)$	$(1.27 \pm 0.06) \%$		NODE=M056;CLUMP=B DESIG=6
Γ ₈₆	$\gamma\rho^0$	$< 9 \times 10^{-6}$	CL=90%	DESIG=55
Γ ₈₇	$\gamma\omega$	$< 8 \times 10^{-6}$	CL=90%	DESIG=56
Γ ₈₈	$\gamma\phi$	$< 6 \times 10^{-6}$	CL=90%	DESIG=57
Γ ₈₉	$\gamma\gamma$	$(2.23 \pm 0.13) \times 10^{-4}$		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 239 measurements to determine 49 parameters. The overall fit has a $\chi^2 = 342.4$ for 190 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	25									
x_8	14	4								
x_{30}	7	2	29							
x_{32}	15	4	16	5						
x_{36}	8	2	9	3	21					
x_{42}	13	3	14	5	28	17				
x_{43}	12	3	13	4	27	16	22			
x_{50}	9	2	8	3	14	8	12	11		
x_{55}	10	3	10	4	14	9	12	12	7	
x_{56}	7	2	9	3	13	6	15	15	8	8
x_{69}	8	2	9	3	20	12	17	16	8	9
x_{85}	4	1	5	1	14	9	10	10	5	5
x_{89}	-16	-4	-9	-6	5	4	2	4	-2	-4
Γ	-22	-6	-17	-8	-16	-9	-15	-14	-10	-13
	x_1	x_2	x_8	x_{30}	x_{32}	x_{36}	x_{42}	x_{43}	x_{50}	x_{55}

x ₆₉	11			
x ₈₅	-21	8		
x ₈₉	2	4	9	
Γ	-7	-9	-8	-48
	x ₅₆	x ₆₉	x ₈₅	x ₈₉

$\chi_{c0}(1P)$ PARTIAL WIDTHS

NODE=M056217

$\chi_{c0}(1P) \Gamma(i) \Gamma(\gamma J/\psi(1S))/\Gamma(\text{total})$

NODE=M056223

$$\Gamma(p\bar{p}) \times \Gamma(\gamma J/\psi(1S))/\Gamma_{\text{total}} \quad \Gamma_{56}\Gamma_{85}/\Gamma$$

NODE=M056G1
NODE=M056G1

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

30.0 ± 2.3 OUR FIT

• • • We do not use the following data for averages, fits, limits, etc. • • •

26.6 ± 2.6 ± 1.4 392 1,2 BAGNASCO 02 E835 $\bar{p}p \rightarrow \chi_{c0} \rightarrow J/\psi \gamma$ 48.7^{+11.3}_{-8.9} ± 2.4 1,2 AMBROGIANI 99B E835 $\bar{p}p \rightarrow \gamma J/\psi$ ¹ Calculated by us using $B(J/\psi(1S) \rightarrow e^+e^-) = 0.0593 \pm 0.0010$.

NODE=M056G;LINKAGE=7A

² Values in $(\Gamma(p\bar{p}) \times \Gamma(\gamma J/\psi(1S))/\Gamma_{\text{total}})$ and $(\Gamma(p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\gamma J/\psi(1S))/\Gamma_{\text{total}})$ are not independent. The latter is used in the fit since it is less correlated to the total width.

NODE=M056G;LINKAGE=KS

$\chi_{c0}(1P) \Gamma(i) \Gamma(\gamma\gamma)/\Gamma(\text{total})$

NODE=M056224

$$\Gamma(2(\pi^+\pi^-)) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_1\Gamma_{89}/\Gamma$$

NODE=M056G2
NODE=M056G2

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

53 ± 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 $e^+e^- \rightarrow e^+e^- \chi_{c0}$

$$\Gamma(\rho^0\rho^0) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_3\Gamma_{89}/\Gamma$$

NODE=M056G07
NODE=M056G07

VALUE (eV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

<12 90 <252 UEHARA 08 BELL $\gamma\gamma \rightarrow \chi_{c0} \rightarrow 2(\pi^+\pi^-)$

$$\Gamma(\pi^+\pi^-K^+K^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_8\Gamma_{89}/\Gamma$$

NODE=M056G08
NODE=M056G08

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

41 ± 4 OUR FIT**38.8 ± 3.7 ± 4.7** 1.7k UEHARA 08 BELL $\gamma\gamma \rightarrow \chi_{c0} \rightarrow K^+K^-\pi^+\pi^-$

$$\Gamma(K^+K^-\pi^+\pi^-\pi^0) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{21}\Gamma_{89}/\Gamma$$

NODE=M056G01
NODE=M056G01

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

26 ± 4 ± 4 1094 DEL-AMO-SA..11M BABR $\gamma\gamma \rightarrow K^+K^-\pi^+\pi^-\pi^0$

$$\Gamma(K^+\bar{K}^*(892)^0\pi^- + \text{c.c.}) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{30}\Gamma_{89}/\Gamma$$

NODE=M056G09
NODE=M056G09

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

17 ± 4 OUR FIT**16.7 ± 6.1 ± 3.0** 495 ± 182 UEHARA 08 BELL $\gamma\gamma \rightarrow \chi_{c0} \rightarrow K^+K^-\pi^+\pi^-$

$$\Gamma(K^*(892)^0\bar{K}^*(892)^0) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{31}\Gamma_{89}/\Gamma$$

NODE=M056G10
NODE=M056G10

VALUE (eV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

<6 90 <148 UEHARA 08 BELL $\gamma\gamma \rightarrow \chi_{c0} \rightarrow K^+K^-\pi^+\pi^-$

$$\Gamma(\pi\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{32}\Gamma_{89}/\Gamma$$

NODE=M056G3
NODE=M056G3

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

19.5 ± 1.4 OUR FIT**23 ± 5 OUR AVERAGE**29.7^{+17.4}_{-12.0} ± 4.8 103⁺⁶⁰₋₄₂ ¹ UEHARA 09 BELL 10.6 $e^+e^- \rightarrow e^+e^-\pi^0\pi^0$ 22.7 ± 3.2 ± 3.5 129 ± 18 ² NAKAZAWA 05 BELL 10.6 $e^+e^- \rightarrow e^+e^-\pi^+\pi^-$ ¹ We multiplied the measurement by 3 to convert from $\pi^0\pi^0$ to $\pi\pi$. Interference with the continuum included.

NODE=M056G3;LINKAGE=UE

² We have multiplied $\pi^+\pi^-$ measurement by 3/2 to obtain $\pi\pi$.

NODE=M056G;LINKAGE=NA

$\Gamma(\eta\eta) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$					$\Gamma_{36}\Gamma_{89}/\Gamma$
VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT	
9.4±2.3±1.2	22	¹ UEHARA	10A	BELL	10.6 $e^+e^- \rightarrow e^+e^-\eta\eta$

¹ Interference with the continuum not included.

NODE=M056G06
NODE=M056G06

NODE=M056G06;LINKAGE=UE

$\Gamma(\omega\omega) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$					$\Gamma_{39}\Gamma_{89}/\Gamma$
VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT	

• • • We do not use the following data for averages, fits, limits, etc. • • •

<3.9 90 ¹LIU 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=M056G02
NODE=M056G02

NODE=M056G02;LINKAGE=LI

$\Gamma(\omega\phi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$					$\Gamma_{40}\Gamma_{89}/\Gamma$
VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT	

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.34 90 ¹LIU 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=M056G03
NODE=M056G03

NODE=M056G03;LINKAGE=LI

$\Gamma(K^+K^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$					$\Gamma_{42}\Gamma_{89}/\Gamma$
VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT	

13.9±1.1 OUR FIT

14.3±1.6±2.3 153 ± 17 NAKAZAWA 05 BELL 10.6 $e^+e^- \rightarrow e^+e^-K^+K^-$

NODE=M056G4
NODE=M056G4

$\Gamma(K_S^0 K_S^0) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$					$\Gamma_{43}\Gamma_{89}/\Gamma$
VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT	

7.3 ±0.6 OUR FIT

8.7 ±1.7 ±0.9 266 ¹UEHARA 13 BELL $\gamma\gamma \rightarrow K_S^0 K_S^0$

• • • We do not use the following data for averages, fits, limits, etc. • • •

7.00±0.65±0.71 134 ± 12 CHEN 07B BELL $e^+e^- \rightarrow e^+e^-\chi_{c0}$

¹ Supersedes CHEN 07B.

NODE=M056G5
NODE=M056G5

NODE=M056G5;LINKAGE=UE

$\Gamma(K^+K^-K^+K^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$					$\Gamma_{50}\Gamma_{89}/\Gamma$
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

$\Gamma(\phi\phi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$					$\Gamma_{55}\Gamma_{89}/\Gamma$
VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT	

1.82±0.19 OUR FIT

1.72±0.33±0.14 56 ± 11 ¹LIU 12B BELL $\gamma\gamma \rightarrow 2(K^+K^-)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

2.3 ±0.9 ±0.4 23.6 ± 9.6 UEHARA 08 BELL $\gamma\gamma \rightarrow \chi_{c0} \rightarrow 2(K^+K^-)$

¹ Supersedes UEHARA 08. Using $B(\phi \rightarrow K^+K^-) = (48.9 \pm 0.5)\%$.

NODE=M056G12
NODE=M056G12

NODE=M056G12;LINKAGE=LI

$\chi_{c0}(1P)$ BRANCHING RATIOS

NODE=M056220

HADRONIC DECAYS

NODE=M056305

$\Gamma(2(\pi^+\pi^-))/\Gamma_{\text{total}}$					Γ_1/Γ
VALUE		DOCUMENT ID			

0.0224±0.0018 OUR FIT

NODE=M056R2
NODE=M056R2

$\Gamma(\rho^0\pi^+\pi^-)/\Gamma(2(\pi^+\pi^-))$					Γ_2/Γ_1
VALUE		DOCUMENT ID	TECN	COMMENT	

0.39±0.12 OUR FIT

0.39±0.12 TANENBAUM 78 MRK1 $\psi(2S) \rightarrow \gamma\chi_{c0}$

NODE=M056R54
NODE=M056R54

$\Gamma(\rho^0\pi^+\pi^-)/\Gamma_{\text{total}}$					Γ_2/Γ
VALUE		DOCUMENT ID			

0.0087±0.0028 OUR FIT

NODE=M056R9
NODE=M056R9

$$\Gamma(f_0(980)f_0(980))/\Gamma_{\text{total}} \quad \Gamma_4/\Gamma$$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$6.5 \pm 2.1 \pm 0.2$	36 ± 9	¹ ABLIKIM	04G BES	$\psi(2S) \rightarrow \gamma 2\pi^+ 2\pi^-$
¹ ABLIKIM 04G reports $[\Gamma(\chi_{c0}(1P) \rightarrow f_0(980)f_0(980))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))] = (6.5 \pm 1.6 \pm 1.3) \times 10^{-5}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.99 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M056R24
NODE=M056R24

NODE=M056R24;LINKAGE=AB

$$\Gamma(\pi^+ \pi^- \pi^0 \pi^0)/\Gamma_{\text{total}} \quad \Gamma_5/\Gamma$$

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
$3.3 \pm 0.4 \pm 0.1$	1751.4	¹ HE	08B CLEO	$e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$
¹ HE 08B reports $3.54 \pm 0.10 \pm 0.43 \pm 0.18$ % from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \pi^+ \pi^- \pi^0 \pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.99 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M056R62
NODE=M056R62

NODE=M056R62;LINKAGE=HE

$$\Gamma(\rho^+ \pi^- \pi^0 + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_6/\Gamma$$

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
$2.8 \pm 0.4 \pm 0.1$	1358.5	^{1,2} HE	08B CLEO	$e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$
¹ HE 08B reports $3.04 \pm 0.18 \pm 0.42 \pm 0.16$ % from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \rho^+ \pi^- \pi^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.99 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				
² Calculated by us. We have added the values from HE 08B for $\rho^+ \pi^- \pi^0$ and $\rho^- \pi^+ \pi^0$ decays assuming uncorrelated statistical and fully correlated systematic uncertainties.				

NODE=M056R63
NODE=M056R63

NODE=M056R63;LINKAGE=HE

NODE=M056R63;LINKAGE=OC

$$\Gamma(4\pi^0)/\Gamma_{\text{total}} \quad \Gamma_7/\Gamma$$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$3.2 \pm 0.4 \pm 0.1$	3296	¹ ABLIKIM	11A BES3	$e^+ e^- \rightarrow \psi(2S) \rightarrow \gamma \chi_{c0}$
¹ ABLIKIM 11A reports $(3.34 \pm 0.06 \pm 0.44) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow 4\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.62 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.99 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M056R71
NODE=M056R71

NODE=M056R71;LINKAGE=AB

$$\Gamma(\pi^+ \pi^- K^+ K^-)/\Gamma_{\text{total}} \quad \Gamma_8/\Gamma$$

VALUE (units 10^{-3})	DOCUMENT ID
17.5 ± 1.4 OUR FIT	

NODE=M056R3
NODE=M056R3

$$\Gamma(K^+ \bar{K}^*(892)^0 \pi^- + \text{c.c.})/\Gamma(\pi^+ \pi^- K^+ K^-) \quad \Gamma_{30}/\Gamma_8$$

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

$$\Gamma(K_0^*(1430)^0 \bar{K}_0^*(1430)^0 \rightarrow \pi^+ \pi^- K^+ K^-)/\Gamma_{\text{total}} \quad \Gamma_9/\Gamma$$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$9.6^{+3.5}_{-2.8} \pm 0.3$	83	¹ ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$
¹ ABLIKIM 05Q reports $(10.44 \pm 2.37^{+3.05}_{-1.90}) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow K_0^*(1430)^0 \bar{K}_0^*(1430)^0 \rightarrow \pi^+ \pi^- K^+ K^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.99 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M056R36
NODE=M056R36

NODE=M056R36;LINKAGE=AB

$$\Gamma(K_0^*(1430)^0 \bar{K}_2^*(1430)^0 + \text{c.c.} \rightarrow \pi^+ \pi^- K^+ K^-)/\Gamma_{\text{total}} \quad \Gamma_{10}/\Gamma$$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$7.8^{+1.9}_{-2.4} \pm 0.2$	62	¹ ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$

NODE=M056R37
NODE=M056R37

¹ ABLIKIM 05Q reports $(8.49 \pm 1.66^{+1.32}_{-1.99}) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow K_0^*(1430)^0 \bar{K}_2^*(1430)^0 + \text{c.c.} \rightarrow \pi^+ \pi^- K^+ K^-) / \Gamma_{\text{total}}] \times [\text{B}(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $\text{B}(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $\text{B}(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.99 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=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
$6.1^{+1.9}_{-1.8} \pm 0.2$	68	¹ ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$

NODE=M056R38
NODE=M056R38

¹ ABLIKIM 05Q reports $(6.66 \pm 1.31^{+1.60}_{-1.51}) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow K_1(1270)^+ K^- + \text{c.c.} \rightarrow \pi^+ \pi^- K^+ K^-) / \Gamma_{\text{total}}] \times [\text{B}(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $\text{B}(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $\text{B}(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.99 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value. The measurement assumes $\text{B}(K_1(1270) \rightarrow K \rho(770)) = 42 \pm 6\%$.

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
<2.6	90	¹ ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$

NODE=M056R39
NODE=M056R39

¹ ABLIKIM 05Q reports $< 2.85 \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow K_1(1400)^+ K^- + \text{c.c.} \rightarrow \pi^+ \pi^- K^+ K^-) / \Gamma_{\text{total}}] \times [\text{B}(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $\text{B}(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $\text{B}(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = 9.99 \times 10^{-2}$. The measurement assumes $\text{B}(K_1(1400) \rightarrow K^*(892)\pi) = 94 \pm 6\%$.

NODE=M056R39;LINKAGE=AB

$\Gamma(f_0(980) f_0(980)) / \Gamma_{\text{total}}$ Γ_{13} / Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
$15.9^{+10.2}_{-8.8} \pm 0.4$	28	¹ ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$

NODE=M056R28
NODE=M056R28

¹ ABLIKIM 05Q reports $[\Gamma(\chi_{c0}(1P) \rightarrow f_0(980) f_0(980)) / \Gamma_{\text{total}}] \times [\text{B}(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))] = (1.59 \pm 0.50^{+0.89}_{-0.72}) \times 10^{-5}$ which we divide by our best value $\text{B}(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.99 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value. 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
$7.8^{+2.0}_{-2.5} \pm 0.2$	77	¹ ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$

NODE=M056R29
NODE=M056R29

¹ ABLIKIM 05Q reports $(8.42 \pm 1.42^{+1.65}_{-2.29}) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow f_0(980) f_0(2200)) / \Gamma_{\text{total}}] \times [\text{B}(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $\text{B}(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $\text{B}(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.99 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value. The f_0 mesons are identified via $f_0(980) \rightarrow \pi^+ \pi^-$ and $f_0(2200) \rightarrow K^+ K^-$ decays.

NODE=M056R29;LINKAGE=AB

$\Gamma(f_0(1370) f_0(1370)) / \Gamma_{\text{total}}$ Γ_{15} / Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<2.7	90	¹ ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$

NODE=M056R30
NODE=M056R30

¹ ABLIKIM 05Q reports $< 2.9 \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow f_0(1370) f_0(1370)) / \Gamma_{\text{total}}] \times [\text{B}(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $\text{B}(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $\text{B}(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = 9.99 \times 10^{-2}$. One of the $f_0(1370)$ mesons is identified via decay to $\pi^+ \pi^-$ while the other via $K^+ K^-$ decay. Both branching fractions for these f_0 decays are implicitly included in the quoted result.

NODE=M056R30;LINKAGE=AB

$\Gamma(f_0(1370) f_0(1500)) / \Gamma_{\text{total}}$ Γ_{16} / Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.7	90	¹ ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$

NODE=M056R31
NODE=M056R31

¹ABLIKIM 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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = 9.99 \times 10^{-2}$. The f_0 mesons are identified via $f_0(1370) \rightarrow \pi^+\pi^-$ and $f_0(1500) \rightarrow K^+K^-$ decays. Both branching fractions for these f_0 decays are implicitly included in the quoted result.

NODE=M056R31;LINKAGE=AB

$\Gamma(f_0(1370)f_0(1710))/\Gamma_{\text{total}}$ Γ_{17}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$6.6^{+3.5}_{-2.3} \pm 0.2$	61	¹ ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma\pi^+\pi^-K^+K^-$

NODE=M056R32
NODE=M056R32

¹ABLIKIM 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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.99 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value. The f_0 mesons are identified via $f_0(1370) \rightarrow \pi^+\pi^-$ and $f_0(1710) \rightarrow K^+K^-$ decays. Both branching fractions for these f_0 decays are implicitly included in the quoted result.

NODE=M056R32;LINKAGE=AB

$\Gamma(f_0(1500)f_0(1370))/\Gamma_{\text{total}}$ Γ_{18}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 1.3	90	¹ ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma\pi^+\pi^-K^+K^-$

NODE=M056R33
NODE=M056R33

¹ABLIKIM 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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = 9.99 \times 10^{-2}$. The f_0 mesons are identified via $f_0(1500) \rightarrow \pi^+\pi^-$ and $f_0(1370) \rightarrow K^+K^-$ decays. Both branching fractions for these f_0 decays are implicitly included in the quoted result.

NODE=M056R33;LINKAGE=AB

$\Gamma(f_0(1500)f_0(1500))/\Gamma_{\text{total}}$ Γ_{19}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 0.5	90	¹ ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma\pi^+\pi^-K^+K^-$

NODE=M056R34
NODE=M056R34

¹ABLIKIM 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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = 9.99 \times 10^{-2}$. One of the $f_0(1500)$ is identified via decay to $\pi^+\pi^-$ while the other via K^+K^- decay. Both branching fractions for these f_0 decays are implicitly included in the quoted result.

NODE=M056R34;LINKAGE=AB

$\Gamma(f_0(1500)f_0(1710))/\Gamma_{\text{total}}$ Γ_{20}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 0.7	90	¹ ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma\pi^+\pi^-K^+K^-$

NODE=M056R35
NODE=M056R35

¹ABLIKIM 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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = 9.99 \times 10^{-2}$. The f_0 mesons are identified via $f_0(1500) \rightarrow \pi^+\pi^-$ and $f_0(1710) \rightarrow K^+K^-$ decays. Both branching fractions for these f_0 decays are implicitly included in the quoted result.

NODE=M056R35;LINKAGE=AB

$\Gamma(K^+K^-\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{21}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$8.61 \pm 0.13 \pm 0.94$	9.0k	¹ ABLIKIM	13B BES3	$e^+e^- \rightarrow \psi(2S) \rightarrow \gamma\chi_{c0}$

NODE=M056R85
NODE=M056R85

¹Using 1.06×10^8 $\psi(2S)$ mesons and $B(\psi(2S) \rightarrow \chi_{c0}\gamma) = (9.68 \pm 0.31)\%$.

NODE=M056R85;LINKAGE=A

$\Gamma(K_S^0 K^\pm \pi^\mp \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{22}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$4.22 \pm 0.10 \pm 0.43$	2.7k	¹ ABLIKIM	13B BES3	$e^+e^- \rightarrow \psi(2S) \rightarrow \gamma\chi_{c0}$

NODE=M056R86
NODE=M056R86

¹Using 1.06×10^8 $\psi(2S)$ mesons and $B(\psi(2S) \rightarrow \chi_{c0}\gamma) = (9.68 \pm 0.31)\%$.

NODE=M056R86;LINKAGE=A

$$\Gamma(K^+ K^- \pi^0 \pi^0) / \Gamma_{\text{total}} \quad \Gamma_{23} / \Gamma$$

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.54 ± 0.09 ± 0.01	213.5	¹ HE	08B CLEO	$e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$

NODE=M056R64
NODE=M056R64

¹ HE 08B reports $0.59 \pm 0.05 \pm 0.08 \pm 0.03$ % from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow K^+ K^- \pi^0 \pi^0) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.99 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R64;LINKAGE=HE

$$\Gamma(K^+ \pi^- \bar{K}^0 \pi^0 + \text{c.c.}) / \Gamma_{\text{total}} \quad \Gamma_{24} / \Gamma$$

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
2.44 ± 0.32 ± 0.07	401.7	¹ HE	08B CLEO	$e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$

NODE=M056R66
NODE=M056R66

¹ HE 08B reports $2.64 \pm 0.15 \pm 0.31 \pm 0.14$ % from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow K^+ \pi^- \bar{K}^0 \pi^0 + \text{c.c.}) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.99 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R66;LINKAGE=HE

$$\Gamma(\rho^+ K^- K^0 + \text{c.c.}) / \Gamma_{\text{total}} \quad \Gamma_{25} / \Gamma$$

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
1.18 ± 0.20 ± 0.03	179.7	¹ HE	08B CLEO	$e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$

NODE=M056R67
NODE=M056R67

¹ HE 08B reports $1.28 \pm 0.16 \pm 0.15 \pm 0.07$ % from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \rho^+ K^- K^0 + \text{c.c.}) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.99 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R67;LINKAGE=HE

$$\Gamma(K^*(892)^- K^+ \pi^0 \rightarrow K^+ \pi^- \bar{K}^0 \pi^0 + \text{c.c.}) / \Gamma_{\text{total}} \quad \Gamma_{26} / \Gamma$$

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.45 ± 0.11 ± 0.01	64.1	¹ HE	08B CLEO	$e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$

NODE=M056R68
NODE=M056R68

¹ HE 08B reports $0.49 \pm 0.10 \pm 0.07 \pm 0.03$ % from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow K^*(892)^- K^+ \pi^0 \rightarrow K^+ \pi^- \bar{K}^0 \pi^0 + \text{c.c.}) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.99 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R68;LINKAGE=HE

$$\Gamma(K_S^0 K_S^0 \pi^+ \pi^-) / \Gamma_{\text{total}} \quad \Gamma_{27} / \Gamma$$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
5.6 ± 1.0 ± 0.2	152 ± 14	¹ ABLIKIM	050 BES2	$\psi(2S) \rightarrow \gamma \chi_{c0}$

NODE=M056R47
NODE=M056R47

¹ ABLIKIM 050 reports $[\Gamma(\chi_{c0}(1P) \rightarrow K_S^0 K_S^0 \pi^+ \pi^-) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ = $(0.558 \pm 0.051 \pm 0.089) \times 10^{-3}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.99 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R47;LINKAGE=AB

$$\Gamma(K^+ K^- \eta \pi^0) / \Gamma_{\text{total}} \quad \Gamma_{28} / \Gamma$$

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.30 ± 0.07 ± 0.01	56.4	¹ HE	08B CLEO	$e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$

NODE=M056R69
NODE=M056R69

¹ HE 08B reports $0.32 \pm 0.05 \pm 0.05 \pm 0.02$ % from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow K^+ K^- \eta \pi^0) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.99 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R69;LINKAGE=HE

$$\Gamma(3(\pi^+ \pi^-)) / \Gamma_{\text{total}} \quad \Gamma_{29} / \Gamma$$

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			

NODE=M056R4
NODE=M056R4
→ UNCHECKED ←

11.7 ± 1.0 ± 1.9 ¹ BAI 99B BES $\psi(2S) \rightarrow \gamma \chi_{c0}$

12.5 ± 2.9 ± 0.5 ¹ TANENBAUM 78 MRK1 $\psi(2S) \rightarrow \gamma \chi_{c0}$

¹ Rescaled by us using $B(\psi(2S) \rightarrow \gamma \chi_{c0}) = (9.4 \pm 0.4)\%$ and $B(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-) = (32.6 \pm 0.5)\%$.

NODE=M056R;LINKAGE=X1

$$\Gamma(K^+ \bar{K}^*(892)^0 \pi^- + \text{c.c.}) / \Gamma_{\text{total}}$$

VALUE

DOCUMENT ID

0.0072 ± 0.0016 OUR FIT

 Γ_{30}/Γ NODE=M056R10
NODE=M056R10

$$\Gamma(K^*(892)^0 \bar{K}^*(892)^0) / \Gamma_{\text{total}}$$

VALUE (units 10⁻³)

EVTS

DOCUMENT ID

TECN

COMMENT

1.68^{+0.59}_{-0.53} ± 0.05

64

1

ABLIKIM

05Q

BES2

 $\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$ Γ_{31}/Γ NODE=M056R26
NODE=M056R26

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.53 ± 0.39 ± 0.04 30 ± 6 2,3 ABLIKIM 04H BES Repl. by ABLIKIM 05Q

1 ABLIKIM 05Q reports $[\Gamma(\chi_{c0}(1P) \rightarrow K^*(892)^0 \bar{K}^*(892)^0) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))] = (0.168 \pm 0.035^{+0.047}_{-0.040}) \times 10^{-3}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.99 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

2 Assumes $B(K^*(892)^0 \rightarrow K^- \pi^+) = 2/3$.

3 ABLIKIM 04H reports $[\Gamma(\chi_{c0}(1P) \rightarrow K^*(892)^0 \bar{K}^*(892)^0) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))] = (1.53 \pm 0.29 \pm 0.26) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.99 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R26;LINKAGE=AI

NODE=M056R;LINKAGE=AL
NODE=M056R26;LINKAGE=AB

$$\Gamma(\pi\pi) / \Gamma_{\text{total}}$$

VALUE (units 10⁻³)

DOCUMENT ID

8.33 ± 0.35 OUR FIT

 Γ_{32}/Γ NODE=M056R22
NODE=M056R22

$$\Gamma(\pi^0 \eta_c) / \Gamma_{\text{total}}$$

VALUE

CL%

DOCUMENT ID

TECN

COMMENT

< 1.6 × 10⁻³

90

1

ABLIKIM

15N

BES3

 $\psi(2S) e^+ e^- \rightarrow \gamma \pi^0 \eta_c$ Γ_{35}/Γ NODE=M056R00
NODE=M056R00

1 Using $B(\eta_c \rightarrow K_S^0 K^\pm \pi^\mp) \times B(K_S^0 \rightarrow \pi^+ \pi^-) \times B(\pi^0 \rightarrow \gamma\gamma) = (1.66 \pm 0.11) \times 10^{-2}$.

NODE=M056R00;LINKAGE=A

$$\Gamma(\eta\eta) / \Gamma_{\text{total}}$$

VALUE (units 10⁻³)

DOCUMENT ID

2.95 ± 0.19 OUR FIT

 Γ_{36}/Γ NODE=M056R13
NODE=M056R13

$$\Gamma(\eta\eta) / \Gamma(\pi\pi)$$

VALUE

DOCUMENT ID

TECN

COMMENT

0.354 ± 0.025 OUR FIT

 Γ_{36}/Γ_{32} NODE=M056R20
NODE=M056R20

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.26 ± 0.09 ^{+0.03}_{-0.02}

1

ANDREOTTI

05C

E835

 $\bar{p}p \rightarrow 2 \text{ mesons}$

0.24 ± 0.10 ± 0.08

1

BAI

03C

BES

 $\psi(2S) \rightarrow 5\gamma$

1 We have multiplied $\pi^0 \pi^0$ measurement by 3 to obtain $\pi\pi$.

NODE=M056R;LINKAGE=D1

$$\Gamma(\eta\eta') / \Gamma_{\text{total}}$$

VALUE (units 10⁻³)

CL%

EVTS

DOCUMENT ID

TECN

COMMENT

< 0.23

90

35 ± 13

1

ASNER

09

CLEO

 $\psi(2S) \rightarrow \gamma \eta' \eta$ Γ_{37}/Γ NODE=M056R03
NODE=M056R03

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 0.5

90

2

ADAMS

07

CLEO

 $\psi(2S) \rightarrow \gamma \chi_{c0}$

1 ASNER 09 reports $< 0.25 \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \eta\eta') / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))] = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = 9.99 \times 10^{-2}$.

NODE=M056R03;LINKAGE=AS

2 Superseded by ASNER 09. ADAMS 07 reports $< 0.5 \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \eta\eta') / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))] = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = 9.99 \times 10^{-2}$.

NODE=M056R03;LINKAGE=AD

$$\Gamma(\eta'\eta') / \Gamma_{\text{total}}$$

VALUE (units 10⁻³)

EVTS

DOCUMENT ID

TECN

COMMENT

1.96 ± 0.20 ± 0.05

0.4k

1

ASNER

09

CLEO

 $\psi(2S) \rightarrow \gamma \eta' \eta'$ Γ_{38}/Γ NODE=M056R04
NODE=M056R04

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.57 ± 0.40 ± 0.04

23

2

ADAMS

07

CLEO

 $\psi(2S) \rightarrow \gamma \chi_{c0}$

¹ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.99 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R04;LINKAGE=AS

² 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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.99 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R04;LINKAGE=AD

$\Gamma(\omega\omega)/\Gamma_{\text{total}}$					Γ_{39}/Γ
VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT	
0.95±0.11 OUR AVERAGE					
0.91±0.11±0.02	991	¹ ABLIKIM	11K BES3	$\psi(2S) \rightarrow \gamma$ hadrons	
2.1 ±0.6 ±0.1	38.1 ±9.6	² ABLIKIM	05N BES2	$\psi(2S) \rightarrow \gamma \chi_{c0} \rightarrow \gamma 6\pi$	

NODE=M056R27
NODE=M056R27

¹ ABLIKIM 11K reports $(0.95 \pm 0.03 \pm 0.11) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \omega\omega)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.62 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.99 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R27;LINKAGE=AL

² ABLIKIM 05N reports $[\Gamma(\chi_{c0}(1P) \rightarrow \omega\omega)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ = $(0.212 \pm 0.053 \pm 0.037) \times 10^{-3}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.99 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R27;LINKAGE=AB

$\Gamma(\omega\phi)/\Gamma_{\text{total}}$					Γ_{40}/Γ
VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT	
1.16±0.21±0.03	76	¹ ABLIKIM	11K BES3	$\psi(2S) \rightarrow \gamma$ hadrons	

NODE=M056R76
NODE=M056R76

¹ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.99 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R76;LINKAGE=AL

$\Gamma(\omega K^+ K^-)/\Gamma_{\text{total}}$					Γ_{41}/Γ
VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT	
1.94±0.06±0.20	1.4k	¹ ABLIKIM	13B BES3	$e^+ e^- \rightarrow \psi(2S) \rightarrow \gamma \chi_{c0}$	

NODE=M056R87
NODE=M056R87

¹ Using 1.06×10^8 $\psi(2S)$ mesons and $B(\psi(2S) \rightarrow \chi_{c0} \gamma) = (9.68 \pm 0.31)\%$.

NODE=M056R87;LINKAGE=A

$\Gamma(K^+ K^-)/\Gamma_{\text{total}}$					Γ_{42}/Γ
VALUE (units 10^{-3})		DOCUMENT ID			
5.91±0.32 OUR FIT					

NODE=M056R6
NODE=M056R6

$\Gamma(K_S^0 K_S^0)/\Gamma_{\text{total}}$					Γ_{43}/Γ
VALUE (units 10^{-3})		DOCUMENT ID			
3.10±0.18 OUR FIT					

NODE=M056R15
NODE=M056R15

$\Gamma(K_S^0 K_S^0)/\Gamma(\pi\pi)$					Γ_{43}/Γ_{32}
VALUE		DOCUMENT ID	TECN	COMMENT	
0.372±0.023 OUR FIT					

NODE=M056R53
NODE=M056R53

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.31 ±0.05 ±0.05 ^{1,2} CHEN 07B BELL $e^+ e^- \rightarrow e^+ e^- \chi_{c0}$

¹ Using $\Gamma(\pi\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ from the $\pi^+ \pi^-$ measurement of NAKAZAWA 05 rescaled by 3/2 to convert to $\pi\pi$.

NODE=M056R53;LINKAGE=CH

² Not independent from other measurements.

NODE=M056R53;LINKAGE=NI

$\Gamma(K_S^0 K_S^0)/\Gamma(K^+ K^-)$					Γ_{43}/Γ_{42}
VALUE		DOCUMENT ID	TECN	COMMENT	
0.52±0.04 OUR FIT					

NODE=M056R52
NODE=M056R52

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.49±0.07±0.08 ^{1,2} CHEN 07B BELL $e^+ e^- \rightarrow e^+ e^- \chi_{c0}$

¹ Using $\Gamma(K^+ K^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ from NAKAZAWA 05.

NODE=M056R52;LINKAGE=CH

² Not independent from other measurements.

NODE=M056R52;LINKAGE=NI

$\Gamma(\pi^+\pi^-\eta)/\Gamma_{\text{total}}$ Γ_{44}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<0.19	90	¹ ATHAR	07 CLEO	$\psi(2S) \rightarrow \gamma h^+ h^- h^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<1.0	90	² ABLIKIM	06R BES2	$\psi(2S) \rightarrow \gamma \chi_{c0}$

¹ ATHAR 07 reports $< 0.21 \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \pi^+\pi^-\eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = 9.99 \times 10^{-2}$.

² ABLIKIM 06R reports $< 1.1 \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \pi^+\pi^-\eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = 9.99 \times 10^{-2}$.

NODE=M056R08
NODE=M056R08

NODE=M056R08;LINKAGE=AT

NODE=M056R08;LINKAGE=AB

 $\Gamma(\pi^+\pi^-\eta')/\Gamma_{\text{total}}$ Γ_{45}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<0.35	90	¹ ATHAR	07 CLEO	$\psi(2S) \rightarrow \gamma h^+ h^- h^0$
¹ ATHAR 07 reports $< 0.38 \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \pi^+\pi^-\eta')/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = 9.99 \times 10^{-2}$.				

NODE=M056R51
NODE=M056R51

NODE=M056R51;LINKAGE=AT

 $\Gamma(\bar{K}^0 K^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{46}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<0.09	90	¹ ATHAR	07 CLEO	$\psi(2S) \rightarrow \gamma h^+ h^- h^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.6	90	^{2,3} ABLIKIM	06R BES2	$\psi(2S) \rightarrow \gamma \chi_{c0}$
<0.7	90	^{3,4} BAI	99B BES	$\psi(2S) \rightarrow \gamma \chi_{c0}$

¹ ATHAR 07 reports $< 0.10 \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \bar{K}^0 K^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = 9.99 \times 10^{-2}$.

² ABLIKIM 06R reports $< 0.70 \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \bar{K}^0 K^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = 9.99 \times 10^{-2}$.

³ We have multiplied the $K_S^0 K^+ \pi^-$ measurement by a factor of 2 to convert to $K^0 K^+ \pi^-$.

⁴ Rescaled by us using $B(\psi(2S) \rightarrow \gamma \chi_{c0}) = (9.4 \pm 0.4)\%$ and $B(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-) = (32.6 \pm 0.5)\%$.

NODE=M056R17
NODE=M056R17

NODE=M056R17;LINKAGE=AT

NODE=M056R17;LINKAGE=AB

NODE=M056R17;LINKAGE=BA

NODE=M056R17;LINKAGE=X1

 $\Gamma(K^+ K^- \pi^0)/\Gamma_{\text{total}}$ Γ_{47}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<0.06	90	¹ ATHAR	07 CLEO	$\psi(2S) \rightarrow \gamma h^+ h^- h^0$
¹ ATHAR 07 reports $< 0.06 \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow K^+ K^- \pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = 9.99 \times 10^{-2}$.				

NODE=M056R05
NODE=M056R05

NODE=M056R05;LINKAGE=AT

 $\Gamma(K^+ K^- \eta)/\Gamma_{\text{total}}$ Γ_{48}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<0.22	90	¹ ATHAR	07 CLEO	$\psi(2S) \rightarrow \gamma h^+ h^- h^0$
¹ ATHAR 07 reports $< 0.24 \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow K^+ K^- \eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = 9.99 \times 10^{-2}$.				

NODE=M056R09
NODE=M056R09

NODE=M056R09;LINKAGE=AT

 $\Gamma(K^+ K^- K_S^0 K_S^0)/\Gamma_{\text{total}}$ Γ_{49}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.38 \pm 0.46 \pm 0.04$	16.8 ± 4.8	¹ ABLIKIM	050 BES2	$\psi(2S) \rightarrow \gamma \chi_{c0}$
¹ ABLIKIM 050 reports $[\Gamma(\chi_{c0}(1P) \rightarrow K^+ K^- K_S^0 K_S^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ $= (0.138 \pm 0.039 \pm 0.025) \times 10^{-3}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.99 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M056R48
NODE=M056R48

NODE=M056R48;LINKAGE=AB

$\Gamma(K^+ K^- K^+ K^-)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})**2.75±0.28 OUR FIT**

DOCUMENT ID

 Γ_{50}/Γ NODE=M056R14
NODE=M056R14 $\Gamma(K^+ K^- \phi)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

EVTS

DOCUMENT ID

TECN

COMMENT

 Γ_{51}/Γ NODE=M056R01
NODE=M056R01**0.95±0.24±0.03**

38

¹

ABLIKIM

06T

BES2

 $\psi(2S) \rightarrow \gamma 2K^+ 2K^-$

¹ ABLIKIM 06T reports $(1.03 \pm 0.22 \pm 0.15) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow K^+ K^- \phi)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.99 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R01;LINKAGE=AB

 $\Gamma(\bar{K}^0 K^+ \pi^- \phi + \text{c.c.})/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

DOCUMENT ID

TECN

COMMENT

 Γ_{52}/Γ NODE=M056R90
NODE=M056R90**3.68±0.30±0.50**

ABLIKIM

15M

BES3

 $\psi(2S) \rightarrow \gamma \chi_{c0}$ $\Gamma(K^+ K^- \pi^0 \phi)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

DOCUMENT ID

TECN

COMMENT

 Γ_{53}/Γ NODE=M056R91
NODE=M056R91**1.90±0.14±0.32**

ABLIKIM

15M

BES3

 $\psi(2S) \rightarrow \gamma \chi_{c0}$ $\Gamma(\phi \pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

EVTS

¹

ABLIKIM

13B

BES3

 $e^+ e^- \rightarrow \psi(2S) \rightarrow \gamma \chi_{c0}$ Γ_{54}/Γ NODE=M056R88
NODE=M056R88**1.18±0.07±0.13**

538

¹ Using 1.06×10^8 $\psi(2S)$ mesons and $B(\psi(2S) \rightarrow \chi_{c0} \gamma) = (9.68 \pm 0.31)\%$.

NODE=M056R88;LINKAGE=A

 $\Gamma(\phi\phi)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

DOCUMENT ID

 Γ_{55}/Γ NODE=M056R16
NODE=M056R16**0.77±0.07 OUR FIT** $\Gamma(p\bar{p})/\Gamma_{\text{total}}$ VALUE (units 10^{-4})

DOCUMENT ID

 Γ_{56}/Γ NODE=M056R11
NODE=M056R11**2.25±0.09 OUR FIT** $\Gamma(p\bar{p}\pi^0)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

DOCUMENT ID

TECN

COMMENT

 Γ_{57}/Γ NODE=M056R06
NODE=M056R06**0.68±0.07 OUR AVERAGE**

Error includes scale factor of 1.3.

0.72±0.06±0.02

¹

ONYISI

10

CLE3

 $\psi(2S) \rightarrow \gamma p\bar{p}X$

0.54±0.11±0.01

²

ATHAR

07

CLEO

 $\psi(2S) \rightarrow \gamma h^+ h^- h^0$

¹ ONYISI 10 reports $(7.76 \pm 0.37 \pm 0.51 \pm 0.39) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow p\bar{p}\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.99 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R06;LINKAGE=ON

² ATHAR 07 reports $(0.59 \pm 0.10 \pm 0.08) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow p\bar{p}\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.99 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R06;LINKAGE=AT

 $\Gamma(p\bar{p}\eta)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

DOCUMENT ID

TECN

COMMENT

 Γ_{58}/Γ NODE=M056R50
NODE=M056R50**0.35±0.04 OUR AVERAGE**

0.34±0.04±0.01

¹

ONYISI

10

CLE3

 $\psi(2S) \rightarrow \gamma p\bar{p}X$

0.36±0.11±0.01

²

ATHAR

07

CLEO

 $\psi(2S) \rightarrow \gamma h^+ h^- h^0$

¹ ONYISI 10 reports $(3.73 \pm 0.38 \pm 0.28 \pm 0.19) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow p\bar{p}\eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.99 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R50;LINKAGE=ON

² ATHAR 07 reports $(0.39 \pm 0.11 \pm 0.04) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow p\bar{p}\eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.99 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R50;LINKAGE=AT

$\Gamma(p\bar{p}\omega)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

DOCUMENT ID

TECN

COMMENT

 Γ_{59}/Γ NODE=M056R70
NODE=M056R70**0.51±0.05±0.01**¹

ONYISI

10

CLE3

 $\psi(2S) \rightarrow \gamma p\bar{p}X$

¹ ONYISI 10 reports $(5.57 \pm 0.48 \pm 0.42 \pm 0.14) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow p\bar{p}\omega)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.99 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R70;LINKAGE=ON

 $\Gamma(p\bar{p}\phi)/\Gamma_{\text{total}}$ VALUE (units 10^{-5})

EVTS

DOCUMENT ID

TECN

COMMENT

 Γ_{60}/Γ NODE=M056R75
NODE=M056R75**5.9±1.4±0.2**

42 ± 8

¹

ABLIKIM

11F

BES3

 $\psi(2S) \rightarrow \gamma p\bar{p}K^+K^-$

¹ ABLIKIM 11F reports $(6.12 \pm 1.18 \pm 0.86) \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow p\bar{p}\phi)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.62 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.99 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R75;LINKAGE=AB

 $\Gamma(p\bar{p}\pi^+\pi^-)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

DOCUMENT ID

TECN

COMMENT

 Γ_{61}/Γ NODE=M056R7
NODE=M056R7**2.1 ±0.7 OUR EVALUATION**

Error includes scale factor of 1.4. Treating systematic error as correlated.

2.1 ±1.0 OUR AVERAGE

Error includes scale factor of 2.0.

1.57±0.21±0.53

¹

BAI

99B

BES

 $\psi(2S) \rightarrow \gamma\chi_{c0}$

4.20±1.15±0.18

¹

TANENBAUM 78

MRK1

 $\psi(2S) \rightarrow \gamma\chi_{c0}$

¹ Rescaled by us using $B(\psi(2S) \rightarrow \gamma\chi_{c0}) = (9.4 \pm 0.4)\%$ and $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (32.6 \pm 0.5)\%$.

NODE=M056R7;LINKAGE=X1

 $\Gamma(p\bar{p}\pi^0\pi^0)/\Gamma_{\text{total}}$

VALUE (%)

EVTS

DOCUMENT ID

TECN

COMMENT

 Γ_{62}/Γ NODE=M056R65
NODE=M056R65**0.102±0.027±0.003**

39.5

¹

HE

08B

CLEO

 $e^+e^- \rightarrow \gamma h^+h^-h^0h^0$

¹ HE 08B reports $0.11 \pm 0.02 \pm 0.02 \pm 0.01\%$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow p\bar{p}\pi^0\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.99 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R65;LINKAGE=HE

 $\Gamma(p\bar{p}K^+K^- \text{ (non-resonant)})/\Gamma_{\text{total}}$ VALUE (units 10^{-4})

EVTS

DOCUMENT ID

TECN

COMMENT

 Γ_{63}/Γ NODE=M056R72
NODE=M056R72**1.19±0.26±0.03**

48 ± 8

¹

ABLIKIM

11F

BES3

 $\psi(2S) \rightarrow \gamma p\bar{p}K^+K^-$

¹ ABLIKIM 11F reports $(1.24 \pm 0.20 \pm 0.18) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow p\bar{p}K^+K^- \text{ (non-resonant)})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.62 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.99 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R72;LINKAGE=AB

 $\Gamma(p\bar{p}K_S^0K_S^0)/\Gamma_{\text{total}}$ VALUE (units 10^{-4})

CL%

DOCUMENT ID

TECN

COMMENT

 Γ_{64}/Γ NODE=M056R46
NODE=M056R46**<8.8**

90

¹

ABLIKIM

06D

BES2

 $\psi(2S) \rightarrow \chi_{c0}\gamma$

¹ Using $B(\psi(2S) \rightarrow \chi_{c0}\gamma) = (9.2 \pm 0.5)\%$

NODE=M056R;LINKAGE=AB

 $\Gamma(p\bar{n}\pi^-)/\Gamma_{\text{total}}$ VALUE (units 10^{-4})

EVTS

DOCUMENT ID

TECN

COMMENT

 Γ_{65}/Γ NODE=M056R49
NODE=M056R49**12.4±1.1 OUR AVERAGE**

12.6±1.1±0.3

5150

¹

ABLIKIM

12J

BES3

 $\psi(2S) \rightarrow \gamma p\bar{n}\pi^-$

11.0±3.0±0.3

²

ABLIKIM

06I

BES2

 $\psi(2S) \rightarrow \gamma p\pi^-X$

¹ ABLIKIM 12J reports $[\Gamma(\chi_{c0}(1P) \rightarrow p\bar{n}\pi^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ = $(1.26 \pm 0.02 \pm 0.11) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.99 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R49;LINKAGE=AL

² ABLIKIM 06I reports $[\Gamma(\chi_{c0}(1P) \rightarrow p\bar{n}\pi^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ = $(1.10 \pm 0.24 \pm 0.18) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.99 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R49;LINKAGE=AB

$\Gamma(\bar{p}n\pi^+)/\Gamma_{\text{total}}$ Γ_{66}/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
13.4±1.1±0.4	5808	¹ ABLIKIM	12J BES3	$\psi(2S) \rightarrow \gamma \bar{p}n\pi^+$

NODE=M056R82
 NODE=M056R82

¹ ABLIKIM 12J reports $[\Gamma(\chi_{c0}(1P) \rightarrow \bar{p}n\pi^+)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))] = (1.34 \pm 0.03 \pm 0.11) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.99 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R82;LINKAGE=AL

 $\Gamma(p\bar{n}\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{67}/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
22.9±2.0±0.6	2480	¹ ABLIKIM	12J BES3	$\psi(2S) \rightarrow \gamma p\bar{n}\pi^-\pi^0$

NODE=M056R83
 NODE=M056R83

¹ ABLIKIM 12J reports $[\Gamma(\chi_{c0}(1P) \rightarrow p\bar{n}\pi^-\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))] = (2.29 \pm 0.08 \pm 0.18) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.99 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R83;LINKAGE=AL

 $\Gamma(\bar{p}n\pi^+\pi^0)/\Gamma_{\text{total}}$ Γ_{68}/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
21.6±1.7±0.6	2757	¹ ABLIKIM	12J BES3	$\psi(2S) \rightarrow \gamma \bar{p}n\pi^+\pi^0$

NODE=M056R84
 NODE=M056R84

¹ ABLIKIM 12J reports $[\Gamma(\chi_{c0}(1P) \rightarrow \bar{p}n\pi^+\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))] = (2.16 \pm 0.07 \pm 0.16) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.99 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R84;LINKAGE=AL

 $\Gamma(\Lambda\bar{\Lambda})/\Gamma_{\text{total}}$ Γ_{69}/Γ

VALUE (units 10^{-4})	DOCUMENT ID
3.21±0.25 OUR FIT	

NODE=M056R23
 NODE=M056R23

 $\Gamma(\Lambda\bar{\Lambda}\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{70}/Γ

VALUE (units 10^{-5})	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
115±12±3		426	¹ ABLIKIM	12I BES3	$\psi(2S) \rightarrow \gamma \Lambda\bar{\Lambda}\pi^+\pi^-$

NODE=M056R44
 NODE=M056R44

• • • We do not use the following data for averages, fits, limits, etc. • • •

<400	90	² ABLIKIM	06D BES2	$\psi(2S) \rightarrow \chi_{c0}\gamma$

¹ ABLIKIM 12I reports $(119.0 \pm 6.4 \pm 11.4) \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \Lambda\bar{\Lambda}\pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.68 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.99 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R44;LINKAGE=AL

² Using $B(\psi(2S) \rightarrow \chi_{c0}\gamma) = (9.2 \pm 0.5)\%$

NODE=M056R44;LINKAGE=AB

 $\Gamma(\Lambda\bar{\Lambda}\pi^+\pi^- (\text{non-resonant}))/\Gamma_{\text{total}}$ Γ_{71}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<50	90	¹ ABLIKIM	12I BES3	$\psi(2S) \rightarrow \gamma \Lambda\bar{\Lambda}\pi^+\pi^-$

NODE=M056R77
 NODE=M056R77

¹ ABLIKIM 12I reports $< 54 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \Lambda\bar{\Lambda}\pi^+\pi^- (\text{non-resonant}))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.68 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = 9.99 \times 10^{-2}$.

NODE=M056R77;LINKAGE=AL

 $\Gamma(\Sigma(1385)^+\bar{\Lambda}\pi^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{72}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<50	90	¹ ABLIKIM	12I BES3	$\psi(2S) \rightarrow \gamma \Sigma(1385)^+\bar{\Lambda}\pi^-$

NODE=M056R78
 NODE=M056R78

¹ ABLIKIM 12I reports $< 55 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \Sigma(1385)^+\bar{\Lambda}\pi^- + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.68 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = 9.99 \times 10^{-2}$.

NODE=M056R78;LINKAGE=AL

 $\Gamma(\Sigma(1385)^-\bar{\Lambda}\pi^+ + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{73}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<50	90	¹ ABLIKIM	12I BES3	$\psi(2S) \rightarrow \gamma \Sigma(1385)^-\bar{\Lambda}\pi^+$

NODE=M056R79
 NODE=M056R79

¹ ABLIKIM 12I reports $< 50 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \Sigma(1385)^-\bar{\Lambda}\pi^+ + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.68 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = 9.99 \times 10^{-2}$.

NODE=M056R79;LINKAGE=AL

$\Gamma(K^+ \bar{p} \Lambda + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{74}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.22±0.12 OUR AVERAGE	Error includes scale factor of 1.3.			
1.28±0.09±0.03	9k	^{1,2} ABLIKIM	13D BES3	$\psi(2S) \rightarrow \gamma \Lambda \bar{p} K^+$
0.99±0.19±0.03		³ ATHAR	07 CLEO	$\psi(2S) \rightarrow \gamma h^+ h^- h^0$
¹ ABLIKIM 13D reports $(1.32 \pm 0.03 \pm 0.10) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow K^+ \bar{p} \Lambda + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.68 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.99 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				
² Using $B(\Lambda \rightarrow p \pi^-) = 63.9\%$.				
³ ATHAR 07 reports $(1.07 \pm 0.17 \pm 0.12) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow K^+ \bar{p} \Lambda + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.99 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M056R07
 NODE=M056R07

NODE=M056R07;LINKAGE=AB

NODE=M056R07;LINKAGE=LB
 NODE=M056R07;LINKAGE=AT

 $\Gamma(K^+ \bar{p} \Lambda(1520) + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{75}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.9±0.7±0.1	62 ± 12	¹ ABLIKIM	11F BES3	$\psi(2S) \rightarrow \gamma p \bar{p} K^+ K^-$
¹ ABLIKIM 11F reports $(3.00 \pm 0.58 \pm 0.50) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow K^+ \bar{p} \Lambda(1520) + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.62 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.99 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M056R73
 NODE=M056R73

NODE=M056R73;LINKAGE=AB

 $\Gamma(\Lambda(1520) \bar{\Lambda}(1520))/\Gamma_{\text{total}}$ Γ_{76}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
3.1±1.2±0.1	28 ± 10	¹ ABLIKIM	11F BES3	$\psi(2S) \rightarrow \gamma p \bar{p} K^+ K^-$
¹ ABLIKIM 11F reports $(3.18 \pm 1.11 \pm 0.53) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \Lambda(1520) \bar{\Lambda}(1520))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.62 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.99 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M056R74
 NODE=M056R74

NODE=M056R74;LINKAGE=AB

 $\Gamma(\Sigma^0 \bar{\Sigma}^0)/\Gamma_{\text{total}}$ Γ_{77}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
4.4±0.4 OUR AVERAGE				
4.6±0.5±0.1	243	¹ ABLIKIM	13H BES3	$\psi(2S) \rightarrow \gamma \Sigma^0 \bar{\Sigma}^0$
4.1±0.6±0.1	78 ± 10	² NAIK	08 CLEO	$\psi(2S) \rightarrow \gamma \Sigma^0 \bar{\Sigma}^0$
¹ ABLIKIM 13H reports $(4.78 \pm 0.34 \pm 0.39) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \Sigma^0 \bar{\Sigma}^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.62 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.99 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				
² 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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.99 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M056R59
 NODE=M056R59

NODE=M056R59;LINKAGE=AB

NODE=M056R59;LINKAGE=NA

 $\Gamma(\Sigma^+ \bar{\Sigma}^-)/\Gamma_{\text{total}}$ Γ_{78}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
3.9±0.7 OUR AVERAGE	Error includes scale factor of 1.7.			
4.4±0.5±0.1	148	¹ ABLIKIM	13H BES3	$\psi(2S) \rightarrow \gamma \Sigma^+ \bar{\Sigma}^-$
3.0±0.6±0.1	39 ± 7	² NAIK	08 CLEO	$\psi(2S) \rightarrow \gamma \Sigma^+ \bar{\Sigma}^-$
¹ ABLIKIM 13H reports $(4.54 \pm 0.42 \pm 0.30) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \Sigma^+ \bar{\Sigma}^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.62 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.99 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				
² 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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.99 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M056R60
 NODE=M056R60

NODE=M056R60;LINKAGE=AB

NODE=M056R60;LINKAGE=NA

$\Gamma(\Sigma(1385)^+ \bar{\Sigma}(1385)^-)/\Gamma_{\text{total}}$ Γ_{79}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
15.9$\pm$5.7$\pm$0.4	27	¹ ABLIKIM	12I BES3	$\psi(2S) \rightarrow \gamma \Lambda \bar{\Lambda} \pi^+ \pi^-$

NODE=M056R80
NODE=M056R80

¹ ABLIKIM 12I reports $(16.4 \pm 5.7 \pm 1.6) \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \Sigma(1385)^+ \bar{\Sigma}(1385)^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.68 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.99 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R80;LINKAGE=AL

 $\Gamma(\Sigma(1385)^- \bar{\Sigma}(1385)^+)/\Gamma_{\text{total}}$ Γ_{80}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
23$\pm$6$\pm$1	33	¹ ABLIKIM	12I BES3	$\psi(2S) \rightarrow \gamma \Lambda \bar{\Lambda} \pi^+ \pi^-$

NODE=M056R81
NODE=M056R81

¹ ABLIKIM 12I reports $(23.5 \pm 6.2 \pm 2.3) \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \Sigma(1385)^- \bar{\Sigma}(1385)^+)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.68 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.99 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R81;LINKAGE=AL

 $\Gamma(K^- \Lambda \bar{\Xi}^+ + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{81}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.90$\pm$0.34$\pm$0.05	57	¹ ABLIKIM	15I BES3	$\psi(2S) \rightarrow \gamma K^- \Lambda \bar{\Xi}^+ + \text{c.c.}$

NODE=M056R92
NODE=M056R92

¹ ABLIKIM 15I reports $[\Gamma(\chi_{c0}(1P) \rightarrow K^- \Lambda \bar{\Xi}^+ + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ $= (1.90 \pm 0.30 \pm 0.16) \times 10^{-5}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.99 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R92;LINKAGE=A

 $\Gamma(\Xi^0 \Xi^0)/\Gamma_{\text{total}}$ Γ_{82}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
3.1$\pm$0.8$\pm$0.1	23.3 $\pm$ 4.9	¹ NAIK	08 CLEO	$\psi(2S) \rightarrow \gamma \Xi^0 \Xi^0$

NODE=M056R61
NODE=M056R61

¹ NAIK 08 reports $(3.34 \pm 0.70 \pm 0.48) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \Xi^0 \Xi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.99 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R61;LINKAGE=NA

 $\Gamma(\Xi^- \Xi^+)/\Gamma_{\text{total}}$ Γ_{83}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
4.7$\pm$0.7$\pm$0.1	95 $\pm$ 11	¹ NAIK	08 CLEO		$\psi(2S) \rightarrow \gamma \Xi^+ \Xi^-$

NODE=M056R45
NODE=M056R45

• • • We do not use the following data for averages, fits, limits, etc. • • •

<10.3 90 ² ABLIKIM 06D BES2 $\psi(2S) \rightarrow \chi_{c0} \gamma$

¹ NAIK 08 reports $(5.14 \pm 0.60 \pm 0.47) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \Xi^- \Xi^+)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.99 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R45;LINKAGE=NA

² Using $B(\psi(2S) \rightarrow \chi_{c0} \gamma) = (9.2 \pm 0.5)\%$

NODE=M056R45;LINKAGE=AB

 $\Gamma(\eta_c \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{84}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
< 7 $\times$ 10⁻⁴	90	^{1,2} ABLIKIM	13B BES3	$e^+ e^- \rightarrow \psi(2S) \rightarrow \gamma \chi_{c0}$

NODE=M056R89
NODE=M056R89

• • • We do not use the following data for averages, fits, limits, etc. • • •

<41 $\times$ 10⁻⁴ 90 ^{1,3} ABLIKIM 13B BES3 $e^+ e^- \rightarrow \psi(2S) \rightarrow \gamma \chi_{c0}$

¹ Using 1.06×10^8 $\psi(2S)$ mesons and $B(\psi(2S) \rightarrow \chi_{c0} \gamma) = (9.68 \pm 0.31)\%$.

² From the $\eta_c \rightarrow K_S^0 K^\pm \pi^\mp$ decays.

³ From the $\eta_c \rightarrow K^+ K^- \pi^0$ decays.

OCCUR=2

NODE=M056R89;LINKAGE=A

NODE=M056R89;LINKAGE=B

NODE=M056R89;LINKAGE=C

 $\Gamma(p \bar{p})/\Gamma_{\text{total}} \times \Gamma(\pi \pi)/\Gamma_{\text{total}}$ $\Gamma_{56}/\Gamma \times \Gamma_{32}/\Gamma$

VALUE (units 10^{-7})	DOCUMENT ID	TECN	COMMENT
18.8$\pm$1.2 OUR FIT			
15.3$\pm$2.4$\pm$0.8	¹ ANDREOTTI	03 E835	$\bar{p} p \rightarrow \chi_{c0} \rightarrow \pi^0 \pi^0$

NODE=M056R21
NODE=M056R21

¹ We have multiplied $B(p \bar{p}) \cdot B(\pi^0 \pi^0)$ measurement by 3 to obtain $B(p \bar{p}) \cdot B(\pi \pi)$.

NODE=M056R;LINKAGE=AD

$$\Gamma(p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\pi^0\eta)/\Gamma_{\text{total}}$$

VALUE (units 10^{-7})

<0.4

DOCUMENT ID

TECN

COMMENT

ANDREOTTI 05C E835

$\bar{p}p \rightarrow \pi^0\eta$

$$\Gamma_{56}/\Gamma \times \Gamma_{33}/\Gamma$$

NODE=M056R41
NODE=M056R41

$$\Gamma(p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\pi^0\eta')/\Gamma_{\text{total}}$$

VALUE (units 10^{-7})

<2.5

DOCUMENT ID

TECN

COMMENT

ANDREOTTI 05C E835

$\bar{p}p \rightarrow \pi^0\eta$

$$\Gamma_{56}/\Gamma \times \Gamma_{34}/\Gamma$$

NODE=M056R42
NODE=M056R42

$$\Gamma(p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\eta\eta)/\Gamma_{\text{total}}$$

VALUE (units 10^{-7})

6.6±0.5 OUR FIT

4.0±1.2^{+0.5}_{-0.3}

DOCUMENT ID

TECN

COMMENT

ANDREOTTI 05C E835

$\bar{p}p \rightarrow \eta\eta$

$$\Gamma_{56}/\Gamma \times \Gamma_{36}/\Gamma$$

NODE=M056R40
NODE=M056R40

$$\Gamma(p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\eta\eta')/\Gamma_{\text{total}}$$

VALUE (units 10^{-6})

2.1^{+2.3}_{-1.5}

DOCUMENT ID

TECN

COMMENT

ANDREOTTI 05C E835

$\bar{p}p \rightarrow \pi^0\eta$

$$\Gamma_{56}/\Gamma \times \Gamma_{37}/\Gamma$$

NODE=M056R43
NODE=M056R43

• • • We do not use the following data for averages, fits, limits, etc. • • •

———— RADIATIVE DECAYS ————

$$\Gamma(\gamma J/\psi(1S))/\Gamma_{\text{total}}$$

VALUE (units 10^{-4})

127± 6 OUR FIT

DOCUMENT ID

TECN

COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

200±20±20

¹ ADAM

05A CLEO

$e^+e^- \rightarrow \psi(2S) \rightarrow \gamma\chi_{c0}$

¹ 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.

$$\Gamma_{85}/\Gamma$$

NODE=M056310

NODE=M056R8
NODE=M056R8

NODE=M056R8;LINKAGE=AD

$$\Gamma(\gamma\rho^0)/\Gamma_{\text{total}}$$

VALUE (units 10^{-6})

< 9

90

1.2 ± 4.5

¹ BENNETT

08A CLEO

$\psi(2S) \rightarrow \gamma\gamma\rho^0$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<10

90

6 ± 12

² ABLIKIM

11E BES3

$\psi(2S) \rightarrow \gamma\gamma\rho^0$

¹ BENNETT 08A reports $< 9.6 \times 10^{-6}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \gamma\rho^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = 9.99 \times 10^{-2}$.

² ABLIKIM 11E reports $< 10.5 \times 10^{-6}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \gamma\rho^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.62 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = 9.99 \times 10^{-2}$.

$$\Gamma_{86}/\Gamma$$

NODE=M056R56
NODE=M056R56

NODE=M056R56;LINKAGE=BE

NODE=M056R56;LINKAGE=AB

$$\Gamma(\gamma\omega)/\Gamma_{\text{total}}$$

VALUE (units 10^{-6})

< 8

90

0.0 ± 2.8

¹ BENNETT

08A CLEO

$\psi(2S) \rightarrow \gamma\gamma\omega$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<12

90

5 ± 11

² ABLIKIM

11E BES3

$\psi(2S) \rightarrow \gamma\gamma\omega$

¹ BENNETT 08A reports $< 8.8 \times 10^{-6}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \gamma\omega)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = 9.99 \times 10^{-2}$.

² ABLIKIM 11E reports $< 12.9 \times 10^{-6}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \gamma\omega)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.62 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = 9.99 \times 10^{-2}$.

$$\Gamma_{87}/\Gamma$$

NODE=M056R57
NODE=M056R57

NODE=M056R57;LINKAGE=BE

NODE=M056R57;LINKAGE=AB

$$\Gamma(\gamma\phi)/\Gamma_{\text{total}}$$

VALUE (units 10^{-6})

< 6

90

0.1 ± 1.6

¹ BENNETT

08A CLEO

$\psi(2S) \rightarrow \gamma\gamma\phi$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<16

90

15 ± 7

² ABLIKIM

11E BES3

$\psi(2S) \rightarrow \gamma\gamma\phi$

¹ BENNETT 08A reports $< 6.4 \times 10^{-6}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \gamma\phi)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = 9.99 \times 10^{-2}$.

² ABLIKIM 11E reports $< 16.2 \times 10^{-6}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \gamma\phi)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.62 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = 9.99 \times 10^{-2}$.

$$\Gamma_{88}/\Gamma$$

NODE=M056R58
NODE=M056R58

NODE=M056R58;LINKAGE=BE

NODE=M056R58;LINKAGE=AB

$\Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ Γ_{89}/Γ

VALUE (units 10^{-4}) CL% DOCUMENT ID TECN COMMENT

2.23±0.13 OUR FIT

• • • We do not use the following data for averages, fits, limits, etc. • • •

<7 90 ¹ WICHT 08 BELL $B^\pm \rightarrow K^\pm \gamma\gamma$

¹ WICHT 08 reports $[\Gamma(\chi_{c0}(1P) \rightarrow \gamma\gamma)/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \chi_{c0} K^+)] < 0.11 \times 10^{-6}$
which we divide by our best value $B(B^+ \rightarrow \chi_{c0} K^+) = 1.50 \times 10^{-4}$.

NODE=M056R1
NODE=M056R1

NODE=M056R1;LINKAGE=W1

 $\Gamma(\gamma\gamma)/\Gamma(\gamma J/\psi(1S))$ Γ_{89}/Γ_{85}

VALUE (units 10^{-2}) DOCUMENT ID TECN COMMENT

1.76±0.13 OUR FIT

2.0 ±0.4 OUR AVERAGE

2.2 ±0.4 ^{+0.1}_{-0.2} ¹ ANDREOTTI 04 E835 $p\bar{p} \rightarrow \chi_{c0} \rightarrow \gamma\gamma$

1.45±0.74 ² AMBROGIANI 00B E835 $\bar{p}p \rightarrow \chi_{c2} \rightarrow \gamma\gamma, \gamma J/\psi$

¹ The values of $B(p\bar{p})B(\gamma\gamma)$ and $B(\gamma\gamma)B(\gamma J/\psi)$ measured by ANDREOTTI 04 are not independent. The latter is used in the fit because of smaller systematics.

² Calculated by us using $B(J/\psi(1S) \rightarrow e^+ e^-) = 0.0593 \pm 0.0010$.

NODE=M056R18
NODE=M056R18

NODE=M056R;LINKAGE=AN

NODE=M056R;LINKAGE=7A

 $\Gamma(p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\gamma J/\psi(1S))/\Gamma_{\text{total}}$ $\Gamma_{56}/\Gamma \times \Gamma_{85}/\Gamma$

VALUE (units 10^{-7}) EVTS DOCUMENT ID TECN COMMENT

28.5±1.6 OUR FIT

28.2±2.1 OUR AVERAGE

28.0±1.9±1.3 392 ^{1,2,3} BAGNASCO 02 E835 $\bar{p}p \rightarrow \chi_{c0} \rightarrow J/\psi\gamma$

29.3 ^{+5.7}_{-4.7} ±1.5 89 ^{1,2} AMBROGIANI 99B $\bar{p}p \rightarrow \chi_{c0} \rightarrow J/\psi\gamma$

¹ Values in $(\Gamma(p\bar{p}) \times \Gamma(\gamma J/\psi(1S))/\Gamma_{\text{total}})$ and $(\Gamma(p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\gamma J/\psi(1S))/\Gamma_{\text{total}})$ are not independent. The latter is used in the fit since it is less correlated to the total width.

² Calculated by us using $B(J/\psi(1S) \rightarrow e^+ e^-) = 0.0593 \pm 0.0010$.

³ Recalculated by ANDREOTTI 05A.

NODE=M056R19
NODE=M056R19

NODE=M056R;LINKAGE=KS

NODE=M056R19;LINKAGE=7A
NODE=M056R19;LINKAGE=AN

 $\Gamma(p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_{56}/\Gamma \times \Gamma_{89}/\Gamma$

VALUE (units 10^{-8}) DOCUMENT ID TECN COMMENT

5.0 ±0.4 OUR FIT

• • • We do not use the following data for averages, fits, limits, etc. • • •

6.52±1.18 ^{+0.48}_{-0.72} ¹ ANDREOTTI 04 E835 $p\bar{p} \rightarrow \chi_{c0} \rightarrow \gamma\gamma$

¹ The values of $B(p\bar{p})B(\gamma\gamma)$ and $B(\gamma\gamma)B(\gamma J/\psi)$ measured by ANDREOTTI 04 are not independent. The latter is used in the fit because of smaller systematics.

NODE=M056R25
NODE=M056R25

NODE=M056R25;LINKAGE=AN

$\chi_{c0}(1P)$ CROSS-PARTICLE BRANCHING RATIOS

NODE=M056230

 $\Gamma(\chi_{c0}(1P) \rightarrow p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))/\Gamma_{\text{total}}$

$\Gamma_{56}/\Gamma \times \Gamma_{134}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}$

VALUE (units 10^{-6}) EVTS DOCUMENT ID TECN COMMENT

22.5±0.9 OUR FIT

23.7±1.0 OUR AVERAGE

23.7±0.8±0.9 1222 ABLIKIM 13v BES3 $\psi(2S) \rightarrow \gamma p\bar{p}$

23.7±1.4±1.4 383 ± 22 ¹ NAIK 08 CLEO $\psi(2S) \rightarrow \gamma p\bar{p}$

23.6 ^{+3.7}_{-3.4} ±3.4 89.5 ⁺¹⁴₋₁₃ BAI 04F BES $\psi(2S) \rightarrow \gamma\chi_{c0}(1P) \rightarrow \gamma\bar{p}p$

¹ Calculated by us. NAIK 08 reports $B(\chi_{c0} \rightarrow p\bar{p}) = (25.7 \pm 1.5 \pm 1.5 \pm 1.3) \times 10^{-5}$ using $B(\psi(2S) \rightarrow \gamma\chi_{c0}) = (9.22 \pm 0.11 \pm 0.46)\%$.

NODE=M056B6
NODE=M056B6

NODE=M056B6;LINKAGE=NA

 $\Gamma(\chi_{c0}(1P) \rightarrow p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)$

$\Gamma_{56}/\Gamma \times \Gamma_{134}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}$

VALUE (units 10^{-5}) DOCUMENT ID TECN COMMENT

6.53±0.27 OUR FIT

4.6 ±1.9

¹ BAI 98i BES $\psi(2S) \rightarrow \gamma\chi_{c0} \rightarrow \gamma\bar{p}p$

¹ Calculated by us. The value for $B(\chi_{c0} \rightarrow p\bar{p})$ reported in BAI 98i is derived using $B(\psi(2S) \rightarrow \gamma\chi_{c0}) = (9.3 \pm 0.8)\%$ and $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (32.4 \pm 2.6)\%$ [BAI 98D].

NODE=M056B1
NODE=M056B1

NODE=M056B;LINKAGE=B1

$$\Gamma(\chi_{c0}(1P) \rightarrow \Lambda \bar{\Lambda}) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) / \Gamma_{\text{total}}$$

$$\Gamma_{69} / \Gamma \times \Gamma_{134}^{\psi(2S)} / \Gamma^{\psi(2S)}$$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
32.0$\pm$2.3 OUR FIT				
31.7$\pm$2.3 OUR AVERAGE				
32.0 $\pm$ 1.9 $\pm$ 2.2	369	¹ ABLIKIM	13H BES3	$\psi(2S) \rightarrow \gamma \Lambda \bar{\Lambda}$
31.2 $\pm$ 3.3 $\pm$ 2.0	131 $\pm$ 12	² NAIK	08 CLEO	$\psi(2S) \rightarrow \gamma \Lambda \bar{\Lambda}$

NODE=M056B20
NODE=M056B20

¹ Calculated by us. ABLIKIM 13H reports $B(\chi_{c0} \rightarrow \Lambda \bar{\Lambda}) = (33.3 \pm 2.0 \pm 2.6) \times 10^{-5}$ from a measurement of $B(\chi_{c0} \rightarrow \Lambda \bar{\Lambda}) \times B(\psi(2S) \rightarrow \gamma \chi_{c0})$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}) = (9.62 \pm 0.31)\%$.

NODE=M056B20;LINKAGE=AB

² Calculated by us. NAIK 08 reports $B(\chi_{c0} \rightarrow \Lambda \bar{\Lambda}) = (33.8 \pm 3.6 \pm 2.2 \pm 1.7) \times 10^{-5}$ using $B(\psi(2S) \rightarrow \gamma \chi_{c0}) = (9.22 \pm 0.11 \pm 0.46)\%$.

NODE=M056B20;LINKAGE=NA

$$\Gamma(\chi_{c0}(1P) \rightarrow \Lambda \bar{\Lambda}) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) / \Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)$$

$$\Gamma_{69} / \Gamma \times \Gamma_{134}^{\psi(2S)} / \Gamma_{11}^{\psi(2S)}$$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
9.3$\pm$0.7 OUR FIT				
13.0$^{+3.6}_{-3.5}$$\pm$2.5				
15.2 $^{+4.2}_{-4.0}$		¹ BAI	03E BES	$\psi(2S) \rightarrow \gamma \Lambda \bar{\Lambda}$

NODE=M056B21
NODE=M056B21

¹ BAI 03E reports $[B(\chi_{c0} \rightarrow \Lambda \bar{\Lambda}) B(\psi(2S) \rightarrow \gamma \chi_{c0}) / B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-)] \times [B^2(\Lambda \rightarrow \pi^- p) / B(J/\psi \rightarrow p \bar{p})] = (2.45^{+0.68}_{-0.65} \pm 0.46)\%$. We calculate from this measurement the presented value using $B(\Lambda \rightarrow \pi^- p) = (63.9 \pm 0.5)\%$ and $B(J/\psi \rightarrow p \bar{p}) = (2.17 \pm 0.07) \times 10^{-3}$.

NODE=M056B21;LINKAGE=BA

$$\Gamma(\chi_{c0}(1P) \rightarrow \gamma J/\psi(1S)) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) / \Gamma_{\text{total}}$$

$$\Gamma_{85} / \Gamma \times \Gamma_{134}^{\psi(2S)} / \Gamma^{\psi(2S)}$$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
0.127$\pm$0.006 OUR FIT				
0.131$\pm$0.035 OUR AVERAGE				
Error includes scale factor of 3.9.				
0.151 $\pm$ 0.003 $\pm$ 0.010	4.3k	ABLIKIM	120 BES3	$\psi(2S) \rightarrow \gamma \chi_{c0}$
0.069 $\pm$ 0.018		¹ OREGIA	82 CBAL	$\psi(2S) \rightarrow \gamma \chi_{c0}$
0.4 $\pm$ 0.3		² BRANDELIK	79B DASP	$\psi(2S) \rightarrow \gamma \chi_{c0}$
0.16 $\pm$ 0.11		² BARTEL	78B CNTR	$\psi(2S) \rightarrow \gamma \chi_{c0}$
3.3 $\pm$ 1.7		³ BIDDICK	77 CNTR	$e^+ e^- \rightarrow \gamma X$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.125 $\pm$ 0.007 $\pm$ 0.013	560	⁴ MENDEZ	08 CLEO	$\psi(2S) \rightarrow \gamma \chi_{c0}$
0.18 $\pm$ 0.01 $\pm$ 0.02	172	⁵ ADAM	05A CLEO	Repl. by MENDEZ 08

NODE=M056B2
NODE=M056B2

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 Assumes isotropic gamma distribution.

⁴ Not independent from other measurements of MENDEZ 08.

⁵ Not independent from other values reported by ADAM 05A.

NODE=M056B;LINKAGE=3Q
NODE=M056B;LINKAGE=2Q
NODE=M056B;LINKAGE=EA
NODE=M056B2;LINKAGE=ME
NODE=M056B2;LINKAGE=AD

$$\Gamma(\chi_{c0}(1P) \rightarrow \gamma J/\psi(1S)) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) / \Gamma(\psi(2S) \rightarrow J/\psi(1S) \text{ anything})$$

$$\Gamma_{85} / \Gamma \times \Gamma_{134}^{\psi(2S)} / \Gamma_9^{\psi(2S)} = \Gamma_{85} / \Gamma \times \Gamma_{134}^{\psi(2S)} / (\Gamma_{11}^{\psi(2S)} + \Gamma_{12}^{\psi(2S)} + \Gamma_{13}^{\psi(2S)} + 0.339 \Gamma_{135}^{\psi(2S)} + 0.192 \Gamma_{136}^{\psi(2S)})$$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
0.207$\pm$0.011 OUR FIT				

NODE=M056B7

NODE=M056B7

NODE=M056B7

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.201 $\pm$ 0.011 $\pm$ 0.021	560	¹ MENDEZ	08 CLEO	$\psi(2S) \rightarrow \gamma \chi_{c0}$
0.31 $\pm$ 0.02 $\pm$ 0.03	172	ADAM	05A CLEO	Repl. by MENDEZ 08

¹ Not independent from other measurements of MENDEZ 08.

NODE=M056B7;LINKAGE=ME

$$\Gamma(\chi_{c0}(1P) \rightarrow \gamma J/\psi(1S)) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) / \Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)$$

$$\Gamma_{85} / \Gamma \times \Gamma_{134}^{\psi(2S)} / \Gamma_{11}^{\psi(2S)}$$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
0.367$\pm$0.019 OUR FIT				
0.358$\pm$0.020$\pm$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 $\pm$ 0.04 $\pm$ 0.06	172	¹ ADAM	05A CLEO	Repl. by MENDEZ 08

¹ Not independent from other values reported by ADAM 05A.

NODE=M056B8
NODE=M056B8

NODE=M056B;LINKAGE=AD

$$\Gamma(\chi_{c0}(1P) \rightarrow \gamma\gamma)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))/\Gamma_{\text{total}}$$

$$\Gamma_{89}/\Gamma \times \Gamma_{134}^{\psi(2S)}/\Gamma^{\psi(2S)}$$

NODE=M056B3
NODE=M056B3

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
2.23±0.14 OUR FIT				
2.18±0.18 OUR AVERAGE				
2.17±0.17±0.12	0.8k	ABLIKIM	12A BES3	$\psi(2S) \rightarrow \gamma\chi_{c0} \rightarrow 3\gamma$
2.17±0.32±0.10	0.2k	ECKLUND	08A CLEO	$\psi(2S) \rightarrow \gamma\chi_{c0} \rightarrow 3\gamma$
3.7 ±1.8 ±1.0		LEE	85 CBAL	$\psi(2S) \rightarrow \gamma\chi_{c0}$

$$\Gamma(\chi_{c0}(1P) \rightarrow \pi\pi)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))/\Gamma_{\text{total}}$$

$$\Gamma_{32}/\Gamma \times \Gamma_{134}^{\psi(2S)}/\Gamma^{\psi(2S)}$$

NODE=M056B22
NODE=M056B22

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
8.32±0.29 OUR FIT				
8.80±0.34 OUR AVERAGE				
9.11±0.08±0.65	17k	¹ ABLIKIM	10A BES3	$e^+e^- \rightarrow \psi(2S) \rightarrow \gamma\chi_{c0}$
8.81±0.11±0.43	8.9k	² ASNER	09 CLEO	$\psi(2S) \rightarrow \gamma\pi^+\pi^-$
8.13±0.19±0.89	2.8k	³ ASNER	09 CLEO	$\psi(2S) \rightarrow \gamma\pi^0\pi^0$

OCCUR=2

NODE=M056B22;LINKAGE=AB

NODE=M056B22;LINKAGE=AS

NODE=M056B22;LINKAGE=AN

¹ Calculated by us. ABLIKIM 10A reports $B(\chi_{c0} \rightarrow \pi^0\pi^0) = (3.23 \pm 0.03 \pm 0.23 \pm 0.14) \times 10^{-3}$ using $B(\psi(2S) \rightarrow \gamma\chi_{c0}) = (9.4 \pm 0.4)\%$. We have multiplied the $\pi^0\pi^0$ measurement by 3 to obtain $\pi\pi$.

² Calculated by us. ASNER 09 reports $B(\chi_{c0} \rightarrow \pi^+\pi^-) = (6.37 \pm 0.08 \pm 0.31 \pm 0.32) \times 10^{-3}$ using $B(\psi(2S) \rightarrow \gamma\chi_{c0}) = (9.22 \pm 0.11 \pm 0.46)\%$. We have multiplied the $\pi^+\pi^-$ measurement by 3/2 to obtain $\pi\pi$.

³ Calculated by us. ASNER 09 reports $B(\chi_{c0} \rightarrow \pi^0\pi^0) = (2.94 \pm 0.07 \pm 0.32 \pm 0.15) \times 10^{-3}$ using $B(\psi(2S) \rightarrow \gamma\chi_{c0}) = (9.22 \pm 0.11 \pm 0.46)\%$. We have multiplied the $\pi^0\pi^0$ measurement by 3 to obtain $\pi\pi$.

$$\Gamma(\chi_{c0}(1P) \rightarrow \pi\pi)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)$$

$$\Gamma_{32}/\Gamma \times \Gamma_{134}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}$$

NODE=M056B5
NODE=M056B5

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
24.1±0.8 OUR FIT				
20.7±1.7 OUR AVERAGE				
23.9±2.7±4.1	97 ± 11	¹ BAI	03C BES	$\psi(2S) \rightarrow \gamma\chi_{c0} \rightarrow \gamma\pi^0\pi^0$
20.2±1.1±1.5	720 ± 32	² BAI	98I BES	$\psi(2S) \rightarrow \gamma\chi_{c0} \rightarrow \gamma\pi^+\pi^-$

¹ We have multiplied $\pi^0\pi^0$ measurement by 3 to obtain $\pi\pi$.

² Calculated by us. The value for $B(\chi_{c0} \rightarrow \pi^+\pi^-)$ reported in BAI 98I is derived using $B(\psi' \rightarrow \gamma\chi_{c0}) = (9.3 \pm 0.8)\%$ and $B(\psi' \rightarrow J/\psi\pi^+\pi^-) = (32.4 \pm 2.6)\%$ [BAI 98D].

We have multiplied $\pi^+\pi^-$ measurement by 3/2 to obtain $\pi\pi$.

NODE=M056B;LINKAGE=D1

NODE=M056B;LINKAGE=D2

$$\Gamma(\chi_{c0}(1P) \rightarrow \eta\eta)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))/\Gamma_{\text{total}}$$

$$\Gamma_{36}/\Gamma \times \Gamma_{134}^{\psi(2S)}/\Gamma^{\psi(2S)}$$

NODE=M056B11
NODE=M056B11

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.95±0.18 OUR FIT				
3.12±0.19 OUR AVERAGE				
3.23±0.09±0.23	2132	¹ ABLIKIM	10A BES3	$e^+e^- \rightarrow \psi(2S) \rightarrow \gamma\chi_{c0}$
2.93±0.12±0.29	0.9k	² ASNER	09 CLEO	$\psi(2S) \rightarrow \gamma\eta\eta$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2.86±0.46±0.37	48	³ ADAMS	07 CLEO	$\psi(2S) \rightarrow \gamma\chi_{c0}$

¹ Calculated by us. ABLIKIM 10A reports $B(\chi_{c0} \rightarrow \eta\eta) = (3.44 \pm 0.10 \pm 0.24 \pm 0.13) \times 10^{-3}$ using $B(\psi(2S) \rightarrow \gamma\chi_{c0}) = (9.4 \pm 0.4)\%$.

² Calculated by us. ASNER 09 reports $B(\chi_{c0} \rightarrow \eta\eta) = (3.18 \pm 0.13 \pm 0.31 \pm 0.16) \times 10^{-3}$ using $B(\psi(2S) \rightarrow \gamma\chi_{c0}) = (9.22 \pm 0.11 \pm 0.46)\%$.

³ Superseded by ASNER 09. Calculated by us. The value of $B(\chi_{c0}(1P) \rightarrow \eta\eta)$ reported by ADAMS 07 was derived using $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46)\%$ (ATHAR 04).

NODE=M056B11;LINKAGE=AB

NODE=M056B11;LINKAGE=AS

NODE=M056B11;LINKAGE=AD

$$\Gamma(\chi_{c0}(1P) \rightarrow \eta\eta)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)$$

$$\Gamma_{36}/\Gamma \times \Gamma_{134}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}$$

NODE=M056B10
NODE=M056B10

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
0.85 ±0.05 OUR FIT			
0.578±0.241±0.158			
	BAI	03C BES	$\psi(2S) \rightarrow \gamma\eta\eta$

$$\Gamma(\chi_{c0}(1P) \rightarrow K^+ K^-) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) / \Gamma_{\text{total}}$$

$$\Gamma_{42} / \Gamma \times \Gamma_{134}^{\psi(2S)} / \Gamma_{\psi(2S)}$$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
5.91±0.28 OUR FIT				
5.97±0.07±0.32	8.1k	¹ ASNER	09 CLEO	$\psi(2S) \rightarrow \gamma K^+ K^-$

NODE=M056B23
NODE=M056B23

¹ Calculated by us. ASNER 09 reports $B(\chi_{c0} \rightarrow K^+ K^-) = (6.47 \pm 0.08 \pm 0.35 \pm 0.32) \times 10^{-3}$ using $B(\psi(2S) \rightarrow \gamma \chi_{c0}) = (9.22 \pm 0.11 \pm 0.46)\%$.

NODE=M056B23;LINKAGE=AS

$$\Gamma(\chi_{c0}(1P) \rightarrow K^+ K^-) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) / \Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)$$

$$\Gamma_{42} / \Gamma \times \Gamma_{134}^{\psi(2S)} / \Gamma_{11}^{\psi(2S)}$$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.71±0.08 OUR FIT				
1.63±0.10±0.15	774 ± 38	¹ BAI	98i BES	$\psi(2S) \rightarrow \gamma K^+ K^-$

NODE=M056B9
NODE=M056B9

¹ Calculated by us. The value for $B(\chi_{c0} \rightarrow K^+ K^-)$ reported by BAI 98i is derived using $B(\psi(2S) \rightarrow \gamma \chi_{c0}) = (9.3 \pm 0.8)\%$ and $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = (32.4 \pm 2.6)\%$ [BAI 98D].

NODE=M056B9;LINKAGE=BA

$$\Gamma(\chi_{c0}(1P) \rightarrow K_S^0 K_S^0) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) / \Gamma_{\text{total}}$$

$$\Gamma_{43} / \Gamma \times \Gamma_{134}^{\psi(2S)} / \Gamma_{\psi(2S)}$$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
3.09±0.16 OUR FIT				
3.18±0.17 OUR AVERAGE				

3.22±0.07±0.17	2.1k	¹ ASNER	09 CLEO	$\psi(2S) \rightarrow \gamma K_S^0 K_S^0$
3.02±0.19±0.33	322	ABLIKIM	05o BES2	$\psi(2S) \rightarrow \gamma K_S^0 K_S^0$

NODE=M056B12
NODE=M056B12

¹ Calculated by us. ASNER 09 reports $B(\chi_{c0} \rightarrow K_S^0 K_S^0) = (3.49 \pm 0.08 \pm 0.18 \pm 0.17) \times 10^{-3}$ using $B(\psi(2S) \rightarrow \gamma \chi_{c0}) = (9.22 \pm 0.11 \pm 0.46)\%$.

NODE=M056B12;LINKAGE=AS

$$\Gamma(\chi_{c0}(1P) \rightarrow K_S^0 K_S^0) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) / \Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)$$

$$\Gamma_{43} / \Gamma \times \Gamma_{134}^{\psi(2S)} / \Gamma_{11}^{\psi(2S)}$$

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
9.0±0.5 OUR FIT			
5.6±0.8±1.3	¹ BAI	99B BES	$\psi(2S) \rightarrow \gamma K_S^0 K_S^0$

NODE=M056B13
NODE=M056B13

¹ Calculated by us. The value of $B(\chi_{c0} \rightarrow K_S^0 K_S^0)$ reported by BAI 99B was derived using $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.3 \pm 0.8)\%$ and $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = (32.4 \pm 2.6)\%$ [BAI 98D].

NODE=M056B13;LINKAGE=BA

$$\Gamma(\chi_{c0}(1P) \rightarrow 2(\pi^+ \pi^-)) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) / \Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)$$

$$\Gamma_1 / \Gamma \times \Gamma_{134}^{\psi(2S)} / \Gamma_{11}^{\psi(2S)}$$

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	¹ BAI	99B BES	$\psi(2S) \rightarrow \gamma \chi_{c0}$
9.3±0.9	² TANENBAUM	78 MRK1	$\psi(2S) \rightarrow \gamma \chi_{c0}$

NODE=M056B4
NODE=M056B4

¹ Calculated by us. The value for $B(\chi_{c0} \rightarrow 2\pi^+ 2\pi^-)$ reported in BAI 99B is derived using $B(\psi(2S) \rightarrow \gamma \chi_{c0}) = (9.3 \pm 0.8)\%$ and $B(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-) = (32.4 \pm 2.6)\%$ [BAI 98D].

NODE=M056B;LINKAGE=B2

² The value $B(\psi(1S) \rightarrow \gamma \chi_{c0}) \times B(\chi_{c0} \rightarrow 2\pi^+ 2\pi^-)$ reported in TANENBAUM 78 is derived using $B(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-) \times B(J/\psi(1S) \rightarrow \ell^+ \ell^-) = (4.6 \pm 0.7)\%$. Calculated by us using $B(J/\psi(1S) \rightarrow \ell^+ \ell^-) = 0.1181 \pm 0.0020$.

NODE=M056B;LINKAGE=J1

$$\Gamma(\chi_{c0}(1P) \rightarrow \pi^+ \pi^- K^+ K^-) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) / \Gamma_{\text{total}}$$

$$\Gamma_8 / \Gamma \times \Gamma_{134}^{\psi(2S)} / \Gamma_{\psi(2S)}$$

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
1.75±0.14 OUR FIT			
1.64±0.05±0.2	ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma \chi_{c0}$

NODE=M056B18
NODE=M056B18

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow \pi^+ \pi^- K^+ K^-)}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))}{\Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)} \times \frac{\Gamma_8}{\Gamma} \times \frac{\Gamma_{134}^{\psi(2S)}}{\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10⁻³)

DOCUMENT ID

TECN

COMMENT

5.1 ±0.4 OUR FIT**5.8 ±1.6 OUR AVERAGE** Error includes scale factor of 2.3.

4.22 ±0.20 ±0.97

BAI

99B

BES

 $\psi(2S) \rightarrow \gamma \chi_{c0}$

7.4 ±1.0

¹ TANENBAUM

78

MRK1

 $\psi(2S) \rightarrow \gamma \chi_{c0}$

¹ The reported value is derived using $B(\psi(2S) \rightarrow \pi^+ \pi^- J/\psi) \times B(J/\psi \rightarrow \ell^+ \ell^-) = (4.6 \pm 0.7)\%$. Calculated by us using $B(J/\psi \rightarrow \ell^+ \ell^-) = 0.1181 \pm 0.0020$.

NODE=M056B19
NODE=M056B19

NODE=M056B19;LINKAGE=TA

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow K^+ K^- K^+ K^-)}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))}{\Gamma_{\text{total}}} \times \frac{\Gamma_{50}}{\Gamma} \times \frac{\Gamma_{134}^{\psi(2S)}}{\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10⁻⁴)

EVTS

DOCUMENT ID

TECN

COMMENT

2.74 ±0.28 OUR FIT**3.20 ±0.11 ±0.41**

278

¹ ABLIKIM

06T

BES2

 $\psi(2S) \rightarrow \gamma 2K^+ 2K^-$

¹ Calculated by us. The value of $B(\chi_{c0} \rightarrow 2K^+ 2K^-)$ reported by ABLIKIM 06T was derived using $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.2 \pm 0.4)\%$.

NODE=M056B14
NODE=M056B14

NODE=M056B14;LINKAGE=AB

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow K^+ K^- K^+ K^-)}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))}{\Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)} \times \frac{\Gamma_{50}}{\Gamma} \times \frac{\Gamma_{134}^{\psi(2S)}}{\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10⁻⁴)

DOCUMENT ID

TECN

COMMENT

8.0 ±0.8 OUR FIT**6.1 ±0.8 ±0.9**¹ BAI

99B

BES

 $\psi(2S) \rightarrow \gamma 2K^+ 2K^-$

¹ Calculated by us. The value of $B(\chi_{c0} \rightarrow 2K^+ 2K^-)$ reported by BAI 99B was derived using $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.3 \pm 0.8)\%$ and $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = (32.4 \pm 2.6)\%$ [BAI 98D].

NODE=M056B15
NODE=M056B15

NODE=M056B15;LINKAGE=BA

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow \phi \phi)}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))}{\Gamma_{\text{total}}} \times \frac{\Gamma_{55}}{\Gamma} \times \frac{\Gamma_{134}^{\psi(2S)}}{\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10⁻⁴)

EVTS

DOCUMENT ID

TECN

COMMENT

0.77 ±0.07 OUR FIT**0.78 ±0.08 OUR AVERAGE**

0.77 ±0.03 ±0.08

612

¹ ABLIKIM

11K

BES3

 $\psi(2S) \rightarrow \gamma \text{ hadrons}$

0.86 ±0.19 ±0.12

26

² ABLIKIM

06T

BES2

 $\psi(2S) \rightarrow \gamma 2K^+ 2K^-$

¹ Calculated by us. The value of $B(\chi_{c0} \rightarrow \phi \phi)$ reported by ABLIKIM 11K was derived using $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.62 \pm 0.31)\%$.

² Calculated by us. The value of $B(\chi_{c0} \rightarrow \phi \phi)$ reported by ABLIKIM 06T was derived using $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.2 \pm 0.4)\%$.

NODE=M056B16
NODE=M056B16

NODE=M056B16;LINKAGE=AL

NODE=M056B16;LINKAGE=AB

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow \phi \phi)}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))}{\Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)} \times \frac{\Gamma_{55}}{\Gamma} \times \frac{\Gamma_{134}^{\psi(2S)}}{\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10⁻⁴)

DOCUMENT ID

TECN

COMMENT

2.24 ±0.21 OUR FIT**2.6 ±1.0 ±1.1**¹ BAI

99B

BES

 $\psi(2S) \rightarrow \gamma 2K^+ 2K^-$

¹ Calculated by us. The value of $B(\chi_{c0} \rightarrow \phi \phi)$ reported by BAI 99B was derived using $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.3 \pm 0.8)\%$ and $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = (32.4 \pm 2.6)\%$ [BAI 98D].

NODE=M056B17
NODE=M056B17

NODE=M056B17;LINKAGE=BA

$\chi_{c0}(1P)$ REFERENCES

ABLIKIM	15I	PR D91 092006	M. Ablikim <i>et al.</i>	(BES III Collab.)
ABLIKIM	15M	PR D91 112008	M. Ablikim <i>et al.</i>	(BES III Collab.)
ABLIKIM	15N	PR D91 112018	M. Ablikim <i>et al.</i>	(BES III Collab.)
ABLIKIM	13B	PR D87 012002	M. Ablikim <i>et al.</i>	(BES III Collab.)
ABLIKIM	13D	PR D87 012007	M. Ablikim <i>et al.</i>	(BES III Collab.)
ABLIKIM	13H	PR D87 032007	M. Ablikim <i>et al.</i>	(BES III Collab.)
ABLIKIM	13V	PR D88 112001	M. Ablikim <i>et al.</i>	(BES III Collab.)
UEHARA	13	PTEP 2013 123C01	S. Uehara <i>et al.</i>	(BELLE Collab.)
ABLIKIM	12A	PR D85 112008	M. Ablikim <i>et al.</i>	(BES III Collab.)
ABLIKIM	12I	PR D86 052004	M. Ablikim <i>et al.</i>	(BES III Collab.)
ABLIKIM	12J	PR D86 052011	M. Ablikim <i>et al.</i>	(BES III Collab.)
ABLIKIM	12O	PRL 109 172002	M. Ablikim <i>et al.</i>	(BES III Collab.)
LIU	12B	PRL 108 232001	Z.Q. Liu <i>et al.</i>	(BELLE 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.)

NODE=M056

REFID=56774
REFID=56778
REFID=56779
REFID=54877
REFID=54879
REFID=54953
REFID=55583
REFID=55592
REFID=54266
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REFID=54303
REFID=53647
REFID=16717
REFID=16719
REFID=53940
REFID=16751
REFID=53347
REFID=53360

UEHARA	10A	PR D82 114031	S. Uehara <i>et al.</i>	(BELLE Collab.)	REFID=53641
ASNER	09	PR D79 072007	D.M. Asner <i>et al.</i>	(CLEO Collab.)	REFID=52721
UEHARA	09	PR D79 052009	S. Uehara <i>et al.</i>	(BELLE Collab.)	REFID=52761
BENNETT	08A	PRL 101 151801	J.V. Bennett <i>et al.</i>	(CLEO Collab.)	REFID=52575
ECKLUND	08A	PR D78 091501	K.M. Ecklund <i>et al.</i>	(CLEO Collab.)	REFID=52583
HE	08B	PR D78 092004	Q. He <i>et al.</i>	(CLEO Collab.)	REFID=52588
MENDEZ	08	PR D78 011102	H. Mendez <i>et al.</i>	(CLEO Collab.)	REFID=52684
NAIK	08	PR D78 031101	P. Naik <i>et al.</i>	(CLEO Collab.)	REFID=52301
UEHARA	08	EPJ C53 1	S. Uehara <i>et al.</i>	(BELLE Collab.)	REFID=52064
WICHT	08	PL B662 323	J. Wicht <i>et al.</i>	(BELLE Collab.)	REFID=52204
ABE	07	PRL 98 082001	K. Abe <i>et al.</i>	(BELLE Collab.)	REFID=51627
ADAMS	07	PR D75 071101	G.S. Adams <i>et al.</i>	(CLEO Collab.)	REFID=51651
ATHAR	07	PR D75 032002	S.B. Athar <i>et al.</i>	(CLEO Collab.)	REFID=51618
CHEN	07B	PL B651 15	W.T. Chen <i>et al.</i>	(BELLE Collab.)	REFID=51710
ABLIKIM	06D	PR D73 052006	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51049
ABLIKIM	06I	PR D74 012004	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51126
ABLIKIM	06R	PR D74 072001	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51447
ABLIKIM	06T	PL B642 197	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51453
ABLIKIM	05G	PR D71 092002	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50756
ABLIKIM	05N	PL B630 7	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50847
ABLIKIM	05O	PL B630 21	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50846
ABLIKIM	05Q	PR D72 092002	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50958
ADAM	05A	PRL 94 232002	N.E. Adam <i>et al.</i>	(CLEO Collab.)	REFID=50763
ANDREOTTI	05A	NP B717 34	M. Andreotti <i>et al.</i>	(FNAL E835 Collab.)	REFID=50769
ANDREOTTI	05C	PR D72 112002	M. Andreotti <i>et al.</i>	(FNAL E835 Collab.)	REFID=50991
NAKAZAWA	05	PL B615 39	H. Nakazawa <i>et al.</i>	(BELLE Collab.)	REFID=50807
ABE	04G	PR D70 071102	K. Abe <i>et al.</i>	(BELLE Collab.)	REFID=50182
ABLIKIM	04G	PR D70 092002	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50187
ABLIKIM	04H	PR D70 092003	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50188
ANDREOTTI	04	PL B584 16	M. Andreotti <i>et al.</i>	(E835 Collab.)	REFID=49744
ATHAR	04	PR D70 112002	S.B. Athar <i>et al.</i>	(CLEO Collab.)	REFID=50331
BAI	04F	PR D69 092001	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49752
ANDREOTTI	03	PRL 91 091801	M. Andreotti <i>et al.</i>	(FNAL E835 Collab.)	REFID=49578
AULCHENKO	03	PL B573 63	V.M. Aulchenko <i>et al.</i>	(KEDR Collab.)	REFID=49579
BAI	03C	PR D67 032004	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49190
BAI	03E	PR D67 112001	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49416
ABE,K	02	PRL 89 142001	K. Abe <i>et al.</i>	(BELLE Collab.)	REFID=49188
BAGNASCO	02	PL B533 237	S. Bagnasco <i>et al.</i>	(FNAL E835 Collab.)	REFID=48833
EISENSTEIN	01	PRL 87 061801	B.I. Eisenstein <i>et al.</i>	(CLEO Collab.)	REFID=48344
AMBROGIANI	00B	PR D62 052002	M. Ambrogiani <i>et al.</i>	(FNAL E835 Collab.)	REFID=47940
AMBROGIANI	99B	PRL 83 2902	M. Ambrogiani <i>et al.</i>	(FNAL E835 Collab.)	REFID=47389
BAI	99B	PR D60 072001	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=47385
BAI	98D	PR D58 092006	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=46338
BAI	98I	PRL 81 3091	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=46343
GAISER	86	PR D34 711	J. Gaiser <i>et al.</i>	(Crystal Ball Collab.)	REFID=22012
LEE	85	SLAC 282	R.A. Lee	(SLAC)	REFID=40589
OREGLIA	82	PR D25 2259	M.J. Oreglia <i>et al.</i>	(SLAC, CIT, HARV+)	REFID=22120
BRANDELIK	79B	NP B160 426	R. Brandelik <i>et al.</i>	(DASP Collab.)	REFID=22115
BARTEL	78B	PL 79B 492	W. Bartel <i>et al.</i>	(DESY, HEIDP)	REFID=22111
TANENBAUM	78	PR D17 1731	W.M. Tanenbaum <i>et al.</i>	(SLAC, LBL)	REFID=22112
Also		Private Comm.	G. Trilling	(LBL, UCB)	REFID=22113
BIDDICK	77	PRL 38 1324	C.J. Biddick <i>et al.</i>	(UCSD, UMD, PAVI+)	REFID=22059

$\chi_{c1}(1P)$

$$I^G(J^{PC}) = 0^+(1^{++})$$

See the Review on " $\psi(2S)$ and χ_c branching ratios" before the $\chi_{c0}(1P)$ Listings.

NODE=M055

NODE=M055

NODE=M055M

NODE=M055M

OCCUR=2

NODE=M055M;LINKAGE=NW

NODE=M055M;LINKAGE=C

NODE=M055M;LINKAGE=P

NODE=M055M;LINKAGE=D

NODE=M055M;LINKAGE=M

 $\chi_{c1}(1P)$ MASS

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 ± 0.4		² GAISER	86 CBAL	$\psi(2S) \rightarrow \gamma X$
3507.4 ± 1.7	91	³ LEMOIGNE	82 GOLI	$185 \pi^- \text{Be} \rightarrow \gamma \mu^+ \mu^- A$
3510.4 ± 0.6		OREGLIA	82 CBAL	$e^+ e^- \rightarrow J/\psi 2\gamma$
3510.1 ± 1.1	254	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

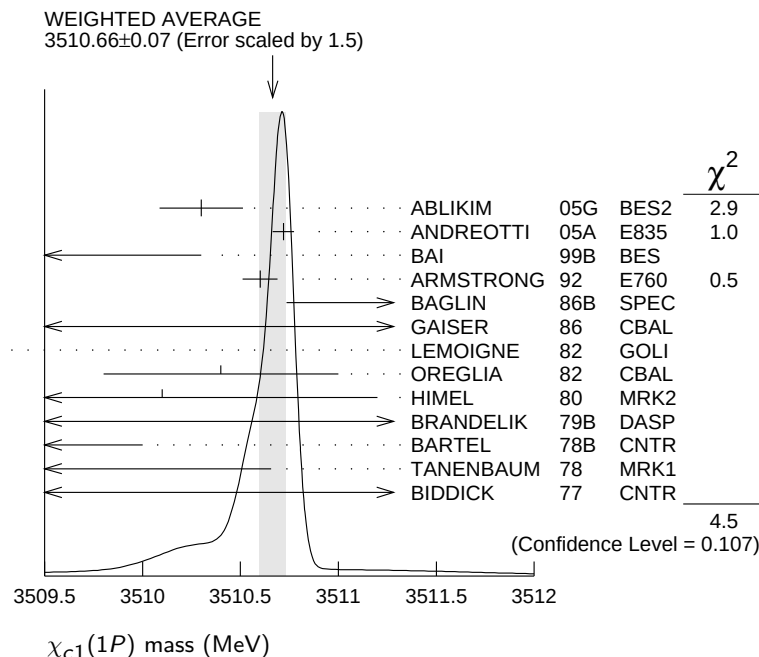
¹ Recalculated by ANDREOTTI 05A, using the value of $\psi(2S)$ mass from AULCHENKO 03.

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.

 **$\chi_{c1}(1P)$ WIDTH**

VALUE (MeV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
0.84 ± 0.04 OUR FIT					
0.88 ± 0.05 OUR AVERAGE					
1.39 +0.40 +0.26 -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	¹ ARMSTRONG	92 E760	$\bar{p}p \rightarrow e^+ e^- \gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

NODE=M055W

NODE=M055W

<1.3 95 BAGLIN 86B SPEC $\bar{p}p \rightarrow e^+e^-X$
 <3.8 90 GAISER 86 CBAL $\psi(2S) \rightarrow \gamma X$

¹ Recalculated by ANDREOTTI 05A.

NODE=M055W;LINKAGE=AN

$\chi_{c1}(1P)$ DECAY MODES

NODE=M055215;NODE=M055

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	
Hadronic decays			
Γ_1 $3(\pi^+\pi^-)$	$(5.8 \pm 1.4) \times 10^{-3}$	S=1.2	NODE=M055;CLUMP=A
Γ_2 $2(\pi^+\pi^-)$	$(7.6 \pm 2.6) \times 10^{-3}$		DESIG=6
Γ_3 $\pi^+\pi^-\pi^0\pi^0$	$(1.22 \pm 0.16) \%$		DESIG=5
Γ_4 $\rho^+\pi^-\pi^0 + \text{c.c.}$	$(1.48 \pm 0.25) \%$		DESIG=51
Γ_5 $\rho^0\pi^+\pi^-$	$(3.9 \pm 3.5) \times 10^{-3}$		DESIG=52
Γ_6 $4\pi^0$	$(5.5 \pm 0.8) \times 10^{-4}$		DESIG=9
Γ_7 $\pi^+\pi^-K^+K^-$	$(4.5 \pm 1.0) \times 10^{-3}$		DESIG=60
Γ_8 $K^+K^-\pi^0\pi^0$	$(1.14 \pm 0.28) \times 10^{-3}$		DESIG=7
Γ_9 $K^+K^-\pi^+\pi^-\pi^0$	$(1.15 \pm 0.13) \%$		DESIG=53
Γ_{10} $K_S^0 K^\pm \pi^\mp \pi^+\pi^-$	$(7.5 \pm 0.8) \times 10^{-3}$		DESIG=79
Γ_{11} $K^+\pi^-\bar{K}^0\pi^0 + \text{c.c.}$	$(8.7 \pm 1.4) \times 10^{-3}$		DESIG=84
Γ_{12} $\rho^-K^+\bar{K}^0 + \text{c.c.}$	$(5.1 \pm 1.2) \times 10^{-3}$		DESIG=55
Γ_{13} $K^*(892)^0\bar{K}^0\pi^0 \rightarrow$ $K^+\pi^-\bar{K}^0\pi^0 + \text{c.c.}$	$(2.4 \pm 0.7) \times 10^{-3}$		DESIG=56
Γ_{14} $K^+K^-\eta\pi^0$	$(1.14 \pm 0.35) \times 10^{-3}$		DESIG=57
Γ_{15} $\pi^+\pi^-K_S^0K_S^0$	$(7.0 \pm 3.0) \times 10^{-4}$		DESIG=58
Γ_{16} $K^+K^-\eta$	$(3.2 \pm 1.0) \times 10^{-4}$		DESIG=28
Γ_{17} $\bar{K}^0K^+\pi^- + \text{c.c.}$	$(7.1 \pm 0.6) \times 10^{-3}$		DESIG=42
Γ_{18} $K^*(892)^0\bar{K}^0 + \text{c.c.}$	$(1.0 \pm 0.4) \times 10^{-3}$		DESIG=17
Γ_{19} $K^*(892)^+K^- + \text{c.c.}$	$(1.5 \pm 0.7) \times 10^{-3}$		DESIG=32
Γ_{20} $K_J^*(1430)^0\bar{K}^0 + \text{c.c.} \rightarrow$ $K_S^0K^+\pi^- + \text{c.c.}$	$< 8 \times 10^{-4}$	CL=90%	DESIG=33
Γ_{21} $K_J^*(1430)^+K^- + \text{c.c.} \rightarrow$ $K_S^0K^+\pi^- + \text{c.c.}$	$< 2.2 \times 10^{-3}$	CL=90%	DESIG=34
Γ_{22} $K^+K^-\pi^0$	$(1.85 \pm 0.25) \times 10^{-3}$		DESIG=35
Γ_{23} $\eta\pi^+\pi^-$	$(4.9 \pm 0.5) \times 10^{-3}$		DESIG=38
Γ_{24} $a_0(980)^+\pi^- + \text{c.c.} \rightarrow \eta\pi^+\pi^-$	$(1.8 \pm 0.6) \times 10^{-3}$		DESIG=31
Γ_{25} $f_2(1270)\eta$	$(2.7 \pm 0.8) \times 10^{-3}$		DESIG=36
Γ_{26} $\pi^+\pi^-\eta'$	$(2.3 \pm 0.5) \times 10^{-3}$		DESIG=37
Γ_{27} $K^+K^-\eta'(958)$	$(8.8 \pm 0.9) \times 10^{-4}$		DESIG=44
Γ_{28} $K_0^*(1430)^+K^- + \text{c.c.}$	$(6.4 \pm 2.2 \mp 2.8) \times 10^{-4}$		DESIG=85
Γ_{29} $f_0(980)\eta'(958)$	$(1.6 \pm 1.4 \mp 0.7) \times 10^{-4}$		DESIG=86
Γ_{30} $f_0(1710)\eta'(958)$	$(7 \pm 7 \mp 5) \times 10^{-5}$		DESIG=87
Γ_{31} $f_2'(1525)\eta'(958)$	$(9 \pm 6) \times 10^{-5}$		DESIG=88
Γ_{32} $\pi^0 f_0(980) \rightarrow \pi^0\pi^+\pi^-$	$< 6 \times 10^{-6}$	CL=90%	DESIG=89
Γ_{33} $K^+\bar{K}^*(892)^0\pi^- + \text{c.c.}$	$(3.2 \pm 2.1) \times 10^{-3}$		DESIG=61
Γ_{34} $K^*(892)^0\bar{K}^*(892)^0$	$(1.5 \pm 0.4) \times 10^{-3}$		DESIG=10
Γ_{35} $K^+K^-\bar{K}_S^0K_S^0$	$< 4 \times 10^{-4}$	CL=90%	DESIG=21
Γ_{36} $K^+K^-\bar{K}^+K^-$	$(5.5 \pm 1.1) \times 10^{-4}$		DESIG=29
Γ_{37} $K^+K^-\phi$	$(4.2 \pm 1.6) \times 10^{-4}$		DESIG=14
Γ_{38} $\bar{K}^0K^+\pi^-\phi + \text{c.c.}$	$(3.3 \pm 0.5) \times 10^{-3}$		DESIG=30
Γ_{39} $K^+K^-\pi^0\phi$	$(1.62 \pm 0.30) \times 10^{-3}$		DESIG=90
Γ_{40} $\phi\pi^+\pi^-\pi^0$	$(7.5 \pm 1.0) \times 10^{-4}$		DESIG=91
Γ_{41} $\omega\omega$	$(5.8 \pm 0.7) \times 10^{-4}$		DESIG=82
Γ_{42} ωK^+K^-	$(7.8 \pm 0.9) \times 10^{-4}$		DESIG=66
Γ_{43} $\omega\phi$	$(2.1 \pm 0.6) \times 10^{-5}$		DESIG=81
Γ_{44} $\phi\phi$	$(4.2 \pm 0.5) \times 10^{-4}$		DESIG=67
			DESIG=68

Γ ₄₅	$p\bar{p}$	$(7.72 \pm 0.35) \times 10^{-5}$		DESIG=11
Γ ₄₆	$p\bar{p}\pi^0$	$(1.59 \pm 0.19) \times 10^{-4}$		DESIG=39
Γ ₄₇	$p\bar{p}\eta$	$(1.48 \pm 0.25) \times 10^{-4}$		DESIG=43
Γ ₄₈	$p\bar{p}\omega$	$(2.16 \pm 0.31) \times 10^{-4}$		DESIG=59
Γ ₄₉	$p\bar{p}\phi$	$< 1.8 \times 10^{-5}$	CL=90%	DESIG=65
Γ ₅₀	$p\bar{p}\pi^+\pi^-$	$(5.0 \pm 1.9) \times 10^{-4}$		DESIG=8
Γ ₅₁	$p\bar{p}\pi^0\pi^0$			DESIG=54
Γ ₅₂	$p\bar{p}K^+K^-$ (non-resonant)	$(1.30 \pm 0.23) \times 10^{-4}$		DESIG=62
Γ ₅₃	$p\bar{p}K_S^0 K_S^0$	$< 4.5 \times 10^{-4}$	CL=90%	DESIG=25
Γ ₅₄	$p\bar{n}\pi^-$	$(3.9 \pm 0.5) \times 10^{-4}$		DESIG=74
Γ ₅₅	$\bar{p}n\pi^+$	$(4.0 \pm 0.5) \times 10^{-4}$		DESIG=75
Γ ₅₆	$p\bar{n}\pi^-\pi^0$	$(1.05 \pm 0.12) \times 10^{-3}$		DESIG=76
Γ ₅₇	$\bar{p}n\pi^+\pi^0$	$(1.03 \pm 0.12) \times 10^{-3}$		DESIG=77
Γ ₅₈	$\Lambda\bar{\Lambda}$	$(1.16 \pm 0.12) \times 10^{-4}$		DESIG=19
Γ ₅₉	$\Lambda\bar{\Lambda}\pi^+\pi^-$	$(3.0 \pm 0.5) \times 10^{-4}$		DESIG=24
Γ ₆₀	$\Lambda\bar{\Lambda}\pi^+\pi^-$ (non-resonant)	$(2.5 \pm 0.6) \times 10^{-4}$		DESIG=69
Γ ₆₁	$\Sigma(1385)^+\bar{\Lambda}\pi^- + \text{c.c.}$	$< 1.3 \times 10^{-4}$	CL=90%	DESIG=70
Γ ₆₂	$\Sigma(1385)^-\bar{\Lambda}\pi^+ + \text{c.c.}$	$< 1.3 \times 10^{-4}$	CL=90%	DESIG=71
Γ ₆₃	$K^+\bar{p}\Lambda$	$(4.2 \pm 0.4) \times 10^{-4}$	S=1.1	DESIG=40
Γ ₆₄	$K^+\bar{p}\Lambda(1520) + \text{c.c.}$	$(1.7 \pm 0.5) \times 10^{-4}$		DESIG=63
Γ ₆₅	$\Lambda(1520)\bar{\Lambda}(1520)$	$< 1.0 \times 10^{-4}$	CL=90%	DESIG=64
Γ ₆₆	$\Sigma^0\bar{\Sigma}^0$	$< 4 \times 10^{-5}$	CL=90%	DESIG=48
Γ ₆₇	$\Sigma^+\bar{\Sigma}^-$	$< 6 \times 10^{-5}$	CL=90%	DESIG=49
Γ ₆₈	$\Sigma(1385)^+\bar{\Sigma}(1385)^-$	$< 1.0 \times 10^{-4}$	CL=90%	DESIG=72
Γ ₆₉	$\Sigma(1385)^-\bar{\Sigma}(1385)^+$	$< 5 \times 10^{-5}$	CL=90%	DESIG=73
Γ ₇₀	$K^-\Lambda\Xi^+ + \text{c.c.}$	$(1.38 \pm 0.25) \times 10^{-4}$		DESIG=92
Γ ₇₁	$\Xi^0\bar{\Xi}^0$	$< 6 \times 10^{-5}$	CL=90%	DESIG=50
Γ ₇₂	$\Xi^-\bar{\Xi}^+$	$(8.2 \pm 2.2) \times 10^{-5}$		DESIG=26
Γ ₇₃	$\pi^+\pi^- + K^+K^-$	$< 2.1 \times 10^{-3}$		DESIG=23
Γ ₇₄	$K_S^0 K_S^0$	$< 6 \times 10^{-5}$	CL=90%	DESIG=27
Γ ₇₅	$\eta_c\pi^+\pi^-$	$< 3.2 \times 10^{-3}$	CL=90%	DESIG=83

Radiative decays

Γ ₇₆	$\gamma J/\psi(1S)$	$(33.9 \pm 1.2) \%$		NODE=M055;CLUMP=B DESIG=1
Γ ₇₇	$\gamma\rho^0$	$(2.20 \pm 0.18) \times 10^{-4}$		DESIG=45
Γ ₇₈	$\gamma\omega$	$(6.9 \pm 0.8) \times 10^{-5}$		DESIG=46
Γ ₇₉	$\gamma\phi$	$(2.5 \pm 0.5) \times 10^{-5}$		DESIG=47
Γ ₈₀	$\gamma\gamma$			DESIG=4

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 239 measurements to determine 49 parameters. The overall fit has a $\chi^2 = 342.4$ for 190 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_{36}	6				
x_{45}	8	3			
x_{58}	13	5	7		
x_{76}	31	13	6	26	
Γ	-19	-8	-62	-16	-51
	x_{17}	x_{36}	x_{45}	x_{58}	x_{76}

$\chi_{c1}(1P)$ PARTIAL WIDTHS

$\chi_{c1}(1P) \Gamma(i) \Gamma(\gamma J/\psi(1S)) / \Gamma(\text{total})$				
$\Gamma(p\bar{p}) \times \Gamma(\gamma J/\psi(1S)) / \Gamma_{\text{total}}$				$\Gamma_{45} \Gamma_{76} / \Gamma$
VALUE (eV)	DOCUMENT ID	TECN	COMMENT	
21.9±0.8 OUR FIT				
21.4±0.9 OUR AVERAGE				
21.5±0.5±0.8	¹ ANDREOTTI 05A	E835	$p\bar{p} \rightarrow e^+ e^- \gamma$	
21.4±1.5±2.2	^{1,2} ARMSTRONG 92	E760	$\bar{p}p \rightarrow e^+ e^- \gamma$	
19.9 ^{+4.4} _{-4.0}	¹ BAGLIN 86B	SPEC	$\bar{p}p \rightarrow e^+ e^- X$	

¹ Calculated by us using $B(J/\psi(1S) \rightarrow e^+ e^-) = 0.0593 \pm 0.0010$.² Recalculated by ANDREOTTI 05A.

NODE=M055220

NODE=M055223

NODE=M055G1
NODE=M055G1NODE=M055G;LINKAGE=7A
NODE=M055G;LINKAGE=AN $\chi_{c1}(1P)$ BRANCHING RATIOS

HADRONIC DECAYS				
$\Gamma(3(\pi^+ \pi^-)) / \Gamma_{\text{total}}$				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	¹ BAI 99B	BES	$\psi(2S) \rightarrow \gamma \chi_{c1}$	
16.0±5.9±0.8	¹ TANENBAUM 78	MRK1	$\psi(2S) \rightarrow \gamma \chi_{c1}$	
¹ Rescaled by us using $B(\psi(2S) \rightarrow \gamma \chi_{c1}) = (8.8 \pm 0.4)\%$ and $B(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-) = (32.6 \pm 0.5)\%$.				

NODE=M055225

NODE=M055305

NODE=M055R6
NODE=M055R6

→ UNCHECKED ←

NODE=M055R;LINKAGE=X2

$\Gamma(2(\pi^+ \pi^-)) / \Gamma_{\text{total}}$				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	¹ BAI 99B	BES	$\psi(2S) \rightarrow \gamma \chi_{c1}$	
12.5±4.2±0.6	¹ TANENBAUM 78	MRK1	$\psi(2S) \rightarrow \gamma \chi_{c1}$	
¹ Rescaled by us using $B(\psi(2S) \rightarrow \gamma \chi_{c1}) = (8.8 \pm 0.4)\%$ and $B(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-) = (32.6 \pm 0.5)\%$.				

NODE=M055R4
NODE=M055R4

→ UNCHECKED ←

NODE=M055R4;LINKAGE=X2

$\Gamma(\pi^+ \pi^- \pi^0 \pi^0) / \Gamma_{\text{total}}$				Γ_3 / Γ
VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
1.22±0.15±0.04	604.7	¹ HE 08B	CLEO	$e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$
¹ HE 08B reports $1.28 \pm 0.06 \pm 0.15 \pm 0.08 \%$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \pi^+ \pi^- \pi^0 \pi^0) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M055R35
NODE=M055R35

NODE=M055R35;LINKAGE=HE

$\Gamma(\rho^+ \pi^- \pi^0 + \text{c.c.}) / \Gamma_{\text{total}}$				Γ_4 / Γ
VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
1.48±0.24±0.05	712.3	^{1,2} HE 08B	CLEO	$e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$
¹ HE 08B reports $1.56 \pm 0.13 \pm 0.22 \pm 0.10 \%$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \rho^+ \pi^- \pi^0 + \text{c.c.}) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				
² Calculated by us. We have added the values from HE 08B for $\rho^+ \pi^- \pi^0$ and $\rho^- \pi^+ \pi^0$ decays assuming uncorrelated statistical and fully correlated systematic uncertainties.				

NODE=M055R36
NODE=M055R36

NODE=M055R36;LINKAGE=HE

NODE=M055R36;LINKAGE=OC

$\Gamma(\rho^0 \pi^+ \pi^-) / \Gamma_{\text{total}}$				Γ_5 / Γ
VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT	
39±35	¹ TANENBAUM 78	MRK1	$\psi(2S) \rightarrow \gamma \chi_{c1}$	
¹ Estimated using $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 0.087$. The errors do not contain the uncertainty in the $\psi(2S)$ decay.				

NODE=M055R8
NODE=M055R8

NODE=M055R;LINKAGE=T

$\Gamma(4\pi^0)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
0.55±0.08±0.02	608	¹ ABLIKIM	11A BES3	$e^+e^- \rightarrow \psi(2S) \rightarrow \gamma\chi_{c1}$

NODE=M055R44
 NODE=M055R44

¹ ABLIKIM 11A reports $(0.57 \pm 0.03 \pm 0.08) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow 4\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=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			

NODE=M055R5
 NODE=M055R5

→ UNCHECKED ←

4.2±0.4±0.9	¹ BAI	99B BES	$\psi(2S) \rightarrow \gamma\chi_{c1}$
7.3±3.0±0.4	¹ TANENBAUM	78 MRK1	$\psi(2S) \rightarrow \gamma\chi_{c1}$

¹ Rescaled by us using $B(\psi(2S) \rightarrow \gamma\chi_{c1}) = (8.8 \pm 0.4)\%$ and $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (32.6 \pm 0.5)\%$.

NODE=M055R5;LINKAGE=X2

 $\Gamma(K^+K^-\pi^0\pi^0)/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.114±0.028±0.004	45.1	¹ HE	08B CLEO	$e^+e^- \rightarrow \gamma h^+ h^- h^0 h^0$

NODE=M055R37
 NODE=M055R37

¹ 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 $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R37;LINKAGE=HE

 $\Gamma(K^+K^-\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
11.46±0.12±1.29	12k	¹ ABLIKIM	13B BES3	$e^+e^- \rightarrow \psi(2S) \rightarrow \gamma\chi_{c1}$

NODE=M055R00
 NODE=M055R00

¹ Using 1.06×10^8 $\psi(2S)$ mesons and $B(\psi(2S) \rightarrow \chi_{c1}\gamma) = (9.2 \pm 0.4)\%$.

NODE=M055R00;LINKAGE=A

 $\Gamma(K_S^0 K^\pm \pi^\mp \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{10}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
7.52±0.11±0.79	5.1k	¹ ABLIKIM	13B BES3	$e^+e^- \rightarrow \psi(2S) \rightarrow \gamma\chi_{c1}$

NODE=M055R60
 NODE=M055R60

¹ Using 1.06×10^8 $\psi(2S)$ mesons and $B(\psi(2S) \rightarrow \chi_{c1}\gamma) = (9.2 \pm 0.4)\%$.

NODE=M055R60;LINKAGE=A

 $\Gamma(K^+\pi^-\bar{K}^0\pi^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{11}/Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.87±0.14±0.03	141.3	¹ HE	08B CLEO	$e^+e^- \rightarrow \gamma h^+ h^- h^0 h^0$

NODE=M055R39
 NODE=M055R39

¹ HE 08B reports $0.92 \pm 0.09 \pm 0.11 \pm 0.06\%$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K^+\pi^-\bar{K}^0\pi^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R39;LINKAGE=HE

 $\Gamma(\rho^- K^+ \bar{K}^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{12}/Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.51±0.12±0.02	141.3	¹ HE	08B CLEO	$e^+e^- \rightarrow \gamma h^+ h^- h^0 h^0$

NODE=M055R40
 NODE=M055R40

¹ HE 08B reports $0.54 \pm 0.11 \pm 0.07 \pm 0.03\%$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \rho^- K^+ \bar{K}^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R40;LINKAGE=HE

 $\Gamma(K^*(892)^0 \bar{K}^0 \pi^0 \rightarrow K^+ \pi^- \bar{K}^0 \pi^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{13}/Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.24±0.06±0.01	141.3	¹ HE	08B CLEO	$e^+e^- \rightarrow \gamma h^+ h^- h^0 h^0$

NODE=M055R41
 NODE=M055R41

¹ HE 08B reports $0.25 \pm 0.06 \pm 0.03 \pm 0.02\%$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K^*(892)^0 \bar{K}^0 \pi^0 \rightarrow K^+ \pi^- \bar{K}^0 \pi^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R41;LINKAGE=HE

$\Gamma(K^+ K^- \eta \pi^0)/\Gamma_{\text{total}}$ Γ_{14}/Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.114±0.035±0.004	141.3	¹ HE	08B CLEO	$e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$

NODE=M055R42
NODE=M055R42

¹ HE 08B reports $0.12 \pm 0.03 \pm 0.02 \pm 0.01$ % from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K^+ K^- \eta \pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R42;LINKAGE=HE

$\Gamma(\pi^+ \pi^- K_S^0 K_S^0)/\Gamma_{\text{total}}$ Γ_{15}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
7.0±3.0±0.2	19.8±7.7	¹ ABLIKIM	050 BES2	$\psi(2S) \rightarrow \chi_{c1} \gamma$

NODE=M055R05
NODE=M055R05

¹ ABLIKIM 050 reports $[\Gamma(\chi_{c1}(1P) \rightarrow \pi^+ \pi^- K_S^0 K_S^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (0.67 \pm 0.26 \pm 0.11) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R05;LINKAGE=AB

$\Gamma(K^+ K^- \eta)/\Gamma_{\text{total}}$ Γ_{16}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
0.32±0.10±0.01	¹ ATHAR 07	CLEO	$\psi(2S) \rightarrow \gamma h^+ h^- h^0$

NODE=M055R25
NODE=M055R25

¹ ATHAR 07 reports $(0.34 \pm 0.10 \pm 0.04) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K^+ K^- \eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 0.0907 \pm 0.0011 \pm 0.0054$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R25;LINKAGE=AT

$\Gamma(\bar{K}^0 K^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{17}/Γ

VALUE (units 10^{-3})	DOCUMENT ID
7.1±0.6 OUR FIT	

NODE=M055R17
NODE=M055R17

$\Gamma(K^*(892)^0 \bar{K}^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{18}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.00±0.37±0.03	22	¹ ABLIKIM	06R BES2	$\psi(2S) \rightarrow \gamma \chi_{c1}$

NODE=M055R09
NODE=M055R09

¹ ABLIKIM 06R reports $(1.1 \pm 0.4 \pm 0.1) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K^*(892)^0 \bar{K}^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (8.7 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R09;LINKAGE=AB

$\Gamma(K^*(892)^+ K^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{19}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.46±0.66±0.05	27	¹ ABLIKIM	06R BES2	$\psi(2S) \rightarrow \gamma \chi_{c1}$

NODE=M055R10
NODE=M055R10

¹ ABLIKIM 06R reports $(1.6 \pm 0.7 \pm 0.2) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K^*(892)^+ K^- + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (8.7 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R10;LINKAGE=AB

$\Gamma(K_J^*(1430)^0 \bar{K}^0 + \text{c.c.} \rightarrow K_S^0 K^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{20}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<0.8	90	¹ ABLIKIM	06R BES2	$\psi(2S) \rightarrow \gamma \chi_{c1}$

NODE=M055R12
NODE=M055R12

¹ ABLIKIM 06R reports $< 0.9 \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K_J^*(1430)^0 \bar{K}^0 + \text{c.c.} \rightarrow K_S^0 K^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (8.7 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 9.55 \times 10^{-2}$.

NODE=M055R12;LINKAGE=AB

$\Gamma(K_J^*(1430)^+ K^- + \text{c.c.} \rightarrow K_S^0 K^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{21}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<2.2	90	¹ ABLIKIM	06R BES2	$\psi(2S) \rightarrow \gamma \chi_{c1}$

NODE=M055R13
NODE=M055R13

¹ ABLIKIM 06R reports $< 2.4 \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K_J^*(1430)^+ K^- + \text{c.c.} \rightarrow K_S^0 K^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (8.7 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 9.55 \times 10^{-2}$.

NODE=M055R13;LINKAGE=AB

$\Gamma(K^+ K^- \pi^0)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

DOCUMENT ID

TECN

COMMENT

1.85±0.24±0.06

1 ATHAR

07

CLEO

 $\psi(2S) \rightarrow \gamma h^+ h^- h^0$

¹ ATHAR 07 reports $(1.95 \pm 0.16 \pm 0.23) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K^+ K^- \pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 0.0907 \pm 0.0011 \pm 0.0054$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

 Γ_{22}/Γ NODE=M055R20
NODE=M055R20

NODE=M055R20;LINKAGE=AT

 $\Gamma(\eta \pi^+ \pi^-)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

EVTS

DOCUMENT ID

TECN

COMMENT

4.9±0.5 OUR AVERAGE

4.7±0.5±0.2

1 ATHAR

07

CLEO

 $\psi(2S) \rightarrow \gamma h^+ h^- h^0$

5.4±0.9±0.2

222

2 ABLIKIM

06R

BES2

 $\psi(2S) \rightarrow \gamma \chi_{c1}$

¹ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² 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 $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

 Γ_{23}/Γ 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

1.8±0.6±0.1

58

1 ABLIKIM

06R

BES2

 $\psi(2S) \rightarrow \gamma \chi_{c1}$

¹ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

 Γ_{24}/Γ 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

2.7±0.8±0.1

53

1 ABLIKIM

06R

BES2

 $\psi(2S) \rightarrow \gamma \chi_{c1}$

¹ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

 Γ_{25}/Γ 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±0.1

1 ATHAR

07

CLEO

 $\psi(2S) \rightarrow \gamma h^+ h^- h^0$

¹ ATHAR 07 reports $(2.4 \pm 0.4 \pm 0.3) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \pi^+ \pi^- \eta')/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 0.0907 \pm 0.0011 \pm 0.0054$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

 Γ_{26}/Γ NODE=M055R28
NODE=M055R28

NODE=M055R28;LINKAGE=AT

 $\Gamma(K^+ K^- \eta'(958))/\Gamma_{\text{total}}$ VALUE (units 10^{-4})

EVTS

DOCUMENT ID

TECN

COMMENT

8.75±0.87

310

1 ABLIKIM

14J

BES3

 $\psi(2S) \rightarrow \gamma K^+ K^- \eta'(958)$

¹ Derived using $B(\psi(2S) \rightarrow \gamma \chi_{c1}) = (9.2 \pm 0.4)\%$. Uncertainty includes both statistical and systematic contributions combined in quadrature.

 Γ_{27}/Γ NODE=M055R64
NODE=M055R64

NODE=M055R64;LINKAGE=A

 $\Gamma(K_0^*(1430)^+ K^- + \text{c.c.})/\Gamma_{\text{total}}$ VALUE (units 10^{-4})

DOCUMENT ID

TECN

COMMENT

6.41±0.57^{+2.09}_{-2.71}

1 ABLIKIM

14J

BES3

 $\psi(2S) \rightarrow \gamma K^+ K^- \eta'(958)$

¹ Normalized to $B(\chi_{c1} \rightarrow K^+ K^- \eta'(958))$ branching fraction.

 Γ_{28}/Γ NODE=M055R65
NODE=M055R65

NODE=M055R65;LINKAGE=A

$\Gamma(f_0(980)\eta'(958))/\Gamma_{\text{total}}$ Γ_{29}/Γ VALUE (units 10^{-4})

DOCUMENT ID

TECN

COMMENT

 $1.65 \pm 0.47^{+1.32}_{-0.56}$ ¹ ABLIKIM 14J BES3 $\psi(2S) \rightarrow \gamma K^+ K^- \eta'(958)$ ¹ Normalized to $B(\chi_{c1} \rightarrow K^+ K^- \eta'(958))$ branching fraction.NODE=M055R66
NODE=M055R66

NODE=M055R66;LINKAGE=A

 $\Gamma(f_0(1710)\eta'(958))/\Gamma_{\text{total}}$ Γ_{30}/Γ VALUE (units 10^{-4})

DOCUMENT ID

TECN

COMMENT

 $0.71 \pm 0.22^{+0.68}_{-0.48}$ ¹ ABLIKIM 14J BES3 $\psi(2S) \rightarrow \gamma K^+ K^- \eta'(958)$ ¹ Normalized to $B(\chi_{c1} \rightarrow K^+ K^- \eta'(958))$ branching fraction.NODE=M055R67
NODE=M055R67

NODE=M055R67;LINKAGE=A

 $\Gamma(f'_2(1525)\eta'(958))/\Gamma_{\text{total}}$ Γ_{31}/Γ VALUE (units 10^{-4})

DOCUMENT ID

TECN

COMMENT

 $0.92 \pm 0.23^{+0.55}_{-0.51}$ ¹ ABLIKIM 14J BES3 $\psi(2S) \rightarrow \gamma K^+ K^- \eta'(958)$ ¹ Normalized to $B(\chi_{c1} \rightarrow K^+ K^- \eta'(958))$ branching fraction.NODE=M055R68
NODE=M055R68

NODE=M055R68;LINKAGE=A

 $\Gamma(\pi^0 f_0(980) \rightarrow \pi^0 \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{32}/Γ

VALUE

CL%

DOCUMENT ID

TECN

COMMENT

 $< 6 \times 10^{-6}$

90

¹ ABLIKIM 11D BES3 $\psi(2S) \rightarrow \gamma \pi^0 \pi^+ \pi^-$ ¹ ABLIKIM 11D reports $[\Gamma(\chi_{c1}(1P) \rightarrow \pi^0 f_0(980) \rightarrow \pi^0 \pi^+ \pi^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))] < 6.0 \times 10^{-7}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 9.55 \times 10^{-2}$.NODE=M055R18
NODE=M055R18

NODE=M055R18;LINKAGE=BR

 $\Gamma(K^+ \bar{K}^*(892)^0 \pi^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{33}/Γ VALUE (units 10^{-4})

DOCUMENT ID

TECN

COMMENT

 32 ± 21 ¹ TANENBAUM 78 MRK1 $\psi(2S) \rightarrow \gamma \chi_{c1}$ ¹ Estimated using $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 0.087$. The errors do not contain the uncertainty in the $\psi(2S)$ decay.NODE=M055R9
NODE=M055R9

NODE=M055R9;LINKAGE=T

 $\Gamma(K^*(892)^0 \bar{K}^*(892)^0)/\Gamma_{\text{total}}$ Γ_{34}/Γ VALUE (units 10^{-3})

EVTS

DOCUMENT ID

TECN

COMMENT

 $1.47 \pm 0.36 \pm 0.05$ 28.4 ± 5.5 ^{1,2} ABLIKIM 04H BES $\psi(2S) \rightarrow \gamma K^+ K^- \pi^+ \pi^-$ ¹ ABLIKIM 04H reports $[\Gamma(\chi_{c1}(1P) \rightarrow K^*(892)^0 \bar{K}^*(892)^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))] = (1.40 \pm 0.27 \pm 0.22) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.² Assumes $B(K^*(892)^0 \rightarrow K^- \pi^+) = 2/3$.NODE=M055R26
NODE=M055R26

NODE=M055R26;LINKAGE=AB

NODE=M055R26;LINKAGE=AL

 $\Gamma(K^+ K^- K_S^0 \bar{K}_S^0)/\Gamma_{\text{total}}$ Γ_{35}/Γ VALUE (units 10^{-4})

CL%

EVTS

DOCUMENT ID

TECN

COMMENT

 < 4

90

 3.2 ± 2.4 ¹ ABLIKIM 050 BES2 $\psi(2S) \rightarrow \chi_{c1} \gamma$ ¹ ABLIKIM 050 reports $[\Gamma(\chi_{c1}(1P) \rightarrow K^+ K^- K_S^0 \bar{K}_S^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))] < 4.2 \times 10^{-5}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 9.55 \times 10^{-2}$.NODE=M055R06
NODE=M055R06

NODE=M055R06;LINKAGE=AB

 $\Gamma(K^+ K^- K^+ K^-)/\Gamma_{\text{total}}$ Γ_{36}/Γ VALUE (units 10^{-3})

DOCUMENT ID

 0.55 ± 0.11 OUR FITNODE=M055R14
NODE=M055R14 $\Gamma(K^+ K^- \phi)/\Gamma_{\text{total}}$ Γ_{37}/Γ VALUE (units 10^{-3})

EVTS

DOCUMENT ID

TECN

COMMENT

 $0.42 \pm 0.15 \pm 0.01$

17

¹ ABLIKIM 06T BES2 $\psi(2S) \rightarrow \gamma 2K^+ 2K^-$ ¹ ABLIKIM 06T reports $(0.46 \pm 0.16 \pm 0.06) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K^+ K^- \phi)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (8.7 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.NODE=M055R07
NODE=M055R07

NODE=M055R07;LINKAGE=AB

 $\Gamma(\bar{K}^0 K^+ \pi^- \phi + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{38}/Γ VALUE (units 10^{-3})

DOCUMENT ID

TECN

COMMENT

 $3.27 \pm 0.28 \pm 0.46$ ABLIKIM 15M BES3 $\psi(2S) \rightarrow \gamma \chi_{c1}$ NODE=M055R69
NODE=M055R69

$\Gamma(K^+K^-\pi^0\phi)/\Gamma_{\text{total}}$ Γ_{39}/Γ VALUE (units 10^{-3})

DOCUMENT ID

TECN

COMMENT

1.62±0.12±0.28

ABLIKIM

15M

BES3

 $\psi(2S) \rightarrow \gamma\chi_{c1}$ NODE=M055R70
NODE=M055R70 $\Gamma(\phi\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{40}/Γ VALUE (units 10^{-3})

EVTS

DOCUMENT ID

TECN

COMMENT

0.75±0.06±0.08

373

¹ ABLIKIM

13B

BES3

 $e^+e^- \rightarrow \psi(2S) \rightarrow \gamma\chi_{c1}$ NODE=M055R62
NODE=M055R62¹ Using 1.06×10^8 $\psi(2S)$ mesons and $B(\psi(2S) \rightarrow \chi_{c1}\gamma) = (9.2 \pm 0.4)\%$.

NODE=M055R62;LINKAGE=A

 $\Gamma(\omega\omega)/\Gamma_{\text{total}}$ Γ_{41}/Γ VALUE (units 10^{-4})

EVTS

DOCUMENT ID

TECN

COMMENT

5.8±0.7±0.2

597

¹ ABLIKIM

11K

BES3

 $\psi(2S) \rightarrow \gamma$ hadronsNODE=M055R49
NODE=M055R49¹ 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 $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R49;LINKAGE=AL

 $\Gamma(\omega K^+K^-)/\Gamma_{\text{total}}$ Γ_{42}/Γ VALUE (units 10^{-3})

EVTS

DOCUMENT ID

TECN

COMMENT

0.78±0.04±0.08

628

¹ ABLIKIM

13B

BES3

 $e^+e^- \rightarrow \psi(2S) \rightarrow \gamma\chi_{c1}$ NODE=M055R61
NODE=M055R61¹ Using 1.06×10^8 $\psi(2S)$ mesons and $B(\psi(2S) \rightarrow \chi_{c1}\gamma) = (9.2 \pm 0.4)\%$.

NODE=M055R61;LINKAGE=A

 $\Gamma(\omega\phi)/\Gamma_{\text{total}}$ Γ_{43}/Γ VALUE (units 10^{-4})

EVTS

DOCUMENT ID

TECN

COMMENT

0.21±0.06±0.01

15

¹ ABLIKIM

11K

BES3

 $\psi(2S) \rightarrow \gamma$ hadronsNODE=M055R50
NODE=M055R50¹ 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 $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R50;LINKAGE=AL

 $\Gamma(\phi\phi)/\Gamma_{\text{total}}$ Γ_{44}/Γ VALUE (units 10^{-4})

EVTS

DOCUMENT ID

TECN

COMMENT

4.2±0.5±0.1

366

¹ ABLIKIM

11K

BES3

 $\psi(2S) \rightarrow \gamma$ hadronsNODE=M055R51
NODE=M055R51¹ 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 $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R51;LINKAGE=AL

 $\Gamma(p\bar{p})/\Gamma_{\text{total}}$ Γ_{45}/Γ VALUE (units 10^{-4})

DOCUMENT ID

0.772±0.035 OUR FITNODE=M055R11
NODE=M055R11 $\Gamma(p\bar{p}\pi^0)/\Gamma_{\text{total}}$ Γ_{46}/Γ VALUE (units 10^{-3})

DOCUMENT ID

TECN

COMMENT

0.159±0.019 OUR AVERAGE

0.166±0.020±0.005

¹ ONYISI

10

CLE3

 $\psi(2S) \rightarrow \gamma p\bar{p}X$

0.114±0.048±0.004

² ATHAR

07

CLEO

 $\psi(2S) \rightarrow \gamma h^+ h^- h^0$ NODE=M055R21
NODE=M055R21¹ 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 $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R21;LINKAGE=ON

² ATHAR 07 reports $(1.2 \pm 0.5 \pm 0.1) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow p\bar{p}\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R21;LINKAGE=AT

$\Gamma(p\bar{p}\eta)/\Gamma_{\text{total}}$ Γ_{47}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
0.148±0.025±0.005		¹ ONYISI	10 CLE3	$\psi(2S) \rightarrow \gamma p \bar{p} X$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.15 90 ² ATHAR 07 CLEO $\psi(2S) \rightarrow \gamma h^+ h^- h^0$

¹ ONYISI 10 reports $(1.56 \pm 0.22 \pm 0.14 \pm 0.10) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow p\bar{p}\eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² ATHAR 07 reports $< 0.16 \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow p\bar{p}\eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = 9.55 \times 10^{-2}$.

NODE=M055R27
NODE=M055R27

NODE=M055R27;LINKAGE=ON

NODE=M055R27;LINKAGE=AT

 $\Gamma(p\bar{p}\omega)/\Gamma_{\text{total}}$ Γ_{48}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
0.216±0.031±0.007	¹ ONYISI	10 CLE3	$\psi(2S) \rightarrow \gamma p \bar{p} X$

¹ ONYISI 10 reports $(2.28 \pm 0.28 \pm 0.16 \pm 0.14) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow p\bar{p}\omega)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R43
NODE=M055R43

NODE=M055R43;LINKAGE=ON

 $\Gamma(p\bar{p}\phi)/\Gamma_{\text{total}}$ Γ_{49}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<1.8	90	¹ ABLIKIM	11F BES3	$\psi(2S) \rightarrow \gamma p \bar{p} K^+ K^-$

¹ ABLIKIM 11F reports $< 1.82 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow p\bar{p}\phi)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = 9.55 \times 10^{-2}$.

NODE=M055R48
NODE=M055R48

NODE=M055R48;LINKAGE=AB

 $\Gamma(p\bar{p}\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{50}/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±0.12±0.15

¹ BAI 99B BES $\psi(2S) \rightarrow \gamma\chi_{c1}$

1.08±0.77±0.05

¹ TANENBAUM 78 MRK1 $\psi(2S) \rightarrow \gamma\chi_{c1}$

¹ Rescaled by us using $B(\psi(2S) \rightarrow \gamma\chi_{c1}) = (8.8 \pm 0.4)\%$ and $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (32.6 \pm 0.5)\%$.

NODE=M055R7
NODE=M055R7

→ UNCHECKED ←

NODE=M055R7;LINKAGE=X2

 $\Gamma(p\bar{p}\pi^0\pi^0)/\Gamma_{\text{total}}$ Γ_{51}/Γ

VALUE (%)	CL%	DOCUMENT ID	TECN	COMMENT
<0.05	90	¹ HE	08B CLEO	$e^+e^- \rightarrow \gamma h^+ h^- h^0 h^0$

¹ 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 $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = 9.55 \times 10^{-2}$.

NODE=M055R38
NODE=M055R38

NODE=M055R38;LINKAGE=HE

 $\Gamma(p\bar{p}K^+K^- \text{ (non-resonant)})/\Gamma_{\text{total}}$ Γ_{52}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.30±0.23±0.04	82 ± 9	¹ ABLIKIM	11F BES3	$\psi(2S) \rightarrow \gamma p \bar{p} K^+ K^-$

¹ ABLIKIM 11F reports $(1.35 \pm 0.15 \pm 0.19) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow p\bar{p}K^+K^- \text{ (non-resonant)})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R45
NODE=M055R45

NODE=M055R45;LINKAGE=AB

 $\Gamma(p\bar{p}K_S^0 K_S^0)/\Gamma_{\text{total}}$ Γ_{53}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<4.5	90	¹ ABLIKIM	06D BES2	$\psi(2S) \rightarrow \gamma\chi_{c1}$

¹ Using $B(\psi(2S) \rightarrow \chi_{c1}\gamma) = (9.1 \pm 0.6)\%$.

NODE=M055R02
NODE=M055R02

NODE=M055R;LINKAGE=AB

$\Gamma(p\bar{n}\pi^-)/\Gamma_{\text{total}}$ Γ_{54}/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
3.9±0.5±0.1	1412	¹ ABLIKIM	12J BES3	$\psi(2S) \rightarrow \gamma p\bar{n}\pi^-$

NODE=M055R56
NODE=M055R56

¹ ABLIKIM 12J reports $[\Gamma(\chi_{c1}(1P) \rightarrow p\bar{n}\pi^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))] = (0.37 \pm 0.02 \pm 0.04) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R56;LINKAGE=AL

$\Gamma(\bar{p}n\pi^+)/\Gamma_{\text{total}}$ Γ_{55}/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
4.0±0.5±0.1	1625	¹ ABLIKIM	12J BES3	$\psi(2S) \rightarrow \gamma \bar{p}n\pi^+$

NODE=M055R57
NODE=M055R57

¹ ABLIKIM 12J reports $[\Gamma(\chi_{c1}(1P) \rightarrow \bar{p}n\pi^+)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))] = (0.38 \pm 0.02 \pm 0.04) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R57;LINKAGE=AL

$\Gamma(p\bar{n}\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{56}/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
10.5±1.2±0.3	1082	¹ ABLIKIM	12J BES3	$\psi(2S) \rightarrow \gamma p\bar{n}\pi^-\pi^0$

NODE=M055R58
NODE=M055R58

¹ ABLIKIM 12J reports $[\Gamma(\chi_{c1}(1P) \rightarrow p\bar{n}\pi^-\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))] = (1.00 \pm 0.05 \pm 0.10) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R58;LINKAGE=AL

$\Gamma(\bar{p}n\pi^+\pi^0)/\Gamma_{\text{total}}$ Γ_{57}/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
10.3±1.2±0.3	1261	¹ ABLIKIM	12J BES3	$\psi(2S) \rightarrow \gamma \bar{p}n\pi^+\pi^0$

NODE=M055R59
NODE=M055R59

¹ ABLIKIM 12J reports $[\Gamma(\chi_{c1}(1P) \rightarrow \bar{p}n\pi^+\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))] = (0.98 \pm 0.05 \pm 0.10) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R59;LINKAGE=AL

$\Gamma(\Lambda\bar{\Lambda})/\Gamma_{\text{total}}$ Γ_{58}/Γ

VALUE (units 10^{-4})	DOCUMENT ID
1.16±0.12 OUR FIT	

NODE=M055R23
NODE=M055R23

$\Gamma(\Lambda\bar{\Lambda}\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{59}/Γ

VALUE (units 10^{-5})	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
30±5±1		105	¹ ABLIKIM	12I BES3	$\psi(2S) \rightarrow \gamma \Lambda\bar{\Lambda}\pi^+\pi^-$

NODE=M055R01
NODE=M055R01

• • • We do not use the following data for averages, fits, limits, etc. • • •

<150	90	² ABLIKIM	06D BES2	$\psi(2S) \rightarrow \gamma\chi_{c1}$

¹ ABLIKIM 12I reports $(31.1 \pm 3.4 \pm 3.9) \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \Lambda\bar{\Lambda}\pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R01;LINKAGE=AL

² Using $B(\psi(2S) \rightarrow \chi_{c1}\gamma) = (9.1 \pm 0.6)\%$.

NODE=M055R01;LINKAGE=AB

$\Gamma(\Lambda\bar{\Lambda}\pi^+\pi^- (\text{non-resonant}))/\Gamma_{\text{total}}$ Γ_{60}/Γ

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT
25±6±1	13	¹ ABLIKIM	12I BES3	$\psi(2S) \rightarrow \gamma \Lambda\bar{\Lambda}\pi^+\pi^-$

NODE=M055R19
NODE=M055R19

¹ ABLIKIM 12I reports $(26.2 \pm 5.5 \pm 3.3) \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \Lambda\bar{\Lambda}\pi^+\pi^- (\text{non-resonant}))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R19;LINKAGE=AL

$\Gamma(\Sigma(1385)^+\bar{\Lambda}\pi^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{61}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<13	90	¹ ABLIKIM	12I BES3	$\psi(2S) \rightarrow \gamma \Sigma(1385)^+\bar{\Lambda}\pi^-$

NODE=M055R52
NODE=M055R52

¹ ABLIKIM 12I reports $< 14 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \Sigma(1385)^+\bar{\Lambda}\pi^- + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = 9.55 \times 10^{-2}$.

NODE=M055R52;LINKAGE=AL

$\Gamma(\Sigma(1385)^- \bar{\Lambda}\pi^+ + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{62}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<13	90	¹ ABLIKIM	12I BES3	$\psi(2S) \rightarrow \gamma \Sigma(1385)^- \bar{\Lambda}\pi^+$
¹ ABLIKIM 12I reports $< 14 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \Sigma(1385)^- \bar{\Lambda}\pi^+ + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 9.55 \times 10^{-2}$.				

NODE=M055R53
 NODE=M055R53

NODE=M055R53;LINKAGE=AL

 $\Gamma(K^+ \bar{p} \Lambda)/\Gamma_{\text{total}}$ Γ_{63}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
4.2 ± 0.4 OUR AVERAGE	Error includes scale factor of 1.1.			
$4.3 \pm 0.4 \pm 0.1$	3k	^{1,2} ABLIKIM	13D BES3	$\psi(2S) \rightarrow \gamma \Lambda \bar{p} K^+$
$3.1 \pm 0.9 \pm 0.1$		³ ATHAR	07 CLEO	$\psi(2S) \rightarrow \gamma h^+ h^- h^0$
¹ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				
² Using $B(\Lambda \rightarrow p \pi^-) = 63.9\%$.				
³ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M055R22
 NODE=M055R22

NODE=M055R22;LINKAGE=AB

NODE=M055R22;LINKAGE=LB
 NODE=M055R22;LINKAGE=AT

 $\Gamma(K^+ \bar{p} \Lambda(1520) + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{64}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.7 \pm 0.4 \pm 0.1$	48 ± 10	¹ ABLIKIM	11F BES3	$\psi(2S) \rightarrow \gamma p \bar{p} K^+ K^-$
¹ ABLIKIM 11F reports $(1.81 \pm 0.38 \pm 0.28) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K^+ \bar{p} \Lambda(1520) + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M055R46
 NODE=M055R46

NODE=M055R46;LINKAGE=AB

 $\Gamma(\Lambda(1520) \bar{\Lambda}(1520))/\Gamma_{\text{total}}$ Γ_{65}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.0	90	¹ ABLIKIM	11F BES3	$\psi(2S) \rightarrow \gamma p \bar{p} K^+ K^-$
¹ ABLIKIM 11F reports $< 1.00 \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \Lambda(1520) \bar{\Lambda}(1520))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$.				

NODE=M055R47
 NODE=M055R47

NODE=M055R47;LINKAGE=AB

 $\Gamma(\Sigma^0 \bar{\Sigma}^0)/\Gamma_{\text{total}}$ Γ_{66}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<0.4	90	3.8 ± 2.5	¹ NAIK	08 CLEO	$\psi(2S) \rightarrow \gamma \Sigma^0 \bar{\Sigma}^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.6	90		² ABLIKIM	13H BES3	$\psi(2S) \rightarrow \gamma \Sigma^0 \bar{\Sigma}^0$
¹ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 9.55 \times 10^{-2}$.					
² ABLIKIM 13H reports $< 0.62 \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \Sigma^0 \bar{\Sigma}^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 9.55 \times 10^{-2}$.					

NODE=M055R32
 NODE=M055R32

NODE=M055R32;LINKAGE=NA

NODE=M055R32;LINKAGE=AB

 $\Gamma(\Sigma^+ \bar{\Sigma}^-)/\Gamma_{\text{total}}$ Γ_{67}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<0.6	90	4.3 ± 2.3	¹ NAIK	08 CLEO	$\psi(2S) \rightarrow \gamma \Sigma^+ \bar{\Sigma}^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.8	90		² ABLIKIM	13H BES3	$\psi(2S) \rightarrow \gamma \Sigma^+ \bar{\Sigma}^-$

NODE=M055R33
 NODE=M055R33

¹ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 9.55 \times 10^{-2}$.

NODE=M055R33;LINKAGE=NA

² ABLIKIM 13H reports $< 0.87 \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \Sigma^+ \bar{\Sigma}^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 9.55 \times 10^{-2}$.

NODE=M055R33;LINKAGE=AB

$\Gamma(\Sigma(1385)^+ \bar{\Sigma}(1385)^-)/\Gamma_{\text{total}}$ Γ_{68}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<10	90	¹ ABLIKIM 12i	BES3	$\psi(2S) \rightarrow \gamma \Lambda \bar{\Lambda} \pi^+ \pi^-$
¹ ABLIKIM 12i reports $< 10 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \Sigma(1385)^+ \bar{\Sigma}(1385)^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 9.55 \times 10^{-2}$.				

NODE=M055R54
NODE=M055R54

NODE=M055R54;LINKAGE=AL

$\Gamma(\Sigma(1385)^- \bar{\Sigma}(1385)^+)/\Gamma_{\text{total}}$ Γ_{69}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<5	90	¹ ABLIKIM 12i	BES3	$\psi(2S) \rightarrow \gamma \Lambda \bar{\Lambda} \pi^+ \pi^-$
¹ ABLIKIM 12i reports $< 5.7 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \Sigma(1385)^- \bar{\Sigma}(1385)^+)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 9.55 \times 10^{-2}$.				

NODE=M055R55
NODE=M055R55

NODE=M055R55;LINKAGE=AL

$\Gamma(K^- \Lambda \bar{\Xi}^+ + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{70}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.38 \pm 0.24 \pm 0.05$	49	¹ ABLIKIM 15i	BES3	$\psi(2S) \rightarrow \gamma K^- \Lambda \bar{\Xi}^+ + \text{c.c.}$
¹ ABLIKIM 15i reports $[\Gamma(\chi_{c1}(1P) \rightarrow K^- \Lambda \bar{\Xi}^+ + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ $= (1.32 \pm 0.20 \pm 0.12) \times 10^{-5}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M055R71
NODE=M055R71

NODE=M055R71;LINKAGE=A

$\Gamma(\Xi^0 \bar{\Xi}^0)/\Gamma_{\text{total}}$ Γ_{71}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<0.6	90	1.7 ± 2.4	¹ NAIK 08	CLEO	$\psi(2S) \rightarrow \gamma \Xi^0 \bar{\Xi}^0$
¹ NAIK 08 reports $< 0.60 \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \Xi^0 \bar{\Xi}^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 9.55 \times 10^{-2}$.					

NODE=M055R34
NODE=M055R34

NODE=M055R34;LINKAGE=NA

$\Gamma(\Xi^- \bar{\Xi}^+)/\Gamma_{\text{total}}$ Γ_{72}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$0.82 \pm 0.22 \pm 0.03$	16.4 ± 4.3		¹ NAIK 08	CLEO	$\psi(2S) \rightarrow \gamma \Xi^+ \bar{\Xi}^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 3.4	90		² ABLIKIM 06D	BES2	$\psi(2S) \rightarrow \gamma \chi_{c1}$
¹ NAIK 08 reports $(0.86 \pm 0.22 \pm 0.08) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \Xi^- \bar{\Xi}^+)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.					
² 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_{73}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<21		¹ FELDMAN 77	MRK1	$\psi(2S) \rightarrow \gamma \chi_{c1}$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
< 38	90	¹ BRANDELIK 79B	DASP	$\psi(2S) \rightarrow \gamma \chi_{c1}$
¹ Estimated using $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 0.087$. The errors do not contain the uncertainty in the $\psi(2S)$ decay.				

NODE=M055R2
NODE=M055R2

NODE=M055R2;LINKAGE=T

$\Gamma(K_S^0 K_S^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<0.6	90	¹ ABLIKIM	050 BES2	$\psi(2S) \rightarrow \chi_{c1} \gamma$

¹ ABLIKIM 050 reports $[\Gamma(\chi_{c1}(1P) \rightarrow K_S^0 K_S^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$
 $< 0.6 \times 10^{-5}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 9.55 \times 10^{-2}$.

Γ_{74}/Γ
 NODE=M055R04
 NODE=M055R04

NODE=M055R04;LINKAGE=AB

 $\Gamma(\eta_c \pi^+ \pi^-)/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<3.2 $\times 10^{-3}$	90	^{1,2} ABLIKIM	13B BES3	$e^+ e^- \rightarrow \psi(2S) \rightarrow \gamma \chi_{c1}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<4.4 $\times 10^{-3}$	90	^{1,3} ABLIKIM	13B BES3	$e^+ e^- \rightarrow \psi(2S) \rightarrow \gamma \chi_{c1}$

¹ Using 1.06×10^8 $\psi(2S)$ mesons and $B(\psi(2S) \rightarrow \chi_{c1} \gamma) = (9.2 \pm 0.4)\%$.

² Using the $\eta_c \rightarrow K_S^0 K^\pm \pi^\mp$ decays.

³ Using the $\eta_c \rightarrow K^+ K^- \pi^0$ decays.

Γ_{75}/Γ
 NODE=M055R63
 NODE=M055R63

OCCUR=2

NODE=M055R63;LINKAGE=A

NODE=M055R63;LINKAGE=B

NODE=M055R63;LINKAGE=C

NODE=M055310

RADIATIVE DECAYS

 $\Gamma(\gamma J/\psi(1S))/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT

0.339 $\pm$ 0.012 OUR FIT

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.379$\pm$0.008$\pm$0.021	¹ ADAM	05A CLEO	$e^+ e^- \rightarrow \psi(2S) \rightarrow \gamma \chi_{c1}$

¹ 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.

Γ_{76}/Γ
 NODE=M055R1
 NODE=M055R1

NODE=M055R1;LINKAGE=AD

 $\Gamma(\gamma \rho^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT

220 $\pm$ 18 OUR AVERAGE

220 $\pm$ 23 $\pm$ 7	432 $\pm$ 25	¹ ABLIKIM	11E BES3	$\psi(2S) \rightarrow \gamma \gamma \rho^0$
221 $\pm$ 24 $\pm$ 7	186 $\pm$ 15	² BENNETT	08A CLEO	$\psi(2S) \rightarrow \gamma \gamma \rho^0$

¹ ABLIKIM 11E reports $(228 \pm 13 \pm 22) \times 10^{-6}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \gamma \rho^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² BENNETT 08A reports $(243 \pm 19 \pm 22) \times 10^{-6}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \gamma \rho^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (8.7 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

Γ_{77}/Γ
 NODE=M055R29
 NODE=M055R29

NODE=M055R29;LINKAGE=AB

NODE=M055R29;LINKAGE=BE

 $\Gamma(\gamma \omega)/\Gamma_{\text{total}}$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT

69 $\pm$ 8 OUR AVERAGE

67 $\pm$ 9 $\pm$ 2	136 $\pm$ 14	¹ ABLIKIM	11E BES3	$\psi(2S) \rightarrow \gamma \gamma \omega$
76 $\pm$ 17 $\pm$ 2	39 $\pm$ 7	² BENNETT	08A CLEO	$\psi(2S) \rightarrow \gamma \gamma \omega$

¹ ABLIKIM 11E reports $(69.7 \pm 7.2 \pm 6.6) \times 10^{-6}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \gamma \omega)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² BENNETT 08A reports $(83 \pm 15 \pm 12) \times 10^{-6}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \gamma \omega)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (8.7 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

Γ_{78}/Γ
 NODE=M055R30
 NODE=M055R30

NODE=M055R30;LINKAGE=AB

NODE=M055R30;LINKAGE=BE

 $\Gamma(\gamma \phi)/\Gamma_{\text{total}}$

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT

25$\pm$5$\pm$1		43 $\pm$ 9	¹ 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 $\pm$ 3.1	² BENNETT	08A CLEO	$\psi(2S) \rightarrow \gamma \gamma \phi$

Γ_{79}/Γ
 NODE=M055R31
 NODE=M055R31

¹ ABLIKIM 11E reports $(25.8 \pm 5.2 \pm 2.3) \times 10^{-6}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \gamma\phi)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² BENNETT 08A reports $< 26 \times 10^{-6}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \gamma\phi)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (8.7 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = 9.55 \times 10^{-2}$.

NODE=M055R31;LINKAGE=AB

NODE=M055R31;LINKAGE=BE

$\Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ Γ_{80}/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	¹ YAMADA	77	DASP	$e^+e^- \rightarrow 3\gamma$

¹ Estimated using $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = 0.087$. The errors do not contain the uncertainty in the $\psi(2S)$ decay.

NODE=M055R3
NODE=M055R3

NODE=M055R;LINKAGE=T1

$\chi_{c1}(1P)$ CROSS-PARTICLE BRANCHING RATIOS

NODE=M055230

$\Gamma(\chi_{c1}(1P) \rightarrow p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)$ $\Gamma_{45}/\Gamma \times \Gamma_{135}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}$

VALUE (units 10^{-5}) DOCUMENT ID TECN COMMENT

2.14±0.11 OUR FIT

1.1 ±1.0 ¹ BAI 98I BES $\psi(2S) \rightarrow \gamma\chi_{c1} \rightarrow \gamma p\bar{p}$

¹ Calculated by us. The value for $B(\chi_{c1} \rightarrow p\bar{p})$ reported in BAI 98I is derived using $B(\psi(2S) \rightarrow \gamma\chi_{c1}) = (8.7 \pm 0.8)\%$ and $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (32.4 \pm 2.6)\%$ [BAI 98d].

NODE=M055B1
NODE=M055B1

NODE=M055B;LINKAGE=J2

$\Gamma(\chi_{c1}(1P) \rightarrow \Lambda\bar{\Lambda})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))/\Gamma_{\text{total}}$ $\Gamma_{58}/\Gamma \times \Gamma_{135}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}$

VALUE (units 10^{-6}) EVTS DOCUMENT ID TECN COMMENT

11.1±1.1 OUR FIT

10.9±1.1 OUR AVERAGE

11.2±1.0±0.9	136	¹ ABLIKIM	13H	BES3	$\psi(2S) \rightarrow \gamma\Lambda\bar{\Lambda}$
10.5±1.6±0.6	46 ± 7	² NAIK	08	CLEO	$\psi(2S) \rightarrow \gamma\Lambda\bar{\Lambda}$

¹ Calculated by us. ABLIKIM 13H reports $B(\chi_{c1} \rightarrow \Lambda\bar{\Lambda}) = (12.2 \pm 1.1 \pm 1.1) \times 10^{-5}$ from a measurement of $B(\chi_{c1} \rightarrow \Lambda\bar{\Lambda}) \times B(\psi(2S) \rightarrow \gamma\chi_{c1})$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}) = (9.2 \pm 0.4)\%$.

² Calculated by us. NAIK 08 reports $B(\chi_{c1} \rightarrow \Lambda\bar{\Lambda}) = (11.6 \pm 1.8 \pm 0.7 \pm 0.7) \times 10^{-5}$ using $B(\psi(2S) \rightarrow \gamma\chi_{c1}) = (9.07 \pm 0.11 \pm 0.54)\%$.

NODE=M055B10
NODE=M055B10

NODE=M055B10;LINKAGE=AB

NODE=M055B10;LINKAGE=NA

$\Gamma(\chi_{c1}(1P) \rightarrow \Lambda\bar{\Lambda})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)$ $\Gamma_{58}/\Gamma \times \Gamma_{135}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}$

VALUE (units 10^{-5}) EVTS DOCUMENT ID TECN COMMENT

3.22±0.31 OUR FIT

7.1 $^{+2.8}_{-2.4}$ ±1.3 9.0 $^{+3.5}_{-3.1}$ ¹ BAI 03E BES $\psi(2S) \rightarrow \gamma\Lambda\bar{\Lambda}$

¹ BAI 03E reports $[B(\chi_{c1} \rightarrow \Lambda\bar{\Lambda}) B(\psi(2S) \rightarrow \gamma\chi_{c1}) / B(\psi(2S) \rightarrow J/\psi\pi^+\pi^-)] \times [B^2(\Lambda \rightarrow \pi^-p) / B(J/\psi \rightarrow p\bar{p})] = (1.33^{+0.52}_{-0.46} \pm 0.25)\%$. We calculate from this measurement the presented value using $B(\Lambda \rightarrow \pi^-p) = (63.9 \pm 0.5)\%$ and $B(J/\psi \rightarrow p\bar{p}) = (2.17 \pm 0.07) \times 10^{-3}$.

NODE=M055B11
NODE=M055B11

NODE=M055B11;LINKAGE=BA

$\Gamma(\chi_{c1}(1P) \rightarrow \gamma J/\psi(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))/\Gamma_{\text{total}}$ $\Gamma_{76}/\Gamma \times \Gamma_{135}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}$

VALUE (units 10^{-2}) EVTS DOCUMENT ID TECN COMMENT

3.24 ±0.07 OUR FIT

2.93 ±0.15 OUR AVERAGE Error includes scale factor of 1.4. See the ideogram below.

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		¹ OREGLIA	82	CBAL	$\psi(2S) \rightarrow \gamma\chi_{c1}$

NODE=M055B2
NODE=M055B2

2.2 ±0.5		² BRANDELIK	79B	DASP	$\psi(2S) \rightarrow \gamma \chi_{c1}$
2.9 ±0.5		² BARTEL	78B	CNTR	$\psi(2S) \rightarrow \gamma \chi_{c1}$
5.0 ±1.5		³ BIDDICK	77	CNTR	$e^+ e^- \rightarrow \gamma X$
2.8 ±0.9		¹ 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	⁴ MENDEZ	08	CLEO	$\psi(2S) \rightarrow \gamma \chi_{c1}$
3.44 ±0.06 ±0.13	3.7k	⁵ ADAM	05A	CLEO	Repl. by MENDEZ 08

¹ Recalculated by us using $B(J/\psi(1S) \rightarrow \ell^+ \ell^-) = 0.1181 \pm 0.0020$.

² Recalculated by us using $B(J/\psi(1S) \rightarrow \mu^+ \mu^-) = 0.0588 \pm 0.0010$.

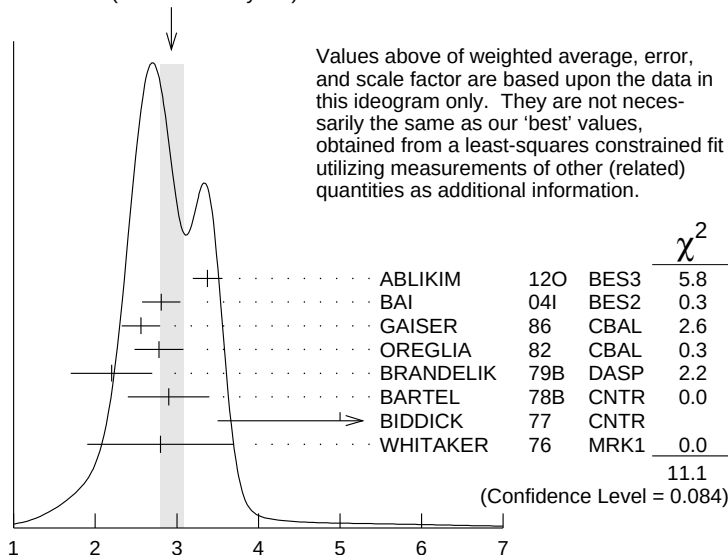
³ Assumes isotropic gamma distribution.

⁴ Not independent from other measurements of MENDEZ 08.

⁵ Not independent from other values reported by ADAM 05A.

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)



$$10^{-2}) \quad \Gamma(\chi_{c1}(1P) \rightarrow \gamma J/\psi(1S)) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) / \Gamma_{\text{total}} \text{ (units)}$$

$$\Gamma(\chi_{c1}(1P) \rightarrow \gamma J/\psi(1S)) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) / \Gamma(\psi(2S) \rightarrow J/\psi(1S) \text{ anything})$$

$$\Gamma_{76} / \Gamma \times \Gamma_{135}^{\psi(2S)} / \Gamma_9^{\psi(2S)} = \Gamma_{76} / \Gamma \times \Gamma_{135}^{\psi(2S)} / (\Gamma_{11}^{\psi(2S)} + \Gamma_{12}^{\psi(2S)} + \Gamma_{13}^{\psi(2S)} + 0.339 \Gamma_{135}^{\psi(2S)} + 0.192 \Gamma_{136}^{\psi(2S)})$$

NODE=M055B7
 NODE=M055B7

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
5.31±0.11 OUR FIT				

• • • We do not use the following data for averages, fits, limits, etc. • • •

5.70±0.04±0.15	24.9k	¹ MENDEZ	08	CLEO	$\psi(2S) \rightarrow \gamma \chi_{c1}$
5.77±0.10±0.12	3.7k	ADAM	05A	CLEO	Repl. by MENDEZ 08

¹ Not independent from other measurements of MENDEZ 08.

NODE=M055B7;LINKAGE=ME

$$\Gamma(\chi_{c1}(1P) \rightarrow \gamma J/\psi(1S)) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) / \Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)$$

$$\Gamma_{76} / \Gamma \times \Gamma_{135}^{\psi(2S)} / \Gamma_{11}^{\psi(2S)}$$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
9.40±0.21 OUR FIT				
10.15±0.28 OUR AVERAGE				

10.17±0.07±0.27	24.9k	MENDEZ	08	CLEO	$\psi(2S) \rightarrow \gamma \chi_{c1}$
12.6 ±0.3 ±3.8	3k	¹ ABLIKIM	04B	BES	$\psi(2S) \rightarrow J/\psi X$
8.5 ±2.1		² HIMEL	80	MRK2	$\psi(2S) \rightarrow \gamma \chi_{c1}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

10.24±0.17±0.23	3.7k	³ ADAM	05A	CLEO	Repl. by MENDEZ 08

¹ From a fit to the J/ψ recoil mass spectra.

² The value for $B(\psi(2S) \rightarrow \gamma \chi_{c1}) \times B(\chi_{c1} \rightarrow \gamma J/\psi(1S))$ quoted in HIMEL 80 is derived using $B(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-) = (33 \pm 3)\%$ and $B(J/\psi(1S) \rightarrow \ell^+ \ell^-) = 0.138 \pm 0.018$. Calculated by us using $B(J/\psi(1S) \rightarrow \ell^+ \ell^-) = 0.1181 \pm 0.0020$.

³ Not independent from other values reported by ADAM 05A.

NODE=M055B;LINKAGE=AB
 NODE=M055B;LINKAGE=J3

NODE=M055B3;LINKAGE=AD

$$\frac{\Gamma(\chi_{c1}(1P) \rightarrow \bar{K}^0 K^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))/\Gamma_{\text{total}}}{\Gamma_{17}/\Gamma \times \Gamma_{135}^{\psi(2S)}/\Gamma^{\psi(2S)}}$$

VALUE (units 10^{-4})

DOCUMENT ID

TECN

COMMENT

6.8±0.5 OUR FIT**7.2±0.6 OUR AVERAGE**

7.3±0.5±0.5

¹ ATHAR

07

CLEO

 $\psi(2S) \rightarrow \gamma K_S^0 K^+ \pi^-$

7.0±0.5±0.9

² ABLIKIM

06R

BES2

 $\psi(2S) \rightarrow \gamma \chi_{c1}$

¹ Calculated by us. The value of $B(\chi_{c1} \rightarrow K_S^0 K^+ \pi^- + \text{c.c.})$ reported by ATHAR 07 was derived using $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54)\%$.

² Calculated by us. ABLIKIM 06R reports $B(\chi_{c1} \rightarrow K_S^0 K^+ \pi^-) = (4.0 \pm 0.3 \pm 0.5) \times 10^{-3}$. We use $B(\psi(2S) \rightarrow \gamma \chi_{c1}) = (8.7 \pm 0.4) \times 10^{-2}$.

NODE=M055B16
NODE=M055B16

NODE=M055B16;LINKAGE=AT

NODE=M055B16;LINKAGE=AB

$$\frac{\Gamma(\chi_{c1}(1P) \rightarrow \bar{K}^0 K^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))/\Gamma_{\text{total}}}{\Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-) \Gamma_{17}/\Gamma \times \Gamma_{135}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10^{-4})

DOCUMENT ID

TECN

COMMENT

19.7±1.6 OUR FIT**13.2±2.4±3.2**¹ BAI

99B

BES

 $\psi(2S) \rightarrow \gamma K_S^0 K^+ \pi^-$

¹ Calculated by us. The value of $B(\chi_{c1} \rightarrow K_S^0 K^+ \pi^-)$ reported by BAI 99B was derived using $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (8.7 \pm 0.8)\%$ and $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = (32.4 \pm 2.6)\%$ [BAI 98D].

NODE=M055B17
NODE=M055B17

NODE=M055B17;LINKAGE=BA

$$\frac{\Gamma(\chi_{c1}(1P) \rightarrow K^+ K^- K^+ K^-)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))/\Gamma_{\text{total}}}{\Gamma_{36}/\Gamma \times \Gamma_{135}^{\psi(2S)}/\Gamma^{\psi(2S)}}$$

VALUE (units 10^{-4})

EVTS

DOCUMENT ID

TECN

COMMENT

0.52±0.11 OUR FIT**0.61±0.11±0.08**

54

¹ ABLIKIM

06T

BES2

 $\psi(2S) \rightarrow \gamma K^+ K^+ K^- K^-$

¹ Calculated by us. The value of $B(\chi_{c1} \rightarrow 2K^+ 2K^-)$ reported by ABLIKIM 06T was derived using $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (8.7 \pm 0.8)\%$.

NODE=M055B14
NODE=M055B14

NODE=M055B14;LINKAGE=AB

$$\frac{\Gamma(\chi_{c1}(1P) \rightarrow K^+ K^- K^+ K^-)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))/\Gamma_{\text{total}}}{\Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-) \Gamma_{36}/\Gamma \times \Gamma_{135}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10^{-4})

DOCUMENT ID

TECN

COMMENT

1.52±0.31 OUR FIT**1.13±0.40±0.29**¹ BAI

99B

BES

 $\psi(2S) \rightarrow \gamma K^+ K^+ K^- K^-$

¹ Calculated by us. The value of $B(\chi_{c1} \rightarrow 2K^+ 2K^-)$ reported by BAI 99B was derived using $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (8.7 \pm 0.8)\%$ and $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = (32.4 \pm 2.6)\%$ [BAI 98D].

NODE=M055B15
NODE=M055B15

NODE=M055B15;LINKAGE=BA

$$\frac{\Gamma(\chi_{c1}(1P) \rightarrow p \bar{p})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))/\Gamma_{\text{total}}}{\Gamma_{45}/\Gamma \times \Gamma_{135}^{\psi(2S)}/\Gamma^{\psi(2S)}}$$

VALUE (units 10^{-6})

EVTS

DOCUMENT ID

TECN

COMMENT

7.4±0.4 OUR FIT**7.8±0.6 OUR AVERAGE**

Error includes scale factor of 1.4. See the ideogram below.

7.9±0.4±0.3

453

ABLIKIM

13v

BES3

 $\psi(2S) \rightarrow \gamma p \bar{p}$

8.2±0.7±0.4

141 ± 13

¹ NAIK

08

CLEO

 $\psi(2S) \rightarrow \gamma p \bar{p}$ 4.8^{+1.4}_{-1.3}±0.618.2^{+5.5}_{-4.9}

BAI

04F

BES

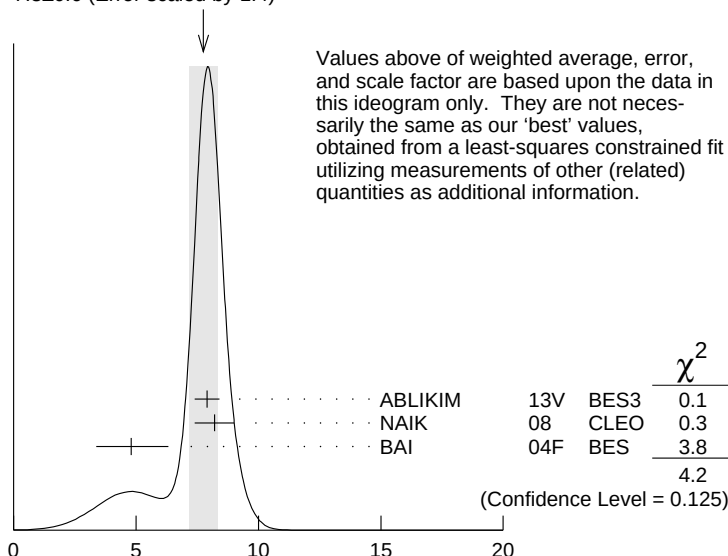
 $\psi(2S) \rightarrow \gamma \chi_{c1}(1P) \rightarrow \gamma \bar{p} p$

¹ Calculated by us. NAIK 08 reports $B(\chi_{c1} \rightarrow p \bar{p}) = (9.0 \pm 0.8 \pm 0.4 \pm 0.5) \times 10^{-5}$ using $B(\psi(2S) \rightarrow \gamma \chi_{c1}) = (9.07 \pm 0.11 \pm 0.54)\%$.

NODE=M055B6
NODE=M055B6

NODE=M055B6;LINKAGE=NA

WEIGHTED AVERAGE
7.8±0.6 (Error scaled by 1.4)



$$\Gamma(\chi_{c1}(1P) \rightarrow p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))/\Gamma_{\text{total}} \text{ (units } 10^{-6})$$

MULTIPOLE AMPLITUDES IN $\chi_{c1}(1P) \rightarrow \gamma J/\psi(1S)$

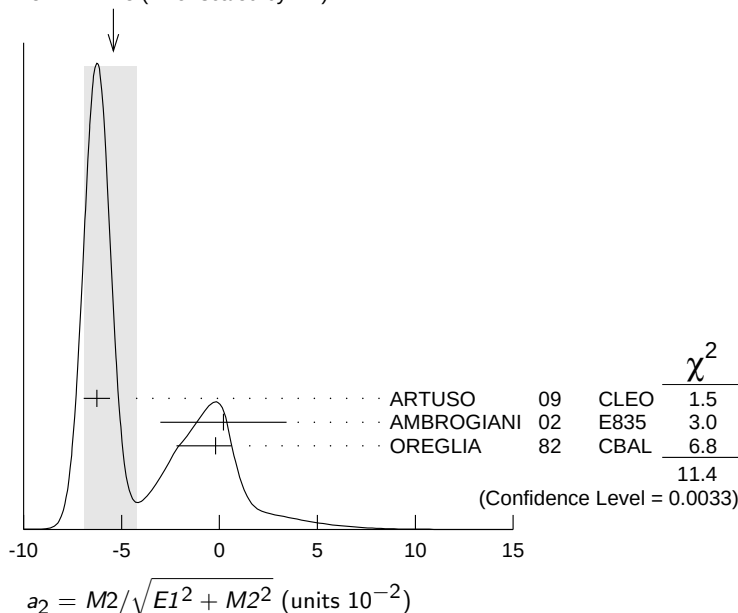
NODE=M055240

$a_2 = M_2/\sqrt{E_1^2 + M_2^2}$ Magnetic quadrupole fractional transition amplitude

NODE=M055A1
NODE=M055A1

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
-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

NODE=M055QB2
NODE=M055QB2

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
2.9 ±0.8				OUR AVERAGE
2.76±0.73±0.23	39k	ARTUSO	09	CLEO $\psi(2S) \rightarrow \gamma\gamma\ell^+\ell^-$
7.7 ± 5.0 -4.5	921	OREGLIA	82	CBAL $\psi(2S) \rightarrow \gamma\gamma\ell^+\ell^-$

MULTIPOLE AMPLITUDE RATIOS IN RADIATIVE DECAYS

$$\psi(2S) \rightarrow \gamma \chi_{c1}(1S) \text{ and } \chi_{c1} \rightarrow \gamma J/\psi(1S)$$

a_2/b_2 Magnetic quadrupole transition amplitude ratio

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
$-2.27^{+0.57}_{-0.99}$	39k	¹ ARTUSO	09	CLEO $\psi(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$

¹ Statistical and systematic errors combined. Not independent of $a_2(\chi_{c1})$ and $b_2(\chi_{c1})$ values from ARTUSO 09.

NODE=M055260

NODE=M055QAR
NODE=M055QAR

NODE=M055QAR;LINKAGE=AR

$\chi_{c1}(1P)$ REFERENCES

NODE=M055

ABLIKIM	15I	PR D91 092006	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=56774
ABLIKIM	15M	PR D91 112008	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=56778
ABLIKIM	14J	PR D89 074030	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=55901
ABLIKIM	13B	PR D87 012002	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=54877
ABLIKIM	13D	PR D87 012007	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=54879
ABLIKIM	13H	PR D87 032007	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=54953
ABLIKIM	13V	PR D88 112001	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=55583
ABLIKIM	12I	PR D86 052004	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=54736
ABLIKIM	12J	PR D86 052011	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=54737
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

NODE=M144M

NODE=M144M

$h_c(1P)$ MASS

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
3525.38±0.11 OUR AVERAGE				
3525.31±0.11±0.14	832	¹ ABLIKIM	12N BES3	$\psi(2S) \rightarrow \pi^0 \gamma$ hadrons
3525.40±0.13±0.18	3679	ABLIKIM	10B BES3	$\psi(2S) \rightarrow \pi^0 \gamma \eta_c$
3525.20±0.18±0.12	1282	² DOBBS	08A CLEO	$\psi(2S) \rightarrow \pi^0 \eta_c \gamma$
3525.8 ±0.2 ±0.2	13	ANDREOTTI	05B E835	$\bar{p}p \rightarrow \eta_c \gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
3525.6 ±0.5	92 ⁺²³ ₋₂₂	ADAMS	09 CLEO	$\psi(2S) \rightarrow 2(\pi^+ \pi^- \pi^0)$
3524.4 ±0.6 ±0.4	168 ± 40	³ ROSNER	05 CLEO	$\psi(2S) \rightarrow \pi^0 \eta_c \gamma$
3527 ±8	42	ANTONIAZZI	94 E705	300 $\pi^\pm$, $p\text{Li} \rightarrow J/\psi \pi^0 X$
3526.28±0.18±0.19	59	⁴ ARMSTRONG	92D E760	$\bar{p}p \rightarrow J/\psi \pi^0$
3525.4 ±0.8 ±0.4	5	BAGLIN	86 SPEC	$\bar{p}p \rightarrow J/\psi X$

¹With floating width.

²Combination of exclusive and inclusive analyses for the reaction $\psi(2S) \rightarrow \pi^0 h_c \rightarrow \pi^0 \eta_c \gamma$. This result is the average of DOBBS 08A and ROSNER 05.

³Superseded by DOBBS 08A.

⁴Mass central value and systematic error recalculated by us according to Eq.(16) in ARMSTRONG 93B, using the value for the $\psi(2S)$ mass from AULCHENKO 03.

NODE=M144M;LINKAGE=AB

NODE=M144M;LINKAGE=DO

NODE=M144M;LINKAGE=RO

NODE=M144M;LINKAGE=NW

$h_c(1P)$ WIDTH

VALUE (MeV)	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
0.70±0.28±0.22					
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 1.44	90	3679	² ABLIKIM	10B BES3	$\psi(2S) \rightarrow \pi^0 \gamma \eta_c$
< 1		13	ANDREOTTI	05B E835	$\bar{p}p \rightarrow \eta_c \gamma$
< 1.1	90	59	ARMSTRONG	92D E760	$\bar{p}p \rightarrow J/\psi \pi^0$

¹With floating mass.

²The central value is $\Gamma = 0.73 \pm 0.45 \pm 0.28$ MeV.

NODE=M144W

NODE=M144W

NODE=M144W;LINKAGE=AL

NODE=M144W;LINKAGE=AB

$h_c(1P)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 $J/\psi(1S)\pi^0$		
Γ_2 $J/\psi(1S)\pi\pi$	not seen	
Γ_3 $p\bar{p}$	< 1.5 $\times 10^{-4}$	90%
Γ_4 $\pi^+ \pi^- \pi^0$	< 2.2 $\times 10^{-3}$	
Γ_5 $2\pi^+ 2\pi^- \pi^0$	($2.2^{+0.8}_{-0.7}$) %	
Γ_6 $3\pi^+ 3\pi^- \pi^0$	< 2.9 %	

Radiative decays

Γ_7 $\gamma \eta$	(4.7 ± 2.1) $\times 10^{-4}$
Γ_8 $\gamma \eta'(958)$	(1.5 ± 0.4) $\times 10^{-3}$
Γ_9 $\gamma \eta_c(1S)$	(51 ± 6) %

DESIG=1

DESIG=2;OUR EST;→ UNCHECKED ←

DESIG=3

DESIG=5

DESIG=6

DESIG=7

NODE=M144;CLUMP=R

DESIG=9

DESIG=8

DESIG=4

NODE=M144215;NODE=M144

$h_c(1P)$ PARTIAL WIDTHS

NODE=M144220

$h_c(1P) \Gamma(i)\Gamma(\bar{p}p)/\Gamma(\text{total})$

NODE=M144223

$\Gamma(\gamma \eta_c(1S)) \times \Gamma(p\bar{p})/\Gamma_{\text{total}}$					$\Gamma_9 \Gamma_3/\Gamma$
VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
12.0±4.5	13	¹ ANDREOTTI	05B E835	$\bar{p}p \rightarrow \eta_c \gamma$	
¹ Assuming $\Gamma = 1$ MeV.					

NODE=M144G1

NODE=M144G1

NODE=M144G1;LINKAGE=AN

$h_c(1P)$ BRANCHING RATIOS

NODE=M144225

$$\Gamma(J/\psi(1S)\pi\pi)/\Gamma(J/\psi(1S)\pi^0)$$

 Γ_2/Γ_1

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.18	90	ARMSTRONG 92D	E760	$\bar{p}p \rightarrow J/\psi\pi^0$

NODE=M144R1
NODE=M144R1

$$\Gamma(\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$$

 Γ_4/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
<2.2	¹ ADAMS 09	CLEO	$\psi(2S) \rightarrow \pi^0\gamma\eta_c$

NODE=M144R01
NODE=M144R01

¹ 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_5/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
$2.2^{+0.8}_{-0.6} \pm 0.3$	92	¹ ADAMS 09	CLEO	$\psi(2S) \rightarrow \pi^0\gamma\eta_c$

NODE=M144R02
NODE=M144R02

¹ 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_6/Γ

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
<2.9	¹ ADAMS 09	CLEO	$\psi(2S) \rightarrow \pi^0\gamma\eta_c$

NODE=M144R03
NODE=M144R03

¹ 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

RADIATIVE DECAYS

NODE=M144230

$$\Gamma(\gamma\eta)/\Gamma_{\text{total}}$$

 Γ_7/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$4.7 \pm 1.5 \pm 1.4$	18	ABLIKIM 16I	BES3	$\psi(2S) \rightarrow \pi^0\gamma\eta$

NODE=M144R06
NODE=M144R06

$$\Gamma(\gamma\eta'(958))/\Gamma_{\text{total}}$$

 Γ_8/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.52 \pm 0.27 \pm 0.29$	44	ABLIKIM 16I	BES3	$\psi(2S) \rightarrow \pi^0\gamma\eta'(958)$

NODE=M144R00
NODE=M144R00

$$\Gamma(\gamma\eta_c(1S))/\Gamma_{\text{total}}$$

 Γ_9/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
51 ± 6 OUR AVERAGE				

NODE=M144R2
NODE=M144R2

$54.3 \pm 6.7 \pm 5.2$	3679	ABLIKIM 10B	BES3	$\psi(2S) \rightarrow \pi^0\gamma\eta_c$
$48 \pm 6 \pm 7$		¹ DOBBS 08A	CLEO	$\psi(2S) \rightarrow \pi^0\eta_c\gamma$

OCCUR=2

• • • We do not use the following data for averages, fits, limits, etc. • • •

$48 \pm 6 \pm 7$	1282	² DOBBS 08A	CLEO	$\psi(2S) \rightarrow \pi^0\eta_c\gamma$
$46 \pm 12 \pm 7$	168	³ ROSNER 05	CLEO	$\psi(2S) \rightarrow \pi^0\eta_c\gamma$

¹ Average of DOBBS 08A and ROSNER 05. DOBBS 08A reports $[\Gamma(h_c(1P) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \pi^0 h_c(1P))]$
 $= (4.16 \pm 0.30 \pm 0.37) \times 10^{-4}$ which we divide by
our best value $B(\psi(2S) \rightarrow \pi^0 h_c(1P)) = (8.6 \pm 1.3) \times 10^{-4}$. Our first error is their
experiment's error and our second error is the systematic error from using our best value.

NODE=M144R2;LINKAGE=DB

² DOBBS 08A reports $[\Gamma(h_c(1P) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \pi^0 h_c(1P))]$
 $= (4.19 \pm 0.32 \pm 0.45) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow \pi^0 h_c(1P))$
 $= (8.6 \pm 1.3) \times 10^{-4}$. Our first error is their experiment's error and our second error is
the systematic error from using our best value.

NODE=M144R2;LINKAGE=DO

³ ROSNER 05 reports $[\Gamma(h_c(1P) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \pi^0 h_c(1P))]$
 $= (4.0 \pm 0.8 \pm 0.7) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow \pi^0 h_c(1P))$
 $= (8.6 \pm 1.3) \times 10^{-4}$. Our first error is their experiment's error and our second error is
the systematic error from using our best value.

NODE=M144R2;LINKAGE=RO

CROSS-PARTICLE BRANCHING RATIOS

NODE=M144235

$$\Gamma(h_c(1P) \rightarrow p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}}$$

 $\Gamma_3/\Gamma \times \Gamma_{15}^{\psi(2S)}/\Gamma_{\psi(2S)}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<1.3 \times 10^{-7}$	90	ABLIKIM 13V	BES3	$\psi(2S) \rightarrow \gamma p\bar{p}$

NODE=M144R05
NODE=M144R05

$$\Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S)) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P)) / \Gamma_{\text{total}}$$

$$\Gamma_9 / \Gamma \times \Gamma_{15}^{\psi(2S)} / \Gamma_{\psi(2S)}$$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
4.3 ± 0.4 OUR AVERAGE				
4.58 ± 0.40 ± 0.50	3679	¹ ABLIKIM	10B BES3	$\psi(2S) \rightarrow \pi^0 \gamma X$
4.16 ± 0.30 ± 0.37	1430	² DOBBS	08A CLEO	$\psi(2S) \rightarrow \pi^0 \gamma \eta_c$

¹ Not independent of other branching fractions in ABLIKIM 10B.

² Not independent of other branching fractions in DOBBS 08A.

NODE=M144R04
NODE=M144R04

NODE=M144R04;LINKAGE=AB
NODE=M144R04;LINKAGE=DO

$h_c(1P)$ REFERENCES

ABLIKIM	16I	PRL 116 251802	M. Ablikim <i>et al.</i>	(BES III Collab.)
ABLIKIM	13V	PR D88 112001	M. Ablikim <i>et al.</i>	(BES III Collab.)
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+)

NODE=M144

REFID=57450
REFID=55583
REFID=54741
REFID=53348
REFID=53103
REFID=52579
REFID=50768
REFID=50812
REFID=49579
REFID=44074
REFID=43307
REFID=43174
REFID=43180

$\chi_{c2}(1P)$

$$J^G(J^{PC}) = 0^+(2^{++})$$

See the Review on " $\psi(2S)$ and χ_c branching ratios" before the $\chi_{c0}(1P)$ Listings.

NODE=M057

NODE=M057

$\chi_{c2}(1P)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
3556.20 ± 0.09 OUR AVERAGE				
3555.3 ± 0.6 ± 2.2	2.5k	UEHARA	08 BELL	$\gamma\gamma \rightarrow \text{hadrons}$
3555.70 ± 0.59 ± 0.39		ABLIKIM	05G BES2	$\psi(2S) \rightarrow \gamma \chi_{c2}$
3556.173 ± 0.123 ± 0.020		ANDREOTTI	05A E835	$p\bar{p} \rightarrow e^+ e^- \gamma$
3559.9 ± 2.9		EISENSTEIN	01 CLE2	$e^+ e^- \rightarrow e^+ e^- \chi_{c2}$
3556.4 ± 0.7		BAI	99B BES	$\psi(2S) \rightarrow \gamma X$
3556.22 ± 0.131 ± 0.020	585	¹ ARMSTRONG	92 E760	$\bar{p}p \rightarrow e^+ e^- \gamma$
3556.9 ± 0.4 ± 0.5	50	BAGLIN	86B SPEC	$\bar{p}p \rightarrow e^+ e^- X$
3557.8 ± 0.2 ± 4		² GAISER	86 CBAL	$\psi(2S) \rightarrow \gamma X$
3553.4 ± 2.2	66	³ LEMOIGNE	82 GOLI	$185 \pi^- \text{Be} \rightarrow \gamma \mu^+ \mu^- A$
3555.9 ± 0.7		⁴ OREGLIA	82 CBAL	$e^+ e^- \rightarrow J/\psi 2\gamma$
3557 ± 1.5	69	⁵ HIMEL	80 MRK2	$e^+ e^- \rightarrow J/\psi 2\gamma$
3551 ± 11	15	BRANDELIK	79B DASP	$e^+ e^- \rightarrow J/\psi 2\gamma$
3553 ± 4		⁵ BARTEL	78B CNTR	$e^+ e^- \rightarrow J/\psi 2\gamma$
3553 ± 4 ± 4		^{5,6} TANENBAUM	78 MRK1	$e^+ e^-$
3563 ± 7	360	⁵ BIDDICK	77 CNTR	$e^+ e^- \rightarrow \gamma X$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
3555.4 ± 1.3	53	UEHARA	13 BELL	$\gamma\gamma \rightarrow K_S^0 K_S^0$
3543 ± 10	4	WHITAKER	76 MRK1	$e^+ e^- \rightarrow J/\psi 2\gamma$

¹ 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

NODE=M057W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1.93 ±0.11 OUR FIT				
1.95 ±0.13 OUR AVERAGE				
1.915±0.188±0.013		ANDREOTTI 05A	E835	$p\bar{p} \rightarrow e^+e^-\gamma$
1.96 ±0.17 ±0.07	585	¹ ARMSTRONG 92	E760	$\bar{p}p \rightarrow e^+e^-\gamma$
2.6 $\begin{smallmatrix} +1.4 \\ -1.0 \end{smallmatrix}$	50	BAGLIN	86B SPEC	$\bar{p}p \rightarrow e^+e^-X$
2.8 $\begin{smallmatrix} +2.1 \\ -2.0 \end{smallmatrix}$		² GAISER 86	CBAL	$\psi(2S) \rightarrow \gamma X$

¹ Recalculated by ANDREOTTI 05A.² Errors correspond to 90% confidence level; authors give only width range.

NODE=M057W

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 $2(\pi^+\pi^-)$	(1.07±0.10) %	
Γ_2 $\rho\rho$		
Γ_3 $\pi^+\pi^-\pi^0\pi^0$	(1.91±0.25) %	
Γ_4 $\rho^+\pi^-\pi^0 + \text{c.c.}$	(2.3 ±0.4) %	
Γ_5 $4\pi^0$	(1.16±0.16) $\times 10^{-3}$	
Γ_6 $K^+K^-\pi^0\pi^0$	(2.2 ±0.4) $\times 10^{-3}$	
Γ_7 $K^+\pi^-\bar{K}^0\pi^0 + \text{c.c.}$	(1.44±0.21) %	
Γ_8 $\rho^-K^+\bar{K}^0 + \text{c.c.}$	(4.3 ±1.3) $\times 10^{-3}$	
Γ_9 $K^*(892)^0 K^-\pi^+ \rightarrow K^-\pi^+K^0\pi^0 + \text{c.c.}$	(3.1 ±0.8) $\times 10^{-3}$	
Γ_{10} $K^*(892)^0 \bar{K}^0\pi^0 \rightarrow K^+\pi^-\bar{K}^0\pi^0 + \text{c.c.}$	(4.0 ±0.9) $\times 10^{-3}$	
Γ_{11} $K^*(892)^- K^+\pi^0 \rightarrow K^+\pi^-\bar{K}^0\pi^0 + \text{c.c.}$	(3.9 ±0.9) $\times 10^{-3}$	
Γ_{12} $K^*(892)^+ \bar{K}^0\pi^- \rightarrow K^+\pi^-\bar{K}^0\pi^0 + \text{c.c.}$	(3.1 ±0.8) $\times 10^{-3}$	
Γ_{13} $K^+K^-\eta\pi^0$	(1.3 ±0.5) $\times 10^{-3}$	
Γ_{14} $K^+K^-\pi^+\pi^-$	(8.9 ±1.0) $\times 10^{-3}$	
Γ_{15} $K^+K^-\pi^+\pi^-\pi^0$	(1.17±0.13) %	
Γ_{16} $K_S^0 K^\pm \pi^\mp \pi^+ \pi^-$	(7.3 ±0.8) $\times 10^{-3}$	
Γ_{17} $K^+\bar{K}^*(892)^0 \pi^- + \text{c.c.}$	(2.2 ±1.1) $\times 10^{-3}$	
Γ_{18} $K^*(892)^0 \bar{K}^*(892)^0$	(2.4 ±0.5) $\times 10^{-3}$	
Γ_{19} $3(\pi^+\pi^-)$	(8.6 ±1.8) $\times 10^{-3}$	
Γ_{20} $\phi\phi$	(1.12±0.10) $\times 10^{-3}$	
Γ_{21} $\omega\omega$	(8.8 ±1.1) $\times 10^{-4}$	
Γ_{22} $\omega K^+ K^-$	(7.3 ±0.9) $\times 10^{-4}$	
Γ_{23} $\omega\phi$		
Γ_{24} $\pi\pi$	(2.33±0.12) $\times 10^{-3}$	
Γ_{25} $\rho^0\pi^+\pi^-$	(3.8 ±1.6) $\times 10^{-3}$	
Γ_{26} $\pi^+\pi^-\eta$	(5.0 ±1.3) $\times 10^{-4}$	
Γ_{27} $\pi^+\pi^-\eta'$	(5.2 ±1.9) $\times 10^{-4}$	
Γ_{28} $\eta\eta$	(5.7 ±0.5) $\times 10^{-4}$	
Γ_{29} K^+K^-	(1.05±0.07) $\times 10^{-3}$	
Γ_{30} $K_S^0 K_S^0$	(5.5 ±0.4) $\times 10^{-4}$	
Γ_{31} $\bar{K}^0 K^+ \pi^- + \text{c.c.}$	(1.34±0.19) $\times 10^{-3}$	
Γ_{32} $K^+K^-\pi^0$	(3.2 ±0.8) $\times 10^{-4}$	
Γ_{33} $K^+K^-\eta$	< 3.4 $\times 10^{-4}$	90%
Γ_{34} $K^+K^-\eta'(958)$	(1.94±0.34) $\times 10^{-4}$	
Γ_{35} $\eta\eta'$	< 6 $\times 10^{-5}$	90%
Γ_{36} $\eta'\eta'$	< 1.0 $\times 10^{-4}$	90%
Γ_{37} $\pi^+\pi^- K_S^0 K_S^0$	(2.3 ±0.6) $\times 10^{-3}$	
Γ_{38} $K^+K^- K_S^0 K_S^0$	< 4 $\times 10^{-4}$	90%
Γ_{39} $K^+K^- K^+K^-$	(1.73±0.21) $\times 10^{-3}$	

NODE=M057;CLUMP=A

DESIG=3

DESIG=43

DESIG=50

DESIG=51

DESIG=62

DESIG=52

DESIG=54

DESIG=55

DESIG=60

DESIG=56

DESIG=57

DESIG=58

DESIG=59

DESIG=5

DESIG=67

DESIG=78

DESIG=10

DESIG=21

DESIG=4

DESIG=16

DESIG=25

DESIG=79

DESIG=68

DESIG=22

DESIG=9

DESIG=39

DESIG=42

DESIG=14

DESIG=2

DESIG=15

DESIG=17

DESIG=36

DESIG=40

DESIG=82

DESIG=34

DESIG=35

DESIG=29

DESIG=30

DESIG=24

Γ ₄₀	$K^+ K^- \phi$	$(1.48 \pm 0.31) \times 10^{-3}$		DESIG=32
Γ ₄₁	$\bar{K}^0 K^+ \pi^- \phi + \text{c.c.}$	$(4.8 \pm 0.7) \times 10^{-3}$		DESIG=83
Γ ₄₂	$K^+ K^- \pi^0 \phi$	$(2.7 \pm 0.5) \times 10^{-3}$		DESIG=84
Γ ₄₃	$\phi \pi^+ \pi^- \pi^0$	$(9.3 \pm 1.2) \times 10^{-4}$		DESIG=80
Γ ₄₄	$p \bar{p}$	$(7.5 \pm 0.4) \times 10^{-5}$		DESIG=11
Γ ₄₅	$p \bar{p} \pi^0$	$(4.9 \pm 0.4) \times 10^{-4}$		DESIG=37
Γ ₄₆	$p \bar{p} \eta$	$(1.82 \pm 0.26) \times 10^{-4}$		DESIG=41
Γ ₄₇	$p \bar{p} \omega$	$(3.8 \pm 0.5) \times 10^{-4}$		DESIG=61
Γ ₄₈	$p \bar{p} \phi$	$(2.9 \pm 0.9) \times 10^{-5}$		DESIG=66
Γ ₄₉	$p \bar{p} \pi^+ \pi^-$	$(1.32 \pm 0.34) \times 10^{-3}$		DESIG=8
Γ ₅₀	$p \bar{p} \pi^0 \pi^0$	$(8.2 \pm 2.5) \times 10^{-4}$		DESIG=53
Γ ₅₁	$p \bar{p} K^+ K^- (\text{non-resonant})$	$(2.00 \pm 0.34) \times 10^{-4}$		DESIG=63
Γ ₅₂	$p \bar{p} K_S^0 K_S^0$	$< 7.9 \times 10^{-4}$	90%	DESIG=28
Γ ₅₃	$p \bar{n} \pi^-$	$(8.9 \pm 1.0) \times 10^{-4}$		DESIG=31
Γ ₅₄	$\bar{p} n \pi^+$	$(9.3 \pm 0.9) \times 10^{-4}$		DESIG=75
Γ ₅₅	$p \bar{n} \pi^- \pi^0$	$(2.27 \pm 0.19) \times 10^{-3}$		DESIG=76
Γ ₅₆	$\bar{p} n \pi^+ \pi^0$	$(2.21 \pm 0.20) \times 10^{-3}$		DESIG=77
Γ ₅₇	$\Lambda \bar{\Lambda}$	$(1.92 \pm 0.16) \times 10^{-4}$		DESIG=19
Γ ₅₈	$\Lambda \bar{\Lambda} \pi^+ \pi^-$	$(1.31 \pm 0.17) \times 10^{-3}$		DESIG=27
Γ ₅₉	$\Lambda \bar{\Lambda} \pi^+ \pi^- (\text{non-resonant})$	$(6.9 \pm 1.6) \times 10^{-4}$		DESIG=70
Γ ₆₀	$\Sigma(1385)^+ \bar{\Lambda} \pi^- + \text{c.c.}$	$< 4 \times 10^{-4}$	90%	DESIG=71
Γ ₆₁	$\Sigma(1385)^- \bar{\Lambda} \pi^+ + \text{c.c.}$	$< 6 \times 10^{-4}$	90%	DESIG=72
Γ ₆₂	$K^+ \bar{p} \Lambda + \text{c.c.}$	$(8.1 \pm 0.6) \times 10^{-4}$		DESIG=38
Γ ₆₃	$K^+ \bar{p} \Lambda(1520) + \text{c.c.}$	$(2.9 \pm 0.7) \times 10^{-4}$		DESIG=64
Γ ₆₄	$\Lambda(1520) \bar{\Lambda}(1520)$	$(4.8 \pm 1.5) \times 10^{-4}$		DESIG=65
Γ ₆₅	$\Sigma^0 \bar{\Sigma}^0$	$< 6 \times 10^{-5}$	90%	DESIG=47
Γ ₆₆	$\Sigma^+ \bar{\Sigma}^-$	$< 7 \times 10^{-5}$	90%	DESIG=48
Γ ₆₇	$\Sigma(1385)^+ \bar{\Sigma}(1385)^-$	$< 1.6 \times 10^{-4}$	90%	DESIG=73
Γ ₆₈	$\Sigma(1385)^- \bar{\Sigma}(1385)^+$	$< 8 \times 10^{-5}$	90%	DESIG=74
Γ ₆₉	$K^- \Lambda \Xi^+ + \text{c.c.}$	$(1.84 \pm 0.34) \times 10^{-4}$		DESIG=85
Γ ₇₀	$\Xi^0 \bar{\Xi}^0$	$< 1.1 \times 10^{-4}$	90%	DESIG=49
Γ ₇₁	$\Xi^- \bar{\Xi}^+$	$(1.48 \pm 0.33) \times 10^{-4}$		DESIG=26
Γ ₇₂	$J/\psi(1S) \pi^+ \pi^- \pi^0$	$< 1.5 \%$	90%	DESIG=12
Γ ₇₃	$\pi^0 \eta_c$	$< 3.2 \times 10^{-3}$	90%	DESIG=81
Γ ₇₄	$\eta_c(1S) \pi^+ \pi^-$	$< 5.4 \times 10^{-3}$	90%	DESIG=69

Radiative decays

Γ ₇₅	$\gamma J/\psi(1S)$	$(19.2 \pm 0.7) \%$		NODE=M057;CLUMP=B DESIG=6
Γ ₇₆	$\gamma \rho^0$	$< 2.0 \times 10^{-5}$	90%	DESIG=44
Γ ₇₇	$\gamma \omega$	$< 6 \times 10^{-6}$	90%	DESIG=45
Γ ₇₈	$\gamma \phi$	$< 8 \times 10^{-6}$	90%	DESIG=46
Γ ₇₉	$\gamma \gamma$	$(2.74 \pm 0.14) \times 10^{-4}$		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 239 measurements to determine 49 parameters. The overall fit has a $\chi^2 = 342.4$ for 190 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta p_i \delta p_j \rangle / (\delta p_i \delta p_j)$, in percent, from the fit to parameters p_i , including the branching fractions, $x_i \equiv \Gamma_i / \Gamma_{\text{total}}$.

x_{14}	13									
x_{17}	3	21								
x_{18}	8	7	1							
x_{20}	14	12	3	7						
x_{24}	19	16	3	10	24					
x_{25}	19	3	1	2	3	4				
x_{28}	11	9	2	6	14	27	2			
x_{29}	14	12	3	7	17	33	3	19		
x_{30}	13	11	2	6	15	28	3	17	20	
x_{31}	7	6	1	4	8	16	1	9	11	10
x_{39}	9	8	2	5	10	18	2	10	13	11
x_{44}	16	13	3	8	16	24	4	14	17	15
x_{57}	11	9	2	6	14	28	2	16	20	17
x_{75}	24	21	4	12	29	55	5	32	40	34
x_{79}	-8	-6	-1	-3	1	19	-2	13	13	10
Γ	-28	-23	-5	-14	-28	-43	-6	-25	-32	-28
	x_1	x_{14}	x_{17}	x_{18}	x_{20}	x_{24}	x_{25}	x_{28}	x_{29}	x_{30}

x_{39}	6									
x_{44}	8	10								
x_{57}	9	11	14							
x_{75}	19	22	19	33						
x_{79}	6	4	26	13	30					
Γ	-15	-19	-54	-25	-61	-52				
	x_{31}	x_{39}	x_{44}	x_{57}	x_{75}	x_{79}				

$\chi_{c2}(1P)$ PARTIAL WIDTHS

$$\chi_{c2}(1P) \Gamma(i) \Gamma(\gamma J/\psi(1S)) / \Gamma(\text{total})$$

NODE=M057220

NODE=M057223

$$\Gamma(p\bar{p}) \times \Gamma(\gamma J/\psi(1S)) / \Gamma_{\text{total}} \quad \Gamma_{44}\Gamma_{75}/\Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT

27.9±1.3 OUR FIT**27.5±1.5 OUR AVERAGE**

27.0±1.5±1.1	¹ ANDREOTTI	05A	E835	$p\bar{p} \rightarrow e^+e^-\gamma$
27.7±1.5±2.0	^{1,2} ARMSTRONG	92	E760	$p\bar{p} \rightarrow e^+e^-\gamma$
36 ±8	¹ BAGLIN	86B	SPEC	$p\bar{p} \rightarrow e^+e^-X$

¹ Calculated by us using $B(J/\psi(1S) \rightarrow e^+e^-) = 0.0593 \pm 0.0010$.

² Recalculated by ANDREOTTI 05A.

NODE=M057G1
NODE=M057G1NODE=M057G;LINKAGE=7A
NODE=M057G;LINKAGE=AN

$$\Gamma(\gamma\gamma) \times \Gamma(\gamma J/\psi(1S)) / \Gamma_{\text{total}} \quad \Gamma_{79}\Gamma_{75}/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

102± 5 OUR FIT**117± 10 OUR AVERAGE**

111± 12± 9	147 ± 15	¹ DOBBS	06	CLE3	$10.4 e^+e^- \rightarrow e^+e^-\chi_{c2}$
114± 11± 9	136 ± 13.3	^{1,2} ABE	02T	BELL	$e^+e^- \rightarrow e^+e^-\chi_{c2}$
139± 55± 21		^{1,3} ACCIARRI	99E	L3	$e^+e^- \rightarrow e^+e^-\chi_{c2}$
242± 65± 51		^{1,4} ACKER.,K...	98	OPAL	$e^+e^- \rightarrow e^+e^-\chi_{c2}$
150± 42± 36		^{1,5} DOMINICK	94	CLE2	$e^+e^- \rightarrow e^+e^-\chi_{c2}$
470±240±120		^{1,6} BAUER	93	TPC	$e^+e^- \rightarrow e^+e^-\chi_{c2}$

NODE=M057G2
NODE=M057G2

¹ Calculated by us using $B(J/\psi \rightarrow \ell^+ \ell^-) = 0.1187 \pm 0.0008$.

² All systematic errors added in quadrature.

³ The value for $\Gamma(\chi_{c2} \rightarrow \gamma\gamma)$ reported in ACCIARRI 99E is derived using $B(\chi_{c2} \rightarrow \gamma J/\psi(1S)) \times B(J/\psi(1S) \rightarrow \ell^+ \ell^-) = 0.0162 \pm 0.0014$.

⁴ The value for $\Gamma(\chi_{c2} \rightarrow \gamma\gamma)$ reported in ACKERSTAFF, K 98 is derived using $B(\chi_{c2} \rightarrow \gamma J/\psi(1S)) = 0.135 \pm 0.011$ and $B(J/\psi(1S) \rightarrow \ell^+ \ell^-) = 0.1203 \pm 0.0038$.

⁵ The value for $\Gamma(\chi_{c2} \rightarrow \gamma\gamma)$ reported in DOMINICK 94 is derived using $B(\chi_{c2} \rightarrow \gamma J/\psi(1S)) = 0.135 \pm 0.011$, $B(J/\psi(1S) \rightarrow e^+ e^-) = 0.0627 \pm 0.0020$, and $B(J/\psi(1S) \rightarrow \mu^+ \mu^-) = 0.0597 \pm 0.0025$.

⁶ The value for $\Gamma(\chi_{c2} \rightarrow \gamma\gamma)$ reported in BAUER 93 is derived using $B(\chi_{c2} \rightarrow \gamma J/\psi(1S)) = 0.135 \pm 0.011$, $B(J/\psi(1S) \rightarrow e^+ e^-) = 0.0627 \pm 0.0020$, and $B(J/\psi(1S) \rightarrow \mu^+ \mu^-) = 0.0597 \pm 0.0025$.

$\chi_{c2}(1P) \Gamma(i) \Gamma(\gamma\gamma) / \Gamma(\text{total})$

NODE=M057G;LINKAGE=LL

NODE=M057G;LINKAGE=GT

NODE=M057G;LINKAGE=J4

NODE=M057G;LINKAGE=J5

NODE=M057G;LINKAGE=J6

NODE=M057G;LINKAGE=J7

NODE=M057224

$\Gamma(2(\pi^+ \pi^-)) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}} \quad \Gamma_1 \Gamma_{79} / \Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

5.7 ± 0.5 OUR FIT

5.2 ± 0.7 OUR AVERAGE

5.01 ± 0.44 ± 0.55	1597 ± 138	UEHARA	08 BELL	$\gamma\gamma \rightarrow \chi_{c2} \rightarrow 2(\pi^+ \pi^-)$

6.4 ± 1.8 ± 0.8		EISENSTEIN	01 CLE2	$e^+ e^- \rightarrow e^+ e^- \chi_{c2}$

NODE=M057G3

NODE=M057G3

$\Gamma(\rho\rho) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}} \quad \Gamma_2 \Gamma_{79} / \Gamma$

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

$\Gamma(K^+ K^- \pi^+ \pi^-) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}} \quad \Gamma_{14} \Gamma_{79} / \Gamma$

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

$\Gamma(K^+ K^- \pi^+ \pi^- \pi^0) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}} \quad \Gamma_{15} \Gamma_{79} / \Gamma$

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

$\Gamma(K^*(892)^0 \bar{K}^*(892)^0) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}} \quad \Gamma_{18} \Gamma_{79} / \Gamma$

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

$\Gamma(\phi\phi) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}} \quad \Gamma_{20} \Gamma_{79} / \Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

0.59 ± 0.05 OUR FIT

0.62 ± 0.07 ± 0.05	89 ± 11	¹ LIU	12B BELL	$\gamma\gamma \rightarrow 2(K^+ K^-)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.58 ± 0.18 ± 0.16	26.5 ± 8.1	UEHARA	08 BELL	$\gamma\gamma \rightarrow \chi_{c2} \rightarrow 2(K^+ K^-)$

¹ Supersedes UEHARA 08. Using $B(\phi \rightarrow K^+ K^-) = (48.9 \pm 0.5)\%$.

NODE=M057G12;LINKAGE=LI

$\Gamma(\omega\omega) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}} \quad \Gamma_{21} \Gamma_{79} / \Gamma$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.64	90	¹ LIU	12B BELL	$\gamma\gamma \rightarrow 2(\pi^+ \pi^- \pi^0)$

¹ Using $B(\omega \rightarrow \pi^+ \pi^- \pi^0) = (89.2 \pm 0.7)\%$.

NODE=M057G03

NODE=M057G03

NODE=M057G03;LINKAGE=LI

$\Gamma(\omega\phi) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}} \quad \Gamma_{23} \Gamma_{79} / \Gamma$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.04	90	¹ LIU	12B BELL	$\gamma\gamma \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$

¹ Using $B(\phi \rightarrow K^+ K^-) = (48.9 \pm 0.5)\%$ and $B(\omega \rightarrow \pi^+ \pi^- \pi^0) = (89.2 \pm 0.7)\%$.

NODE=M057G04

NODE=M057G04

NODE=M057G04;LINKAGE=LI

$$\Gamma(\pi\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{24}\Gamma_{79}/\Gamma$$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT

1.23±0.08 OUR FIT

1.18±0.25 OUR AVERAGE

1.44±0.54±0.47 34 ± 13 ¹ UEHARA 09 BELL 10.6 e⁺e⁻ → e⁺e⁻π⁰π⁰
 1.14±0.21±0.17 54 ± 10 ² NAKAZAWA 05 BELL 10.6 e⁺e⁻ → e⁺e⁻π⁺π⁻

¹ We multiplied the measurement by 3 to convert from π⁰π⁰ to ππ. Interference with the continuum included.
² We have multiplied π⁺π⁻ measurement by 3/2 to obtain ππ.

NODE=M057G4
 NODE=M057G4

NODE=M057G4;LINKAGE=UE

NODE=M057G;LINKAGE=NA

$$\Gamma(\rho^0\pi^+\pi^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{25}\Gamma_{79}/\Gamma$$

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

$$\Gamma(\eta\eta) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{28}\Gamma_{79}/\Gamma$$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT

0.53±0.22±0.09

8 ¹ UEHARA 10A BELL 10.6 e⁺e⁻ → e⁺e⁻ηη

¹ Interference with the continuum not included.

NODE=M057G13
 NODE=M057G13

NODE=M057G13;LINKAGE=UE

$$\Gamma(K^+K^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{29}\Gamma_{79}/\Gamma$$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT

0.56±0.04 OUR FIT

0.44±0.11±0.07 33 ± 8 NAKAZAWA 05 BELL 10.6 e⁺e⁻ → e⁺e⁻K⁺K⁻

NODE=M057G5
 NODE=M057G5

$$\Gamma(K_S^0 K_S^0) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{30}\Gamma_{79}/\Gamma$$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT

0.291±0.025 OUR FIT

0.27 ^{+0.07}_{-0.06} ±0.03 53 ¹ UEHARA 13 BELL γγ → K_S⁰K_S⁰

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.31 ±0.05 ±0.03 38 ± 7 CHEN 07B BELL e⁺e⁻ → e⁺e⁻χ_{c2}

¹ Supersedes CHEN 07B.

NODE=M057G6
 NODE=M057G6

NODE=M057G6;LINKAGE=UE

$$\Gamma(\bar{K}^0 K^+ \pi^- + \text{c.c.}) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{31}\Gamma_{79}/\Gamma$$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT

0.71±0.11 OUR FIT

1.20±0.33±0.13 126 ¹ DEL-AMO-SA..11M BABR γγ → K_S⁰K[±]π[∓]

¹ We have multiplied $\bar{K}K\pi$ by 2/3 to obtain $\bar{K}^0 K^+ \pi^- + \text{c.c.}$

NODE=M057G01
 NODE=M057G01

NODE=M057G01;LINKAGE=DE

$$\Gamma(K^+K^-K^+K^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{39}\Gamma_{79}/\Gamma$$

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

$$\Gamma(\eta_c(1S)\pi^+\pi^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{74}\Gamma_{79}/\Gamma$$

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

0.0107±0.0010 OUR FIT

NODE=M057R2
 NODE=M057R2

$$\Gamma(\rho^0\pi^+\pi^-)/\Gamma(2(\pi^+\pi^-)) \quad \Gamma_{25}/\Gamma_1$$

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

$$\Gamma(\pi^+\pi^-\pi^0\pi^0)/\Gamma_{\text{total}} \quad \Gamma_3/\Gamma$$

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
1.91±0.24±0.07	903.5	¹ HE	08B CLEO	$e^+e^- \rightarrow \gamma h^+ h^- h^0 h^0$

NODE=M057R46
NODE=M057R46

¹ HE 08B reports $1.87 \pm 0.07 \pm 0.22 \pm 0.13$ % from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \pi^+\pi^-\pi^0\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R46;LINKAGE=HE

$$\Gamma(\rho^+\pi^-\pi^0 + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_4/\Gamma$$

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
2.28±0.35±0.08	1031.9	^{1,2} HE	08B CLEO	$e^+e^- \rightarrow \gamma h^+ h^- h^0 h^0$

NODE=M057R47
NODE=M057R47

¹ HE 08B reports $2.23 \pm 0.11 \pm 0.32 \pm 0.16$ % from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \rho^+\pi^-\pi^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R47;LINKAGE=HE

² Calculated by us. We have added the values from HE 08B for $\rho^+\pi^-\pi^0$ and $\rho^-\pi^+\pi^0$ decays assuming uncorrelated statistical and fully correlated systematic uncertainties.

NODE=M057R47;LINKAGE=OC

$$\Gamma(4\pi^0)/\Gamma_{\text{total}} \quad \Gamma_5/\Gamma$$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.16±0.15±0.04	1164	¹ ABLIKIM	11A BES3	$e^+e^- \rightarrow \psi(2S) \rightarrow \gamma\chi_{c2}$

NODE=M057R58
NODE=M057R58

¹ ABLIKIM 11A reports $(1.21 \pm 0.05 \pm 0.16) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow 4\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.74 \pm 0.35) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R58;LINKAGE=AB

$$\Gamma(K^+K^-\pi^0\pi^0)/\Gamma_{\text{total}} \quad \Gamma_6/\Gamma$$

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.22±0.04±0.01	76.9	¹ HE	08B CLEO	$e^+e^- \rightarrow \gamma h^+ h^- h^0 h^0$

NODE=M057R48
NODE=M057R48

¹ HE 08B reports $0.21 \pm 0.03 \pm 0.03 \pm 0.01$ % from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K^+K^-\pi^0\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R48;LINKAGE=HE

$$\Gamma(K^+\pi^-\bar{K}^0\pi^0 + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_7/\Gamma$$

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
1.44±0.20±0.05	211.6	¹ HE	08B CLEO	$e^+e^- \rightarrow \gamma h^+ h^- h^0 h^0$

NODE=M057R50
NODE=M057R50

¹ HE 08B reports $1.41 \pm 0.11 \pm 0.16 \pm 0.10$ % from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K^+\pi^-\bar{K}^0\pi^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R50;LINKAGE=HE

$$\Gamma(\rho^-K^+\bar{K}^0 + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_8/\Gamma$$

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.43±0.13±0.01	62.9	¹ HE	08B CLEO	$e^+e^- \rightarrow \gamma h^+ h^- h^0 h^0$

NODE=M057R51
NODE=M057R51

¹ HE 08B reports $0.42 \pm 0.11 \pm 0.06 \pm 0.03$ % from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \rho^-K^+\bar{K}^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=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
0.31±0.08±0.01	38.7	¹ HE	08B CLEO	$e^+e^- \rightarrow \gamma h^+ h^- h^0 h^0$

NODE=M057R57
NODE=M057R57

¹ HE 08B reports $0.30 \pm 0.07 \pm 0.04 \pm 0.02$ % from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K^*(892)^0 K^- \pi^+ \rightarrow K^- \pi^+ K^0 \pi^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R57;LINKAGE=HE

$$\Gamma(K^*(892)^0 \bar{K}^0 \pi^0 \rightarrow K^+ \pi^- \bar{K}^0 \pi^0 + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_{10}/\Gamma$$

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.40±0.09±0.01	63.0	¹ HE	08B CLEO	$e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$

NODE=M057R52
NODE=M057R52

¹ HE 08B reports $0.39 \pm 0.07 \pm 0.05 \pm 0.03$ % from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K^*(892)^0 \bar{K}^0 \pi^0 \rightarrow K^+ \pi^- \bar{K}^0 \pi^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R52;LINKAGE=HE

$$\Gamma(K^*(892)^- K^+ \pi^0 \rightarrow K^+ \pi^- \bar{K}^0 \pi^0 + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_{11}/\Gamma$$

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.39±0.08±0.01	51.1	¹ HE	08B CLEO	$e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$

NODE=M057R53
NODE=M057R53

¹ HE 08B reports $0.38 \pm 0.07 \pm 0.04 \pm 0.03$ % from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K^*(892)^- K^+ \pi^0 \rightarrow K^+ \pi^- \bar{K}^0 \pi^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R53;LINKAGE=HE

$$\Gamma(K^*(892)^+ \bar{K}^0 \pi^- \rightarrow K^+ \pi^- \bar{K}^0 \pi^0 + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_{12}/\Gamma$$

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.31±0.08±0.01	39.3	¹ HE	08B CLEO	$e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$

NODE=M057R54
NODE=M057R54

¹ HE 08B reports $0.30 \pm 0.07 \pm 0.04 \pm 0.02$ % from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K^*(892)^+ \bar{K}^0 \pi^- \rightarrow K^+ \pi^- \bar{K}^0 \pi^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R54;LINKAGE=HE

$$\Gamma(K^+ K^- \eta \pi^0)/\Gamma_{\text{total}} \quad \Gamma_{13}/\Gamma$$

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.133±0.046±0.005	22.9	¹ HE	08B CLEO	$e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$

NODE=M057R55
NODE=M057R55

¹ HE 08B reports $0.13 \pm 0.04 \pm 0.02 \pm 0.01$ % from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K^+ K^- \eta \pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R55;LINKAGE=HE

$$\Gamma(K^+ K^- \pi^+ \pi^-)/\Gamma_{\text{total}} \quad \Gamma_{14}/\Gamma$$

VALUE (units 10^{-3})	DOCUMENT ID
8.9±1.0 OUR FIT	

NODE=M057R3
NODE=M057R3

$$\Gamma(K^+ K^- \pi^+ \pi^- \pi^0)/\Gamma_{\text{total}} \quad \Gamma_{15}/\Gamma$$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
11.69±0.13±1.31	11k	¹ ABLIKIM	13B BES3	$e^+ e^- \rightarrow \psi(2S) \rightarrow \gamma \chi_{c2}$

NODE=M057R00
NODE=M057R00

¹ Using 1.06×10^8 $\psi(2S)$ mesons and $B(\psi(2S) \rightarrow \chi_{c2} \gamma) = (8.72 \pm 0.34)\%$.

NODE=M057R00;LINKAGE=A

$$\Gamma(K_S^0 K^\pm \pi^\mp \pi^+ \pi^-)/\Gamma_{\text{total}} \quad \Gamma_{16}/\Gamma$$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
7.30±0.11±0.75	4.5k	¹ ABLIKIM	13B BES3	$e^+ e^- \rightarrow \psi(2S) \rightarrow \gamma \chi_{c2}$

NODE=M057R73
NODE=M057R73

¹ Using 1.06×10^8 $\psi(2S)$ mesons and $B(\psi(2S) \rightarrow \chi_{c2} \gamma) = (8.72 \pm 0.34)\%$.

NODE=M057R73;LINKAGE=A

$$\Gamma(K^+ \bar{K}^*(892)^0 \pi^- + \text{c.c.})/\Gamma(K^+ K^- \pi^+ \pi^-) \quad \Gamma_{17}/\Gamma_{14}$$

VALUE	DOCUMENT ID	TECN	COMMENT
0.25±0.13 OUR FIT			
0.25±0.13	TANENBAUM 78	MRK1	$\psi(2S) \rightarrow \gamma \chi_{c2}$

NODE=M057R39
NODE=M057R39

$$\Gamma(K^+ \bar{K}^*(892)^0 \pi^- + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_{17}/\Gamma$$

VALUE (units 10^{-4})	DOCUMENT ID
22±11 OUR FIT	

NODE=M057R9
NODE=M057R9

$$\Gamma(K^*(892)^0 \bar{K}^*(892)^0)/\Gamma_{\text{total}} \quad \Gamma_{18}/\Gamma$$

VALUE (units 10^{-3})	DOCUMENT ID
2.4±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

¹ BAI 99B BES $\psi(2S) \rightarrow \gamma\chi_{c2}$

8.7±5.9±0.4

¹ TANENBAUM 78 MRK1 $\psi(2S) \rightarrow \gamma\chi_{c2}$

¹ Rescaled by us using $B(\psi(2S) \rightarrow \gamma\chi_{c2}) = (8.3 \pm 0.4)\%$ and $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (32.6 \pm 0.5)\%$. Multiplied by a factor of 2 to convert from $K_S^0 K^+\pi^-$ to $K^0 K^+\pi^-$ decay.

 Γ_{19}/Γ

NODE=M057R4

NODE=M057R4

→ UNCHECKED ←

NODE=M057R;LINKAGE=X3

 $\Gamma(\phi\phi)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

DOCUMENT ID

1.12±0.10 OUR FIT Γ_{20}/Γ

NODE=M057R20

NODE=M057R20

 $\Gamma(\omega\omega)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

EVTs

DOCUMENT ID

TECN

COMMENT

0.88±0.11 OUR AVERAGE

0.85±0.10±0.03

762

¹ ABLIKIM 11K BES3 $\psi(2S) \rightarrow \gamma$ hadrons

1.8 ±0.6 ±0.1 27.7 ± 7.4

² ABLIKIM 05N BES2 $\psi(2S) \rightarrow \gamma\chi_{c2} \rightarrow \gamma 6\pi$

¹ ABLIKIM 11K reports $(8.9 \pm 0.3 \pm 1.1) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \omega\omega)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.74 \pm 0.35) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² ABLIKIM 05N reports $[\Gamma(\chi_{c2}(1P) \rightarrow \omega\omega)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))] = (0.165 \pm 0.044 \pm 0.032) \times 10^{-3}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

 Γ_{21}/Γ

NODE=M057R28

NODE=M057R28

NODE=M057R28;LINKAGE=AL

NODE=M057R28;LINKAGE=AB

 $\Gamma(\omega K^+ K^-)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

EVTs

DOCUMENT ID

TECN

COMMENT

0.73±0.04±0.08

512

¹ ABLIKIM 13B BES3 $e^+e^- \rightarrow \psi(2S) \rightarrow \gamma\chi_{c2}$

¹ Using 1.06×10^8 $\psi(2S)$ mesons and $B(\psi(2S) \rightarrow \chi_{c2}\gamma) = (8.72 \pm 0.34)\%$.

 Γ_{22}/Γ

NODE=M057R74

NODE=M057R74

NODE=M057R74;LINKAGE=A

 $\Gamma(\omega\phi)/\Gamma_{\text{total}}$ VALUE (units 10^{-5})

CL%

DOCUMENT ID

TECN

COMMENT

<1.9

90

¹ ABLIKIM 11K BES3 $\psi(2S) \rightarrow \gamma$ hadrons

¹ ABLIKIM 11K reports $< 2 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \omega\phi)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.74 \pm 0.35) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = 9.11 \times 10^{-2}$.

 Γ_{23}/Γ

NODE=M057R63

NODE=M057R63

NODE=M057R63;LINKAGE=AL

 $\Gamma(\pi\pi)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

DOCUMENT ID

2.33±0.12 OUR FIT Γ_{24}/Γ

NODE=M057R27

NODE=M057R27

 $\Gamma(\rho^0\pi^+\pi^-)/\Gamma_{\text{total}}$ VALUE (units 10^{-4})

DOCUMENT ID

38±16 OUR FIT Γ_{25}/Γ

NODE=M057R8

NODE=M057R8

 $\Gamma(\pi^+\pi^-\eta)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

CL%

DOCUMENT ID

TECN

COMMENT

0.50±0.13±0.02¹ ATHAR 07 CLEO $\psi(2S) \rightarrow \gamma h^+ h^- h^0$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<1.5

90

² ABLIKIM 06R BES2 $\psi(2S) \rightarrow \gamma\chi_{c2}$

¹ ATHAR 07 reports $(0.49 \pm 0.12 \pm 0.06) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \pi^+\pi^-\eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² ABLIKIM 06R reports $< 1.7 \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \pi^+\pi^-\eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.1 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = 9.11 \times 10^{-2}$.

 Γ_{26}/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_{27}/Γ NODE=M057R35
NODE=M057R35**0.52±0.19±0.02**¹ ATHAR 07 CLEO $\psi(2S) \rightarrow \gamma h^+ h^- h^0$

¹ ATHAR 07 reports $(0.51 \pm 0.18 \pm 0.06) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \pi^+\pi^-\eta')/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R35;LINKAGE=AT

 $\Gamma(\eta\eta)/\Gamma_{\text{total}}$ VALUE (units 10^{-4})

DOCUMENT ID

 Γ_{28}/Γ NODE=M057R16
NODE=M057R16**5.7±0.5 OUR FIT** $\Gamma(K^+K^-)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

DOCUMENT ID

 Γ_{29}/Γ NODE=M057R11
NODE=M057R11**1.05±0.07 OUR FIT** $\Gamma(K_S^0 K_S^0)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

DOCUMENT ID

 Γ_{30}/Γ NODE=M057R19
NODE=M057R19**0.55±0.04 OUR FIT** $\Gamma(K_S^0 K_S^0)/\Gamma(\pi\pi)$

VALUE

DOCUMENT ID

TECN

COMMENT

 Γ_{30}/Γ_{24} NODE=M057R36
NODE=M057R36**0.235±0.019 OUR FIT**

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.27 ±0.07 ±0.04 ^{1,2} CHEN 07B BELL $e^+e^- \rightarrow e^+e^-\chi_{c2}$

¹ Using $\Gamma(\pi\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ from the $\pi^+\pi^-$ measurement of NAKAZAWA 05 rescaled by 3/2 to convert to $\pi\pi$.

² Not independent from other measurements.

NODE=M057R36;LINKAGE=CH

NODE=M057R36;LINKAGE=NI

 $\Gamma(K_S^0 K_S^0)/\Gamma(K^+K^-)$

VALUE

DOCUMENT ID

TECN

COMMENT

 Γ_{30}/Γ_{29} NODE=M057R37
NODE=M057R37**0.52±0.05 OUR FIT**

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.70±0.21±0.12 ^{1,2} CHEN 07B BELL $e^+e^- \rightarrow e^+e^-\chi_{c2}$

¹ Using $\Gamma(K^+K^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ from NAKAZAWA 05.

² Not independent from other measurements.

NODE=M057R37;LINKAGE=CH

NODE=M057R37;LINKAGE=NI

 $\Gamma(K^+K^-\pi^0)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

DOCUMENT ID

TECN

COMMENT

 Γ_{32}/Γ NODE=M057R05
NODE=M057R05**0.32±0.08±0.01**¹ ATHAR 07 CLEO $\psi(2S) \rightarrow \gamma h^+ h^- h^0$

¹ ATHAR 07 reports $(0.31 \pm 0.07 \pm 0.04) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K^+K^-\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R05;LINKAGE=AT

 $\Gamma(K^+K^-\eta)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

CL%

DOCUMENT ID

TECN

COMMENT

 Γ_{33}/Γ NODE=M057R09
NODE=M057R09**<0.34**

90

¹ ATHAR 07 CLEO $\psi(2S) \rightarrow \gamma h^+ h^- h^0$

¹ ATHAR 07 reports $< 0.33 \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K^+K^-\eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = 9.11 \times 10^{-2}$.

NODE=M057R09;LINKAGE=AT

 $\Gamma(K^+K^-\eta'(958))/\Gamma_{\text{total}}$ VALUE (units 10^{-4})

EVTS

DOCUMENT ID

TECN

COMMENT

 Γ_{34}/Γ NODE=M057R78
NODE=M057R78**1.94±0.34**

107

¹ ABLIKIM 14J BES3 $\psi(2S) \rightarrow \gamma K^+ K^-\eta'(958)$

¹ Derived using $B(\psi(2S) \rightarrow \gamma\chi_{c2}) = (8.72 \pm 0.34)\%$. Uncertainty includes both statistical and systematic contributions combined in quadrature.

NODE=M057R78;LINKAGE=A

$\Gamma(\eta\eta')/\Gamma_{\text{total}}$ Γ_{35}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<0.6	90	3.3 ± 8.0	¹ ASNER 09	CLEO	$\psi(2S) \rightarrow \gamma\eta\eta'$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<2.4	90		² ADAMS 07	CLEO	$\psi(2S) \rightarrow \gamma\chi_{c2}$

¹ ASNER 09 reports $< 0.6 \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \eta\eta')/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = 9.11 \times 10^{-2}$.

² Superseded by ASNER 09. ADAMS 07 reports $< 2.3 \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \eta\eta')/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = 0.0933 \pm 0.0014 \pm 0.0061$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = 9.11 \times 10^{-2}$.

NODE=M057R03
NODE=M057R03

NODE=M057R03;LINKAGE=AS

NODE=M057R03;LINKAGE=AD

 $\Gamma(\eta'\eta')/\Gamma_{\text{total}}$ Γ_{36}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<1.0	90	12 ± 7	¹ ASNER 09	CLEO	$\psi(2S) \rightarrow \gamma\eta'\eta'$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<3.2	90		² ADAMS 07	CLEO	$\psi(2S) \rightarrow \gamma\chi_{c2}$

¹ ASNER 09 reports $< 1.0 \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \eta'\eta')/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = 9.11 \times 10^{-2}$.

² Superseded by ASNER 09. ADAMS 07 reports $< 3.1 \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \eta'\eta')/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = 0.0933 \pm 0.0014 \pm 0.0061$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = 9.11 \times 10^{-2}$.

NODE=M057R04
NODE=M057R04

NODE=M057R04;LINKAGE=AS

NODE=M057R04;LINKAGE=AD

 $\Gamma(\pi^+\pi^-K_S^0K_S^0)/\Gamma_{\text{total}}$ Γ_{37}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$2.3 \pm 0.6 \pm 0.1$	57 ± 11	¹ ABLIKIM 050	BES2	$\psi(2S) \rightarrow \gamma\chi_{c2}$

¹ ABLIKIM 050 reports $[\Gamma(\chi_{c2}(1P) \rightarrow \pi^+\pi^-K_S^0K_S^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))] = (0.207 \pm 0.039 \pm 0.033) \times 10^{-3}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R31
NODE=M057R31

NODE=M057R31;LINKAGE=AB

 $\Gamma(K^+K^-K_S^0K_S^0)/\Gamma_{\text{total}}$ Γ_{38}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<4	90	2.3 ± 2.2	¹ ABLIKIM 050	BES2	$e^+e^- \rightarrow \chi_{c2}\gamma$

¹ ABLIKIM 050 reports $[\Gamma(\chi_{c2}(1P) \rightarrow K^+K^-K_S^0K_S^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))] < 3.5 \times 10^{-5}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = 9.11 \times 10^{-2}$.

NODE=M057R32
NODE=M057R32

NODE=M057R32;LINKAGE=AB

 $\Gamma(K^+K^-K^+K^-)/\Gamma_{\text{total}}$ Γ_{39}/Γ

VALUE (units 10^{-3})	DOCUMENT ID
1.73 ± 0.21 OUR FIT	

NODE=M057R18
NODE=M057R18

 $\Gamma(K^+K^-\phi)/\Gamma_{\text{total}}$ Γ_{40}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.48 \pm 0.31 \pm 0.05$	52	¹ ABLIKIM 06T	BES2	$\psi(2S) \rightarrow \gamma 2K^+ 2K^-$

¹ ABLIKIM 06T reports $(1.67 \pm 0.26 \pm 0.24) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K^+K^-\phi)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.1 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R01
NODE=M057R01

NODE=M057R01;LINKAGE=AB

 $\Gamma(\bar{K}^0K^+\pi^-\phi + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{41}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
$4.83 \pm 0.32 \pm 0.66$	ABLIKIM 15M	BES3	$\psi(2S) \rightarrow \gamma\chi_{c2}$

NODE=M057R79
NODE=M057R79

 $\Gamma(K^+K^-\pi^0\phi)/\Gamma_{\text{total}}$ Γ_{42}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
$2.74 \pm 0.16 \pm 0.44$	ABLIKIM 15M	BES3	$\psi(2S) \rightarrow \gamma\chi_{c2}$

NODE=M057R80
NODE=M057R80

$\Gamma(\phi\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{43}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
0.93±0.06±0.10	408	¹ ABLIKIM	13B BES3	$e^+e^- \rightarrow \psi(2S) \rightarrow \gamma\chi_{c2}$

¹ Using 1.06×10^8 $\psi(2S)$ mesons and $B(\psi(2S) \rightarrow \chi_{c2}\gamma) = (8.72 \pm 0.34)\%$.

NODE=M057R75
NODE=M057R75

NODE=M057R75;LINKAGE=A

 $\Gamma(p\bar{p})/\Gamma_{\text{total}}$ Γ_{44}/Γ

VALUE (units 10^{-4})	DOCUMENT ID
0.75±0.04 OUR FIT	

NODE=M057R12
NODE=M057R12

 $\Gamma(p\bar{p}\pi^0)/\Gamma_{\text{total}}$ Γ_{45}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
0.49±0.04 OUR AVERAGE			

0.49±0.04±0.02	¹ ONYISI	10	CLE3	$\psi(2S) \rightarrow \gamma p\bar{p}X$
0.45±0.09±0.02	² ATHAR	07	CLEO	$\psi(2S) \rightarrow \gamma h^+ h^- h^0$

¹ ONYISI 10 reports $(4.83 \pm 0.25 \pm 0.35 \pm 0.31) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow p\bar{p}\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R06
NODE=M057R06

NODE=M057R06;LINKAGE=ON

² ATHAR 07 reports $(0.44 \pm 0.08 \pm 0.05) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow p\bar{p}\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R06;LINKAGE=AT

 $\Gamma(p\bar{p}\eta)/\Gamma_{\text{total}}$ Γ_{46}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
0.182±0.026 OUR AVERAGE			

0.180±0.027±0.006	¹ ONYISI	10	CLE3	$\psi(2S) \rightarrow \gamma p\bar{p}X$
0.19 ±0.07 ±0.01	² ATHAR	07	CLEO	$\psi(2S) \rightarrow \gamma h^+ h^- h^0$

¹ ONYISI 10 reports $(1.76 \pm 0.23 \pm 0.14 \pm 0.11) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow p\bar{p}\eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R34
NODE=M057R34

NODE=M057R34;LINKAGE=ON

² ATHAR 07 reports $(0.19 \pm 0.07 \pm 0.02) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow p\bar{p}\eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R34;LINKAGE=AT

 $\Gamma(p\bar{p}\omega)/\Gamma_{\text{total}}$ Γ_{47}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
0.38±0.04±0.01	¹ ONYISI	10	CLE3
			$\psi(2S) \rightarrow \gamma p \bar{p} X$

¹ ONYISI 10 reports $(3.68 \pm 0.35 \pm 0.26 \pm 0.24) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow p\bar{p}\omega)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R56
NODE=M057R56

NODE=M057R56;LINKAGE=ON

 $\Gamma(p\bar{p}\phi)/\Gamma_{\text{total}}$ Γ_{48}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
2.9±0.9±0.1	24 ± 7	¹ ABLIKIM	11F BES3	$\psi(2S) \rightarrow \gamma p\bar{p}K^+K^-$

¹ ABLIKIM 11F reports $(3.04 \pm 0.85 \pm 0.43) \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow p\bar{p}\phi)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.74 \pm 0.35) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R62
NODE=M057R62

NODE=M057R62;LINKAGE=AB

 $\Gamma(p\bar{p}\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{49}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
1.32±0.34 OUR EVALUATION	Treating systematic error as correlated.		

1.3 ±0.4 OUR AVERAGE Error includes scale factor of 1.3.

1.17±0.19±0.30	¹ BAI	99B	BES	$\psi(2S) \rightarrow \gamma\chi_{c2}$
2.64±1.03±0.14	¹ TANENBAUM	78	MRK1	$\psi(2S) \rightarrow \gamma\chi_{c2}$

NODE=M057R6
NODE=M057R6

→ UNCHECKED ←

¹ Rescaled by us using $B(\psi(2S) \rightarrow \gamma\chi_{c2}) = (8.3 \pm 0.4)\%$ and $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (32.6 \pm 0.5)\%$. Multiplied by a factor of 2 to convert from $K_S^0 K^+ \pi^-$ to $K^0 K^+ \pi^-$ decay.

NODE=M057R6;LINKAGE=X3

$\Gamma(p\bar{p}\pi^0\pi^0)/\Gamma_{\text{total}}$ Γ_{50}/Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.082±0.024±0.003	29.2	¹ HE	08B CLEO	$e^+e^- \rightarrow \gamma h^+ h^- h^0 h^0$

NODE=M057R49
NODE=M057R49

¹ HE 08B reports $0.08 \pm 0.02 \pm 0.01 \pm 0.01\%$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow p\bar{p}\pi^0\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R49;LINKAGE=HE

$\Gamma(p\bar{p}K^+K^- \text{ (non-resonant)})/\Gamma_{\text{total}}$ Γ_{51}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.00±0.33±0.07	131 ± 12	¹ ABLIKIM	11F BES3	$\psi(2S) \rightarrow \gamma p\bar{p}K^+K^-$

NODE=M057R59
NODE=M057R59

¹ ABLIKIM 11F reports $(2.08 \pm 0.19 \pm 0.30) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow p\bar{p}K^+K^- \text{ (non-resonant)})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.74 \pm 0.35) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R59;LINKAGE=AB

$\Gamma(p\bar{p}K_S^0K_S^0)/\Gamma_{\text{total}}$ Γ_{52}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<7.9	90	¹ ABLIKIM	06D BES2	$\psi(2S) \rightarrow \chi_{c2}\gamma$

NODE=M057R30
NODE=M057R30

¹ Using $B(\psi(2S) \rightarrow \chi_{c2}\gamma) = (9.3 \pm 0.6)\%$.

NODE=M057R;LINKAGE=AB

$\Gamma(p\bar{n}\pi^-)/\Gamma_{\text{total}}$ Γ_{53}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
8.9±1.0 OUR AVERAGE				
8.8±1.0±0.3	3309	¹ ABLIKIM	12J BES3	$\psi(2S) \rightarrow \gamma p\bar{n}\pi^-$
10.6±3.6±0.4		² ABLIKIM	06I BES2	$\psi(2S) \rightarrow \gamma p\pi^- X$

NODE=M057R33
NODE=M057R33

¹ ABLIKIM 12J reports $[\Gamma(\chi_{c2}(1P) \rightarrow p\bar{n}\pi^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ = $(0.80 \pm 0.02 \pm 0.09) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R33;LINKAGE=AL

² ABLIKIM 06I reports $[\Gamma(\chi_{c2}(1P) \rightarrow p\bar{n}\pi^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ = $(0.97 \pm 0.20 \pm 0.26) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R33;LINKAGE=AB

$\Gamma(\bar{p}n\pi^+)/\Gamma_{\text{total}}$ Γ_{54}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
9.3±0.8±0.3	3732	¹ ABLIKIM	12J BES3	$\psi(2S) \rightarrow \gamma \bar{p}n\pi^+$

NODE=M057R70
NODE=M057R70

¹ ABLIKIM 12J reports $[\Gamma(\chi_{c2}(1P) \rightarrow \bar{p}n\pi^+)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ = $(0.85 \pm 0.02 \pm 0.07) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R70;LINKAGE=AL

$\Gamma(p\bar{n}\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{55}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
22.7±1.8±0.8	2128	¹ ABLIKIM	12J BES3	$\psi(2S) \rightarrow \gamma p\bar{n}\pi^-\pi^0$

NODE=M057R71
NODE=M057R71

¹ ABLIKIM 12J reports $[\Gamma(\chi_{c2}(1P) \rightarrow p\bar{n}\pi^-\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ = $(2.07 \pm 0.06 \pm 0.15) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R71;LINKAGE=AL

$\Gamma(\bar{p}n\pi^+\pi^0)/\Gamma_{\text{total}}$ Γ_{56}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
22.1±1.9±0.8	2352	¹ ABLIKIM	12J BES3	$\psi(2S) \rightarrow \gamma \bar{p}n\pi^+\pi^0$

NODE=M057R72
NODE=M057R72

¹ ABLIKIM 12J reports $[\Gamma(\chi_{c2}(1P) \rightarrow \bar{p}n\pi^+\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ = $(2.01 \pm 0.06 \pm 0.16) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R72;LINKAGE=AL

$\Gamma(\Lambda\bar{\Lambda})/\Gamma_{\text{total}}$ VALUE (units 10^{-4})**1.92±0.16 OUR FIT**

DOCUMENT ID

 Γ_{57}/Γ NODE=M057R25
NODE=M057R25 $\Gamma(\Lambda\bar{\Lambda}\pi^+\pi^-)/\Gamma_{\text{total}}$ VALUE (units 10^{-5})

CL%

EVTS

DOCUMENT ID

TECN

COMMENT

131±16±5

371

¹

ABLIKIM

12I

BES3

 $\psi(2S) \rightarrow \gamma\Lambda\bar{\Lambda}\pi^+\pi^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<350

90

²

ABLIKIM

06D

BES2

 $\psi(2S) \rightarrow \chi_{c2}\gamma$

¹ ABLIKIM 12I reports $(137.0 \pm 7.6 \pm 15.7) \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \Lambda\bar{\Lambda}\pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.72 \pm 0.34) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² Using $B(\psi(2S) \rightarrow \chi_{c2}\gamma) = (9.3 \pm 0.6)\%$.

 Γ_{58}/Γ NODE=M057R29
NODE=M057R29

NODE=M057R29;LINKAGE=AL

NODE=M057R29;LINKAGE=AB

 $\Gamma(\Lambda\bar{\Lambda}\pi^+\pi^- (\text{non-resonant}))/\Gamma_{\text{total}}$ VALUE (units 10^{-5})

EVTS

DOCUMENT ID

TECN

COMMENT

69±16±2

36

¹

ABLIKIM

12I

BES3

 $\psi(2S) \rightarrow \gamma\Lambda\bar{\Lambda}\pi^+\pi^-$

¹ ABLIKIM 12I reports $(71.8 \pm 14.5 \pm 8.2) \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \Lambda\bar{\Lambda}\pi^+\pi^- (\text{non-resonant}))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.72 \pm 0.34) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

 Γ_{59}/Γ NODE=M057R65
NODE=M057R65

NODE=M057R65;LINKAGE=AL

 $\Gamma(\Sigma(1385)^+\bar{\Lambda}\pi^- + \text{c.c.})/\Gamma_{\text{total}}$ VALUE (units 10^{-5})

CL%

DOCUMENT ID

TECN

COMMENT

<40

90

¹

ABLIKIM

12I

BES3

 $\psi(2S) \rightarrow \gamma\Sigma(1385)^+\bar{\Lambda}\pi^-$

¹ ABLIKIM 12I reports $< 42 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \Sigma(1385)^+\bar{\Lambda}\pi^- + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.72 \pm 0.34) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = 9.11 \times 10^{-2}$.

 Γ_{60}/Γ NODE=M057R66
NODE=M057R66

NODE=M057R66;LINKAGE=AL

 $\Gamma(\Sigma(1385)^-\bar{\Lambda}\pi^+ + \text{c.c.})/\Gamma_{\text{total}}$ VALUE (units 10^{-5})

CL%

DOCUMENT ID

TECN

COMMENT

<60

90

¹

ABLIKIM

12I

BES3

 $\psi(2S) \rightarrow \gamma\Sigma(1385)^-\bar{\Lambda}\pi^+$

¹ ABLIKIM 12I reports $< 61 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \Sigma(1385)^-\bar{\Lambda}\pi^+ + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.72 \pm 0.34) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = 9.11 \times 10^{-2}$.

 Γ_{61}/Γ NODE=M057R67
NODE=M057R67

NODE=M057R67;LINKAGE=AL

 $\Gamma(K^+\bar{p}\Lambda + \text{c.c.})/\Gamma_{\text{total}}$ VALUE (units 10^{-4})

EVTS

DOCUMENT ID

TECN

COMMENT

8.1±0.6 OUR AVERAGE

8.0±0.6±0.3

5k

^{1,2}

ABLIKIM

13D

BES3

 $\psi(2S) \rightarrow \gamma\Lambda\bar{p}K^+$

8.7±1.7±0.3

³

ATHAR

07

CLEO

 $\psi(2S) \rightarrow \gamma h^+ h^- h^0$

¹ ABLIKIM 13D reports $(8.4 \pm 0.3 \pm 0.6) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K^+\bar{p}\Lambda + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.72 \pm 0.34) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² Using $B(\Lambda \rightarrow p\pi^-) = 63.9\%$.

³ ATHAR 07 reports $(8.5 \pm 1.4 \pm 1.0) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K^+\bar{p}\Lambda + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

 Γ_{62}/Γ NODE=M057R07
NODE=M057R07

NODE=M057R07;LINKAGE=AB

NODE=M057R07;LINKAGE=LB
NODE=M057R07;LINKAGE=AT

$\Gamma(K^+ \bar{p} \Lambda(1520) + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{63}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$2.9 \pm 0.7 \pm 0.1$	79 $\pm$ 13	¹ ABLIKIM	11F BES3	$\psi(2S) \rightarrow \gamma p \bar{p} K^+ K^-$

NODE=M057R60
 NODE=M057R60

¹ ABLIKIM 11F reports $(3.06 \pm 0.50 \pm 0.54) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K^+ \bar{p} \Lambda(1520) + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (8.74 \pm 0.35) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R60;LINKAGE=AB

 $\Gamma(\Lambda(1520) \bar{\Lambda}(1520))/\Gamma_{\text{total}}$ Γ_{64}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$4.8 \pm 1.5 \pm 0.2$	29 $\pm$ 7	¹ ABLIKIM	11F BES3	$\psi(2S) \rightarrow \gamma p \bar{p} K^+ K^-$

NODE=M057R61
 NODE=M057R61

¹ ABLIKIM 11F reports $(5.05 \pm 1.29 \pm 0.93) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \Lambda(1520) \bar{\Lambda}(1520))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (8.74 \pm 0.35) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R61;LINKAGE=AB

 $\Gamma(\Sigma^0 \bar{\Sigma}^0)/\Gamma_{\text{total}}$ Γ_{65}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<0.6	90		¹ ABLIKIM	13H BES3	$\psi(2S) \rightarrow \gamma \Sigma^0 \bar{\Sigma}^0$

NODE=M057R43
 NODE=M057R43

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.8	90	7.5 $\pm$ 3.4	² NAIK	08 CLEO	$\psi(2S) \rightarrow \gamma \Sigma^0 \bar{\Sigma}^0$

¹ ABLIKIM 13H reports $< 0.65 \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \Sigma^0 \bar{\Sigma}^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (8.74 \pm 0.35) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 9.11 \times 10^{-2}$.

NODE=M057R43;LINKAGE=AB

² NAIK 08 reports $< 0.75 \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \Sigma^0 \bar{\Sigma}^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 9.11 \times 10^{-2}$.

NODE=M057R43;LINKAGE=NA

 $\Gamma(\Sigma^+ \bar{\Sigma}^-)/\Gamma_{\text{total}}$ Γ_{66}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<0.7	90	4.0 $\pm$ 3.5	¹ NAIK	08 CLEO	$\psi(2S) \rightarrow \gamma \Sigma^+ \bar{\Sigma}^-$

NODE=M057R44
 NODE=M057R44

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.8	90		² ABLIKIM	13H BES3	$\psi(2S) \rightarrow \gamma \Sigma^+ \bar{\Sigma}^-$

¹ NAIK 08 reports $< 0.67 \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \Sigma^+ \bar{\Sigma}^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 9.11 \times 10^{-2}$.

NODE=M057R44;LINKAGE=NA

² ABLIKIM 13H reports $< 0.88 \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \Sigma^+ \bar{\Sigma}^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (8.74 \pm 0.35) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 9.11 \times 10^{-2}$.

NODE=M057R44;LINKAGE=AB

 $\Gamma(\Sigma(1385)^+ \bar{\Sigma}(1385)^-)/\Gamma_{\text{total}}$ Γ_{67}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<16	90	¹ ABLIKIM	12I BES3	$\psi(2S) \rightarrow \gamma \Sigma(1385)^+ \bar{\Sigma}(1385)^-$

NODE=M057R68
 NODE=M057R68

¹ ABLIKIM 12I reports $< 17 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \Sigma(1385)^+ \bar{\Sigma}(1385)^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (8.72 \pm 0.34) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 9.11 \times 10^{-2}$.

NODE=M057R68;LINKAGE=AL

 $\Gamma(\Sigma(1385)^- \bar{\Sigma}(1385)^+)/\Gamma_{\text{total}}$ Γ_{68}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<8	90	¹ ABLIKIM	12I BES3	$\psi(2S) \rightarrow \gamma \Sigma(1385)^- \bar{\Sigma}(1385)^+$

NODE=M057R69
 NODE=M057R69

¹ ABLIKIM 12I reports $< 8.5 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \Sigma(1385)^- \bar{\Sigma}(1385)^+)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (8.72 \pm 0.34) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 9.11 \times 10^{-2}$.

NODE=M057R69;LINKAGE=AL

$\Gamma(K^- \Lambda \Xi^+ + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{69}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.84 \pm 0.33 \pm 0.06$	51	¹ ABLIKIM	15I BES3	$\psi(2S) \rightarrow \gamma K^- \Lambda \Xi^+ + \text{c.c.}$
¹ ABLIKIM 15I reports $[\Gamma(\chi_{c2}(1P) \rightarrow K^- \Lambda \Xi^+ + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))] = (1.68 \pm 0.26 \pm 0.15) \times 10^{-5}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M057R81
NODE=M057R81

NODE=M057R81;LINKAGE=A

$\Gamma(\Xi^0 \Xi^0)/\Gamma_{\text{total}}$ Γ_{70}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<1.1	90	2.9 ± 1.7	¹ NAIK	08 CLEO	$\psi(2S) \rightarrow \gamma \Xi^0 \Xi^0$
¹ NAIK 08 reports $< 1.06 \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \Xi^0 \Xi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 9.11 \times 10^{-2}$.					

NODE=M057R45
NODE=M057R45

NODE=M057R45;LINKAGE=NA

$\Gamma(\Xi^- \Xi^+)/\Gamma_{\text{total}}$ Γ_{71}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$1.48 \pm 0.33 \pm 0.05$	29 $\pm$ 5		¹ NAIK	08 CLEO	$\psi(2S) \rightarrow \gamma \Xi^+ \Xi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 3.7	90		² ABLIKIM	06D BES2	$\psi(2S) \rightarrow \chi_{c2} \gamma$
¹ NAIK 08 reports $(1.45 \pm 0.30 \pm 0.15) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \Xi^- \Xi^+)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.					
² Using $B(\psi(2S) \rightarrow \chi_{c2} \gamma) = (9.3 \pm 0.6)\%$.					

NODE=M057R17
NODE=M057R17

NODE=M057R17;LINKAGE=NA

NODE=M057R17;LINKAGE=AB

$\Gamma(J/\psi(1S) \pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}$ Γ_{72}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.015	90	BARATE	81 SPEC	$190 \text{ GeV } \pi^- \text{ Be} \rightarrow 2\pi 2\mu$

NODE=M057R13
NODE=M057R13

$\Gamma(\pi^0 \eta_c)/\Gamma_{\text{total}}$ Γ_{73}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<3.2 $\times 10^{-3}$	90	¹ ABLIKIM	15N BES3	$\psi(2S) e^+ e^- \rightarrow \gamma \pi^0 \eta_c$
¹ Using $B(\eta_c \rightarrow K_S^0 K^\pm \pi^\mp) \times B(K_S^0 \rightarrow \pi^+ \pi^-) \times B(\pi^0 \rightarrow \gamma \gamma) = (1.66 \pm 0.11) \times 10^{-2}$.				

NODE=M057R77
NODE=M057R77

NODE=M057R77;LINKAGE=A

$\Gamma(\eta_c(1S) \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{74}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.54 $\times 10^{-2}$	90	^{1,2} ABLIKIM	13B BES3	$e^+ e^- \rightarrow \psi(2S) \rightarrow \gamma \chi_{c2}$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<1.2 $\times 10^{-2}$	90	^{1,3} ABLIKIM	13B BES3	$e^+ e^- \rightarrow \psi(2S) \rightarrow \gamma \chi_{c2}$
¹ Using $1.06 \times 10^8 \psi(2S)$ mesons and $B(\psi(2S) \rightarrow \chi_{c2} \gamma) = (8.72 \pm 0.34)\%$.				
² From the $\eta_c \rightarrow K_S^0 K^\pm \pi^\mp$ decays.				
³ From the $\eta_c \rightarrow K^+ K^- \pi^0$ decays.				

NODE=M057R76
NODE=M057R76

OCCUR=2

NODE=M057R76;LINKAGE=A

NODE=M057R76;LINKAGE=B

NODE=M057R76;LINKAGE=C

$\Gamma(\eta_c(1S) \pi^+ \pi^-)/\Gamma(K^0 K^+ \pi^- + \text{c.c.})$ Γ_{74}/Γ_{31}

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<16.4	90	¹ LEES	12AE BABR	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^- \eta_c$
¹ We divided the reported limit by 2 to take into account the $K_L^0 K^+ \pi^-$ mode.				

NODE=M057R64
NODE=M057R64

NODE=M057R64;LINKAGE=LE

NODE=M057310

RADIATIVE DECAYS

$\Gamma(\gamma J/\psi(1S))/\Gamma_{\text{total}}$ Γ_{75}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
0.192 $\pm$ 0.007 OUR FIT			
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.199 $\pm$ 0.005 $\pm$ 0.012	¹ ADAM	05A CLEO	$e^+ e^- \rightarrow \psi(2S) \rightarrow \gamma \chi_{c2}$
¹ 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

NODE=M057R7;LINKAGE=AD

$\Gamma(\gamma\rho^0)/\Gamma_{\text{total}}$ Γ_{76}/Γ

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT

<20	90	13 ± 11	¹ ABLIKIM	11E BES3	$\psi(2S) \rightarrow \gamma\gamma\rho^0$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<40	90	17.2 ± 6.8	² BENNETT	08A CLEO	$\psi(2S) \rightarrow \gamma\gamma\rho^0$

¹ ABLIKIM 11E reports $< 20.8 \times 10^{-6}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \gamma\rho^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.74 \pm 0.35) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = 9.11 \times 10^{-2}$.

² BENNETT 08A reports $< 50 \times 10^{-6}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \gamma\rho^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.1 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = 9.11 \times 10^{-2}$.

NODE=M057R40
NODE=M057R40

NODE=M057R40;LINKAGE=AB

NODE=M057R40;LINKAGE=BE

 $\Gamma(\gamma\omega)/\Gamma_{\text{total}}$ Γ_{77}/Γ

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT

<6	90	1 ± 6	¹ ABLIKIM	11E BES3	$\psi(2S) \rightarrow \gamma\gamma\omega$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<6	90	0.0 ± 1.8	² BENNETT	08A CLEO	$\psi(2S) \rightarrow \gamma\gamma\omega$

¹ ABLIKIM 11E reports $< 6.1 \times 10^{-6}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \gamma\omega)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.74 \pm 0.35) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = 9.11 \times 10^{-2}$.

² BENNETT 08A reports $< 7.0 \times 10^{-6}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \gamma\omega)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.1 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = 9.11 \times 10^{-2}$.

NODE=M057R41
NODE=M057R41

NODE=M057R41;LINKAGE=AB

NODE=M057R41;LINKAGE=BE

 $\Gamma(\gamma\phi)/\Gamma_{\text{total}}$ Γ_{78}/Γ

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT

< 8	90	5 ± 5	¹ ABLIKIM	11E BES3	$\psi(2S) \rightarrow \gamma\gamma\phi$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<12	90	1.3 ± 2.5	² BENNETT	08A CLEO	$\psi(2S) \rightarrow \gamma\gamma\phi$

¹ ABLIKIM 11E reports $< 8.1 \times 10^{-6}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \gamma\phi)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.74 \pm 0.35) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = 9.11 \times 10^{-2}$.

² BENNETT 08A reports $< 13 \times 10^{-6}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \gamma\phi)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.1 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = 9.11 \times 10^{-2}$.

NODE=M057R42
NODE=M057R42

NODE=M057R42;LINKAGE=AB

NODE=M057R42;LINKAGE=BE

 $\Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ Γ_{79}/Γ

VALUE (units 10^{-4})	DOCUMENT ID

2.74±0.14 OUR FIT

NODE=M057R1
NODE=M057R1

 $\Gamma(\gamma\gamma)/\Gamma(\gamma J/\psi(1S))$ Γ_{79}/Γ_{75}

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT

1.43±0.08 OUR FIT

0.99±0.18

¹ AMBROGIANI	00B	E835	$\bar{p}p \rightarrow \chi_{c2} \rightarrow \gamma\gamma, \gamma J/\psi$

¹ Calculated by us using $B(J/\psi(1S) \rightarrow e^+e^-) = 0.0593 \pm 0.0010$.

NODE=M057R23
NODE=M057R23

NODE=M057R;LINKAGE=7A

 $\Gamma(\gamma\gamma)/\Gamma_{\text{total}} \times \Gamma(p\bar{p})/\Gamma_{\text{total}}$ $\Gamma_{79}/\Gamma \times \Gamma_{44}/\Gamma$

VALUE (units 10^{-8})	DOCUMENT ID	TECN	COMMENT

2.06±0.16 OUR FIT

1.7 ±0.4 OUR AVERAGE

1.60±0.42

ARMSTRONG	93	E760	$\bar{p}p \rightarrow \gamma\gamma X$

9.9 ±4.5

BAGLIN	87B	SPEC	$\bar{p}p \rightarrow \gamma\gamma X$

NODE=M057R24
NODE=M057R24

 $\chi_{c2}(1P)$ CROSS-PARTICLE BRANCHING RATIOS

NODE=M057230

$\Gamma(\chi_{c2}(1P) \rightarrow K^+K^-\pi^+\pi^-)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)$

$\Gamma_{14}/\Gamma \times \Gamma_{136}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}$

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT

2.34±0.26 OUR FIT

2.5 ±0.9 OUR AVERAGE Error includes scale factor of 2.3.

1.90±0.14±0.44

BAI	99B	BES	$\psi(2S) \rightarrow \gamma\chi_{c2}$

3.8 ±0.67

¹ TANENBAUM	78	MRK1	$\psi(2S) \rightarrow \gamma\chi_{c2}$

¹ The reported value is derived using $B(\psi(2S) \rightarrow \pi^+\pi^-J/\psi) \times B(J/\psi \rightarrow \ell^+\ell^-) = (4.6 \pm 0.7)\%$. Calculated by us using $B(J/\psi \rightarrow \ell^+\ell^-) = 0.1181 \pm 0.0020$.

NODE=M057B18
NODE=M057B18

NODE=M057B18;LINKAGE=TA

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow K^*(892)^0 \bar{K}^*(892)^0)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))/\Gamma_{\text{total}}}{\Gamma_{18}/\Gamma \times \Gamma_{136}^{\psi(2S)}/\Gamma^{\psi(2S)}}$$

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

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow p \bar{p})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))/\Gamma_{\text{total}}}{J/\psi(1S) \pi^+ \pi^-} \times \frac{\Gamma_{44}/\Gamma \times \Gamma_{136}^{\psi(2S)}/\Gamma^{\psi(2S)}}{\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10^{-5}) DOCUMENT ID TECN COMMENT

1.98 ± 0.10 OUR FIT

1.4 ± 1.1 ¹BAI 98I BES $\psi(2S) \rightarrow \gamma \chi_{c2} \rightarrow \gamma p \bar{p}$

NODE=M057B1
NODE=M057B1

¹ Calculated by us. The value for $B(\chi_{c2} \rightarrow p \bar{p})$ reported in BAI 98I is derived using $B(\psi(2S) \rightarrow \gamma \chi_{c2}) = (7.8 \pm 0.8)\%$ and $B(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-) = (32.4 \pm 2.6)\%$ [BAI 98D].

NODE=M057B;LINKAGE=J8

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow p \bar{p})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))/\Gamma_{\text{total}}}{\Gamma_{44}/\Gamma \times \Gamma_{136}^{\psi(2S)}/\Gamma^{\psi(2S)}}$$

VALUE (units 10^{-6}) EVTS DOCUMENT ID TECN COMMENT

6.85 ± 0.33 OUR FIT

NODE=M057B6
NODE=M057B6

7.1 ± 0.5 OUR AVERAGE Error includes scale factor of 1.2.

7.3 ± 0.4 ± 0.3 405 ABLIKIM 13V BES3 $\psi(2S) \rightarrow \gamma p \bar{p}$

7.2 ± 0.7 ± 0.4 121 ± 12 ¹NAIK 08 CLEO $\psi(2S) \rightarrow \gamma p \bar{p}$

4.4 $^{+1.6}_{-1.4}$ ± 0.6 14.3 $^{+5.2}_{-4.7}$ BAI 04F BES $\psi(2S) \rightarrow \gamma \chi_{c2}(1P) \rightarrow \gamma p \bar{p}$

¹ Calculated by us. NAIK 08 reports $B(\chi_{c2} \rightarrow p \bar{p}) = (7.7 \pm 0.8 \pm 0.4 \pm 0.5) \times 10^{-5}$ using $B(\psi(2S) \rightarrow \gamma \chi_{c2}) = (9.33 \pm 0.14 \pm 0.61)\%$.

NODE=M057B6;LINKAGE=NA

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow \Lambda \bar{\Lambda})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))/\Gamma_{\text{total}}}{\Gamma_{57}/\Gamma \times \Gamma_{136}^{\psi(2S)}/\Gamma^{\psi(2S)}}$$

VALUE (units 10^{-6}) EVTS DOCUMENT ID TECN COMMENT

17.5 ± 1.3 OUR FIT

NODE=M057B10
NODE=M057B10

17.4 ± 1.4 OUR AVERAGE

18.2 ± 1.4 ± 0.9 207 ¹ABLIKIM 13H BES3 $\psi(2S) \rightarrow \gamma \Lambda \bar{\Lambda}$

15.9 ± 2.1 ± 1.0 71 ± 9 ²NAIK 08 CLEO $\psi(2S) \rightarrow \gamma \Lambda \bar{\Lambda}$

¹ Calculated by us. ABLIKIM 13H reports $B(\chi_{c2} \rightarrow \Lambda \bar{\Lambda}) = (20.8 \pm 1.6 \pm 2.3) \times 10^{-5}$ from a measurement of $B(\chi_{c2} \rightarrow \Lambda \bar{\Lambda}) \times B(\psi(2S) \rightarrow \gamma \chi_{c2})$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}) = (8.74 \pm 0.35)\%$.

NODE=M057B10;LINKAGE=AB

² Calculated by us. NAIK 08 reports $B(\chi_{c2} \rightarrow \Lambda \bar{\Lambda}) = (17.0 \pm 2.2 \pm 1.1 \pm 1.1) \times 10^{-5}$ using $B(\psi(2S) \rightarrow \gamma \chi_{c2}) = (9.33 \pm 0.14 \pm 0.61)\%$.

NODE=M057B10;LINKAGE=NA

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow \Lambda \bar{\Lambda})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))/\Gamma_{\text{total}}}{J/\psi(1S) \pi^+ \pi^-} \times \frac{\Gamma_{57}/\Gamma \times \Gamma_{136}^{\psi(2S)}/\Gamma^{\psi(2S)}}{\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10^{-5}) EVTS DOCUMENT ID TECN COMMENT

5.1 ± 0.4 OUR FIT

NODE=M057B11
NODE=M057B11

7.1 $^{+3.1}_{-2.9}$ ± 1.3 8.3 $^{+3.7}_{-3.4}$ ¹BAI 03E BES $\psi(2S) \rightarrow \gamma \Lambda \bar{\Lambda}$

¹ BAI 03E reports $[B(\chi_{c2} \rightarrow \Lambda \bar{\Lambda}) B(\psi(2S) \rightarrow \gamma \chi_{c2}) / B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-)] \times [B^2(\Lambda \rightarrow \pi^- p) / B(J/\psi \rightarrow p \bar{p})] = (1.33 $^{+0.59}_{-0.55}$ ± 0.25)\%$. We calculate from this measurement the presented value using $B(\Lambda \rightarrow \pi^- p) = (63.9 \pm 0.5)\%$ and $B(J/\psi \rightarrow p \bar{p}) = (2.17 \pm 0.07) \times 10^{-3}$.

NODE=M057B11;LINKAGE=BA

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow \pi \pi)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))/\Gamma_{\text{total}}}{\Gamma_{24}/\Gamma \times \Gamma_{136}^{\psi(2S)}/\Gamma^{\psi(2S)}}$$

VALUE (units 10^{-4}) EVTS DOCUMENT ID TECN COMMENT

2.12 ± 0.08 OUR FIT

NODE=M057B02
NODE=M057B02

2.17 ± 0.09 OUR AVERAGE

2.19 ± 0.05 ± 0.15 4.5k ¹ABLIKIM 10A BES3 $e^+ e^- \rightarrow \psi(2S) \rightarrow \gamma \chi_{c2}$

2.23 ± 0.06 ± 0.10 2.5k ²ASNER 09 CLEO $\psi(2S) \rightarrow \gamma \pi^+ \pi^-$

1.90 ± 0.08 ± 0.20 0.8k ³ASNER 09 CLEO $\psi(2S) \rightarrow \gamma \pi^0 \pi^0$

OCCUR=2

- ¹ Calculated by us. ABLIKIM 10A reports $B(\chi_{c2} \rightarrow \pi^0 \pi^0) = (0.88 \pm 0.02 \pm 0.06 \pm 0.04) \times 10^{-3}$ using $B(\psi(2S) \rightarrow \gamma \chi_{c2}) = (8.3 \pm 0.4)\%$. We have multiplied the $\pi^0 \pi^0$ measurement by 3 to obtain $\pi \pi$.
- ² Calculated by us. ASNER 09 reports $B(\chi_{c2} \rightarrow \pi^+ \pi^-) = (1.59 \pm 0.04 \pm 0.07 \pm 0.10) \times 10^{-3}$ using $B(\psi(2S) \rightarrow \gamma \chi_{c2}) = (9.33 \pm 0.14 \pm 0.61)\%$. We have multiplied the $\pi^+ \pi^-$ measurement by 3/2 to obtain $\pi \pi$.
- ³ Calculated by us. ASNER 09 reports $B(\chi_{c2} \rightarrow \pi^0 \pi^0) = (0.68 \pm 0.03 \pm 0.07 \pm 0.04) \times 10^{-3}$ using $B(\psi(2S) \rightarrow \gamma \chi_{c2}) = (9.33 \pm 0.14 \pm 0.61)\%$. We have multiplied the $\pi^0 \pi^0$ measurement by 3 to obtain $\pi \pi$.

NODE=M057B02;LINKAGE=AB

NODE=M057B02;LINKAGE=AS

NODE=M057B02;LINKAGE=AN

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow \pi \pi)}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))}{\Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)} \quad \frac{\Gamma_{24}/\Gamma \times \Gamma_{136}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}{\Gamma_{136}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT

0.615±0.023 OUR FIT**0.54 ±0.06 OUR AVERAGE**

0.66 ±0.18 ±0.37	21 ± 6	¹ BAI	03C BES	$\psi(2S) \rightarrow \gamma \pi^0 \pi^0$
0.54 ±0.05 ±0.04	185 ± 16	² BAI	98I BES	$\psi(2S) \rightarrow \gamma \pi^+ \pi^-$

¹ We have multiplied $\pi^0 \pi^0$ measurement by 3 to obtain $\pi \pi$.² Calculated by us. The value for $B(\chi_{c2} \rightarrow \pi^+ \pi^-)$ reported by BAI 98I is derived using $B(\psi(2S) \rightarrow \gamma \chi_{c2}) = (7.8 \pm 0.8)\%$ and $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = (32.4 \pm 2.6)\%$ [BAI 98D]. We have multiplied $\pi^+ \pi^-$ measurement by 3/2 to obtain $\pi \pi$.NODE=M057B9
NODE=M057B9NODE=M057B;LINKAGE=BM
NODE=M057B;LINKAGE=BA

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow \eta \eta)}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))}{\Gamma_{\text{total}}} \quad \frac{\Gamma_{28}/\Gamma \times \Gamma_{136}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}{\Gamma_{136}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT

0.52±0.04 OUR FIT**0.52±0.04 OUR AVERAGE**

0.54±0.03±0.04	386	¹ ABLIKIM	10A BES3	$e^+ e^- \rightarrow \psi(2S) \rightarrow \gamma \chi_{c2}$
0.47±0.05±0.05	156	ASNER	09 CLEO	$\psi(2S) \rightarrow \gamma \eta \eta$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
< 0.44	90	² ADAMS	07 CLEO	$\psi(2S) \rightarrow \gamma \chi_{c2}$
< 3	90	BAI	03C BES	$\psi(2S) \rightarrow \gamma \eta \eta \rightarrow 5\gamma$
0.62±0.31±0.19		LEE	85 CBAL	$\psi(2S) \rightarrow \text{photons}$

¹ Calculated by us. ABLIKIM 10A reports $B(\chi_{c2} \rightarrow \eta \eta) = (0.65 \pm 0.04 \pm 0.05 \pm 0.03) \times 10^{-3}$ using $B(\psi(2S) \rightarrow \gamma \chi_{c2}) = (8.3 \pm 0.4)\%$.² Superseded by ASNER 09.NODE=M057B04
NODE=M057B04

NODE=M057B04;LINKAGE=AB

NODE=M057B04;LINKAGE=AD

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow K^+ K^-)}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))}{\Gamma_{\text{total}}} \quad \frac{\Gamma_{29}/\Gamma \times \Gamma_{136}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}{\Gamma_{136}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT

9.6±0.6 OUR FIT**10.5±0.3±0.6**

1.6k	¹ ASNER	09 CLEO	$\psi(2S) \rightarrow \gamma K^+ K^-$

¹ Calculated by us. ASNER 09 reports $B(\chi_{c2} \rightarrow K^+ K^-) = (1.13 \pm 0.03 \pm 0.06 \pm 0.07) \times 10^{-3}$ using $B(\psi(2S) \rightarrow \gamma \chi_{c2}) = (9.33 \pm 0.14 \pm 0.61)\%$.NODE=M057B03
NODE=M057B03

NODE=M057B03;LINKAGE=AS

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow K^+ K^-)}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))}{\Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)} \quad \frac{\Gamma_{29}/\Gamma \times \Gamma_{136}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}{\Gamma_{136}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT

0.277±0.017 OUR FIT**0.190±0.034±0.019**

115 ± 13	¹ BAI	98I BES	$\psi(2S) \rightarrow \gamma K^+ K^-$

¹ Calculated by us. The value for $B(\chi_{c2} \rightarrow K^+ K^-)$ reported by BAI 98I is derived using $B(\psi(2S) \rightarrow \gamma \chi_{c2}) = (7.8 \pm 0.8)\%$ and $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = (32.4 \pm 2.6)\%$ [BAI 98D].NODE=M057B8
NODE=M057B8

NODE=M057B;LINKAGE=BI

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow K_S^0 K_S^0)}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))}{\Gamma_{\text{total}}} \quad \frac{\Gamma_{30}/\Gamma \times \Gamma_{136}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}{\Gamma_{136}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT

5.0 ±0.4 OUR FIT**5.0 ±0.4 OUR AVERAGE**

4.9 ±0.3 ±0.3	373 ± 20	¹ ASNER	09 CLEO	$\psi(2S) \rightarrow \gamma K_S^0 K_S^0$
5.72±0.76±0.63	65	ABLIKIM	05O BES2	$\psi(2S) \rightarrow \gamma K_S^0 K_S^0$

¹ Calculated by us. ASNER 09 reports $B(\chi_{c2} \rightarrow K_S^0 K_S^0) = (0.53 \pm 0.03 \pm 0.03 \pm 0.03) \times 10^{-3}$ using $B(\psi(2S) \rightarrow \gamma \chi_{c2}) = (9.33 \pm 0.14 \pm 0.61)\%$.NODE=M057B12
NODE=M057B12

NODE=M057B12;LINKAGE=AS

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow K_S^0 \bar{K}_S^0)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)}{\Gamma_{30}/\Gamma \times \Gamma_{136}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10⁻⁵)

DOCUMENT ID

TECN

COMMENT

14.5±1.1 OUR FIT**14.7±4.1±3.3**¹ BAI

99B

BES

 $\psi(2S) \rightarrow \gamma K_S^0 \bar{K}_S^0$ NODE=M057B13
NODE=M057B13

¹ Calculated by us. The value of $B(\chi_{c2} \rightarrow K_S^0 \bar{K}_S^0)$ 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;LINKAGE=BA

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow \bar{K}^0 K^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))/\Gamma_{\text{total}}}{\Gamma_{31}/\Gamma \times \Gamma_{136}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10⁻⁴)

EVTS

DOCUMENT ID

TECN

COMMENT

1.22±0.17 OUR FIT**1.15±0.18 OUR AVERAGE**

1.21±0.19±0.09

37

¹ ATHAR

07

CLEO

 $\psi(2S) \rightarrow \gamma K_S^0 K^\pm \pi^\mp$

0.97±0.32±0.13

28

² ABLIKIM

06R

BES2

 $\psi(2S) \rightarrow \gamma K_S^0 K^\pm \pi^\mp$ NODE=M057B05
NODE=M057B05

¹ Calculated by us. ATHAR 07 reports $B(\chi_{c2} \rightarrow \bar{K}^0 K^+ \pi^- + \text{c.c.}) = (1.3 \pm 0.2 \pm 0.1 \pm 0.1) \times 10^{-3}$ using $B(\psi(2S) \rightarrow \gamma \chi_{c2}) = (9.33 \pm 0.14 \pm 0.61)\%$.

NODE=M057B05;LINKAGE=AT

² Calculated by us. ABLIKIM 06R reports $B(\chi_{c2} \rightarrow K_S^0 K^\pm \pi^\mp) = (0.6 \pm 0.2 \pm 0.1) \times 10^{-3}$ using $B(\psi(2S) \rightarrow \gamma \chi_{c2}) = (8.1 \pm 0.6)\%$. We have multiplied by 2 to obtain $\bar{K}^0 K^+ \pi^- + \text{c.c.}$ from $K_S^0 K^\pm \pi^\mp$.

NODE=M057B05;LINKAGE=AB

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow 2(\pi^+ \pi^-))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)}{\Gamma_1/\Gamma \times \Gamma_{136}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10⁻³)

DOCUMENT ID

TECN

COMMENT

2.83±0.27 OUR FIT**3.1 ±1.0 OUR AVERAGE** Error includes scale factor of 2.5.

2.3 ±0.1 ±0.5

¹ BAI

99B

BES

 $\psi(2S) \rightarrow \gamma \chi_{c2}$

4.3 ±0.6

² TANENBAUM

78

MRK1

 $\psi(2S) \rightarrow \gamma \chi_{c2}$ NODE=M057B5
NODE=M057B5

¹ Calculated by us. The value for $B(\chi_{c2} \rightarrow 2\pi^+ 2\pi^-)$ reported in BAI 99B is derived using $B(\psi(2S) \rightarrow \gamma \chi_{c2}) = (7.8 \pm 0.8)\%$ and $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (32.4 \pm 2.6)\%$ [BAI 98D].

NODE=M057B;LINKAGE=K1

² The value for $B(\psi(2S) \rightarrow \gamma \chi_{c2}) \times B(\chi_{c2} \rightarrow 2\pi^+ \pi^-)$ reported in TANENBAUM 78 is derived using $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) \times B(J/\psi(1S)\ell^+\ell^-) = (4.6 \pm 0.7)\%$. Calculated by us using $B(J/\psi(1S) \rightarrow \ell^+\ell^-) = 0.1181 \pm 0.0020$.

NODE=M057B;LINKAGE=K2

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow K^+ K^- K^+ K^-)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))/\Gamma_{\text{total}}}{\Gamma_{39}/\Gamma \times \Gamma_{136}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10⁻⁴)

EVTS

DOCUMENT ID

TECN

COMMENT

1.57±0.19 OUR FIT**1.76±0.16±0.24**

160

¹ ABLIKIM

06T

BES2

 $\psi(2S) \rightarrow \gamma 2K^+ 2K^-$ NODE=M057B14
NODE=M057B14

¹ Calculated by us. The value of $B(\chi_{c2} \rightarrow 2K^+ 2K^-)$ reported by ABLIKIM 06T was derived using $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (8.1 \pm 0.4)\%$.

NODE=M057B14;LINKAGE=AB

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow K^+ K^- K^+ K^-)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)}{\Gamma_{39}/\Gamma \times \Gamma_{136}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10⁻⁴)

DOCUMENT ID

TECN

COMMENT

4.6±0.5 OUR FIT**3.6±0.6±0.6**¹ BAI

99B

BES

 $\psi(2S) \rightarrow \gamma 2K^+ 2K^-$ NODE=M057B15
NODE=M057B15

¹ Calculated by us. The value of $B(\chi_{c2} \rightarrow 2K^+ 2K^-)$ reported by BAI 99B was derived using $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (7.8 \pm 0.8)\%$ and $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = (32.4 \pm 2.6)\%$ [BAI 98D].

NODE=M057B15;LINKAGE=BA

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow \phi\phi)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))/\Gamma_{\text{total}}}{\Gamma_{20}/\Gamma \times \Gamma_{136}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10⁻⁴)

EVTS

DOCUMENT ID

TECN

COMMENT

1.02±0.08 OUR FIT**0.98±0.13 OUR AVERAGE** Error includes scale factor of 1.3.

0.94±0.03±0.10

849

¹ ABLIKIM

11K

BES3

 $\psi(2S) \rightarrow \gamma \text{ hadrons}$

1.38±0.24±0.23

41

² ABLIKIM

06T

BES2

 $\psi(2S) \rightarrow \gamma 2K^+ 2K^-$ NODE=M057B16
NODE=M057B16

¹ Calculated by us. The value of $B(\chi_{c2} \rightarrow \phi\phi)$ reported by ABLIKIM 11K was derived using $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.74 \pm 0.35)\%$.

² Calculated by us. The value of $B(\chi_{c2} \rightarrow \phi\phi)$ reported by ABLIKIM 06T was derived using $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.1 \pm 0.4)\%$.

NODE=M057B16;LINKAGE=AL

NODE=M057B16;LINKAGE=AB

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow \phi\phi)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)}{\Gamma_{20}/\Gamma \times \Gamma_{136}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10^{-4})

DOCUMENT ID

TECN

COMMENT

2.95±0.24 OUR FIT**4.8 ±1.3 ±1.3**¹ BAI

99B

BES

 $\psi(2S) \rightarrow \gamma 2K^+ 2K^-$ NODE=M057B17
NODE=M057B17

¹ Calculated by us. The value of $B(\chi_{c2} \rightarrow \phi\phi)$ reported by BAI 99B was derived using $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (7.8 \pm 0.8)\%$ and $B(\psi(2S) \rightarrow J/\psi\pi^+\pi^-) = (32.4 \pm 2.6)\%$ [BAI 98D].

NODE=M057B17;LINKAGE=BA

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow \gamma J/\psi(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))/\Gamma_{\text{total}}}{\Gamma_{75}/\Gamma \times \Gamma_{136}^{\psi(2S)}/\Gamma_{\psi(2S)}}$$

VALUE (units 10^{-2})

EVTS

DOCUMENT ID

TECN

COMMENT

1.75 ±0.04 OUR FIT**1.52 ±0.15 OUR AVERAGE**

Error includes scale factor of 2.6. See the ideogram below.

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

¹ OREGLIA

82

CBAL

 $\psi(2S) \rightarrow \gamma\chi_{c2}$

1.8 ±0.5

² BRANDELIK

79B

DASP

 $\psi(2S) \rightarrow \gamma\chi_{c2}$

1.2 ±0.2

² BARTEL

78B

CNTR

 $\psi(2S) \rightarrow \gamma\chi_{c2}$

2.2 ±1.2

³ BIDDICK

77

CNTR

 $e^+e^- \rightarrow \gamma X$

1.2 ±0.7

¹ 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

⁴ MENDEZ

08

CLEO

 $\psi(2S) \rightarrow \gamma\chi_{c2}$

1.85 ±0.04 ±0.07

1.9k

⁵ ADAM

05A

CLEO

Repl. by MENDEZ 08

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 Assumes isotropic gamma distribution.

⁴ Not independent from other measurements of MENDEZ 08.

⁵ Not independent from other values reported by ADAM 05A.

NODE=M057B;LINKAGE=3Q

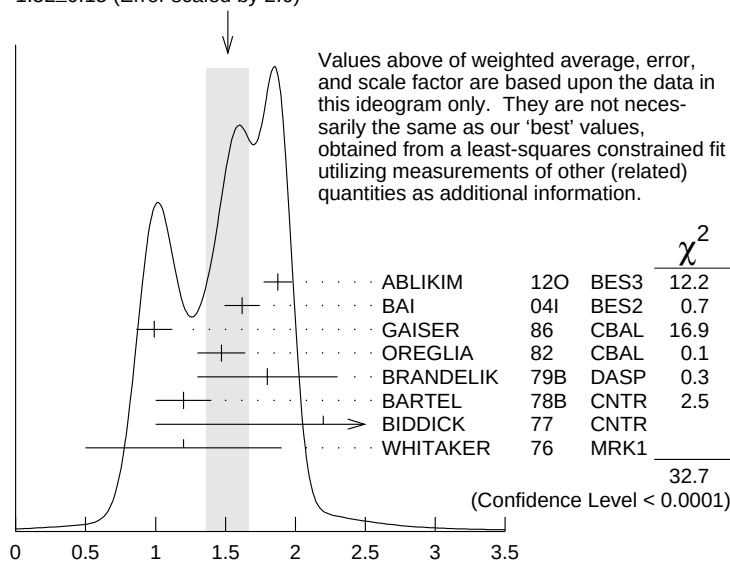
NODE=M057B;LINKAGE=2Q

NODE=M057B;LINKAGE=EA

NODE=M057B2;LINKAGE=ME

NODE=M057B;LINKAGE=AD

WEIGHTED AVERAGE
1.52±0.15 (Error scaled by 2.6)



$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow \gamma J/\psi(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))/\Gamma_{\text{total}}}{10^{-2}}$$

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow \gamma J/\psi(1S))}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))}{\Gamma(\psi(2S) \rightarrow J/\psi(1S) \text{ anything})} = \frac{\Gamma_{75}/\Gamma \times \Gamma_{136}^{\psi(2S)}/\Gamma_9^{\psi(2S)}}{\Gamma_{75}/\Gamma \times \Gamma_{136}^{\psi(2S)}/\Gamma_9^{\psi(2S)} + \Gamma_{11}^{\psi(2S)}/\Gamma_{12}^{\psi(2S)} + \Gamma_{13}^{\psi(2S)}/\Gamma_{13}^{\psi(2S)} + 0.339\Gamma_{135}^{\psi(2S)} + 0.192\Gamma_{136}^{\psi(2S)}}$$

NODE=M057B7

NODE=M057B7

VALUE (units 10^{-2}) EVTS DOCUMENT ID TECN COMMENT
2.87±0.07 OUR FIT

NODE=M057B7

• • • We do not use the following data for averages, fits, limits, etc. • • •

3.12±0.03±0.09	12.4k	¹ MENDEZ	08	CLEO	$\psi(2S) \rightarrow \gamma \chi_{c2}$
3.11±0.07±0.07	1.9k	ADAM	05A	CLEO	Repl. by MENDEZ 08

¹ Not independent from other measurements of MENDEZ 08.

NODE=M057B7;LINKAGE=ME

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow \gamma J/\psi(1S))}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))}{\Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)} = \frac{\Gamma_{75}/\Gamma \times \Gamma_{136}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}{\Gamma_{75}/\Gamma \times \Gamma_{136}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)} + \Gamma_{12}^{\psi(2S)}/\Gamma_{13}^{\psi(2S)} + \Gamma_{13}^{\psi(2S)}/\Gamma_{13}^{\psi(2S)} + 0.339\Gamma_{135}^{\psi(2S)} + 0.192\Gamma_{136}^{\psi(2S)}}$$

NODE=M057B3

NODE=M057B3

VALUE (units 10^{-2}) EVTS DOCUMENT ID TECN COMMENT

5.08±0.12 OUR FIT

5.53±0.17 OUR AVERAGE

5.56±0.05±0.16	12.4k	MENDEZ	08	CLEO	$\psi(2S) \rightarrow \gamma \chi_{c2}$
6.0 ±2.8	1.3k	¹ ABLIKIM	04B	BES	$\psi(2S) \rightarrow J/\psi X$
3.9 ±1.2		² HIMEL	80	MRK2	$\psi(2S) \rightarrow \gamma \chi_{c2}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

5.52±0.13±0.13	1.9k	³ ADAM	05A	CLEO	Repl. by MENDEZ 08

¹ From a fit to the J/ψ recoil mass spectra.

² The value for $B(\psi(2S) \rightarrow \gamma \chi_{c2}) \times B(\chi_{c2} \rightarrow \gamma J/\psi(1S))$ reported in HIMEL 80 is derived using $B(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-) = (33 \pm 3)\%$ and $B(J/\psi(1S) \rightarrow \ell^+ \ell^-) = 0.138 \pm 0.018$. Calculated by us using $B(J/\psi(1S) \rightarrow \ell^+ \ell^-) = (0.1181 \pm 0.0020)$.

³ Not independent from other values reported by ADAM 05A.

NODE=M057B;LINKAGE=AB

NODE=M057B;LINKAGE=H8

NODE=M057B3;LINKAGE=AD

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow \gamma \gamma)}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))}{\Gamma_{\text{total}}} = \frac{\Gamma_{79}/\Gamma \times \Gamma_{136}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}{\Gamma_{79}/\Gamma \times \Gamma_{136}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)} + \Gamma_{12}^{\psi(2S)}/\Gamma_{13}^{\psi(2S)} + \Gamma_{13}^{\psi(2S)}/\Gamma_{13}^{\psi(2S)} + 0.339\Gamma_{135}^{\psi(2S)} + 0.192\Gamma_{136}^{\psi(2S)}}$$

NODE=M057B4

NODE=M057B4

VALUE (units 10^{-5}) EVTS DOCUMENT ID TECN COMMENT

2.50±0.13 OUR FIT

2.78±0.18 OUR AVERAGE

2.81±0.17±0.15	1.1k	¹ ABLIKIM	12A	BES3	$\psi(2S) \rightarrow \gamma \chi_{c2} \rightarrow 3\gamma$
2.68±0.28±0.15	0.3k	ECKLUND	08A	CLEO	$\psi(2S) \rightarrow \gamma \chi_{c2} \rightarrow 3\gamma$
7.0 ±2.1 ±2.0		LEE	85	CBAL	$\psi(2S) \rightarrow \gamma \chi_{c2}$

¹ ABLIKIM 12A measures the ratio of two-photon partial widths for the helicity $\lambda = 0$ and helicity $\lambda = 2$ components to be $f_{0/2} = \Gamma_{\gamma\gamma}^{\lambda=0}/\Gamma_{\gamma\gamma}^{\lambda=2} = 0.00 \pm 0.02 \pm 0.02$.

NODE=M057B4;LINKAGE=AB

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow \gamma \gamma)}{\Gamma(\chi_{c0}(1P) \rightarrow \gamma \gamma)} = \frac{\Gamma_{79}/\Gamma_{89}^{\chi_{c0}(1P)}}{\Gamma_{79}/\Gamma_{89}^{\chi_{c0}(1P)} + \Gamma_{12}^{\chi_{c0}(1P)}/\Gamma_{13}^{\chi_{c0}(1P)} + \Gamma_{13}^{\chi_{c0}(1P)}/\Gamma_{13}^{\chi_{c0}(1P)} + 0.339\Gamma_{135}^{\chi_{c0}(1P)} + 0.192\Gamma_{136}^{\chi_{c0}(1P)}}$$

NODE=M057B06

NODE=M057B06

VALUE EVTS DOCUMENT ID TECN COMMENT

0.273±0.035 OUR AVERAGE

0.271±0.029±0.030	1.9k	¹ ABLIKIM	12A	BES3	$\psi(2S) \rightarrow \gamma \chi_{cJ} \rightarrow 3\gamma$
0.278±0.050±0.036	0.5k	¹ ECKLUND	08A	CLEO	$\psi(2S) \rightarrow \gamma \chi_{cJ} \rightarrow 3\gamma$

¹ Not independent from the values of $\Gamma(\chi_{c0}, \chi_{c2})$ and $B(\psi(2S) \rightarrow \chi_{c0}, \chi_{c2})$.

NODE=M057B06;LINKAGE=AB

MULTIPOLE AMPLITUDES IN $\chi_{c2}(1P) \rightarrow \gamma J/\psi(1S)$ RADIATIVE DECAY

NODE=M057240

$a_2 = M_2/\sqrt{E_1^2 + M_2^2 + E_3^2}$ Magnetic quadrupole fractional transition amplitude

VALUE (units 10^{-2}) EVTS DOCUMENT ID TECN COMMENT

-10.0± 1.5 OUR AVERAGE

- 9.3± 1.6±0.3	19.8k	¹ ARTUSO	09	CLEO	$\psi(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$
- 9.3 ^{+3.9} _{-4.1} ±0.6	5.9k	² AMBROGIANI	02	E835	$p\bar{p} \rightarrow \chi_{c2} \rightarrow J/\psi \gamma$
-14 ± 6	1.9k	² ARMSTRONG	93E	E760	$p\bar{p} \rightarrow \chi_{c2} \rightarrow J/\psi \gamma$
-33.3 ^{+11.6} _{-29.2}	441	² 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	³ ARTUSO	09	CLEO	$\psi(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$

OCCUR=2

¹ From a fit with floating M_2 amplitudes a_2 and b_2 , and fixed E_3 amplitudes $a_3=b_3=0$.

² Assuming $a_3=0$.

³ From a fit with floating M_2 and E_3 amplitudes a_2 , b_2 , and a_3 , and b_3 .

NODE=M057A1;LINKAGE=AR

NODE=M057A1;LINKAGE=A

NODE=M057A1;LINKAGE=AT

$a_3 = E3/\sqrt{E1^2 + M2^2 + E3^2}$ Electric octupole fractional transition amplitude

VALUE (units 10^{-2})	EVTs	DOCUMENT ID	TECN	COMMENT
1.6 ± 1.3 OUR AVERAGE				
$1.7 \pm 1.4 \pm 0.3$	19.8k	¹ ARTUSO	09 CLEO	$\psi(2S) \rightarrow \gamma\gamma\ell^+\ell^-$
$2.0^{+5.5}_{-4.4} \pm 0.9$	5908	AMBROGIANI	02 E835	$p\bar{p} \rightarrow \chi_{c2} \rightarrow J/\psi\gamma$
0^{+6}_{-5}	1904	ARMSTRONG	93E E760	$p\bar{p} \rightarrow \chi_{c2} \rightarrow J/\psi\gamma$

¹ From a fit with floating $M2$ and $E3$ amplitudes a_2 , b_2 , and a_3 , and b_3 .

NODE=M057A2
NODE=M057A2

NODE=M057A2;LINKAGE=AR

MULTIPOLE AMPLITUDES IN $\psi(2S) \rightarrow \gamma\chi_{c2}(1P)$ RADIATIVE DECAY

NODE=M057250

$b_2 = M2/\sqrt{E1^2 + M2^2 + E3^2}$ Magnetic quadrupole fractional transition amplitude

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.
$4.6 \pm 1.0 \pm 1.3$	13.8k	¹ ABLIKIM	11I BES3	$\psi(2S) \rightarrow \gamma\pi^+\pi^-, \gamma K^+K^-$
$0.2 \pm 1.5 \pm 0.4$	19.8k	² ARTUSO	09 CLEO	$\psi(2S) \rightarrow \gamma\gamma\ell^+\ell^-$
$-5.1^{+5.4}_{-3.6}$	721	¹ ABLIKIM	04I BES2	$\psi(2S) \rightarrow \gamma\pi^+\pi^-, \gamma K^+K^-$
$13.2^{+9.8}_{-7.5}$	441	³ OREGLIA	82 CBAL	$\psi(2S) \rightarrow \gamma\gamma\ell^+\ell^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

$1.0 \pm 1.3 \pm 0.3$ 19.8k ³ ARTUSO 09 CLEO $\psi(2S) \rightarrow \gamma\gamma\ell^+\ell^-$

¹ From a fit with floating $M2$ and $E3$ amplitudes b_2 and b_3 .

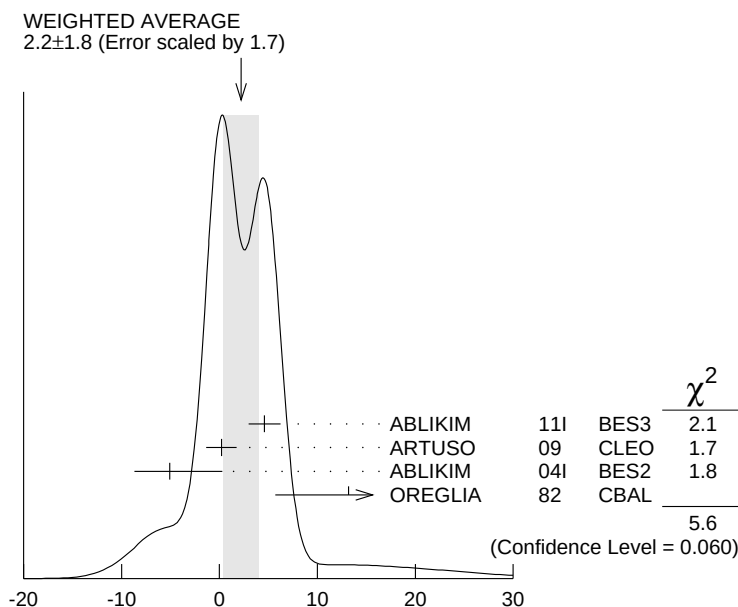
² From a fit with floating $M2$ and $E3$ amplitudes a_2 , b_2 , and a_3 , and b_3 .

³ From a fit with floating $M2$ amplitudes a_2 and b_2 , and fixed $E3$ amplitudes $a_3=b_3=0$.

NODE=M057QB2
NODE=M057QB2

OCCUR=2

NODE=M057QB2;LINKAGE=AB
NODE=M057QB2;LINKAGE=AT
NODE=M057QB2;LINKAGE=AR



$b_2 = M2/\sqrt{E1^2 + M2^2 + E3^2}$ Magnetic quadrupole fractional transition amplitude (units 10^{-2})

$b_3 = E3/\sqrt{E1^2 + M2^2 + E3^2}$ Electric octupole fractional transition amplitude

VALUE (units 10^{-2})	EVTs	DOCUMENT ID	TECN	COMMENT
-0.3 ± 1.0 OUR AVERAGE				
$1.5 \pm 0.8 \pm 1.8$	13.8k	¹ ABLIKIM	11I BES3	$\psi(2S) \rightarrow \gamma\pi^+\pi^-, \gamma K^+K^-$
$-0.8 \pm 1.2 \pm 0.2$	19.8k	ARTUSO	09 CLEO	$\psi(2S) \rightarrow \gamma\gamma\ell^+\ell^-$
$-2.7^{+4.3}_{-2.9}$	721	¹ ABLIKIM	04I BES2	$\psi(2S) \rightarrow \gamma\pi^+\pi^-, \gamma K^+K^-$

¹ From a fit with floating $M2$ and $E3$ amplitudes b_2 and b_3 .

NODE=M057QB3
NODE=M057QB3

NODE=M057QB3;LINKAGE=AB

MULTIPOLE AMPLITUDE RATIOS IN RADIATIVE DECAYS

$$\psi(2S) \rightarrow \gamma \chi_{c2}(1P) \text{ and } \chi_{c2} \rightarrow \gamma J/\psi(1S)$$

 b_2/a_2 Magnetic quadrupole transition amplitude ratio

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
-11^{+14}_{-15}	19.8k	¹ ARTUSO	09	CLEO $\psi(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$

¹ Statistical and systematic errors combined. From a fit with floating $M2$ amplitudes a_2 and b_2 , and fixed $E3$ 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=M057260

NODE=M057QAR

NODE=M057QAR

NODE=M057QAR;LINKAGE=AR

 $\chi_{c2}(1P)$ REFERENCES

NODE=M057

ABLIKIM	15I	PR D91 092006	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=56774
ABLIKIM	15M	PR D91 112008	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=56778
ABLIKIM	15N	PR D91 112018	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=56779
ABLIKIM	14J	PR D89 074030	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=55901
ABLIKIM	13B	PR D87 012002	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=54877
ABLIKIM	13D	PR D87 012007	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=54879
ABLIKIM	13H	PR D87 032007	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=54953
ABLIKIM	13V	PR D88 112001	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=55583
UEHARA	13	PTEP 2013 123C01	S. Uehara <i>et al.</i>	(BELLE Collab.)	REFID=55592
ABLIKIM	12A	PR D85 112008	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=54266
ABLIKIM	12I	PR D86 052004	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=54736
ABLIKIM	12J	PR D86 052011	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=54737
ABLIKIM	12O	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. Ackerstaff <i>et al.</i>	(OPAL Collab.)	REFID=46324
BAI	98D	PR D58 092006	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=46338
BAI	98I	PRL 81 3091	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=46343
DOMINICK	94	PR D50 4265	J. Dominick <i>et al.</i>	(CLEO Collab.)	REFID=44077
ARMSTRONG	93	PRL 70 2988	T.A. Armstrong <i>et al.</i>	(FNAL E760 Collab.)	REFID=43306
ARMSTRONG	93E	PR D48 3037	T.A. Armstrong <i>et al.</i>	(FNAL E760 Collab.)	REFID=48616
BAUER	93	PL B302 345	D.A. Bauer <i>et al.</i>	(TPC Collab.)	REFID=43315
ARMSTRONG	92	NP B373 35	T.A. Armstrong <i>et al.</i>	(FNAL, FERR, GENO+)	REFID=41865
Also		PRL 68 1468	T.A. Armstrong <i>et al.</i>	(FNAL, FERR, GENO+)	REFID=41907
BAGLIN	87B	PL B187 191	C. Baglin <i>et al.</i>	(R704 Collab.)	REFID=40018
BAGLIN	86B	PL B172 455	C. Baglin	(LAPP, CERN, GENO, LYON, OSLO+)	REFID=22145
GAISER	86	PR D34 711	J. Gaiser <i>et al.</i>	(Crystal Ball Collab.)	REFID=22012
LEE	85	SLAC 282	R.A. Lee	(SLAC)	REFID=40589
LEMOIGNE	82	PL 113B 509	Y. Lemoigne <i>et al.</i>	(SACL, LOIC, SHMP+)	REFID=22084
OREGLIA	82	PR D25 2259	M.J. Oreglia <i>et al.</i>	(SLAC, CIT, HARV+)	REFID=22120
Also		Private Comm.	M.J. Oreglia	(EFI)	REFID=22143
BARATE	81	PR D24 2994	R. Barate <i>et al.</i>	(SACL, LOIC, SHMP, CERN+)	REFID=22164
HIMEL	80	PRL 44 920	T. Himel <i>et al.</i>	(LBL, SLAC)	REFID=22119
Also		Private Comm.	G. Trilling	(LBL, UCB)	REFID=22113
BRANDELIK	79B	NP B160 426	R. Brandelik <i>et al.</i>	(DASP Collab.)	REFID=22115
BARTEL	78B	PL 79B 492	W. Bartel <i>et al.</i>	(DESY, HEIDP)	REFID=22111
TANENBAUM	78	PR D17 1731	W.M. Tanenbaum <i>et al.</i>	(SLAC, LBL)	REFID=22112
Also		Private Comm.	G. Trilling	(LBL, UCB)	REFID=22113
BIDDICK	77	PRL 38 1324	C.J. Biddick <i>et al.</i>	(UCSD, UMD, PAVI+)	REFID=22059
WHITAKER	76	PRL 37 1596	J.S. Whitaker <i>et al.</i>	(SLAC, LBL)	REFID=22151

$$\eta_c(2S)$$

$$I^G(J^{PC}) = 0^+(0^-+)$$

Quantum numbers are quark model predictions.

NODE=M059

NODE=M059

NODE=M059M

NODE=M059M

OCCUR=2

OCCUR=2

NODE=M059M;LINKAGE=DE
 NODE=M059M;LINKAGE=LE
 NODE=M059M;LINKAGE=LS
 NODE=M059M;LINKAGE=AB
 NODE=M059M;LINKAGE=VA
 NODE=M059M;LINKAGE=EB
 NODE=M059M;LINKAGE=AU
 NODE=M059M;LINKAGE=AR
 NODE=M059M;LINKAGE=CH
 NODE=M059M;LINKAGE=A

NODE=M059W

NODE=M059W

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

$\eta_c(2S)$ MASS

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
3639.2$\pm$1.2 OUR AVERAGE				
3637.0 $\pm$ 5.7 $\pm$ 3.4	178 ^{1,2}	LEES	14E BABR	$\gamma\gamma \rightarrow K^+ K^- \pi^0$
3635.1 $\pm$ 5.8 $\pm$ 2.1	47 ^{1,3}	LEES	14E BABR	$\gamma\gamma \rightarrow K^+ K^- \eta$
3646.9 $\pm$ 1.6 $\pm$ 3.6	57 $\pm$ 17	ABLIKIM	13K BES3	$\psi(2S) \rightarrow \gamma K_S^0 K^\pm \pi^\mp \pi^+ \pi^-$
3637.6 $\pm$ 2.9 $\pm$ 1.6	127 $\pm$ 18	⁴ ABLIKIM	12G BES3	$\psi(2S) \rightarrow \gamma K^0 K \pi,$ $K K \pi^0$
3638.5 $\pm$ 1.5 $\pm$ 0.8	624	¹ DEL-AMO-SA..11M	BABR	$\gamma\gamma \rightarrow K_S^0 K^\pm \pi^\mp$
3640.5 $\pm$ 3.2 $\pm$ 2.5	1201	¹ DEL-AMO-SA..11M	BABR	$\gamma\gamma \rightarrow K^\mp K^- \pi^+ \pi^- \pi^0$
3636.1 $^{+3.9+0.7}_{-4.2-2.0}$	128	⁵ VINOKUROVA	11 BELL	$B^\pm \rightarrow K^\pm (K_S^0 K^\pm \pi^\mp)$
3626 $\pm 5 \pm 6$	311	⁶ ABE	07 BELL	$e^+ e^- \rightarrow J/\psi(c\bar{c})$
3645.0 $\pm$ 5.5 $^{+4.9}_{-7.8}$	121 $\pm$ 27	AUBERT	05C BABR	$e^+ e^- \rightarrow J/\psi c\bar{c}$
3642.9 $\pm$ 3.1 $\pm$ 1.5	61	ASNER	04 CLEO	$\gamma\gamma \rightarrow \eta_c \rightarrow K_S^0 K^\pm \pi^\mp$

• • • We do not use the following data for averages, fits, limits, etc. • • •

3639 ± 7	98 $\pm$ 52	⁷ AUBERT	06E BABR	$B^\pm \rightarrow K^\pm X_{c\bar{c}}$
3630.8 $\pm$ 3.4 $\pm$ 1.0	112 $\pm$ 24	⁸ AUBERT	04D BABR	$\gamma\gamma \rightarrow \eta_c(2S) \rightarrow K \bar{K} \pi$
3654 $\pm 6 \pm 8$	39 $\pm$ 11	⁹ CHOI	02 BELL	$B \rightarrow K K_S K^- \pi^+$
3594 ± 5		¹⁰ EDWARDS	82C CBAL	$e^+ e^- \rightarrow \gamma X$

¹ Ignoring possible interference with continuum.

² With a width fixed to 11.3 MeV.

³ With a width fixed to 11.3 MeV. Using both $\eta \rightarrow \gamma\gamma$ and $\eta \rightarrow \pi^+ \pi^- \pi^0$ decays.

⁴ From a simultaneous fit to $K_S^0 K^\pm \pi^\mp$ and $K^+ K^- \pi^0$ decay modes.

⁵ Accounts for interference with non-resonant continuum.

⁶ From a fit of the J/ψ recoil mass spectrum. Supersedes ABE, K 02 and ABE 04G.

⁷ From the fit of the kaon momentum spectrum. Systematic errors not evaluated.

⁸ Superseded by DEL-AMO-SANCHEZ 11M.

⁹ Superseded by VINOKUROVA 11.

¹⁰ Assuming mass of $\psi(2S) = 3686$ MeV.

$\eta_c(2S)$ WIDTH

VALUE (MeV)	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
11.3$^{+3.2}_{-2.9}$ OUR AVERAGE					
9.9 $\pm$ 4.8 $\pm$ 2.9		57 $\pm$ 17	ABLIKIM	13K BES3	$\psi(2S) \rightarrow \gamma K_S^0 K^\pm \pi^\mp \pi^+ \pi^-$
16.9 $\pm$ 6.4 $\pm$ 4.8		127 $\pm$ 18	¹¹ ABLIKIM	12G BES3	$\psi(2S) \rightarrow \gamma K^0 K \pi,$ $K K \pi^0$
13.4 $\pm$ 4.6 $\pm$ 3.2		624	¹² 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	¹³ 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	¹⁴ 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	¹⁵ AUBERT	04D BABR	$\gamma\gamma \rightarrow \eta_c(2S) \rightarrow K \bar{K} \pi$
<55	90	39 $\pm$ 11	¹⁶ CHOI	02 BELL	$B \rightarrow K K_S K^- \pi^+$
<8.0	95		¹⁷ EDWARDS	82C CBAL	$e^+ e^- \rightarrow \gamma X$

¹¹ From a simultaneous fit to $K_S^0 K^\pm \pi^\mp$ and $K^+ K^- \pi^0$ decay modes.

¹² Ignoring possible interference with continuum.

¹³ Accounts for interference with non-resonant continuum.

¹⁴ From the fit of the kaon momentum spectrum. Systematic errors not evaluated.

¹⁵ Superseded by DEL-AMO-SANCHEZ 11M.

¹⁶ For a mass value of 3654 $\pm$ 6 MeV. Superseded by VINOKUROVA 11.

¹⁷ For a mass value of 3594 $\pm$ 5 MeV

$\eta_c(2S)$ DECAY MODES

NODE=M059215;NODE=M059

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 hadrons	not seen	
Γ_2 $K\bar{K}\pi$	(1.9 ± 1.2) %	
Γ_3 $K\bar{K}\eta$	(5 ± 4) $\times 10^{-3}$	
Γ_4 $2\pi^+ 2\pi^-$	not seen	
Γ_5 $\rho^0 \rho^0$	not seen	
Γ_6 $3\pi^+ 3\pi^-$	not seen	
Γ_7 $K^+ K^- \pi^+ \pi^-$	not seen	
Γ_8 $K^{*0} \bar{K}^{*0}$	not seen	
Γ_9 $K^+ K^- \pi^+ \pi^- \pi^0$	(1.4 ± 1.0) %	
Γ_{10} $K^+ K^- 2\pi^+ 2\pi^-$	not seen	
Γ_{11} $K_S^0 K^- 2\pi^+ \pi^- + \text{c.c.}$	seen	
Γ_{12} $2K^+ 2K^-$	not seen	
Γ_{13} $\phi\phi$	not seen	
Γ_{14} $p\bar{p}$	$< 2.0 \times 10^{-3}$	90%
Γ_{15} $\gamma\gamma$	(1.9 ± 1.3) $\times 10^{-4}$	
Γ_{16} $\pi^+ \pi^- \eta$	not seen	
Γ_{17} $\pi^+ \pi^- \eta'$	not seen	
Γ_{18} $\pi^+ \pi^- \eta_c(1S)$	< 25 %	90%

DESIG=1

DESIG=4

DESIG=20

DESIG=5

DESIG=16

DESIG=8;OUR EVAL;→ UNCHECKED ←

DESIG=6

DESIG=17

DESIG=9

DESIG=10;OUR EVAL;→ UNCHECKED ←

DESIG=11

DESIG=7

DESIG=18

DESIG=3

DESIG=2

DESIG=12;OUR EVAL;→ UNCHECKED ←

DESIG=13;OUR EVAL;→ UNCHECKED ←

DESIG=15

 $\eta_c(2S)$ PARTIAL WIDTHS

NODE=M059216

 $\Gamma(\gamma\gamma)$ Γ_{15}

VALUE (keV)	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.3±0.6	18 ASNER	04	CLEO	$\gamma\gamma \rightarrow \eta_c \rightarrow K_S^0 K^\pm \pi^\mp$

¹⁸ They measure $\Gamma(\eta_c(2S)\gamma\gamma)$ $B(\eta_c(2S) \rightarrow K\bar{K}\pi) = (0.18 \pm 0.05 \pm 0.02) \Gamma(\eta_c(1S)\gamma\gamma)$ $B(\eta_c(1S) \rightarrow K\bar{K}\pi)$. The value for $\Gamma(\eta_c(2S) \rightarrow \gamma\gamma)$ is derived assuming that the branching fractions for $\eta_c(2S)$ and $\eta_c(1S)$ decays to $K_S K\pi$ are equal and using $\Gamma(\eta_c(1S) \rightarrow \gamma\gamma) = 7.4 \pm 0.4 \pm 2.3$ keV.

NODE=M059W1
NODE=M059W1

NODE=M059W1;LINKAGE=AS

 $\eta_c(2S) \Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

NODE=M059218

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT

<6.5	90	UEHARA	08	BELL $\gamma\gamma \rightarrow \eta_c(2S) \rightarrow 2(\pi^+ \pi^-)$

 $\Gamma_4 \Gamma_{15} / \Gamma$ NODE=M059G01
NODE=M059G01

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT

$41 \pm 4 \pm 6$	624	19 DEL-AMO-SA..11M	BABR	$\gamma\gamma \rightarrow K_S^0 K^\pm \pi^\mp$

¹⁹ Not independent from other measurements reported in DEL-AMO-SANCHEZ 11M.

 $\Gamma_2 \Gamma_{15} / \Gamma$ NODE=M059G04
NODE=M059G04

NODE=M059G04;LINKAGE=DE

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT

<5.0	90	UEHARA	08	BELL $\gamma\gamma \rightarrow \eta_c(2S) \rightarrow K^+ K^- \pi^+ \pi^-$

 $\Gamma_7 \Gamma_{15} / \Gamma$ NODE=M059G02
NODE=M059G02

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT

$30 \pm 6 \pm 5$	1201	20 DEL-AMO-SA..11M	BABR	$\gamma\gamma \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$

²⁰ Not independent from other measurements reported in DEL-AMO-SANCHEZ 11M.

 $\Gamma_9 \Gamma_{15} / \Gamma$ NODE=M059G05
NODE=M059G05

NODE=M059G05;LINKAGE=DE

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT

<2.9	90	UEHARA	08	BELL $\gamma\gamma \rightarrow \eta_c(2S) \rightarrow 2(K^+ K^-)$

 $\Gamma_{12} \Gamma_{15} / \Gamma$ NODE=M059G03
NODE=M059G03

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT

<133	90	LEES	12AE BABR	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^- \eta_c$

 $\Gamma_{18} \Gamma_{15} / \Gamma$ NODE=M059G06
NODE=M059G06

$\eta_c(2S) \Gamma(i) \Gamma(\gamma\gamma) / \Gamma^2(\text{total})$

NODE=M059217

 $\Gamma(p\bar{p}) / \Gamma_{\text{total}} \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$ $\Gamma_{14} / \Gamma \times \Gamma_{15} / \Gamma$

VALUE (units 10^{-8})	CL%	DOCUMENT ID	TECN	COMMENT
< 5.6	90 ^{21,22,23}	AMBROGIANI 01	E835	$\bar{p}p \rightarrow \gamma\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
< 8.0	90 ^{21,22,24}	AMBROGIANI 01	E835	$\bar{p}p \rightarrow \gamma\gamma$
< 12.0	90 ^{22,24}	AMBROGIANI 01	E835	$\bar{p}p \rightarrow \gamma\gamma$
²¹ Including the measurements of of ARMSTRONG 95F in the AMBROGIANI 01 analysis.				
²² For a total width $\Gamma=5$ MeV.				
²³ For the resonance mass region 3589–3599 MeV/ c^2 .				
²⁴ For the resonance mass region 3575–3660 MeV/ c^2 .				

NODE=M059G1
NODE=M059G1OCCUR=2
OCCUR=3NODE=M059G1;LINKAGE=A
NODE=M059G1;LINKAGE=B
NODE=M059G1;LINKAGE=C1
NODE=M059G1;LINKAGE=C2 $\eta_c(2S) \text{ BRANCHING RATIOS}$

NODE=M059220

 $\Gamma(\text{hadrons}) / \Gamma_{\text{total}}$ Γ_1 / Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	ABREU 98O	DLPH	$e^+e^- \rightarrow e^+e^- + \text{hadrons}$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
seen	²⁵ EDWARDS 82C	CBAL	$e^+e^- \rightarrow \gamma X$
²⁵ For a mass value of 3594 ± 5 MeV			

NODE=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	²⁶ 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	²⁷ CHOI 02	BELL	$B \rightarrow K K_S K^- \pi^+$
²⁶ 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 $[B(B^+ \rightarrow \eta_c K^+) \times B(\eta_c \rightarrow K\bar{K}\pi)] = (6.88 \pm 0.77^{+0.55}_{-0.66}) \times 10^{-5}$.				
²⁷ For a mass value of 3654 ± 6 MeV				

NODE=M059R3
NODE=M059R3

NODE=M059R3;LINKAGE=AU

NODE=M059R;LINKAGE=W2

 $\Gamma(K\bar{K}\eta) / \Gamma(K\bar{K}\pi)$ Γ_3 / Γ_2

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
$27.3 \pm 7.0 \pm 9.0$	225	²⁸ LEES 14E	BABR	$\gamma\gamma \rightarrow K^+ K^- \gamma\gamma$
²⁸ LEES 14E reports $B(\eta_c(2S) \rightarrow K^+ K^- \eta) / B(\eta_c(2S) \rightarrow K^+ K^- \pi^0) = 0.82 \pm 0.21 \pm 0.27$, which we divide by 3 to account for isospin symmetry.				

NODE=M059R26
NODE=M059R26

NODE=M059R26;LINKAGE=LE

 $\Gamma(2\pi^+ 2\pi^-) / \Gamma_{\text{total}}$ Γ_4 / Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	UEHARA 08	BELL	$\gamma\gamma \rightarrow \eta_c(2S)$

NODE=M059R01
NODE=M059R01 $\Gamma(\rho^0 \rho^0) / \Gamma_{\text{total}}$ Γ_5 / Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	ABLIKIM 11H	BES3	$\psi(2S) \rightarrow \gamma 2\pi^+ 2\pi^-$

NODE=M059R15
NODE=M059R15 $\Gamma(K^+ K^- \pi^+ \pi^-) / \Gamma_{\text{total}}$ Γ_7 / Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	UEHARA 08	BELL	$\gamma\gamma \rightarrow \eta_c(2S)$

NODE=M059R02
NODE=M059R02 $\Gamma(K^+ K^- \pi^+ \pi^- \pi^0) / \Gamma(K\bar{K}\pi)$ Γ_9 / Γ_2

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
$0.73 \pm 0.17 \pm 0.17$	1201	²⁹ DEL-AMO-SA..11M	BABR	$\gamma\gamma \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$
²⁹ 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

 $\Gamma(K^* \bar{K}^*) / \Gamma_{\text{total}}$ Γ_8 / Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	ABLIKIM 11H	BES3	$\psi(2S) \rightarrow \gamma K^+ K^- \pi^+ \pi^-$

NODE=M059R16
NODE=M059R16

$$\Gamma(K_S^0 K^- 2\pi^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_{11}/\Gamma$$

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

$$\Gamma(2K^+ 2K^-)/\Gamma_{\text{total}} \quad \Gamma_{12}/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	UEHARA	08 BELL	$\gamma\gamma \rightarrow \eta_c(2S)$

NODE=M059R03
NODE=M059R03

$$\Gamma(\phi\phi)/\Gamma_{\text{total}} \quad \Gamma_{13}/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	ABLIKIM	11H BES3	$\psi(2S) \rightarrow \gamma K^+ K^- K^+ K^-$

NODE=M059R17
NODE=M059R17

$$\Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{15}/\Gamma$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

<5 × 10 ⁻⁴	90	30 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	$\psi' \rightarrow \text{photons}$

30 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=W1

$$\Gamma(\pi^+ \pi^- \eta_c(1S))/\Gamma(K \bar{K} \pi) \quad \Gamma_{18}/\Gamma_2$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<3.33	90	31 LEES	12AE BABR	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^- \eta_c$

31 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

$$\Gamma(\eta_c(2S) \rightarrow 2\pi^+ 2\pi^-)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S))/\Gamma_{\text{total}} \quad \Gamma_4/\Gamma \times \Gamma_{138}^{\psi(2S)}/\Gamma\psi(2S)$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<14.6 × 10 ⁻⁶	90	32 CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma 2\pi^+ 2\pi^-$

32 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

$$\Gamma(\eta_c(2S) \rightarrow \rho^0 \rho^0)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S))/\Gamma_{\text{total}} \quad \Gamma_5/\Gamma \times \Gamma_{138}^{\psi(2S)}/\Gamma\psi(2S)$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<12.7 × 10 ⁻⁷	90	ABLIKIM	11H BES3	$\psi(2S) \rightarrow \gamma 2\pi^+ 2\pi^-$

NODE=M059R18
NODE=M059R18

$$\Gamma(\eta_c(2S) \rightarrow 3\pi^+ 3\pi^-)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S))/\Gamma_{\text{total}} \quad \Gamma_6/\Gamma \times \Gamma_{138}^{\psi(2S)}/\Gamma\psi(2S)$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<13.2 × 10 ⁻⁶	90	33 CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma 3\pi^+ 3\pi^-$

33 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

$$\Gamma(\eta_c(2S) \rightarrow K^+ K^- \pi^+ \pi^-)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S))/\Gamma_{\text{total}} \quad \Gamma_7/\Gamma \times \Gamma_{138}^{\psi(2S)}/\Gamma\psi(2S)$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<9.6 × 10 ⁻⁶	90	34 CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma K^+ K^- \pi^+ \pi^-$

34 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

$$\Gamma(\eta_c(2S) \rightarrow K^{*0} \bar{K}^{*0})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S))/\Gamma_{\text{total}} \quad \Gamma_8/\Gamma \times \Gamma_{138}^{\psi(2S)}/\Gamma\psi(2S)$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<19.6 × 10 ⁻⁷	90	ABLIKIM	11H BES3	$\psi(2S) \rightarrow \gamma K^+ K^- \pi^+ \pi^-$

NODE=M059R19
NODE=M059R19

$$\Gamma(\eta_c(2S) \rightarrow K^+ K^- \pi^+ \pi^- \pi^0) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S)) / \Gamma_{\text{total}}$$

$$\Gamma_9 / \Gamma \times \Gamma_{138}^{\psi(2S)} / \Gamma \psi(2S)$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<43.0 \times 10^{-6}$	90	35 CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma K^+ K^- \pi^+ \pi^- \pi^0$

NODE=M059R08
NODE=M059R08

³⁵ Assuming $\Gamma(\eta_c(2S)) = 14$ MeV. CRONIN-HENNESSY 10 gives the analytic dependence of limits on width.

NODE=M059R08;LINKAGE=CR

$$\Gamma(\eta_c(2S) \rightarrow K^+ K^- 2\pi^+ 2\pi^-) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S)) / \Gamma_{\text{total}}$$

$$\Gamma_{10} / \Gamma \times \Gamma_{138}^{\psi(2S)} / \Gamma \psi(2S)$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<9.7 \times 10^{-6}$	90	36 CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma K^+ K^- 2\pi^+ 2\pi^-$

NODE=M059R09
NODE=M059R09

³⁶ Assuming $\Gamma(\eta_c(2S)) = 14$ MeV. CRONIN-HENNESSY 10 gives the analytic dependence of limits on width.

NODE=M059R09;LINKAGE=CR

$$\Gamma(\eta_c(2S) \rightarrow K_S^0 K^- 2\pi^+ \pi^- + \text{c.c.}) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S)) / \Gamma_{\text{total}}$$

$$\Gamma_{11} / \Gamma \times \Gamma_{138}^{\psi(2S)} / \Gamma \psi(2S)$$

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	37 CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma K_S^0 K^- 2\pi^+ \pi^- + \text{c.c.}$

³⁷ Assuming $\Gamma(\eta_c(2S)) = 14$ MeV. CRONIN-HENNESSY 10 gives the analytic dependence of limits on width.

NODE=M059R10;LINKAGE=CR

$$\Gamma(\eta_c(2S) \rightarrow \phi \phi) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S)) / \Gamma_{\text{total}}$$

$$\Gamma_{13} / \Gamma \times \Gamma_{138}^{\psi(2S)} / \Gamma \psi(2S)$$

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

$$\Gamma(\eta_c(2S) \rightarrow \pi^+ \pi^- \eta) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S)) / \Gamma_{\text{total}}$$

$$\Gamma_{16} / \Gamma \times \Gamma_{138}^{\psi(2S)} / \Gamma \psi(2S)$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<4.3 \times 10^{-6}$	90	38 CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- \eta$

NODE=M059R11
NODE=M059R11

³⁸ Assuming $\Gamma(\eta_c(2S)) = 14$ MeV. CRONIN-HENNESSY 10 gives the analytic dependence of limits on width.

NODE=M059R11;LINKAGE=CR

$$\Gamma(\eta_c(2S) \rightarrow \pi^+ \pi^- \eta') / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S)) / \Gamma_{\text{total}}$$

$$\Gamma_{17} / \Gamma \times \Gamma_{138}^{\psi(2S)} / \Gamma \psi(2S)$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<14.2 \times 10^{-6}$	90	39 CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- \eta'$

NODE=M059R12
NODE=M059R12

³⁹ Assuming $\Gamma(\eta_c(2S)) = 14$ MeV. CRONIN-HENNESSY 10 gives the analytic dependence of limits on width.

NODE=M059R12;LINKAGE=CR

$$\Gamma(\eta_c(2S) \rightarrow K \bar{K} \eta) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S)) / \Gamma_{\text{total}}$$

$$\Gamma_3 / \Gamma \times \Gamma_{138}^{\psi(2S)} / \Gamma \psi(2S)$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<11.8 \times 10^{-6}$	90	40 CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma K^+ K^- \eta$

NODE=M059R25
NODE=M059R25

⁴⁰ CRONIN-HENNESSY 10 reports a limit of $< 5.9 \times 10^{-6}$ for the decay $\eta_c(2S) \rightarrow K^+ K^- \eta$ which we multiply by 2 account for isospin symmetry. It assumes $\Gamma(\eta_c(2S)) = 14$ MeV. It also gives the analytic dependence of limits on width.

NODE=M059R25;LINKAGE=CR

$$\Gamma(\eta_c(2S) \rightarrow \pi^+ \pi^- \eta_c(1S)) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S)) / \Gamma_{\text{total}}$$

$$\Gamma_{18} / \Gamma \times \Gamma_{138}^{\psi(2S)} / \Gamma \psi(2S)$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<1.7 \times 10^{-4}$	90	41 CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- \eta_c(1S)$

NODE=M059R14
NODE=M059R14

⁴¹ Assuming $\Gamma(\eta_c(2S)) = 14$ MeV. CRONIN-HENNESSY 10 gives the analytic dependence of limits on width.

NODE=M059R14;LINKAGE=CR

$$\Gamma(\eta_c(2S) \rightarrow p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\eta_c(2S))/\Gamma_{\text{total}}$$

$$\Gamma_{14}/\Gamma \times \Gamma_{138}^{\psi(2S)}/\Gamma_{\psi(2S)}$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<1.4 \times 10^{-6}$	90	ABLIKIM	13V BES3	$\psi(2S) \rightarrow \gamma p\bar{p}$

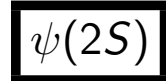
NODE=M059R24
 NODE=M059R24

$\eta_c(2S)$ REFERENCES

LEES	14E	PR D89 112004	J.P. Lees <i>et al.</i>	(BABAR Collab.)
ABLIKIM	13K	PR D87 052005	M. Ablikim <i>et al.</i>	(BES III Collab.)
ABLIKIM	13V	PR D88 112001	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.)
AUBERT	05C	PR D72 031101	B. Aubert <i>et al.</i>	(BABAR Collab.)
ABE	04G	PR D70 071102	K. Abe <i>et al.</i>	(BELLE Collab.)
ASNER	04	PRL 92 142001	D.M. Asner <i>et al.</i>	(CLEO Collab.)
AUBERT	04D	PRL 92 142002	B. Aubert <i>et al.</i>	(BABAR Collab.)
ABE,K	02	PRL 89 142001	K. Abe <i>et al.</i>	(BELLE Collab.)
CHOI	02	PRL 89 102001	S.-K. Choi <i>et al.</i>	(BELLE Collab.)
AMBROGIANI	01	PR D64 052003	M. Ambrogiani <i>et al.</i>	(FNAL E835 Collab.)
ABREU	98O	PL B441 479	P. Abreu <i>et al.</i>	(DELPHI Collab.)
ARMSTRONG	95F	PR D52 4839	T.A. Armstrong <i>et al.</i>	(FNAL, FERR, GENO+)
LEE	85	SLAC 282	R.A. Lee	(SLAC)
EDWARDS	82C	PRL 48 70	C. Edwards <i>et al.</i>	(CIT, HARV, PRIN+)

NODE=M059

REFID=55937
 REFID=54956
 REFID=55583
 REFID=54272
 REFID=54752
 REFID=53929
 REFID=16751
 REFID=53927
 REFID=53233
 REFID=52267
 REFID=52064
 REFID=52204
 REFID=51627
 REFID=51059
 REFID=50773
 REFID=50182
 REFID=49745
 REFID=49746
 REFID=49188
 REFID=48760
 REFID=48340
 REFID=46553
 REFID=44623
 REFID=40589
 REFID=22173



$$I^G(J^{PC}) = 0^-(1^{--})$$

See the Review on " $\psi(2S)$ and χ_c branching ratios" before the $\chi_{c0}(1P)$ Listings.

NODE=M071

NODE=M071

$\psi(2S)$ MASS

NODE=M071M

OUR FIT includes measurements of $m_{\psi(2S)}$, $m_{\psi(3770)}$, and $m_{\psi(3770)} - m_{\psi(2S)}$.

NODE=M071M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
3686.097±0.025 OUR FIT	Error includes scale factor of 2.6.			
3686.097±0.010 OUR AVERAGE				
3686.099±0.004±0.009	1	ANASHIN 15	KEDR	$e^+e^- \rightarrow \text{hadrons}$
3686.12 ±0.06 ±0.10	4k	AAIJ 12H	LHCB	$pp \rightarrow J/\psi \pi^+ \pi^- X$
3685.95 ±0.10	413	2 ARTAMONOV 00	OLYA	$e^+e^- \rightarrow \text{hadrons}$
3685.98 ±0.09 ±0.04	3	ARMSTRONG 93B	E760	$p\bar{p} \rightarrow e^+e^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
3686.114±0.007 ^{+0.011} _{-0.016}	4	ANASHIN 12	KEDR	$e^+e^- \rightarrow \text{hadrons}$
3686.111±0.025±0.009		AULCHENKO 03	KEDR	$e^+e^- \rightarrow \text{hadrons}$
3686.00 ±0.10	413	5 ZHOLENTZ 80	OLYA	e^+e^-

NODE=M071M

¹Supersedes AULCHENKO 03 and ANASHIN 12.

²Reanalysis of ZHOLENTZ 80 using new electron mass (COHEN 87) and radiative corrections (KURAEV 85).

³Mass central value and systematic error recalculated by us according to Eq.(16) in ARMSTRONG 93B, using the value for the $J/\psi(1S)$ mass from AULCHENKO 03.

⁴From the scans in 2004 and 2006. ANASHIN 12 reports the value $3686.114 \pm 0.007 \pm 0.011^{+0.002}_{-0.012}$ MeV, where the third uncertainty is due to assumptions on the interference between the resonance and hadronic continuum. We combined the two systematic uncertainties.

⁵Superseded by ARTAMONOV 00.

NODE=M071M;LINKAGE=A
 NODE=M071M;LINKAGE=AR

NODE=M071M;LINKAGE=NW

NODE=M071M;LINKAGE=AN

NODE=M071M;LINKAGE=RZ

$$m_{\psi(2S)} = m_{J/\psi(1S)}$$

NODE=M071DM

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
589.188±0.028 OUR AVERAGE			
589.194±0.027±0.011	1 AULCHENKO 03	KEDR	$e^+e^- \rightarrow \text{hadrons}$
589.7 ±1.2	LEMOIGNE 82	GOLI	$185 \pi^- \text{Be} \rightarrow \gamma \mu^+ \mu^- \text{A}$
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^-

NODE=M071DM

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

NODE=M071W

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
296$\pm$ 8 OUR FIT				
286$\pm$16 OUR AVERAGE				
358 $\pm$ 88 $\pm$ 4		ABLIKIM	08B BES2	$e^+e^- \rightarrow \text{hadrons}$
290 $\pm$ 25 $\pm$ 4	2.7k	ANDREOTTI	07 E835	$p\bar{p} \rightarrow e^+e^-, J/\psi X$
331 $\pm$ 58 $\pm$ 2		ABLIKIM	06L BES2	$e^+e^- \rightarrow \text{hadrons}$
264 $\pm$ 27		¹ BAI	02B BES2	e^+e^-
287 $\pm$ 37 $\pm$ 16		² ARMSTRONG	93B E760	$p\bar{p} \rightarrow e^+e^-$

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

 $\psi(2S)$ DECAY MODES

NODE=M071220;NODE=M071

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
Γ_1 hadrons	(97.85 $\pm$ 0.13) %	
Γ_2 virtual $\gamma \rightarrow \text{hadrons}$	(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^-	(7.89 $\pm$ 0.17) $\times 10^{-3}$	
Γ_7 $\mu^+\mu^-$	(7.9 $\pm$ 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

NODE=M071;CLUMP=A

Γ_9 $J/\psi(1S)\text{anything}$	(61.0 $\pm$ 0.6) %
Γ_{10} $J/\psi(1S)\text{neutrals}$	(25.14 $\pm$ 0.33) %
Γ_{11} $J/\psi(1S)\pi^+\pi^-$	(34.49 $\pm$ 0.30) %
Γ_{12} $J/\psi(1S)\pi^0\pi^0$	(18.17 $\pm$ 0.31) %
Γ_{13} $J/\psi(1S)\eta$	(3.36 $\pm$ 0.05) %
Γ_{14} $J/\psi(1S)\pi^0$	(1.268 $\pm$ 0.032) $\times 10^{-3}$

DESIG=11

DESIG=12

DESIG=13

DESIG=14

DESIG=15

DESIG=18

Hadronic decays

NODE=M071;CLUMP=B

Γ_{15} $\pi^0 h_c(1P)$	(8.6 $\pm$ 1.3) $\times 10^{-4}$	
Γ_{16} $3(\pi^+\pi^-)\pi^0$	(3.5 $\pm$ 1.6) $\times 10^{-3}$	
Γ_{17} $2(\pi^+\pi^-)\pi^0$	(2.9 $\pm$ 1.0) $\times 10^{-3}$	S=4.7
Γ_{18} $\rho a_2(1320)$	(2.6 $\pm$ 0.9) $\times 10^{-4}$	
Γ_{19} $p\bar{p}$	(2.88 $\pm$ 0.10) $\times 10^{-4}$	
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} $\Lambda\bar{\Lambda}$	(3.57 $\pm$ 0.18) $\times 10^{-4}$	
Γ_{27} $\Lambda\bar{\Sigma}^+\pi^- + \text{c.c.}$	(1.40 $\pm$ 0.13) $\times 10^{-4}$	
Γ_{28} $\Lambda\bar{\Sigma}^-\pi^+ + \text{c.c.}$	(1.54 $\pm$ 0.14) $\times 10^{-4}$	
Γ_{29} $\Sigma^0\bar{p}K^+ + \text{c.c.}$	(1.67 $\pm$ 0.18) $\times 10^{-5}$	
Γ_{30} $\Sigma^+\bar{\Sigma}^-$	(2.51 $\pm$ 0.21) $\times 10^{-4}$	
Γ_{31} $\Sigma^0\bar{\Sigma}^0$	(2.32 $\pm$ 0.16) $\times 10^{-4}$	
Γ_{32} $\Sigma(1385)^+\bar{\Sigma}(1385)^-$	(8.5 $\pm$ 0.7) $\times 10^{-5}$	
Γ_{33} $\Sigma(1385)^-\bar{\Sigma}(1385)^+$	(8.5 $\pm$ 0.8) $\times 10^{-5}$	
Γ_{34} $\Xi^-\bar{\Xi}^+$	(2.72 $\pm$ 0.12) $\times 10^{-4}$	
Γ_{35} $\Xi^0\bar{\Xi}^0$	(2.07 $\pm$ 0.23) $\times 10^{-4}$	
Γ_{36} $\Xi(1530)^0\bar{\Xi}(1530)^0$	(5.2 $\pm$ 3.2 $\pm$ 1.2) $\times 10^{-5}$	
Γ_{37} $K^-\Lambda\bar{\Xi}^+ + \text{c.c.}$	(3.9 $\pm$ 0.4) $\times 10^{-5}$	

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=280

DESIG=281

DESIG=274

DESIG=223

DESIG=71

DESIG=72

DESIG=297

DESIG=29

DESIG=224

DESIG=73

DESIG=293

Г ₃₈	$\Xi(1690)^- \Xi^+ \rightarrow K^- \Lambda \Xi^+ +$	$(5.2 \pm 1.6) \times 10^{-6}$		DESIG=294
Г ₃₉	$\Xi(1820)^- \Xi^+ \rightarrow K^- \Lambda \Xi^+ +$	$(1.20 \pm 0.32) \times 10^{-5}$		DESIG=295
Г ₄₀	$K^- \Sigma^0 \Xi^+ + \text{c.c.}$	$(3.7 \pm 0.4) \times 10^{-5}$		DESIG=296
Г ₄₁	$\Omega^- \bar{\Omega}^+$	$(4.7 \pm 1.0) \times 10^{-5}$		DESIG=74
Г ₄₂	$\pi^0 p \bar{p}$	$(1.53 \pm 0.07) \times 10^{-4}$		DESIG=35
Г ₄₃	$N(940) \bar{p} + \text{c.c.} \rightarrow \pi^0 p \bar{p}$	$(6.4 \pm 1.8_{-1.3}) \times 10^{-5}$		DESIG=267
Г ₄₄	$N(1440) \bar{p} + \text{c.c.} \rightarrow \pi^0 p \bar{p}$	$(7.3 \pm 1.7_{-1.5}) \times 10^{-5}$	S=2.5	DESIG=261
Г ₄₅	$N(1520) \bar{p} + \text{c.c.} \rightarrow \pi^0 p \bar{p}$	$(6.4 \pm 2.3_{-1.8}) \times 10^{-6}$		DESIG=268
Г ₄₆	$N(1535) \bar{p} + \text{c.c.} \rightarrow \pi^0 p \bar{p}$	$(2.5 \pm 1.0) \times 10^{-5}$		DESIG=269
Г ₄₇	$N(1650) \bar{p} + \text{c.c.} \rightarrow \pi^0 p \bar{p}$	$(3.8 \pm 1.4_{-1.7}) \times 10^{-5}$		DESIG=270
Г ₄₈	$N(1720) \bar{p} + \text{c.c.} \rightarrow \pi^0 p \bar{p}$	$(1.79 \pm 0.26_{-0.70}) \times 10^{-5}$		DESIG=271
Г ₄₉	$N(2300) \bar{p} + \text{c.c.} \rightarrow \pi^0 p \bar{p}$	$(2.6 \pm 1.2_{-0.7}) \times 10^{-5}$		DESIG=272
Г ₅₀	$N(2570) \bar{p} + \text{c.c.} \rightarrow \pi^0 p \bar{p}$	$(2.13 \pm 0.40_{-0.31}) \times 10^{-5}$		DESIG=273
Г ₅₁	$\pi^0 f_0(2100) \rightarrow \pi^0 p \bar{p}$	$(1.1 \pm 0.4) \times 10^{-5}$		DESIG=262
Г ₅₂	$\eta p \bar{p}$	$(6.0 \pm 0.4) \times 10^{-5}$		DESIG=200
Г ₅₃	$\eta f_0(2100) \rightarrow \eta p \bar{p}$	$(1.2 \pm 0.4) \times 10^{-5}$		DESIG=263
Г ₅₄	$N(1535) \bar{p} \rightarrow \eta p \bar{p}$	$(4.4 \pm 0.7) \times 10^{-5}$		DESIG=264
Г ₅₅	$\omega p \bar{p}$	$(6.9 \pm 2.1) \times 10^{-5}$		DESIG=77
Г ₅₆	$\phi p \bar{p}$	$< 2.4 \times 10^{-5}$	CL=90%	DESIG=80
Г ₅₇	$\pi^+ \pi^- p \bar{p}$	$(6.0 \pm 0.4) \times 10^{-4}$		DESIG=31
Г ₅₈	$p \bar{n} \pi^- \text{ or c.c.}$	$(2.48 \pm 0.17) \times 10^{-4}$		DESIG=227
Г ₅₉	$p \bar{n} \pi^- \pi^0$	$(3.2 \pm 0.7) \times 10^{-4}$		DESIG=228
Г ₆₀	$2(\pi^+ \pi^- \pi^0)$	$(4.8 \pm 1.5) \times 10^{-3}$		DESIG=221
Г ₆₁	$\eta \pi^+ \pi^-$	$< 1.6 \times 10^{-4}$	CL=90%	DESIG=202
Г ₆₂	$\eta \pi^+ \pi^- \pi^0$	$(9.5 \pm 1.7) \times 10^{-4}$		DESIG=203
Г ₆₃	$2(\pi^+ \pi^-) \eta$	$(1.2 \pm 0.6) \times 10^{-3}$		DESIG=251
Г ₆₄	$\eta' \pi^+ \pi^- \pi^0$	$(4.5 \pm 2.1) \times 10^{-4}$		DESIG=204
Г ₆₅	$\omega \pi^+ \pi^-$	$(7.3 \pm 1.2) \times 10^{-4}$	S=2.1	DESIG=75
Г ₆₆	$b_1^\pm \pi^\mp$	$(4.0 \pm 0.6) \times 10^{-4}$	S=1.1	DESIG=40
Г ₆₇	$b_1^0 \pi^0$	$(2.4 \pm 0.6) \times 10^{-4}$		DESIG=193
Г ₆₈	$\omega f_2(1270)$	$(2.2 \pm 0.4) \times 10^{-4}$		DESIG=64
Г ₆₉	$\pi^0 \pi^0 K^+ K^-$	$(2.6 \pm 1.3) \times 10^{-4}$		DESIG=298
Г ₇₀	$\pi^+ \pi^- K^+ K^-$	$(7.3 \pm 0.5) \times 10^{-4}$		DESIG=26
Г ₇₁	$\rho^0 K^+ K^-$	$(2.2 \pm 0.4) \times 10^{-4}$		DESIG=205
Г ₇₂	$K^*(892)^0 \bar{K}_2^*(1430)^0$	$(1.9 \pm 0.5) \times 10^{-4}$		DESIG=66
Г ₇₃	$K^+ K^- \pi^+ \pi^- \eta$	$(1.3 \pm 0.7) \times 10^{-3}$		DESIG=252
Г ₇₄	$K^+ K^- 2(\pi^+ \pi^-) \pi^0$	$(1.00 \pm 0.31) \times 10^{-3}$		DESIG=240
Г ₇₅	$K^+ K^- 2(\pi^+ \pi^-)$	$(1.9 \pm 0.9) \times 10^{-3}$		DESIG=222
Г ₇₆	$K_1(1270)^\pm K^\mp$	$(1.00 \pm 0.28) \times 10^{-3}$		DESIG=41
Г ₇₇	$K_S^0 K_S^0 \pi^+ \pi^-$	$(2.2 \pm 0.4) \times 10^{-4}$		DESIG=225
Г ₇₈	$\rho^0 p \bar{p}$	$(5.0 \pm 2.2) \times 10^{-5}$		DESIG=210
Г ₇₉	$K^+ \bar{K}^*(892)^0 \pi^- + \text{c.c.}$	$(6.7 \pm 2.5) \times 10^{-4}$		DESIG=34
Г ₈₀	$2(\pi^+ \pi^-)$	$(2.4 \pm 0.6) \times 10^{-4}$	S=2.2	DESIG=24
Г ₈₁	$\rho^0 \pi^+ \pi^-$	$(2.2 \pm 0.6) \times 10^{-4}$	S=1.4	DESIG=33
Г ₈₂	$K^+ K^- \pi^+ \pi^- \pi^0$	$(1.26 \pm 0.09) \times 10^{-3}$		DESIG=206
Г ₈₃	$\omega f_0(1710) \rightarrow \omega K^+ K^-$	$(5.9 \pm 2.2) \times 10^{-5}$		DESIG=216
Г ₈₄	$K^*(892)^0 K^- \pi^+ \pi^0 + \text{c.c.}$	$(8.6 \pm 2.2) \times 10^{-4}$		DESIG=217
Г ₈₅	$K^*(892)^+ K^- \pi^+ \pi^- + \text{c.c.}$	$(9.6 \pm 2.8) \times 10^{-4}$		DESIG=218
Г ₈₆	$K^*(892)^+ K^- \rho^0 + \text{c.c.}$	$(7.3 \pm 2.6) \times 10^{-4}$		DESIG=219
Г ₈₇	$K^*(892)^0 K^- \rho^+ + \text{c.c.}$	$(6.1 \pm 1.8) \times 10^{-4}$		DESIG=220
Г ₈₈	$\eta K^+ K^-$, no $\eta \phi$	$(3.1 \pm 0.4) \times 10^{-5}$		DESIG=207
Г ₈₉	$\omega K^+ K^-$	$(1.62 \pm 0.11) \times 10^{-4}$	S=1.1	DESIG=76
Г ₉₀	$\omega K^*(892)^+ K^- + \text{c.c.}$	$(2.07 \pm 0.26) \times 10^{-4}$		DESIG=276

Γ_{91}	$\omega K_2^*(1430)^+ K^- + \text{c.c.}$	$(6.1 \pm 1.2) \times 10^{-5}$		DESIG=277
Γ_{92}	$\omega \bar{K}^*(892)^0 K^0$	$(1.68 \pm 0.30) \times 10^{-4}$		DESIG=278
Γ_{93}	$\omega \bar{K}_2^*(1430)^0 K^0$	$(5.8 \pm 2.2) \times 10^{-5}$		DESIG=279
Γ_{94}	$\omega X(1440) \rightarrow \omega K_S^0 K^- \pi^+ + \text{c.c.}$	$(1.6 \pm 0.4) \times 10^{-5}$		DESIG=282
Γ_{95}	$\omega X(1440) \rightarrow \omega K^+ K^- \pi^0$	$(1.09 \pm 0.26) \times 10^{-5}$		DESIG=283
Γ_{96}	$\omega f_1(1285) \rightarrow \omega K_S^0 K^- \pi^+ + \text{c.c.}$	$(3.0 \pm 1.0) \times 10^{-6}$		DESIG=284
Γ_{97}	$\omega f_1(1285) \rightarrow \omega K^+ K^- \pi^0$	$(1.2 \pm 0.7) \times 10^{-6}$		DESIG=285
Γ_{98}	$3(\pi^+ \pi^-)$	$(3.5 \pm 2.0) \times 10^{-4}$	S=2.8	DESIG=32
Γ_{99}	$p \bar{p} \pi^+ \pi^- \pi^0$	$(7.3 \pm 0.7) \times 10^{-4}$		DESIG=211
Γ_{100}	$K^+ K^-$	$(7.5 \pm 0.5) \times 10^{-5}$		DESIG=23
Γ_{101}	$K_S^0 K_L^0$	$(5.34 \pm 0.33) \times 10^{-5}$		DESIG=85
Γ_{102}	$\pi^+ \pi^- \pi^0$	$(2.01 \pm 0.17) \times 10^{-4}$	S=1.7	DESIG=36
Γ_{103}	$\rho(2150) \pi \rightarrow \pi^+ \pi^- \pi^0$	$(1.9 \pm 1.2 \pm 0.4) \times 10^{-4}$		DESIG=201
Γ_{104}	$\rho(770) \pi \rightarrow \pi^+ \pi^- \pi^0$	$(3.2 \pm 1.2) \times 10^{-5}$	S=1.8	DESIG=22
Γ_{105}	$\pi^+ \pi^-$	$(7.8 \pm 2.6) \times 10^{-6}$		DESIG=21
Γ_{106}	$K_1(1400)^\pm K^\mp$	$< 3.1 \times 10^{-4}$	CL=90%	DESIG=42
Γ_{107}	$K_2^*(1430)^\pm K^\mp$	$(7.1 \pm 1.3 \pm 0.9) \times 10^{-5}$		DESIG=265
Γ_{108}	$K^+ K^- \pi^0$	$(4.07 \pm 0.31) \times 10^{-5}$		DESIG=38
Γ_{109}	$K^+ K^*(892)^- + \text{c.c.}$	$(2.9 \pm 0.4) \times 10^{-5}$	S=1.2	DESIG=39
Γ_{110}	$K^*(892)^0 \bar{K}^0 + \text{c.c.}$	$(1.09 \pm 0.20) \times 10^{-4}$		DESIG=194
Γ_{111}	$\phi \pi^+ \pi^-$	$(1.18 \pm 0.26) \times 10^{-4}$	S=1.5	DESIG=78
Γ_{112}	$\phi f_0(980) \rightarrow \pi^+ \pi^-$	$(7.5 \pm 3.3) \times 10^{-5}$	S=1.6	DESIG=81
Γ_{113}	$2(K^+ K^-)$	$(6.3 \pm 1.3) \times 10^{-5}$		DESIG=208
Γ_{114}	$\phi K^+ K^-$	$(7.0 \pm 1.6) \times 10^{-5}$		DESIG=79
Γ_{115}	$2(K^+ K^-) \pi^0$	$(1.10 \pm 0.28) \times 10^{-4}$		DESIG=209
Γ_{116}	$\phi \eta$	$(3.10 \pm 0.31) \times 10^{-5}$		DESIG=89
Γ_{117}	$\phi \eta'$	$(3.1 \pm 1.6) \times 10^{-5}$		DESIG=90
Γ_{118}	$\omega \eta'$	$(3.2 \pm 2.5 \pm 2.1) \times 10^{-5}$		DESIG=91
Γ_{119}	$\omega \pi^0$	$(2.1 \pm 0.6) \times 10^{-5}$		DESIG=92
Γ_{120}	$\rho \eta'$	$(1.9 \pm 1.7 \pm 1.2) \times 10^{-5}$		DESIG=93
Γ_{121}	$\rho \eta$	$(2.2 \pm 0.6) \times 10^{-5}$	S=1.1	DESIG=94
Γ_{122}	$\omega \eta$	$< 1.1 \times 10^{-5}$	CL=90%	DESIG=95
Γ_{123}	$\phi \pi^0$	$< 4 \times 10^{-7}$	CL=90%	DESIG=96
Γ_{124}	$\eta_c \pi^+ \pi^- \pi^0$	$< 1.0 \times 10^{-3}$	CL=90%	DESIG=229
Γ_{125}	$p \bar{p} K^+ K^-$	$(2.7 \pm 0.7) \times 10^{-5}$		DESIG=212
Γ_{126}	$\bar{\Lambda} n K_S^0 + \text{c.c.}$	$(8.1 \pm 1.8) \times 10^{-5}$		DESIG=237
Γ_{127}	$\phi f_2'(1525)$	$(4.4 \pm 1.6) \times 10^{-5}$		DESIG=67
Γ_{128}	$\Theta(1540) \bar{\Theta}(1540) \rightarrow K_S^0 p K^- \bar{n} + \text{c.c.}$	$< 8.8 \times 10^{-6}$	CL=90%	DESIG=195
Γ_{129}	$\Theta(1540) K^- \bar{n} \rightarrow K_S^0 p K^- \bar{n}$	$< 1.0 \times 10^{-5}$	CL=90%	DESIG=196
Γ_{130}	$\bar{\Theta}(1540) K_S^0 \bar{p} \rightarrow K_S^0 \bar{p} K^+ n$	$< 7.0 \times 10^{-6}$	CL=90%	DESIG=197
Γ_{131}	$\bar{\Theta}(1540) K^+ n \rightarrow K_S^0 \bar{p} K^+ n$	$< 2.6 \times 10^{-5}$	CL=90%	DESIG=198
Γ_{132}	$\bar{\Theta}(1540) K_S^0 p \rightarrow K_S^0 p K^- \bar{n}$	$< 6.0 \times 10^{-6}$	CL=90%	DESIG=199
Γ_{133}	$K_S^0 K_S^0$	$< 4.6 \times 10^{-6}$		DESIG=86

Radiative decays

NODE=M071;CLUMP=C

Γ ₁₃₄	$\gamma\chi_{c0}(1P)$	(9.99 ± 0.27) %		DESIG=56
Γ ₁₃₅	$\gamma\chi_{c1}(1P)$	(9.55 ± 0.31) %		DESIG=58
Γ ₁₃₆	$\gamma\chi_{c2}(1P)$	(9.11 ± 0.31) %		DESIG=59
Γ ₁₃₇	$\gamma\eta_c(1S)$	(3.4 ± 0.5) × 10 ⁻³	S=1.3	DESIG=61
Γ ₁₃₈	$\gamma\eta_c(2S)$	(7 ± 5) × 10 ⁻⁴		DESIG=63
Γ ₁₃₉	$\gamma\pi^0$	(1.6 ± 0.4) × 10 ⁻⁶		DESIG=52
Γ ₁₄₀	$\gamma\eta'(958)$	(1.23 ± 0.06) × 10 ⁻⁴		DESIG=54
Γ ₁₄₁	$\gamma f_2(1270)$	(2.73 ^{+0.29} _{-0.25}) × 10 ⁻⁴	S=1.8	DESIG=82
Γ ₁₄₂	$\gamma f_0(1370) \rightarrow \gamma K \bar{K}$	(3.1 ± 1.7) × 10 ⁻⁵		DESIG=286
Γ ₁₄₃	$\gamma f_0(1500)$	(9.2 ± 1.9) × 10 ⁻⁵		DESIG=287
Γ ₁₄₄	$\gamma f'_2(1525)$	(3.3 ± 0.8) × 10 ⁻⁵		DESIG=288
Γ ₁₄₅	$\gamma f_0(1710)$			DESIG=236
Γ ₁₄₆	$\gamma f_0(1710) \rightarrow \gamma \pi \pi$	(3.5 ± 0.6) × 10 ⁻⁵		DESIG=83
Γ ₁₄₇	$\gamma f_0(1710) \rightarrow \gamma K \bar{K}$	(6.6 ± 0.7) × 10 ⁻⁵		DESIG=84
Γ ₁₄₈	$\gamma f_0(2100) \rightarrow \gamma \pi \pi$	(4.8 ± 1.0) × 10 ⁻⁶		DESIG=289
Γ ₁₄₉	$\gamma f_0(2200) \rightarrow \gamma K \bar{K}$	(3.2 ± 1.0) × 10 ⁻⁶		DESIG=290
Γ ₁₅₀	$\gamma f_J(2220) \rightarrow \gamma \pi \pi$	< 5.8 × 10 ⁻⁶	CL=90%	DESIG=291
Γ ₁₅₁	$\gamma f_J(2220) \rightarrow \gamma K \bar{K}$	< 9.5 × 10 ⁻⁶	CL=90%	DESIG=292
Γ ₁₅₂	$\gamma\gamma$	< 1.5 × 10 ⁻⁴	CL=90%	DESIG=51
Γ ₁₅₃	$\gamma\eta$	(1.4 ± 0.5) × 10 ⁻⁶		DESIG=53
Γ ₁₅₄	$\gamma\eta\pi^+\pi^-$	(8.7 ± 2.1) × 10 ⁻⁴		DESIG=230
Γ ₁₅₅	$\gamma\eta(1405)$			DESIG=231
Γ ₁₅₆	$\gamma\eta(1405) \rightarrow \gamma K \bar{K} \pi$	< 9 × 10 ⁻⁵	CL=90%	DESIG=62
Γ ₁₅₇	$\gamma\eta(1405) \rightarrow \eta\pi^+\pi^-$	(3.6 ± 2.5) × 10 ⁻⁵		DESIG=232
Γ ₁₅₈	$\gamma\eta(1475)$			DESIG=233
Γ ₁₅₉	$\gamma\eta(1475) \rightarrow K \bar{K} \pi$	< 1.4 × 10 ⁻⁴	CL=90%	DESIG=234
Γ ₁₆₀	$\gamma\eta(1475) \rightarrow \eta\pi^+\pi^-$	< 8.8 × 10 ⁻⁵	CL=90%	DESIG=235
Γ ₁₆₁	$\gamma 2(\pi^+\pi^-)$	(4.0 ± 0.6) × 10 ⁻⁴		DESIG=241
Γ ₁₆₂	$\gamma K^{*0} K^+ \pi^- + \text{c.c.}$	(3.7 ± 0.9) × 10 ⁻⁴		DESIG=242
Γ ₁₆₃	$\gamma K^{*0} \bar{K}^{*0}$	(2.4 ± 0.7) × 10 ⁻⁴		DESIG=243
Γ ₁₆₄	$\gamma K_S^0 K^+ \pi^- + \text{c.c.}$	(2.6 ± 0.5) × 10 ⁻⁴		DESIG=244
Γ ₁₆₅	$\gamma K^+ K^- \pi^+ \pi^-$	(1.9 ± 0.5) × 10 ⁻⁴		DESIG=245
Γ ₁₆₆	$\gamma p \bar{p}$	(3.9 ± 0.5) × 10 ⁻⁵	S=2.0	DESIG=246
Γ ₁₆₇	$\gamma f_2(1950) \rightarrow \gamma p \bar{p}$	(1.20 ± 0.22) × 10 ⁻⁵		DESIG=257
Γ ₁₆₈	$\gamma f_2(2150) \rightarrow \gamma p \bar{p}$	(7.2 ± 1.8) × 10 ⁻⁶		DESIG=258
Γ ₁₆₉	$\gamma X(1835) \rightarrow \gamma p \bar{p}$	(4.6 ^{+1.8} _{-4.0}) × 10 ⁻⁶		DESIG=259
Γ ₁₇₀	$\gamma X \rightarrow \gamma p \bar{p}$	[a] < 2 × 10 ⁻⁶	CL=90%	DESIG=260
Γ ₁₇₁	$\gamma \pi^+ \pi^- p \bar{p}$	(2.8 ± 1.4) × 10 ⁻⁵		DESIG=247
Γ ₁₇₂	$\gamma 2(\pi^+ \pi^-) K^+ K^-$	< 2.2 × 10 ⁻⁴	CL=90%	DESIG=248
Γ ₁₇₃	$\gamma 3(\pi^+ \pi^-)$	< 1.7 × 10 ⁻⁴	CL=90%	DESIG=249
Γ ₁₇₄	$\gamma K^+ K^- K^+ K^-$	< 4 × 10 ⁻⁵	CL=90%	DESIG=250
Γ ₁₇₅	$\gamma\gamma J/\psi$	(3.1 ^{+1.0} _{-1.2}) × 10 ⁻⁴		DESIG=266

Other decays

NODE=M071;CLUMP=D
DESIG=275

Γ ₁₇₆	invisible	< 1.6 %	CL=90%

[a] For a narrow resonance in the range $2.2 < M(X) < 2.8$ GeV.

LINKAGE=NMR

CONSTRAINED FIT INFORMATION

A multiparticle fit to $\chi_{c1}(1P)$, $\chi_{c0}(1P)$, $\chi_{c2}(1P)$, and $\psi(2S)$ with 4 total widths, a partial width, 25 combinations of partial widths obtained from integrated cross section, and 84 branching ratios uses 239 measurements to determine 49 parameters. The overall fit has a $\chi^2 = 342.4$ for 190 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta p_i \delta p_j \rangle / (\delta p_i \delta p_j)$, in percent, from the fit to parameters p_i , including the branching fractions, $x_i \equiv \Gamma_i / \Gamma_{\text{total}}$.

x_7	3									
x_8	1	0								
x_{11}	30	8	2							
x_{12}	29	5	1	49						
x_{13}	13	3	1	36	16					
x_{19}	0	0	0	5	3	2				
x_{134}	1	0	0	3	1	1	0			
x_{135}	2	0	0	4	1	1	0	0		
x_{136}	1	0	0	4	1	1	0	0	0	
Γ	-81	-3	-1	-39	-35	-17	-8	-1	-2	-2
	x_6	x_7	x_8	x_{11}	x_{12}	x_{13}	x_{19}	x_{134}	x_{135}	x_{136}

$\psi(2S)$ 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

2.34 ± 0.04 OUR FIT**2.30 ± 0.06 OUR AVERAGE**

$2.24 \pm 0.10 \pm 0.02$	¹ ABLIKIM	15V	BES3 $4.0\text{--}4.4 e^+e^- \rightarrow \pi^+\pi^- J/\psi$
$2.338 \pm 0.037 \pm 0.096$	ABLIKIM	08B	BES2 $e^+e^- \rightarrow \text{hadrons}$
$2.330 \pm 0.036 \pm 0.110$	ABLIKIM	06L	BES2 $e^+e^- \rightarrow \text{hadrons}$
2.44 ± 0.21	² BAI	02B	BES2 e^+e^-
2.14 ± 0.21	ALEXANDER	89	RVUE See Υ mini-review

• • • We do not use the following data for averages, fits, limits, etc. • • •

2.0 ± 0.3	BRANDELIK	79C	DASP e^+e^-
2.1 ± 0.3	³ LUTH	75	MRK1 e^+e^-

¹ ABLIKIM 15V reports $2.213 \pm 0.018 \pm 0.099$ keV from a measurement of $[\Gamma(\psi(2S) \rightarrow e^+e^-)] \times [B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)]$ assuming $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (34.95 \pm 0.45) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (34.49 \pm 0.30) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² From a simultaneous fit to e^+e^- , $\mu^+\mu^-$, and hadronic channel, assuming $\Gamma_e = \Gamma_\mu = \Gamma_\tau / 0.38847$.

³ From a simultaneous fit to e^+e^- , $\mu^+\mu^-$, and hadronic channels assuming $\Gamma(e^+e^-) = \Gamma(\mu^+\mu^-)$.

NODE=M071W1;LINKAGE=A

NODE=M071W;LINKAGE=BB

NODE=M071W1;LINKAGE=F

$\Gamma(\gamma\gamma)$

 Γ_{152}

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT

<43	90	BRANDELIK	79C	DASP e^+e^-

NODE=M071W51
NODE=M071W51

$\psi(2S) \Gamma(i) \Gamma(e^+ e^-) / \Gamma(\text{total})$

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

NODE=M071230

$\Gamma(\text{hadrons}) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_1 \Gamma_6 / \Gamma$

VALUE (keV)	DOCUMENT ID	TECN	COMMENT

2.233±0.015±0.042	¹ ANASHIN	12	KEDR $e^+ e^- \rightarrow \text{hadrons}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

2.2 ± 0.4	ABRAMS	75	MRK1 $e^+ e^-$

¹ ANASHIN 12 reports the value $2.233 \pm 0.015 \pm 0.037 \pm 0.020$ keV, where the third uncertainty is due to assumptions on the interference between the resonance and hadronic continuum. We combined the two systematic uncertainties.

NODE=M071G3
NODE=M071G3

NODE=M071G3;LINKAGE=AN

$\Gamma(\tau^+ \tau^-) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_8 \Gamma_6 / \Gamma$

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.

NODE=M071G9
NODE=M071G9

NODE=M071G9;LINKAGE=AN

$\Gamma(J/\psi(1S) \pi^+ \pi^-) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{11} \Gamma_6 / \Gamma$

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT

0.807±0.013 OUR FIT

0.837±0.025 OUR AVERAGE Error includes scale factor of 1.3. See the ideogram below.

0.837±0.028±0.005	¹ LEES	12E	BABR	10.6 $e^+ e^- \rightarrow 2\pi^+ 2\pi^- \gamma$

0.852±0.010±0.026	19.5k	ADAM	06	CLEO 3.773 $e^+ e^- \rightarrow \gamma \psi(2S)$

0.68 ± 0.09	² BAI	98E	BES	$e^+ e^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.88 ± 0.08 ± 0.03	256	³ AUBERT	07AU	BABR 10.6 $e^+ e^- \rightarrow J/\psi \pi^+ \pi^- \gamma$

0.755±0.048±0.004	544	⁴ AUBERT	05D	BABR 10.6 $e^+ e^- \rightarrow \pi^+ \pi^- \mu^+ \mu^- \gamma$

¹ LEES 12E reports $[\Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-) \times \Gamma(\psi(2S) \rightarrow e^+ e^-) / \Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \mu^+ \mu^-)] = (49.9 \pm 1.3 \pm 1.0) \times 10^{-3}$ keV which we divide by our best value $B(J/\psi(1S) \rightarrow \mu^+ \mu^-) = (5.961 \pm 0.033) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

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 $B(J/\psi(1S) \rightarrow \mu^+ \mu^-) = (5.961 \pm 0.033) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value. Superseded by LEES 12E.

NODE=M071G1
NODE=M071G1

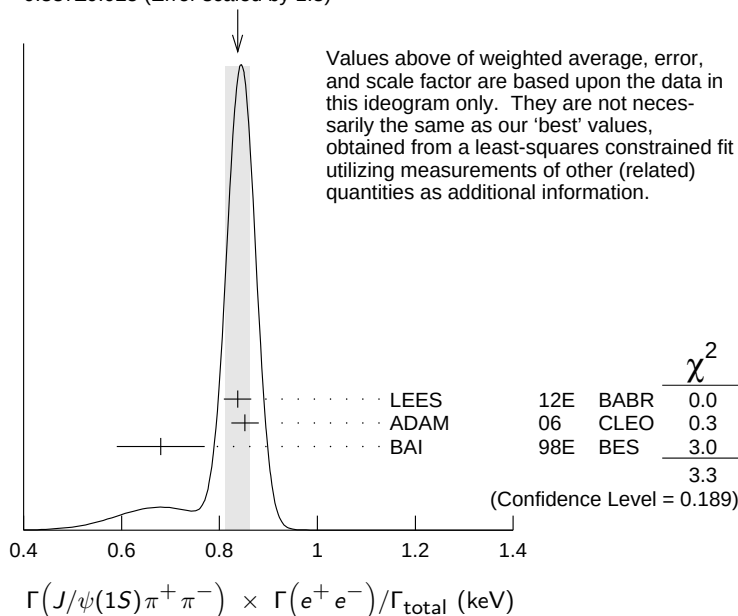
NODE=M071G1;LINKAGE=LE

NODE=M071G1;LINKAGE=A

NODE=M071G1;LINKAGE=UB

NODE=M071G1;LINKAGE=AU

WEIGHTED AVERAGE
0.837±0.025 (Error scaled by 1.3)



$\Gamma(J/\psi(1S)\pi^0\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{12}\Gamma_6/\Gamma$

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
0.425±0.009 OUR FIT				
0.411±0.008±0.018	3.6k±96	ADAM	06	CLEO 3.773 $e^+e^- \rightarrow \gamma\psi(2S)$

NODE=M071G6
NODE=M071G6

$\Gamma(J/\psi(1S)\eta) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{13}\Gamma_6/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
78.6± 1.6 OUR FIT				
87 ± 9 OUR AVERAGE				
83 ±25 ±5	14	¹ AUBERT	07AU	BABR 10.6 $e^+e^- \rightarrow J/\psi\pi^+\pi^-\pi^0\gamma$
88 ± 6 ±7	291 ± 24	ADAM	06	CLEO 3.773 $e^+e^- \rightarrow \gamma\psi(2S)$
¹ AUBERT 07AU quotes $\Gamma_{ee}^{(2S)} \cdot B(\psi(2S) \rightarrow J/\psi\eta) \cdot B(J/\psi \rightarrow \mu^+\mu^-) \cdot B(\eta \rightarrow \pi^+\pi^-\pi^0) = 1.11 \pm 0.33 \pm 0.07 \text{ eV}$.				

NODE=M071G7
NODE=M071G7

NODE=M071G7;LINKAGE=UB

$\Gamma(J/\psi(1S)\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{14}\Gamma_6/\Gamma$

VALUE (eV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<8	90	<37	ADAM	06	CLEO 3.773 $e^+e^- \rightarrow \gamma\psi(2S)$

NODE=M071G8
NODE=M071G8

$\Gamma(p\bar{p}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{19}\Gamma_6/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
0.673±0.023 OUR FIT				
[0.674 ± 0.023 eV OUR 2016 FIT]				
0.63 ±0.05 OUR AVERAGE				Error includes scale factor of 1.2. [0.64 ± 0.04 eV OUR 2016 AVERAGE]

NODE=M071G2
NODE=M071G2
NEW

NEW

0.67 ±0.12 ±0.02	43	¹ LEES	130	BABR	$e^+e^- \rightarrow p\bar{p}\gamma$
0.74 ±0.07 ±0.04	142	² LEES	13Y	BABR	$e^+e^- \rightarrow p\bar{p}\gamma$
0.579±0.038±0.036	2.7k	ANDREOTTI	07	E835	$p\bar{p} \rightarrow e^+e^-, J/\psi X$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.70 ±0.17 ±0.03	22	³ AUBERT	06B	BABR	$e^+e^- \rightarrow p\bar{p}\gamma$

¹ ISR photon reconstructed in the detector

² ISR photon undetected

³ Superseded by LEES 130

NODE=M071G2;LINKAGE=C
NODE=M071G2;LINKAGE=B
NODE=M071G2;LINKAGE=A

$\Gamma(\Lambda\bar{\Lambda}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{26}\Gamma_6/\Gamma$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
1.5±0.4±0.1	AUBERT	07BD	BABR 10.6 $e^+e^- \rightarrow \Lambda\bar{\Lambda}\gamma$

NODE=M071G11
NODE=M071G11

$\Gamma(2(\pi^+\pi^-\pi^0)) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{60}\Gamma_6/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
11.2±3.3±1.3	43	AUBERT	06D	BABR 10.6 $e^+e^- \rightarrow 2(\pi^+\pi^-\pi^0)\gamma$

NODE=M071G4
NODE=M071G4

$$\Gamma(\pi^0\pi^0 K^+ K^-) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}} \quad \Gamma_{69}\Gamma_6/\Gamma$$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT
0.60±0.31±0.03	17 ± 9	LEES	12F BABR	10.6 $e^+ e^- \rightarrow \pi^0\pi^0 K^+ K^- \gamma$

NODE=M071G08
NODE=M071G08

$$\Gamma(K^+ K^- 2(\pi^+ \pi^-)) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}} \quad \Gamma_{75}\Gamma_6/\Gamma$$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT
4.4±2.1±0.3	26	AUBERT	06D BABR	10.6 $e^+ e^- \rightarrow K^+ K^- 2(\pi^+ \pi^-) \gamma$

NODE=M071G5
NODE=M071G5

$$\Gamma(\pi^+ \pi^- K^+ K^-) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}} \quad \Gamma_{70}\Gamma_6/\Gamma$$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT
1.92±0.31 OUR AVERAGE		[2.6 ± 0.4 eV OUR 2016 AVERAGE]		
1.92±0.30±0.06	133 ± 21	LEES	12F BABR	10.6 $e^+ e^- \rightarrow \pi^+ \pi^- K^+ K^- \gamma$

NODE=M071G12
NODE=M071G12
NEW

• • • We do not use the following data for averages, fits, limits, etc. • • •

2.56±0.42±0.16 85 ¹ AUBERT 07AK BABR 10.6 $e^+ e^- \rightarrow \pi^+ \pi^- K^+ K^- \gamma$

¹ Superseded by LEES 12F.

NODE=M071G12;LINKAGE=A

$$\Gamma(\phi f_0(980) \rightarrow \pi^+ \pi^-) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}} \quad \Gamma_{112}\Gamma_6/\Gamma$$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT
0.35 ±0.13 OUR AVERAGE		[0.35 ± 0.17 eV OUR 2016 AVERAGE]		
0.347±0.129±0.003	12 ± 4	¹ LEES	12F BABR	10.6 $e^+ e^- \rightarrow \pi^+ \pi^- K^+ K^- \gamma$

NODE=M071G13
NODE=M071G13
NEW

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.347±0.168±0.003 6 ± 3 ² AUBERT 07AK BABR 10.6 $e^+ e^- \rightarrow \pi^+ \pi^- K^+ K^- \gamma$

¹ LEES 12F reports $[\Gamma(\psi(2S) \rightarrow \phi f_0(980) \rightarrow \pi^+ \pi^-) \times \Gamma(\psi(2S) \rightarrow e^+ e^-)/\Gamma_{\text{total}}] \times [B(\phi(1020) \rightarrow K^+ K^-)] = 0.17 \pm 0.06 \pm 0.02$ eV which we divide by our best value $B(\phi(1020) \rightarrow K^+ K^-) = (49.0 \pm 0.5) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M071G13;LINKAGE=A

² Superseded by LEES 12F. AUBERT 07AK reports $[\Gamma(\psi(2S) \rightarrow \phi f_0(980) \rightarrow \pi^+ \pi^-) \times \Gamma(\psi(2S) \rightarrow e^+ e^-)/\Gamma_{\text{total}}] \times [B(\phi(1020) \rightarrow K^+ K^-)] = 0.17 \pm 0.08 \pm 0.02$ eV which we divide by our best value $B(\phi(1020) \rightarrow K^+ K^-) = (49.0 \pm 0.5) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M071G13;LINKAGE=AU

$$\Gamma(2(K^+ K^-)) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}} \quad \Gamma_{113}\Gamma_6/\Gamma$$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT
0.22±0.10±0.02	13 ± 6	LEES	12F BABR	10.6 $e^+ e^- \rightarrow K^+ K^- K^+ K^- \gamma$

NODE=M071G07
NODE=M071G07

$$\Gamma(\phi \pi^+ \pi^-) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}} \quad \Gamma_{111}\Gamma_6/\Gamma$$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT
0.55±0.19 OUR AVERAGE		[0.57 ± 0.23 eV OUR 2016 AVERAGE]		
0.55±0.19±0.01	19 ± 6	¹ LEES	12F BABR	10.6 $e^+ e^- \rightarrow K^+ K^- \pi^+ \pi^- \gamma$

NODE=M071G10
NODE=M071G10
NEW

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.57±0.23±0.01 10 ² AUBERT,BE 06D BABR 10.6 $e^+ e^- \rightarrow K^+ K^- \pi^+ \pi^- \gamma$

¹ LEES 12F reports $[\Gamma(\psi(2S) \rightarrow \phi \pi^+ \pi^-) \times \Gamma(\psi(2S) \rightarrow e^+ e^-)/\Gamma_{\text{total}}] \times [B(\phi(1020) \rightarrow K^+ K^-)] = 0.27 \pm 0.09 \pm 0.02$ eV which we divide by our best value $B(\phi(1020) \rightarrow K^+ K^-) = (49.0 \pm 0.5) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M071G10;LINKAGE=A

² Superseded by LEES 12F. AUBERT,BE 06D reports $[\Gamma(\psi(2S) \rightarrow \phi \pi^+ \pi^-) \times \Gamma(\psi(2S) \rightarrow e^+ e^-)/\Gamma_{\text{total}}] \times [B(\phi(1020) \rightarrow K^+ K^-)] = 0.28 \pm 0.11 \pm 0.02$ eV which we divide by our best value $B(\phi(1020) \rightarrow K^+ K^-) = (49.0 \pm 0.5) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=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 $e^+ e^- \rightarrow 2(\pi^+ \pi^-) \pi^0 \gamma$

NODE=M071G01
NODE=M071G01

$$\Gamma(\omega\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{65}\Gamma_6/\Gamma$$

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

$$\Gamma(2(\pi^+\pi^-\eta) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{63}\Gamma_6/\Gamma$$

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

$$\Gamma(K^+K^-\pi^+\pi^-\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{82}\Gamma_6/\Gamma$$

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

$$\Gamma(K^+K^-\pi^+\pi^-\eta) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{73}\Gamma_6/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
3.04±1.79±0.02	7	¹ AUBERT	07AU BABR	10.6 e ⁺ e ⁻ → 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

NODE=M071G05;LINKAGE=UB

$$\Gamma(K^+K^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{100}\Gamma_6/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				

0.147±0.035±0.005	66	¹ LEES	15J BABR	e ⁺ e ⁻ → K ⁺ K ⁻ γ
0.197±0.035±0.005	66	² LEES	15J BABR	e ⁺ e ⁻ → K ⁺ K ⁻ γ
0.35 ±0.14 ±0.03	11	³ LEES	13Q BABR	e ⁺ e ⁻ → K ⁺ K ⁻ γ

¹ sinφ > 0.

² sinφ < 0.

³ Interference with non-resonant K⁺K⁻ production not taken into account.

NODE=M071G06
NODE=M071G06

OCCUR=2

NODE=M071G06;LINKAGE=A
NODE=M071G06;LINKAGE=B
NODE=M071G06;LINKAGE=BA

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 Γ(hadrons)/Γ_{total}.

² Using B(ψ(2S) → ℓ⁺ℓ⁻) = (0.73 ± 0.04)% from RPP-2002 and R = 2.28 ± 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(ψ(2S) → XJ/ψ) relative and absolute branching fractions from MENDEZ 08, B(ψ(2S) → γη_c) from MITCHELL 09, and B(ψ(2S) → virtual γ → hadrons), B(ψ(2S) → γχ_{cJ}), and B(ψ(2S) → ℓ⁺ℓ⁻) from PDG 08. The statistical error is negligible and the systematic error is largely uncorrelated with that of Γ(γγg)/Γ_{total} LIBBY 09 measurement.

NODE=M071S43
NODE=M071S43

NODE=M071S43;LINKAGE=LI

$\Gamma(\gamma g g)/\Gamma_{\text{total}}$
 Γ_4/Γ

VALUE (units 10^{-2})	EVTs	DOCUMENT ID	TECN	COMMENT
1.025 ± 0.288	200 k	¹ LIBBY	09	CLEO $\psi(2S) \rightarrow \gamma + \text{hadrons}$

NODE=M071S44
NODE=M071S44

¹ Calculated using $\Gamma(\gamma g g)/\Gamma(g g g) = 0.097 \pm 0.026 \pm 0.016$ from LIBBY 09. The statistical error is negligible and the systematic error is largely uncorrelated with that of $\Gamma(g g g)/\Gamma_{\text{total}}$ LIBBY 09 measurement.

NODE=M071S44;LINKAGE=LI

 $\Gamma(\gamma g g)/\Gamma(g g g)$
 Γ_4/Γ_3

VALUE (units 10^{-2})	EVTs	DOCUMENT ID	TECN	COMMENT
9.7 ± 2.6 ± 1.6	2.9 M	LIBBY	09	CLEO $\psi(2S) \rightarrow (\gamma +) \text{hadrons}$

NODE=M071S45
NODE=M071S45

 $\Gamma(\text{light hadrons})/\Gamma_{\text{total}}$
 Γ_5/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
0.154 ± 0.015	¹ MENDEZ	08	CLEO $e^+ e^- \rightarrow \psi(2S)$

NODE=M071S27
NODE=M071S27

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.169 ± 0.026	² ADAM	05A	CLEO $e^+ e^- \rightarrow \psi(2S)$

¹ Uses $B(\psi(2S) \rightarrow J/\psi X)$ from MENDEZ 08 and other branching fractions from PDG 07.

NODE=M071S27;LINKAGE=ME

² Uses $B(J/\psi X)$ from ADAM 05A, $B(\chi_{cJ} \gamma)$, $B(\eta_c \gamma)$ from ATHAR 04 and $B(\ell^+ \ell^-)$ from PDG 04. Superseded by MENDEZ 08.

NODE=M071S27;LINKAGE=AD

 $\Gamma(e^+ e^-)/\Gamma_{\text{total}}$
 Γ_6/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
78.9 ± 1.7 OUR FIT			

NODE=M071R1
NODE=M071R1

• • • We do not use the following data for averages, fits, limits, etc. • • •

88 ± 13	¹ FELDMAN	77	RVUE $e^+ e^-$

¹ From an overall fit assuming equal partial widths for $e^+ e^-$ and $\mu^+ \mu^-$. For a measurement of the ratio see the entry $\Gamma(\mu^+ \mu^-)/\Gamma(e^+ e^-)$ below. Includes LUTH 75, HILGER 75, BURMESTER 77.

NODE=M071R;LINKAGE=L

 $\Gamma(\mu^+ \mu^-)/\Gamma_{\text{total}}$
 Γ_7/Γ

VALUE (units 10^{-4})	DOCUMENT ID
79 ± 9 OUR FIT	

NODE=M071R2
NODE=M071R2

 $\Gamma(\mu^+ \mu^-)/\Gamma(e^+ e^-)$
 Γ_7/Γ_6

VALUE	DOCUMENT ID	TECN	COMMENT
1.00 ± 0.11 OUR FIT			

NODE=M071R4
NODE=M071R4

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.89 ± 0.16	BOYARSKI	75C	MRK1 $e^+ e^-$

 $\Gamma(\tau^+ \tau^-)/\Gamma_{\text{total}}$
 Γ_8/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
31 ± 4 OUR FIT			

NODE=M071R75
NODE=M071R75

30.8 ± 2.1 ± 3.8	¹ ABLIKIM	06W	BES $e^+ e^- \rightarrow \psi(2S)$

¹ Computed using PDG 02 value of $B(\psi(2S) \rightarrow \text{hadrons}) = 0.9810 \pm 0.0030$ to estimate the total number of $\psi(2S)$ events.

NODE=M071R75;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
0.610 ± 0.006 OUR FIT				
0.55 ± 0.07 OUR AVERAGE				

NODE=M071R10
NODE=M071R10

0.51 ± 0.12	BRANDELIK	79C	DASP $e^+ e^- \rightarrow \mu^+ \mu^- X$

0.57 ± 0.08	ABRAMS	75B	MRK1 $e^+ e^- \rightarrow \mu^+ \mu^- X$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.6254 ± 0.0016 ± 0.0155	1.1M	¹ MENDEZ	08	CLEO $\psi(2S) \rightarrow \ell^+ \ell^- X$

0.5950 ± 0.0015 ± 0.0190	151k	ADAM	05A	CLEO Repl. by MENDEZ 08

¹ Not independent from other measurements of MENDEZ 08.

NODE=M071R10;LINKAGE=ME

$\Gamma(e^+e^-)/\Gamma(J/\psi(1S)\text{anything})$

$$\Gamma_6/\Gamma_9 = \Gamma_6/(\Gamma_{11}+\Gamma_{12}+\Gamma_{13}+0.339\Gamma_{135}+0.192\Gamma_{136})$$

VALUE (units 10^{-2})

EVTS

DOCUMENT ID

TECN

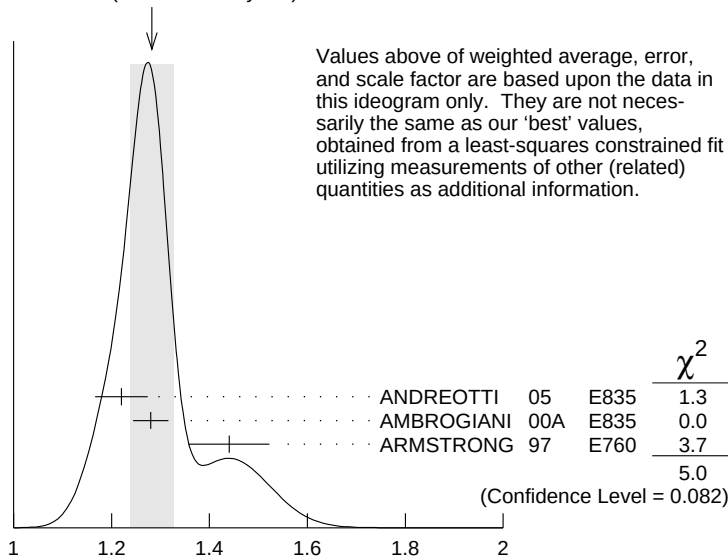
COMMENT

1.294 $\pm$ 0.026 OUR 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 $p\bar{p} \rightarrow \psi(2S)$ ¹ Using $B(J/\psi(1S) \rightarrow e^+e^-) = 0.0593 \pm 0.0010$.

NODE=M071R72

NODE=M071R72

NODE=M071R;LINKAGE=7A

WEIGHTED AVERAGE
1.28 $\pm$ 0.04 (Error scaled by 1.6)
 $\Gamma(e^+e^-)/\Gamma(J/\psi(1S)\text{anything})$ (units 10^{-2})

 $\Gamma(\mu^+\mu^-)/\Gamma(J/\psi(1S)\text{anything})$

$$\Gamma_7/\Gamma_9 = \Gamma_7/(\Gamma_{11}+\Gamma_{12}+\Gamma_{13}+0.339\Gamma_{135}+0.192\Gamma_{136})$$

VALUE

DOCUMENT ID

TECN

COMMENT

0.0130 $\pm$ 0.0014 OUR FIT**0.014 $\pm$ 0.003**HILGER 75 SPEC e^+e^-

NODE=M071R74

NODE=M071R74

 $\Gamma(J/\psi(1S)\text{neutrals})/\Gamma_{\text{total}}$
 Γ_{10}/Γ

VALUE

DOCUMENT ID

0.2514 $\pm$ 0.0033 OUR FIT

NODE=M071R18

NODE=M071R18

 $\Gamma(J/\psi(1S)\pi^+\pi^-)/\Gamma_{\text{total}}$
 Γ_{11}/Γ

VALUE

EVTS

DOCUMENT ID

TECN

COMMENT

0.3449 $\pm$ 0.0030 OUR FIT**0.348 $\pm$ 0.005 OUR AVERAGE** Error includes scale factor of 1.3. See the ideogram below.0.3498 $\pm$ 0.0002 $\pm$ 0.0045 20M ABLIKIM 13R BES3 $\psi(2S) \rightarrow J/\psi\pi^+\pi^-$ 0.3504 $\pm$ 0.0007 $\pm$ 0.0077 565k MENDEZ 08 CLEO $\psi(2S) \rightarrow \ell^+\ell^-\pi^+\pi^-$ 0.323 $\pm$ 0.014 BAI 02B BES2 e^+e^- 0.32 $\pm$ 0.04 ABRAMS 75B MRK1 $e^+e^- \rightarrow J/\psi\pi^+\pi^-$

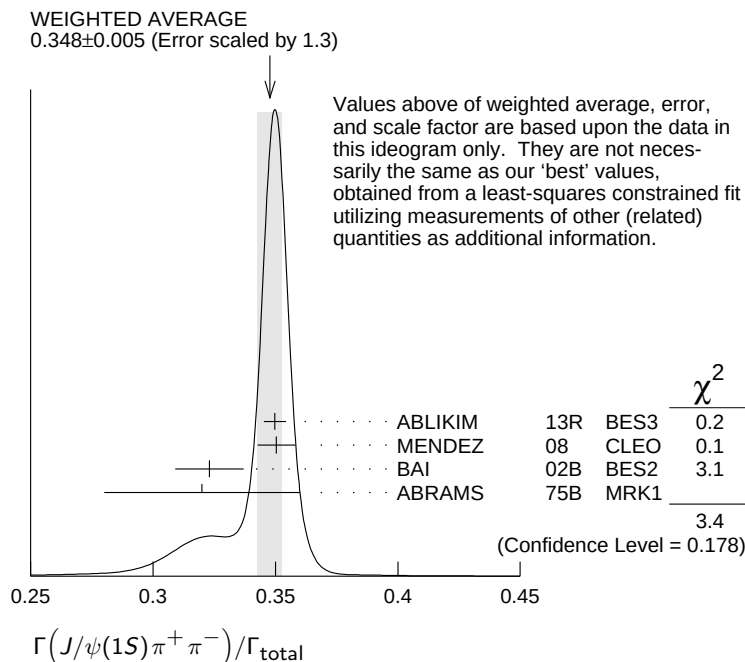
• • • We do not use the following data for averages, fits, limits, etc. • • •

0.3354 $\pm$ 0.0014 $\pm$ 0.0110 60k ¹ADAM 05A CLEO Repl. by MENDEZ 08¹ Not independent from other values reported by ADAM 05A.

NODE=M071R12

NODE=M071R12

NODE=M071R;LINKAGE=AD



$\Gamma(e^+e^-)/\Gamma(J/\psi(1S)\pi^+\pi^-)$

Γ_6/Γ_{11}

VALUE	DOCUMENT ID	TECN	COMMENT
0.0229±0.0005 OUR FIT			
0.0252±0.0028±0.0011	¹ AUBERT	02B	BABR e^+e^-
¹ Using $B(J/\psi(1S) \rightarrow e^+e^-) = 0.0593 \pm 0.0010$.			

NODE=M071R73
NODE=M071R73

NODE=M071R73;LINKAGE=7A

$\Gamma(\mu^+\mu^-)/\Gamma(J/\psi(1S)\pi^+\pi^-)$

Γ_7/Γ_{11}

VALUE	DOCUMENT ID	TECN	COMMENT
0.0229±0.0025 OUR FIT			
0.0224±0.0029 OUR AVERAGE			
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=M071R63
NODE=M071R63

NODE=M071R;LINKAGE=Q2

$\Gamma(\tau^+\tau^-)/\Gamma(J/\psi(1S)\pi^+\pi^-)$

Γ_8/Γ_{11}

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
8.9 ±1.1 OUR FIT			
8.73±1.39±1.57	BAI	02	BES e^+e^-

NODE=M071R76
NODE=M071R76

$\Gamma(J/\psi(1S)\pi^+\pi^-)/\Gamma(J/\psi(1S)\text{anything})$

Γ_{11}/Γ_9

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.5653±0.0026 OUR FIT				
0.554 ±0.008 OUR AVERAGE				Error includes scale factor of 1.3. See the ideogram below.
0.5604±0.0009±0.0062	565k	MENDEZ	08	CLEO $\psi(2S) \rightarrow \ell^+\ell^-\pi^+\pi^-$
0.525 ±0.009 ±0.022	4k	ANDREOTTI	05	E835 $\psi(2S) \rightarrow J/\psi X$
0.536 ±0.007 ±0.016	20k	^{1,2} ABLIKIM	04B	BES $\psi(2S) \rightarrow J/\psi X$
0.496 ±0.037		ARMSTRONG	97	E760 $\bar{p}p \rightarrow \psi(2S)$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
0.5637±0.0027±0.0046	60k	ADAM	05A	CLEO Repl. by MENDEZ 08

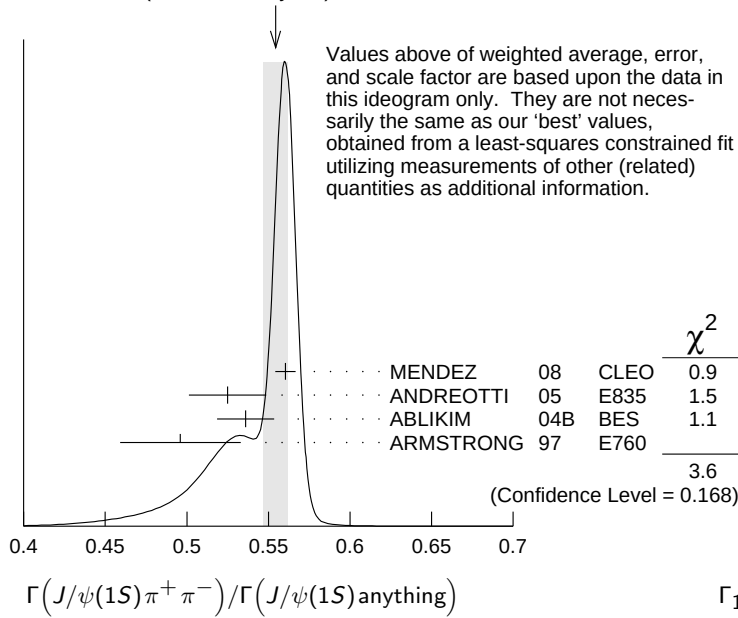
¹ From a fit to the J/ψ recoil mass spectra.

² ABLIKIM 04B quotes $B(\psi(2S) \rightarrow J/\psi X) / B(\psi(2S) \rightarrow J/\psi\pi^+\pi^-)$.

NODE=M071R70
NODE=M071R70

NODE=M071R;LINKAGE=AB
NODE=M071R;LINKAGE=AL

WEIGHTED AVERAGE
0.554±0.008 (Error scaled by 1.3)



$\Gamma(J/\psi(1S)\text{neutrals})/\Gamma(J/\psi(1S)\pi^+\pi^-)$

$$\Gamma_{10}/\Gamma_{11} = (0.9761\Gamma_{12} + 0.719\Gamma_{13} + 0.339\Gamma_{135} + 0.192\Gamma_{136})/\Gamma_{11}$$

VALUE	DOCUMENT ID	TECN	COMMENT
0.729±0.008 OUR FIT			
0.73 ±0.09	TANENBAUM 76	MRK1	e^+e^-

NODE=M071R11
NODE=M071R11

$\Gamma(J/\psi(1S)\pi^0\pi^0)/\Gamma_{\text{total}}$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.1817±0.0031 OUR FIT				
[0.1816 ± 0.0031 OUR 2016 FIT]				

NODE=M071R17
NODE=M071R17
NEW

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.1769±0.0008±0.0053	61k	¹ MENDEZ	08	CLEO	$\psi(2S) \rightarrow \ell^+\ell^-2\pi^0$
0.1652±0.0014±0.0058	13.4k	² ADAM	05A	CLEO	Repl. by MENDEZ 08

¹ Not independent from other measurements of MENDEZ 08.

² Not independent from other values reported by ADAM 05A.

NODE=M071R17;LINKAGE=ME
NODE=M071R17;LINKAGE=AD

$\Gamma(J/\psi(1S)\pi^0\pi^0)/\Gamma(J/\psi(1S)\text{anything})$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.2977±0.0031 OUR FIT				
0.320 ±0.012 OUR AVERAGE				

0.300 ±0.008 ±0.022	1655 ± 44	ANDREOTTI	05	E835	$\psi(2S) \rightarrow J/\psi X$
0.328 ±0.013 ±0.008		AMBROGIANI	00A	E835	$p\bar{p} \rightarrow \psi(2S)$
0.323 ±0.033		ARMSTRONG	97	E760	$\bar{p}p \rightarrow \psi(2S)$

• • • 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

$\Gamma(J/\psi(1S)\pi^0\pi^0)/\Gamma(J/\psi(1S)\pi^+\pi^-)$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.527 ±0.008 OUR FIT				
0.513 ±0.022 OUR AVERAGE				

0.5047±0.0022±0.0102	61k	MENDEZ	08	CLEO	$\psi(2S) \rightarrow \ell^+\ell^-2\pi^0$
0.570 ±0.009 ±0.026	14k	¹ ABLIKIM	04B	BES	$\psi(2S) \rightarrow J/\psi X$
0.4924±0.0047±0.0086	73k	^{2,3} ADAM	05A	CLEO	Repl. by MENDEZ 08
0.571 ±0.018 ±0.044		⁴ ANDREOTTI	05	E835	$\psi(2S) \rightarrow J/\psi X$
0.53 ±0.06		TANENBAUM	76	MRK1	e^+e^-
0.64 ±0.15		⁵ HILGER	75	SPEC	e^+e^-

¹ From a fit to the J/ψ recoil mass spectra.

² Not independent from other values reported by ADAM 05A.

³ Using 13,217 $J/\psi\pi^0\pi^0$ and 60,010 $J/\psi\pi^+\pi^-$ events.

⁴ Not independent from other values reported by ANDREOTTI 05.

⁵ Ignoring the $J/\psi(1S)\eta$ and $J/\psi(1S)\gamma\gamma$ decays.

NODE=M071R14
NODE=M071R14

NODE=M071R14;LINKAGE=AB
NODE=M071R14;LINKAGE=AD
NODE=M071R14;LINKAGE=AM
NODE=M071R;LINKAGE=AN
NODE=M071R;LINKAGE=I

$\Gamma(J/\psi(1S)\eta)/\Gamma_{\text{total}}$ Γ_{13}/Γ VALUE (units 10^{-3})

EVTS

DOCUMENT ID

TECN

COMMENT

33.6 $\pm$ 0.5 OUR FIT**32.9 $\pm$ 1.7 OUR AVERAGE**

Error includes scale factor of 2.1. See the ideogram below.

33.75 $\pm$ 0.17 $\pm$ 0.86 68.2k ABLIKIM 12M BES3 $e^+e^- \rightarrow \ell^+\ell^-2\gamma$ 29.8 $\pm$ 0.9 $\pm$ 2.3 5.7k BAI 04I BES2 $\psi(2S) \rightarrow J/\psi\gamma\gamma$ 25.5 $\pm$ 2.9 386 ¹ OREGLIA 80 CBAL $e^+e^- \rightarrow J/\psi 2\gamma$ 45 $\pm$ 12 17 ² BRANDELIK 79B DASP $e^+e^- \rightarrow J/\psi 2\gamma$ 42 $\pm$ 6 164 ² BARTEL 78B CNTR e^+e^-

• • • We do not use the following data for averages, fits, limits, etc. • • •

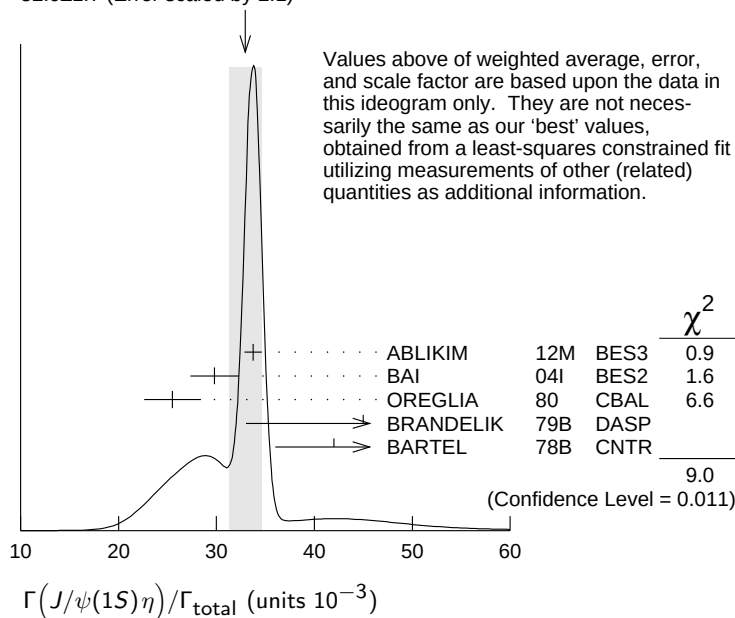
34.3 $\pm$ 0.4 $\pm$ 0.9 18.4k ³ MENDEZ 08 CLEO $\psi(2S) \rightarrow \ell^+\ell^-\eta$ 32.5 $\pm$ 0.6 $\pm$ 1.1 2.8k ⁴ ADAM 05A CLEO Repl. by MENDEZ 0843 $\pm$ 8 44 TANENBAUM 76 MRK1 e^+e^- ¹ Recalculated by us using $B(J/\psi(1S) \rightarrow \ell^+\ell^-) = 0.1181 \pm 0.0020$.² Recalculated by us using $B(J/\psi(1S) \rightarrow \mu^+\mu^-) = 0.0588 \pm 0.0010$.³ Not independent from other measurements of MENDEZ 08.⁴ Not independent from other values reported by ADAM 05A.NODE=M071R15
NODE=M071R15

NODE=M071R;LINKAGE=3Q

NODE=M071R;LINKAGE=2Q

NODE=M071R15;LINKAGE=ME

NODE=M071R15;LINKAGE=AD

WEIGHTED AVERAGE
32.9 $\pm$ 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

0.0551 $\pm$ 0.0008 OUR FIT**0.058 $\pm$ 0.007 OUR AVERAGE**

Error includes scale factor of 1.4. See the ideogram below.

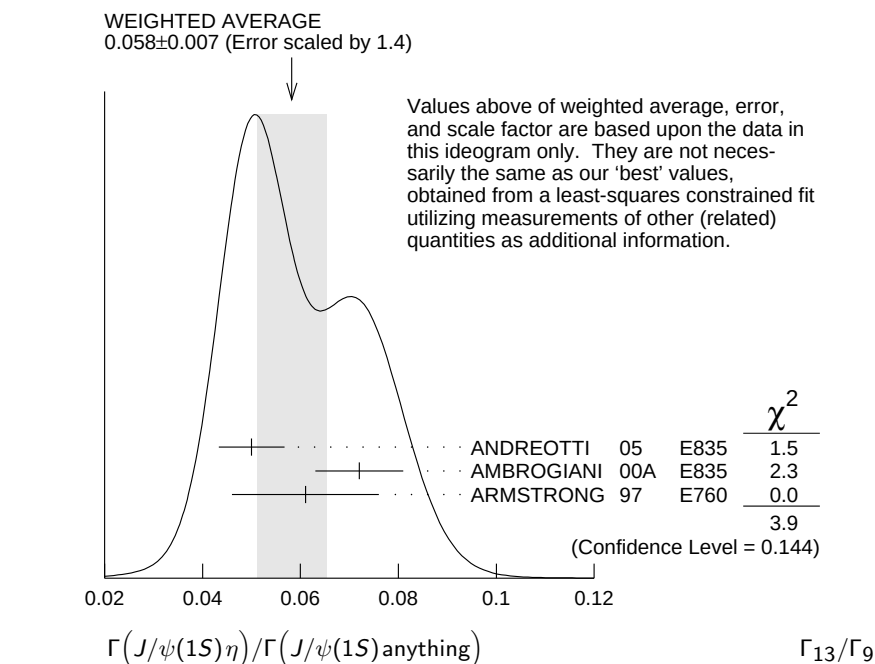
0.050 $\pm$ 0.006 $\pm$ 0.003 298 $\pm$ 20 ANDREOTTI 05 E835 $\psi(2S) \rightarrow J/\psi X$ 0.072 $\pm$ 0.009 AMBROGIANI 00A E835 $p\bar{p} \rightarrow \psi(2S)$ 0.061 $\pm$ 0.015 ARMSTRONG 97 E760 $\bar{p}p \rightarrow \psi(2S)$

• • • 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 08¹ Not independent from other measurements of MENDEZ 08.NODE=M071R68
NODE=M071R68

OCCUR=2

NODE=M071R68;LINKAGE=ME



$\Gamma(J/\psi(1S)\eta)/\Gamma(J/\psi(1S)\pi^+\pi^-)$

Γ_{13}/Γ_{11}

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.0974±0.0014 OUR FIT				
0.0979±0.0018 OUR AVERAGE				
0.0979±0.0010±0.0015	18.4k	MENDEZ	08	CLEO $\psi(2S) \rightarrow \ell^+\ell^-\eta$
0.098 ±0.005 ±0.010	2k	¹ ABLIKIM	04B	BES $\psi(2S) \rightarrow J/\psi X$
0.091 ±0.021		² HIMEL	80	MRK2 $e^+e^- \rightarrow \psi(2S)X$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.0968±0.0019±0.0013	2.8k	³ ADAM	05A	CLEO Repl. by MENDEZ 08
0.095 ±0.007 ±0.007		⁴ ANDREOTTI	05	E835 $\psi(2S) \rightarrow J/\psi X$

¹ From a fit to the J/ψ recoil mass spectra.

² The value for $B(\psi(2S) \rightarrow J/\psi(1S)\eta)$ reported in HIMEL 80 is derived using $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (33 \pm 3)\%$ and $B(J/\psi(1S) \rightarrow \ell^+\ell^-) = 0.138 \pm 0.018$. Calculated by us using $B(J/\psi(1S) \rightarrow \ell^+\ell^-) = (0.1181 \pm 0.0020)$.

³ Not independent from other values reported by ADAM 05A.

⁴ Not independent from other values reported by ANDREOTTI 05.

NODE=M071R71
NODE=M071R71

NODE=M071R71;LINKAGE=AB
NODE=M071R;LINKAGE=8H

NODE=M071R71;LINKAGE=AD
NODE=M071R71;LINKAGE=AN

$\Gamma(J/\psi(1S)\pi^0)/\Gamma_{\text{total}}$

Γ_{14}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
12.68±0.32 OUR AVERAGE				
12.6 ±0.2 ±0.3	4.1k	ABLIKIM	12M	BES3 $e^+e^- \rightarrow \ell^+\ell^-2\gamma$
13.3 ±0.8 ±0.3	530	MENDEZ	08	CLEO $\psi(2S) \rightarrow \ell^+\ell^-2\gamma$
14.3 ±1.4 ±1.2	280	BAI	04i	BES2 $\psi(2S) \rightarrow J/\psi\gamma\gamma$
14 ±6	7	HIMEL	80	MRK2 e^+e^-
9 ±2 ±1	23	¹ OREGLIA	80	CBAL $\psi(2S) \rightarrow J/\psi 2\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
13 ±1 ±1	88	ADAM	05A	CLEO Repl. by MENDEZ 08

¹ Recalculated by us using $B(J/\psi(1S) \rightarrow \ell^+\ell^-) = 0.1181 \pm 0.0020$.

NODE=M071R16;LINKAGE=3Q

$\Gamma(J/\psi(1S)\pi^0)/\Gamma(J/\psi(1S)\text{anything})$

$\Gamma_{14}/\Gamma_9 = \Gamma_{14}/(\Gamma_{11} + \Gamma_{12} + \Gamma_{13} + 0.339\Gamma_{135} + 0.192\Gamma_{136})$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.213±0.012±0.003	527	¹ MENDEZ	08	CLEO $e^+e^- \rightarrow J/\psi\gamma\gamma$
0.22 ±0.02 ±0.01		² ADAM	05A	CLEO $e^+e^- \rightarrow \psi(2S) \rightarrow J/\psi\gamma\gamma$

¹ Not independent from other values reported by MENDEZ 08. Supersedes ADAM 05A.

² Not independent from other values reported by ADAM 05A.

NODE=M071S25
NODE=M071S25

NODE=M071S25;LINKAGE=ME
NODE=M071S25;LINKAGE=AD

$\Gamma(J/\psi(1S)\pi^0)/\Gamma(J/\psi(1S)\pi^+\pi^-)$ Γ_{14}/Γ_{11}

VALUE (units 10^{-2})	EVTs	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

$0.380 \pm 0.022 \pm 0.005$	527	¹ MENDEZ	08	CLEO $e^+e^- \rightarrow J/\psi\gamma\gamma$
$0.39 \pm 0.04 \pm 0.01$		² ADAM	05A	CLEO $e^+e^- \rightarrow \psi(2S) \rightarrow J/\psi\gamma\gamma$

¹ Not independent from other values reported by MENDEZ 08. Supersedes ADAM 05A.

² Not independent from other values reported by ADAM 05A.

NODE=M071S26
NODE=M071S26

NODE=M071S26;LINKAGE=ME
NODE=M071S26;LINKAGE=AD

NODE=M071310

HADRONIC DECAYS

 $\Gamma(\pi^0 h_c(1P))/\Gamma_{\text{total}}$ Γ_{15}/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT

8.6 ± 1.3 OUR AVERAGE

$9.0 \pm 1.5 \pm 1.3$	3k	¹ GE	11	CLEO $\psi(2S) \rightarrow \pi^0$ anything
$8.4 \pm 1.3 \pm 1.0$	11k	ABLIKIM	10B	BES3 $\psi(2S) \rightarrow \pi^0 h_c$

• • • We do not use the following data for averages, fits, limits, etc. • • •

seen	92^{+23}_{-22}	ADAMS	09	CLEO $\psi(2S) \rightarrow 2\pi^+ 2\pi^- 2\pi^0$
seen	1282	DOBBS	08A	CLEO $\psi(2S) \rightarrow \pi^0 \eta_c \gamma$
seen	168 ± 40	ROSNER	05	CLEO $\psi(2S) \rightarrow \pi^0 \eta_c \gamma$

¹ Assuming a width $\Gamma(h_c(1P)) = 0.86 \text{ MeV} \equiv \Gamma_0$, a measured dependence of the central value of $B = (7.6 \pm 1.4 \times \Gamma(h_c(1P))/\Gamma_0) \times 10^{-4}$, and with a systematic error that accounts for the width variation range 0.43–1.29 MeV.

NODE=M071S42
NODE=M071S42

NODE=M071S42;LINKAGE=GE

 $\Gamma(3(\pi^+\pi^-)\pi^0)/\Gamma_{\text{total}}$ Γ_{16}/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT

35 ± 16 6 FRANKLIN 83 MRK2 $e^+e^- \rightarrow \text{hadrons}$

NODE=M071R37
NODE=M071R37

 $\Gamma(2(\pi^+\pi^-)\pi^0)/\Gamma_{\text{total}}$ Γ_{17}/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT

29 ± 10 OUR AVERAGE Error includes scale factor of 4.7. See the ideogram below.

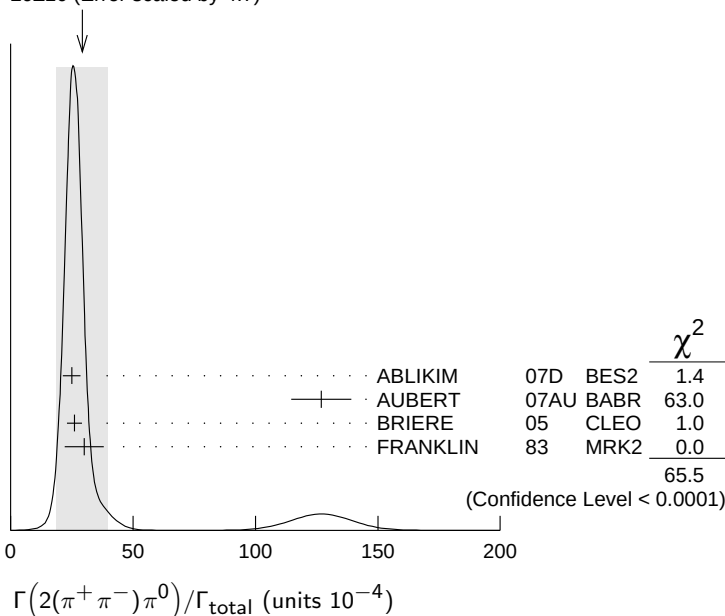
$24.9 \pm 0.7 \pm 3.6$	2173	ABLIKIM	07D	BES2 $e^+e^- \rightarrow \psi(2S)$
$127 \pm 12 \pm 2$	410	¹ AUBERT	07AU	BABR $10.6 e^+e^- \rightarrow 2(\pi^+\pi^-)\pi^0 \gamma$
$26.1 \pm 0.7 \pm 3.0$	1703	BRIERE	05	CLEO $e^+e^- \rightarrow \psi(2S) \rightarrow 2(\pi^+\pi^-)\pi^0$
30 ± 8	42	FRANKLIN	83	MRK2 e^+e^-

¹ AUBERT 07AU reports $[\Gamma(\psi(2S) \rightarrow 2(\pi^+\pi^-)\pi^0)/\Gamma_{\text{total}}] \times [\Gamma(\psi(2S) \rightarrow e^+e^-)] = (297 \pm 22 \pm 18) \times 10^{-4} \text{ keV}$ which we divide by our best value $\Gamma(\psi(2S) \rightarrow e^+e^-) = 2.34 \pm 0.04 \text{ keV}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M071R22
NODE=M071R22

NODE=M071R22;LINKAGE=UB

WEIGHTED AVERAGE
 29 ± 10 (Error scaled by 4.7)



$\Gamma(\rho\pi^0(1320))/\Gamma_{\text{total}}$

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^-

 Γ_{18}/Γ

NODE=M071R65
 NODE=M071R65

 $\Gamma(p\bar{p})/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.88 ± 0.10 OUR FIT				
[(2.88 ± 0.09) $\times 10^{-4}$ OUR 2016 FIT]				
3.00 ± 0.13 OUR AVERAGE Error includes scale factor of 1.1.				
$3.08 \pm 0.05 \pm 0.18$	4.5k	¹ DOBBS	14	$e^+e^- \rightarrow \psi(2S) \rightarrow p\bar{p}$
$3.36 \pm 0.09 \pm 0.25$	1.6k	ABLIKIM	07C BES	$e^+e^- \rightarrow \psi(2S) \rightarrow p\bar{p}$
$2.87 \pm 0.12 \pm 0.15$	557	PEDLAR	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow p\bar{p}$
1.4 ± 0.8	4	BRANDELIK	79C DASP	$e^+e^- \rightarrow \psi(2S) \rightarrow p\bar{p}$
2.3 ± 0.7		FELDMAN	77 MRK1	$e^+e^- \rightarrow \psi(2S) \rightarrow p\bar{p}$

¹ Using CLEO-c data but not authored by the CLEO Collaboration. Γ_{19}/Γ

NODE=M071R25
 NODE=M071R25
 NEW

 $\Gamma(p\bar{p})/\Gamma(J/\psi(1S)\pi^+\pi^-)$

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
8.34 ± 0.28 OUR FIT			
[(8.35 ± 0.28) $\times 10^{-4}$ OUR 2016 FIT]			
$6.98 \pm 0.49 \pm 0.97$	BAI	01 BES	$e^+e^- \rightarrow \psi(2S) \rightarrow p\bar{p}$

 Γ_{19}/Γ_{11}

NODE=M071S40
 NODE=M071S40
 NEW

 $\Gamma(\Delta^{++}\bar{\Delta}^{--})/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
$12.8 \pm 1.0 \pm 3.4$	157	¹ BAI	01 BES	$e^+e^- \rightarrow \psi(2S) \rightarrow$ hadrons

¹ Estimated using $B(\psi(2S) \rightarrow J/\psi\pi^+\pi^-) = 0.310 \pm 0.028$. Γ_{20}/Γ

NODE=M071R50
 NODE=M071R50

 $\Gamma(\Lambda\bar{\Lambda}\pi^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
< 0.29	90	¹ ABLIKIM	13F BES3	$\psi(2S) \rightarrow p\bar{p}\pi^+\pi^-\gamma\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
< 12	90	² ABLIKIM	07H BES2	$e^+e^- \rightarrow \psi(2S)$
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 $B(\eta \rightarrow \gamma\gamma) = 39.4\%$.				

 Γ_{21}/Γ

NODE=M071R6
 NODE=M071R6

 $\Gamma(\Lambda\bar{\Lambda}\eta)/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$2.48 \pm 0.34 \pm 0.19$	60	¹ ABLIKIM	13F BES3		$\psi(2S) \rightarrow p\bar{p}\pi^+\pi^-\gamma\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 4.9	90	² ABLIKIM	07H BES2		$e^+e^- \rightarrow \psi(2S)$
¹ Using $B(\Lambda \rightarrow \pi^-p) = 63.9\%$ and $B(\eta \rightarrow \gamma\gamma) = 39.31\%$.					
² Using $B(\Lambda \rightarrow \pi^-p) = 63.9\%$.					

 Γ_{22}/Γ

NODE=M071R7
 NODE=M071R7

 $\Gamma(\Lambda\bar{p}K^+)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.0 \pm 0.1 \pm 0.1$	74.0	BRIERE	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow$ $p\bar{p}K^+\pi^-$

 Γ_{23}/Γ

NODE=M071S18
 NODE=M071S18

 $\Gamma(\Lambda\bar{p}K^+\pi^+\pi^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.8 \pm 0.3 \pm 0.3$	45.8	BRIERE	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow$ $p\bar{p}K^+\pi^+\pi^-\pi^-$

 Γ_{24}/Γ

NODE=M071S19
 NODE=M071S19

 $\Gamma(\Lambda\bar{\Lambda}\pi^+\pi^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$2.8 \pm 0.4 \pm 0.5$	73.4	BRIERE	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow$ $p\bar{p}2(\pi^+\pi^-)$

 Γ_{25}/Γ

NODE=M071S17
 NODE=M071S17

$\Gamma(\Lambda\bar{\Lambda})/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT

3.57±0.18 OUR AVERAGE

3.75±0.09±0.23	1.9k	¹ DOBBS	14		$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$
3.39±0.20±0.32	337	ABLIKIM	07C	BES	$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$
6.4 ±1.8 ±0.1		² AUBERT	07BD	BABR	10.6 $e^+e^- \rightarrow \Lambda\bar{\Lambda}\gamma$
3.28±0.23±0.25	208	PEDLAR	05	CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1.81±0.20±0.27	80	³ BAI	01	BES	$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$
< 4	90	FELDMAN	77	MRK1	$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$

¹ Using CLEO-c data but not authored by the CLEO Collaboration.² 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 $\Gamma(\psi(2S) \rightarrow e^+e^-) = 2.34 \pm 0.04$ keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.³ Estimated using $B(\psi(2S) \rightarrow J/\psi\pi^+\pi^-) = 0.310 \pm 0.028$. Γ_{26}/Γ NODE=M071R28
NODE=M071R28 $\Gamma(\Lambda\bar{\Sigma}^+\pi^- + \text{c.c.})/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT

1.40±0.03±0.13

2.8k	ABLIKIM	13W	BES3	$\psi(2S) \rightarrow \text{hadrons}$

 Γ_{27}/Γ NODE=M071S65
NODE=M071S65 $\Gamma(\Lambda\bar{\Sigma}^-\pi^+ + \text{c.c.})/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT

1.54±0.04±0.13

2.8k	ABLIKIM	13W	BES3	$\psi(2S) \rightarrow \text{hadrons}$

 Γ_{28}/Γ NODE=M071S66
NODE=M071S66 $\Gamma(\Sigma^0\bar{p}K^+ + \text{c.c.})/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT

1.67±0.13±0.12

276	¹ ABLIKIM	13D	BES3	$\psi(2S) \rightarrow \gamma\Lambda\bar{p}K^+$

 Γ_{29}/Γ NODE=M071S63
NODE=M071S63¹ Using $B(\Lambda \rightarrow p\pi^-) = 63.9\%$, and $B(\Sigma^0 \rightarrow \Lambda\gamma) = 100\%$.

NODE=M071S63;LINKAGE=AB

 $\Gamma(\Sigma^+\bar{\Sigma}^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT

2.51±0.21 OUR AVERAGE

2.51±0.15±0.16	281	¹ DOBBS	14		$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$
2.57±0.44±0.68	35	PEDLAR	05	CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$

¹ Using CLEO-c data but not authored by the CLEO Collaboration. Γ_{30}/Γ NODE=M071R47
NODE=M071R47

NODE=M071R47;LINKAGE=A

 $\Gamma(\Sigma^0\bar{\Sigma}^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT

2.32±0.16 OUR AVERAGE

2.25±0.11±0.16	439	¹ DOBBS	14		$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$
2.35±0.36±0.32	59	ABLIKIM	07C	BES	$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$
2.63±0.35±0.21	58	PEDLAR	05	CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.2 ±0.4 ±0.4	8	² BAI	01	BES	$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$

¹ Using CLEO-c data but not authored by the CLEO Collaboration.² Estimated using $B(\psi(2S) \rightarrow J/\psi\pi^+\pi^-) = 0.310 \pm 0.028$. Γ_{31}/Γ NODE=M071R51
NODE=M071R51NODE=M071R51;LINKAGE=A
NODE=M071R51;LINKAGE=PP $\Gamma(\Sigma(1385)^+\bar{\Sigma}(1385)^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT

8.5±0.7 OUR AVERAGE[(11 ± 4) × 10⁻⁵ OUR 2016 AVERAGE]

8.4±0.5±0.5	1.5k	ABLIKIM	16L	BES3	$\psi(2S) \rightarrow \Sigma(1385)^+\bar{\Sigma}(1385)^-$
11 ±3 ±3	14	¹ BAI	01	BES	$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$

¹ Estimated using $B(\psi(2S) \rightarrow J/\psi\pi^+\pi^-) = 0.310 \pm 0.028$. Γ_{32}/Γ NODE=M071R52
NODE=M071R52
NEW

OCCUR=2

NODE=M071R52;LINKAGE=PP

 $\Gamma(\Sigma(1385)^-\bar{\Sigma}(1385)^+)/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT

8.5±0.6±0.6

1.4K	ABLIKIM	16L	BES3	$\psi(2S) \rightarrow \Sigma(1385)^-\bar{\Sigma}(1385)^+$

 Γ_{33}/Γ NODE=M071R00
NODE=M071R00

$\Gamma(\Xi^- \Xi^+)/\Gamma_{\text{total}}$ Γ_{34}/Γ

VALUE (units 10^{-4}) CL% EVTS DOCUMENT ID TECN COMMENT

2.72±0.12 OUR AVERAGE

[(2.64 ± 0.18) × 10^{-4} OUR 2016 AVERAGE]

2.78±0.05±0.14	5k	ABLIKIM	16L	BES3	$\psi(2S) \rightarrow \Xi^- \Xi^+$
2.66±0.12±0.20	548	¹ DOBBS	14		$e^+ e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$
3.03±0.40±0.32	67	ABLIKIM	07C	BES	$e^+ e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$
2.38±0.30±0.21	63	PEDLAR	05	CLEO	$e^+ e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.94±0.27±0.15	12	² BAI	01	BES	$e^+ e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$
<2	90	FELDMAN	77	MRK1	$e^+ e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$

¹ Using CLEO-c data but not authored by the CLEO Collaboration.

² Estimated using $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = 0.310 \pm 0.028$.

NODE=M071R29
NODE=M071R29
NEW

 $\Gamma(\Xi^0 \Xi^0)/\Gamma_{\text{total}}$ Γ_{35}/Γ

VALUE (units 10^{-4}) EVTS DOCUMENT ID TECN COMMENT

2.07±0.23 OUR AVERAGE

2.02±0.19±0.15	112	¹ DOBBS	14		$e^+ e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$
2.75±0.64±0.61	19	PEDLAR	05	CLEO	$e^+ e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$

¹ Using CLEO-c data but not authored by the CLEO Collaboration.

NODE=M071R48
NODE=M071R48

 $\Gamma(\Xi(1530)^0 \Xi(1530)^0)/\Gamma_{\text{total}}$ Γ_{36}/Γ

VALUE (units 10^{-5}) CL% EVTS DOCUMENT ID TECN COMMENT

5.2±0.3^{+3.2}_{-1.2}

527 ¹ ABLIKIM 13S BES3 $\psi(2S) \rightarrow \eta p \bar{p}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<32	90	PEDLAR	05	CLEO	$e^+ e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$
< 8.1	90	² BAI	01	BES	$e^+ e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$

¹ With $N(1535)$ decaying to $p\eta$.

² Estimated using $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = 0.310 \pm 0.028$.

NODE=M071R53
NODE=M071R53

NODE=M071R48;LINKAGE=A

NODE=M071R53;LINKAGE=A
NODE=M071R53;LINKAGE=PP

 $\Gamma(K^- \Lambda \Xi^+ + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{37}/Γ

VALUE (units 10^{-5}) EVTS DOCUMENT ID TECN COMMENT

3.86±0.27±0.32	236	ABLIKIM	15I	BES3	$e^+ e^- \rightarrow \psi(2S) \rightarrow K^- \Lambda \Xi^+ + \text{c.c.}$

NODE=M071S82
NODE=M071S82

 $\Gamma(\Xi(1690)^- \Xi^+ \rightarrow K^- \Lambda \Xi^+ + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{38}/Γ

VALUE (units 10^{-6}) EVTS DOCUMENT ID TECN COMMENT

5.21±1.48±0.57	74	ABLIKIM	15I	BES3	$e^+ e^- \rightarrow \psi(2S) \rightarrow K^- \Lambda \Xi^+ + \text{c.c.}$

NODE=M071S83
NODE=M071S83

 $\Gamma(\Xi(1820)^- \Xi^+ \rightarrow K^- \Lambda \Xi^+ + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{39}/Γ

VALUE (units 10^{-6}) EVTS DOCUMENT ID TECN COMMENT

12.03±2.94±1.22	136	ABLIKIM	15I	BES3	$e^+ e^- \rightarrow \psi(2S) \rightarrow K^- \Lambda \Xi^+ + \text{c.c.}$

NODE=M071S84
NODE=M071S84

 $\Gamma(K^- \Sigma^0 \Xi^+ + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{40}/Γ

VALUE (units 10^{-5}) EVTS DOCUMENT ID TECN COMMENT

3.67±0.33±0.28	142	ABLIKIM	15I	BES3	$e^+ e^- \rightarrow \psi(2S) \rightarrow K^- \Sigma^0 \Xi^+ + \text{c.c.}$

NODE=M071S85
NODE=M071S85

 $\Gamma(\Omega^- \bar{\Omega}^+)/\Gamma_{\text{total}}$ Γ_{41}/Γ

VALUE (units 10^{-4}) CL% EVTS DOCUMENT ID TECN COMMENT

0.47±0.09±0.05	27	¹ DOBBS	14		$e^+ e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<1.5	90	ABLIKIM	12Q	BES2	$e^+ e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$
<1.6	90	PEDLAR	05	CLEO	$e^+ e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$
<0.73	90	² BAI	01	BES	$e^+ e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$

¹ Using CLEO-c data but not authored by the CLEO Collaboration.

² Estimated using $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = 0.310 \pm 0.028$.

NODE=M071R54
NODE=M071R54

NODE=M071R54;LINKAGE=A
NODE=M071R54;LINKAGE=PP

$\Gamma(\pi^0 p \bar{p})/\Gamma_{\text{total}}$ VALUE (units 10^{-4}) EVTS

DOCUMENT ID

TECN

COMMENT

 Γ_{42}/Γ NODE=M071R35
NODE=M071R35**1.53±0.07 OUR AVERAGE**

1.65±0.03±0.15	4.5k	ABLIKIM	13A	BES3	$\psi(2S) \rightarrow p \bar{p} \pi^0$
1.54±0.06±0.06	948	ALEXANDER	10	CLEO	$\psi(2S) \rightarrow \pi^0 p \bar{p}$
1.32±0.10±0.15	256	¹ ABLIKIM	05E	BES2	$e^+ e^- \rightarrow \psi(2S) \rightarrow p \bar{p} \gamma \gamma$
1.4 ±0.5	9	FRANKLIN	83	MRK2	$e^+ e^-$

¹ Computed using $B(\pi^0 \rightarrow \gamma \gamma) = (98.80 \pm 0.03)\%$.

NODE=M071R35;LINKAGE=AB

 $\Gamma(N(940) \bar{p} + \text{c.c.} \rightarrow \pi^0 p \bar{p})/\Gamma_{\text{total}}$ VALUE (units 10^{-5})

EVTS

DOCUMENT ID

TECN

COMMENT

 Γ_{43}/Γ NODE=M071S56
NODE=M071S56**6.42±0.20^{+1.78}_{-1.28}**

1.9k

¹ ABLIKIM

13A

BES3

 $\psi(2S) \rightarrow p \bar{p} \pi^0$ ¹ From a fit of $\pi^0 p \bar{p}$ data to eight distinct intermediate $N \bar{p}$ resonant states.

NODE=M071S56;LINKAGE=AB

 $\Gamma(N(1440) \bar{p} + \text{c.c.} \rightarrow \pi^0 p \bar{p})/\Gamma_{\text{total}}$ VALUE (units 10^{-5})

EVTS

DOCUMENT ID

TECN

COMMENT

 Γ_{44}/Γ NODE=M071S50
NODE=M071S50**7.3 ^{+1.7}_{-1.5} OUR AVERAGE** Error includes scale factor of 2.5.

3.58±0.25 ^{+1.59} _{-0.84}	1.1k	¹ ABLIKIM	13A	BES3	$\psi(2S) \rightarrow p \bar{p} \pi^0$
8.1 ±0.7 ±0.3	474	² ALEXANDER	10	CLEO	$\psi(2S) \rightarrow \pi^0 p \bar{p}$

¹ From a fit of $\pi^0 p \bar{p}$ data to eight distinct intermediate $N \bar{p}$ resonant states.

NODE=M071S50;LINKAGE=AB

² From a fit of the $p \bar{p}$ and $p \pi^0$ mass distributions to a combination of $N(1440) \bar{p}$, $\pi^0 f_0(2100)$, and two other broad, unestablished resonances.

NODE=M071S50;LINKAGE=AL

 $\Gamma(N(1520) \bar{p} + \text{c.c.} \rightarrow \pi^0 p \bar{p})/\Gamma_{\text{total}}$ VALUE (units 10^{-5})

EVTS

DOCUMENT ID

TECN

COMMENT

 Γ_{45}/Γ NODE=M071S57
NODE=M071S57**0.64±0.05^{+0.22}_{-0.17}**

0.2k

¹ ABLIKIM

13A

BES3

 $\psi(2S) \rightarrow p \bar{p} \pi^0$ ¹ From a fit of $\pi^0 p \bar{p}$ data to eight distinct intermediate $N \bar{p}$ resonant states.

NODE=M071S57;LINKAGE=AB

 $\Gamma(N(1535) \bar{p} + \text{c.c.} \rightarrow \pi^0 p \bar{p})/\Gamma_{\text{total}}$ VALUE (units 10^{-5})

EVTS

DOCUMENT ID

TECN

COMMENT

 Γ_{46}/Γ NODE=M071S58
NODE=M071S58**2.47±0.28^{+0.99}_{-0.97}**

0.7k

¹ ABLIKIM

13A

BES3

 $\psi(2S) \rightarrow p \bar{p} \pi^0$ ¹ From a fit of $\pi^0 p \bar{p}$ data to eight distinct intermediate $N \bar{p}$ resonant states.

NODE=M071S58;LINKAGE=AB

 $\Gamma(N(1650) \bar{p} + \text{c.c.} \rightarrow \pi^0 p \bar{p})/\Gamma_{\text{total}}$ VALUE (units 10^{-5})

EVTS

DOCUMENT ID

TECN

COMMENT

 Γ_{47}/Γ NODE=M071S59
NODE=M071S59**3.76±0.28^{+1.37}_{-1.66}**

1.1k

¹ ABLIKIM

13A

BES3

 $\psi(2S) \rightarrow p \bar{p} \pi^0$ ¹ From a fit of $\pi^0 p \bar{p}$ data to eight distinct intermediate $N \bar{p}$ resonant states.

NODE=M071S59;LINKAGE=AB

 $\Gamma(N(1720) \bar{p} + \text{c.c.} \rightarrow \pi^0 p \bar{p})/\Gamma_{\text{total}}$ VALUE (units 10^{-5})

EVTS

DOCUMENT ID

TECN

COMMENT

 Γ_{48}/Γ NODE=M071S60
NODE=M071S60**1.79±0.10^{+0.24}_{-0.71}**

0.5k

¹ ABLIKIM

13A

BES3

 $\psi(2S) \rightarrow p \bar{p} \pi^0$ ¹ From a fit of $\pi^0 p \bar{p}$ data to eight distinct intermediate $N \bar{p}$ resonant states.

NODE=M071S60;LINKAGE=AB

 $\Gamma(N(2300) \bar{p} + \text{c.c.} \rightarrow \pi^0 p \bar{p})/\Gamma_{\text{total}}$ VALUE (units 10^{-5})

EVTS

DOCUMENT ID

TECN

COMMENT

 Γ_{49}/Γ NODE=M071S61
NODE=M071S61**2.62±0.28^{+1.12}_{-0.64}**

0.9k

¹ ABLIKIM

13A

BES3

 $\psi(2S) \rightarrow p \bar{p} \pi^0$ ¹ From a fit of $\pi^0 p \bar{p}$ data to eight distinct intermediate $N \bar{p}$ resonant states.

NODE=M071S61;LINKAGE=AB

 $\Gamma(N(2570) \bar{p} + \text{c.c.} \rightarrow \pi^0 p \bar{p})/\Gamma_{\text{total}}$ VALUE (units 10^{-5})

EVTS

DOCUMENT ID

TECN

COMMENT

 Γ_{50}/Γ NODE=M071S62
NODE=M071S62**2.13±0.08^{+0.40}_{-0.30}**

0.8k

¹ ABLIKIM

13A

BES3

 $\psi(2S) \rightarrow p \bar{p} \pi^0$ ¹ From a fit of $\pi^0 p \bar{p}$ data to eight distinct intermediate $N \bar{p}$ resonant states.

NODE=M071S62;LINKAGE=AB

$\Gamma(\pi^0 f_0(2100) \rightarrow \pi^0 p \bar{p}) / \Gamma_{\text{total}}$
 Γ_{51}/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_{52}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
6.0±0.4 OUR AVERAGE				

6.4±0.2±0.6	679	¹ ABLIKIM 13S	BES3	$\psi(2S) \rightarrow \eta p \bar{p}$
5.6±0.6±0.3	154	¹ ALEXANDER 10	CLEO	$\psi(2S) \rightarrow \eta p \bar{p}$
5.8±1.1±0.7	44.8 ± 8.5	² 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 With $N(1535)$ decaying to $p \eta$.

² Computed using $B(\eta \rightarrow \gamma \gamma) = (39.43 \pm 0.26)\%$.

NODE=M071R56
NODE=M071R56

NODE=M071R56;LINKAGE=A
NODE=M071R56;LINKAGE=AB

 $\Gamma(\eta f_0(2100) \rightarrow \eta p \bar{p}) / \Gamma_{\text{total}}$
 Γ_{53}/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_{54}/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_{55}/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_{56}/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_{57}/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_{58}/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_{59}/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

$\Gamma(\eta\pi^+\pi^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.6	90	BRIERE	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow 2(\pi^+\pi^-)\pi^0$

 Γ_{61}/Γ

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	$e^+e^- \rightarrow \psi(2S) \rightarrow \eta 3\pi(\eta \rightarrow 3\pi)$

 Γ_{62}/Γ

NODE=M071S07
 NODE=M071S07

¹ Average of $\eta \rightarrow \gamma\gamma$ and $\eta \rightarrow 3\pi$.² Not independent from other values reported by BRIERE 05.

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 $\Gamma_{ee}^{\psi(2S)} \cdot B(\psi(2S) \rightarrow 2(\pi^+\pi^-)\eta) \cdot B(\eta \rightarrow \gamma\gamma) = 1.2 \pm 0.7 \pm 0.1 \text{ eV}$.

 Γ_{63}/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_{64}/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 $\Gamma_{ee}^{\psi(2S)} \cdot B(\psi(2S) \rightarrow \omega\pi^+\pi^-) \cdot B(\omega \rightarrow 3\pi) = 2.69 \pm 0.73 \pm 0.16 \text{ eV}$.

² Normalized to $B(\psi(2S) \rightarrow J/\psi\pi^+\pi^-) = 0.305 \pm 0.016$.

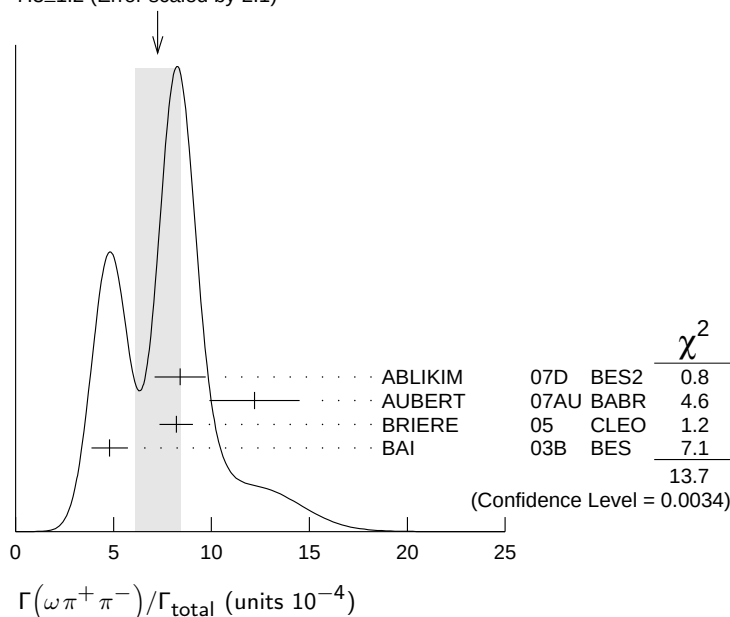
 Γ_{65}/Γ

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 ± 0.6 ± 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 ± 0.6 ± 0.5	61 ± 11	1,2 BAI	03B BES	$\psi(2S) \rightarrow 2(\pi^+ \pi^-) \pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
5.2 ± 0.8 ± 1.0		¹ BAI	99C BES	Repl. by BAI 03B

¹ Assuming $B(b_1 \rightarrow \omega \pi)=1$.² Normalized to $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = 0.305 \pm 0.016$.NODE=M071R40
NODE=M071R40NODE=M071R;LINKAGE=M1
NODE=M071R40;LINKAGE=B3 $\Gamma(b_1^0 \pi^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.35^{+0.47}_{-0.42} ± 0.40	45	ADAM	05 CLEO	$e^+ e^- \rightarrow \psi(2S)$

NODE=M071R21
NODE=M071R21 $\Gamma(\omega f_2(1270))/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
2.2 ± 0.4 OUR AVERAGE					
2.3 ± 0.5 ± 0.4		57	ABLIKIM	07D BES2	$e^+ e^- \rightarrow \psi(2S)$
$2.05 \pm 0.41 \pm 0.38$		62 ± 12	BAI	04C BES2	$\psi(2S) \rightarrow 2(\pi^+ \pi^-) \pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<1.5	90	¹ BAI	03B BES		$\psi(2S) \rightarrow 2(\pi^+ \pi^-) \pi^0$
<1.7	90	BAI	98J BES		Repl. by BAI 03B

¹ Normalized to $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = 0.305 \pm 0.016$.NODE=M071R64
NODE=M071R64

NODE=M071R64;LINKAGE=B3

 $\Gamma(\pi^+ \pi^- K^+ K^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
7.3 ± 0.5 OUR AVERAGE				
[(7.5 ± 0.9) × 10 ⁻⁴ OUR 2016 AVERAGE Scale factor = 1.9]				
8.1 ± 1.3 ± 0.3	133 ± 21	LEES	12F BABR	$10.6 e^+ e^- \rightarrow \pi^+ \pi^- K^+ K^- \gamma$
7.1 ± 0.3 ± 0.4	817.2	BRIERE	05 CLEO	$e^+ e^- \rightarrow \psi(2S) \rightarrow K^+ K^- \pi^+ \pi^-$
16 ± 4		¹ TANENBAUM	78 MRK1	$e^+ e^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
10.9 ± 1.9 ± 0.2	85	² AUBERT	07AK BABR	$10.6 e^+ e^- \rightarrow \pi^+ \pi^- K^+ K^- \gamma$

¹ Assuming entirely strong decay.² Superseded by LEES 12F. AUBERT 07AK reports [$\Gamma(\psi(2S) \rightarrow \pi^+ \pi^- K^+ K^-)/\Gamma_{\text{total}}$] × [$\Gamma(\psi(2S) \rightarrow e^+ e^-)$] = (2.56 ± 0.42 ± 0.16) × 10⁻³ keV which we divide by our best value $\Gamma(\psi(2S) \rightarrow e^+ e^-) = 2.34 \pm 0.04$ keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.NODE=M071R24
NODE=M071R24
NEWNODE=M071R24;LINKAGE=K
NODE=M071R24;LINKAGE=BE $\Gamma(\rho^0 K^+ K^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.2 ± 0.2 ± 0.4	223.8	BRIERE	05 CLEO	$e^+ e^- \rightarrow \psi(2S) \rightarrow K^+ K^- \pi^+ \pi^-$

NODE=M071S09
NODE=M071S09 $\Gamma(K^*(892)^0 \bar{K}_2^*(1430)^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
1.86 ± 0.32 ± 0.43		93 ± 16	BAI	04C	$\psi(2S) \rightarrow K^+ K^- \pi^+ \pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<1.2	90	BAI	98J BES		$e^+ e^-$

NODE=M071R66
NODE=M071R66 $\Gamma(K^+ K^- \pi^+ \pi^- \eta)/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.3 ± 0.7 ± 0.1	7	¹ AUBERT	07AU BABR	$10.6 e^+ e^- \rightarrow K^+ K^- \pi^+ \pi^- \eta \gamma$
¹ AUBERT 07AU quotes $\Gamma_{ee}^{\psi(2S)} \cdot B(\psi(2S) \rightarrow 2(\pi^+ \pi^-) \eta) \cdot B(\eta \rightarrow \gamma \gamma) = 1.2 \pm 0.7 \pm 0.1$ eV.				

NODE=M071S39
NODE=M071S39

NODE=M071S39;LINKAGE=UB

 $\Gamma(K^+ K^- 2(\pi^+ \pi^-) \pi^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
10.0 ± 2.5 ± 1.8	65	ABLIKIM	07D BES2	$e^+ e^- \rightarrow \psi(2S)$

NODE=M071R09
NODE=M071R09

$\Gamma(K_1(1270)^\pm K^\mp)/\Gamma_{\text{total}}$ Γ_{76}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
10.0±1.8±2.1	¹ BAI	99C	BES e^+e^-

¹ Assuming $B(K_1(1270) \rightarrow K\rho)=0.42 \pm 0.06$ NODE=M071R41
NODE=M071R41

NODE=M071R;LINKAGE=M2

 $\Gamma(K_S^0 K_S^0 \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{77}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.20±0.25±0.37	83 ± 9	ABLIKIM	050	BES2 $e^+e^- \rightarrow \psi(2S)$

NODE=M071R49
NODE=M071R49 $\Gamma(\rho^0 \rho \bar{\rho})/\Gamma_{\text{total}}$ Γ_{78}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
0.5±0.1±0.2	61.1	BRIERE	05	CLEO $e^+e^- \rightarrow \psi(2S) \rightarrow \rho \bar{\rho} \pi^+ \pi^-$

NODE=M071S14
NODE=M071S14 $\Gamma(K^+ \bar{K}^*(892)^0 \pi^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{79}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
6.7±2.5	TANENBAUM	78	MRK1 e^+e^-

NODE=M071R34
NODE=M071R34 $\Gamma(2(\pi^+ \pi^-))/\Gamma_{\text{total}}$ Γ_{80}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.4±0.6 OUR AVERAGE	Error includes scale factor of 2.2.			
2.2±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^-

NODE=M071R27
NODE=M071R27 $\Gamma(\rho^0 \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{81}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.2±0.6 OUR AVERAGE	Error includes scale factor of 1.4.			
2.0±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^-

NODE=M071R33
NODE=M071R33 $\Gamma(K^+ K^- \pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}$ Γ_{82}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
12.6±0.9 OUR AVERAGE				
18.8±5.7±0.3	32	¹ AUBERT	07AU	BABR $10.6 e^+e^- \rightarrow K^+ K^- \pi^+ \pi^- \pi^0 \gamma$
11.7±1.0±1.5	597	ABLIKIM	06G	BES2 $\psi(2S) \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$
12.7±0.5±1.0	711.6	BRIERE	05	CLEO $e^+e^- \rightarrow \psi(2S) \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$

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 $\Gamma(\psi(2S) \rightarrow e^+ e^-) = 2.34 \pm 0.04$ 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

 $\Gamma(\omega f_0(1710) \rightarrow \omega K^+ K^-)/\Gamma_{\text{total}}$ Γ_{83}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
5.9±2.0±0.9	19	ABLIKIM	06G	BES2 $\psi(2S) \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$

NODE=M071S20
NODE=M071S20 $\Gamma(K^*(892)^0 K^- \pi^+ \pi^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{84}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
8.6±1.3±1.8	238	ABLIKIM	06G	BES2 $\psi(2S) \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$

NODE=M071S21
NODE=M071S21 $\Gamma(K^*(892)^+ K^- \pi^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{85}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
9.6±2.2±1.7	133	ABLIKIM	06G	BES2 $\psi(2S) \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$

NODE=M071S22
NODE=M071S22 $\Gamma(K^*(892)^+ K^- \rho^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{86}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
7.3±2.2±1.4	78	ABLIKIM	06G	BES2 $\psi(2S) \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$

NODE=M071S23
NODE=M071S23

$$\Gamma(K^*(892)^0 K^- \rho^+ + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_{87}/\Gamma$$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
6.1±1.3±1.2	125	ABLIKIM	06G BES2	$\psi(2S) \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$

NODE=M071S24
NODE=M071S24

$$\Gamma(\eta K^+ K^-, \text{ no } \eta\phi)/\Gamma_{\text{total}} \quad \Gamma_{88}/\Gamma$$

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
3.08±0.29±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

$$\Gamma(\omega K^+ K^-)/\Gamma_{\text{total}} \quad \Gamma_{89}/\Gamma$$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.62±0.11 OUR AVERAGE		Error includes scale factor of 1.1.		

1.56±0.04±0.11	2.8k	ABLIKIM	14G BES3	$\psi(2S) \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$
2.38±0.37±0.29	78	ABLIKIM	06G BES2	$\psi(2S) \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$
1.9 ±0.3 ±0.3	76.8	BRIERE	05 CLEO	$e^+ e^- \rightarrow \psi(2S) \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$
1.5 ±0.3 ±0.2	23	¹ BAI	03B BES	$\psi(2S) \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$

¹ Normalized to $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = 0.305 \pm 0.016$.

NODE=M071R78
NODE=M071R78

NODE=M071R78;LINKAGE=B3

$$\Gamma(\omega K^*(892)^+ K^- + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_{90}/\Gamma$$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
20.7±2.6 OUR AVERAGE				

18.9±2.9±2.2	396	ABLIKIM	13M BES3	$\psi(2S) \rightarrow \omega K_S^0 K^- \pi^+$
22.6±3.0±2.4	535	ABLIKIM	13M BES3	$\psi(2S) \rightarrow \omega K^+ K^- \pi^0$

NODE=M071S67
NODE=M071S67

OCCUR=2

$$\Gamma(\omega K_2^*(1430)^+ K^- + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_{91}/\Gamma$$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
6.1 ±1.2 OUR AVERAGE				

6.39±1.50±0.78	128	ABLIKIM	13M BES3	$\psi(2S) \rightarrow \omega K_S^0 K^- \pi^+$
5.86±1.61±0.83	143	ABLIKIM	13M BES3	$\psi(2S) \rightarrow \omega K^+ K^- \pi^0$

NODE=M071S68
NODE=M071S68

OCCUR=2

$$\Gamma(\omega \bar{K}^*(892)^0 K^0)/\Gamma_{\text{total}} \quad \Gamma_{92}/\Gamma$$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
16.8±2.5±1.6	356	ABLIKIM	13M BES3	$\psi(2S) \rightarrow \omega K_S^0 K^- \pi^+$

NODE=M071S69
NODE=M071S69

$$\Gamma(\omega \bar{K}_2^*(1430)^0 K^0)/\Gamma_{\text{total}} \quad \Gamma_{93}/\Gamma$$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
5.82±2.08±0.72	116	ABLIKIM	13M BES3	$\psi(2S) \rightarrow \omega K_S^0 K^- \pi^+$

NODE=M071S70
NODE=M071S70

$$\Gamma(\omega X(1440) \rightarrow \omega K_S^0 K^- \pi^+ + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_{94}/\Gamma$$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
1.60±0.27±0.24	109	¹ ABLIKIM	13M BES3	$\psi(2S) \rightarrow \omega K_S^0 K^- \pi^+$

¹ X(1440) compatible with $\eta(1405)$ and $\eta(1475)$. A $f_1(1420)$ is also possible.

NODE=M071S71
NODE=M071S71

NODE=M071S71;LINKAGE=AB

$$\Gamma(\omega X(1440) \rightarrow \omega K^+ K^- \pi^0)/\Gamma_{\text{total}} \quad \Gamma_{95}/\Gamma$$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
1.09±0.20±0.16	82	¹ ABLIKIM	13M BES3	$\psi(2S) \rightarrow \omega K^+ K^- \pi^0$

¹ X(1440) compatible with $\eta(1405)$ and $\eta(1475)$. A $f_1(1420)$ is also possible.

NODE=M071S72
NODE=M071S72

NODE=M071S72;LINKAGE=AB

$$\Gamma(\omega f_1(1285) \rightarrow \omega K_S^0 K^- \pi^+ + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_{96}/\Gamma$$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
0.302±0.098±0.027	22	¹ ABLIKIM	13M BES3	$\psi(2S) \rightarrow \omega K_S^0 K^- \pi^+$

¹ Statistical significance 4.5 σ . This measurement is equivalent to a limit of $< 0.478 \times 10^{-5}$ at 90% C.L.

NODE=M071S73
NODE=M071S73

NODE=M071S73;LINKAGE=AB

$$\Gamma(\omega f_1(1285) \rightarrow \omega K^+ K^- \pi^0)/\Gamma_{\text{total}} \quad \Gamma_{97}/\Gamma$$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
0.125±0.070±0.013	10	¹ ABLIKIM	13M BES3	$\psi(2S) \rightarrow \omega K^+ K^- \pi^0$

¹ Statistical significance 3.2 σ . This measurement is equivalent to a limit of $< 0.221 \times 10^{-5}$ at 90% C.L.

NODE=M071S74
NODE=M071S74

NODE=M071S74;LINKAGE=AB

$\Gamma(3(\pi^+\pi^-))/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
3.5 $\pm$ 2.0 OUR AVERAGE		Error includes scale factor of 2.8.		
5.45 $\pm$ 0.42 $\pm$ 0.87	671	ABLIKIM	05H BES2	$e^+e^- \rightarrow \psi(2S) \rightarrow 3(\pi^+\pi^-)$

1.5 $\pm$ 1.0¹ TANENBAUM 78 MRK1 e^+e^- ¹ Assuming entirely strong decay. Γ_{98}/Γ NODE=M071R32
NODE=M071R32

NODE=M071R32;LINKAGE=K

 $\Gamma(p\bar{p}\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
7.3 $\pm$ 0.4 $\pm$ 0.6	434.9	BRIERE	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow p\bar{p}\pi^+\pi^-\pi^0$

 Γ_{99}/Γ NODE=M071S15
NODE=M071S15 $\Gamma(K^+K^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
7.48 $\pm$ 0.23 $\pm$ 0.39		1.3k	¹ METREVELI	12	$\psi(2S) \rightarrow K^+K^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

6.2 $\pm$ 1.5 $\pm$ 0.2	66	^{2,3} LEES	15J BABR	$e^+e^- \rightarrow K^+K^-\gamma$
8.3 $\pm$ 1.5 $\pm$ 0.2	66	^{3,4} LEES	15J BABR	$e^+e^- \rightarrow K^+K^-\gamma$
6.3 $\pm$ 0.6 $\pm$ 0.3		⁵ DOBBS	06A CLEO	e^+e^-
10 $\pm$ 7		⁵ BRANDELIK	79C DASP	e^+e^-
< 5	90	FELDMAN	77 MRK1	e^+e^-

¹ Obtained by analyzing CLEO-c data but not authored by the CLEO Collaboration.² $\sin\phi > 0$.³ Using $\Gamma(\psi(2S) \rightarrow e^+e^-) = (2.37 \pm 0.04) \text{ keV}$.⁴ $\sin\phi < 0$.⁵ Interference with non-resonant K^+K^- production not taken into account.

OCCUR=2

NODE=M071R23;LINKAGE=ME
NODE=M071R23;LINKAGE=A
NODE=M071R23;LINKAGE=B
NODE=M071R23;LINKAGE=C
NODE=M071R23;LINKAGE=BA $\Gamma(K_S^0 K_L^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
5.34 $\pm$ 0.33 OUR AVERAGE				
5.28 $\pm$ 0.25 $\pm$ 0.34	478 $\pm$ 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 $\pm$ 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 $B(K_S^0 \rightarrow \pi^+\pi^-) = 0.6860 \pm 0.0027$. Γ_{101}/Γ NODE=M071R87
NODE=M071R87NODE=M071R87;LINKAGE=ME
NODE=M071R;LINKAGE=KZ $\Gamma(\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$

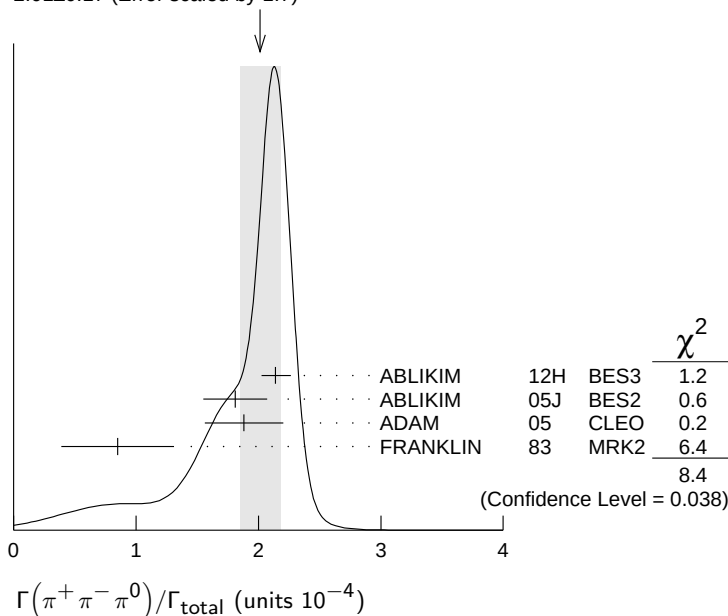
VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.01 $\pm$ 0.17 OUR AVERAGE		Error includes scale factor of 1.7. See the ideogram below.		
2.14 $\pm$ 0.03 $^{+0.12}_{-0.11}$	7k	¹ ABLIKIM	12H BES3	$e^+e^- \rightarrow \psi(2S)$
1.81 $\pm$ 0.18 $\pm$ 0.19	260 $\pm$ 19	² ABLIKIM	05J BES2	$e^+e^- \rightarrow \psi(2S)$
1.88 $^{+0.16}_{-0.15} \pm 0.28$	194	ADAM	05 CLEO	$e^+e^- \rightarrow \psi(2S)$
0.85 $\pm$ 0.46	4	FRANKLIN	83 MRK2	$e^+e^- \rightarrow \text{hadrons}$

¹ From $\psi(2S) \rightarrow \pi^+\pi^-\pi^0$ events directly. The quoted systematic error includes a contribution of 4% (added in quadrature) from the uncertainty on the number of $\psi(2S)$ events.² From a PW analysis of $\psi(2S) \rightarrow \pi^+\pi^-\pi^0$. Γ_{102}/Γ NODE=M071R36
NODE=M071R36

NODE=M071R36;LINKAGE=AB

NODE=M071R;LINKAGE=AK

WEIGHTED AVERAGE
2.01±0.17 (Error scaled by 1.7)



$\Gamma(\rho(2150)\pi \rightarrow \pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{103}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
$1.94 \pm 0.25^{+1.15}_{-0.34}$	¹ ABLIKIM	05J BES2	$\psi(2S) \rightarrow \rho(2150)\pi \rightarrow \pi^+\pi^-\pi^0$

¹ From a PW analysis of $\psi(2S) \rightarrow \pi^+\pi^-\pi^0$.

NODE=M071R57
NODE=M071R57

NODE=M071R57;LINKAGE=AK

$\Gamma(\rho(770)\pi \rightarrow \pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{104}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
0.32±0.12 OUR AVERAGE					Error includes scale factor of 1.8.
$0.51 \pm 0.07 \pm 0.11$			¹ ABLIKIM	05J BES2	$\psi(2S) \rightarrow \rho(770)\pi \rightarrow \pi^+\pi^-\pi^0$

$0.24^{+0.08}_{-0.07} \pm 0.02$ 22 ADAM 05 CLEO $e^+e^- \rightarrow \psi(2S)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.83 90 1 FRANKLIN 83 MRK2 e^+e^-

<10 90 BARTEL 76 CNTR e^+e^-

<10 90 ² ABRAMS 75 MRK1 e^+e^-

¹ From a PW analysis of $\psi(2S) \rightarrow \pi^+\pi^-\pi^0$.

² Final state $\rho^0\pi^0$.

NODE=M071R26
NODE=M071R26

NODE=M071R26;LINKAGE=AK
NODE=M071R;LINKAGE=N

$\Gamma(\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{105}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
0.78±0.26 OUR AVERAGE					
$0.76 \pm 0.25 \pm 0.06$		30	¹ METREVELI	12	$\psi(2S) \rightarrow \pi^+\pi^-$
8 ± 5			BRANDELIK	79C DASP	e^+e^-

• • • We do not use the following data for averages, fits, limits, etc. • • •

<2.1 90 DOBBS 06A CLEO $e^+e^- \rightarrow \psi(2S)$

<5 90 FELDMAN 77 MRK1 e^+e^-

¹ Obtained by analyzing CLEO-c data but not authored by the CLEO Collaboration. Using $\psi(3770) \rightarrow \pi^+\pi^-$ for continuum subtraction.

NODE=M071R20
NODE=M071R20

NODE=M071R20;LINKAGE=ME

$\Gamma(K_1(1400)^\pm K^\mp)/\Gamma_{\text{total}}$ Γ_{106}/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_{107}/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_{108}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$4.07 \pm 0.16 \pm 0.26$		0.9k	ABLIKIM	12L BES3	$e^+ e^- \rightarrow \psi(2S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<8.9	90	1	FRANKLIN	83 MRK2	$e^+ e^- \rightarrow \text{hadrons}$

NODE=M071R38
NODE=M071R38

 $\Gamma(K^+ K^*(892)^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{109}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
2.9 ± 0.4 OUR AVERAGE		Error includes scale factor of 1.2.			
$3.18 \pm 0.30^{+0.26}_{-0.31}$		0.2k	ABLIKIM	12L BES3	$e^+ e^- \rightarrow \psi(2S)$
$2.9^{+1.3}_{-1.7} \pm 0.4$		9.6 ± 4.2	ABLIKIM	05I BES2	$e^+ e^- \rightarrow \psi(2S)$
$1.3^{+1.0}_{-0.7} \pm 0.3$		7	ADAM	05 CLEO	$e^+ e^- \rightarrow \psi(2S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<5.4	90		FRANKLIN	83 MRK2	$e^+ e^- \rightarrow \text{hadrons}$

NODE=M071R39
NODE=M071R39

 $\Gamma(K^*(892)^0 \bar{K}^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{110}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
10.9 ± 2.0 OUR AVERAGE					
$13.3^{+2.4}_{-2.8} \pm 1.7$		65.6 ± 9.0	ABLIKIM	05I BES2	$e^+ e^- \rightarrow \psi(2S)$
$9.2^{+2.7}_{-2.2} \pm 0.9$		25	ADAM	05 CLEO	$e^+ e^- \rightarrow \psi(2S)$

NODE=M071R30
NODE=M071R30

 $\Gamma(K^+ K^*(892)^- + \text{c.c.})/\Gamma(K^*(892)^0 \bar{K}^0 + \text{c.c.})$ $\Gamma_{109}/\Gamma_{110}$

VALUE	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
0.16 ± 0.06 OUR AVERAGE					
$0.22^{+0.10}_{-0.14}$			ABLIKIM	05I BES2	$e^+ e^- \rightarrow \psi(2S)$
$0.14^{+0.08}_{-0.06}$			ADAM	05 CLEO	$e^+ e^- \rightarrow \psi(2S)$

NODE=M071R46
NODE=M071R46

 $\Gamma(\phi \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{111}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
1.18 ± 0.26 OUR AVERAGE					Error includes scale factor of 1.5. See the ideogram below.
[(1.17 ± 0.29) $\times 10^{-4}$ OUR 2016 AVERAGE Scale factor = 1.7]					
$2.3 \pm 0.8 \pm 0.1$		19 ± 6	LEES	12F BABR	$10.6 e^+ e^- \rightarrow \pi^+ \pi^- K^+ K^- \gamma$
$0.9 \pm 0.2 \pm 0.1$		47.6	BRIERE	05 CLEO	$e^+ e^- \rightarrow \psi(2S) \rightarrow K^+ K^- \pi^+ \pi^-$
$1.5 \pm 0.2 \pm 0.2$		51.5 ± 8.3	¹ BAI	03B BES	$\psi(2S) \rightarrow K^+ K^- \pi^+ \pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$2.44 \pm 0.96 \pm 0.04$		10 ± 4	^{2,3} AUBERT	07AK BABR	$10.6 e^+ e^- \rightarrow \pi^+ \pi^- K^+ K^- \gamma$

NODE=M071R80
NODE=M071R80

NEW

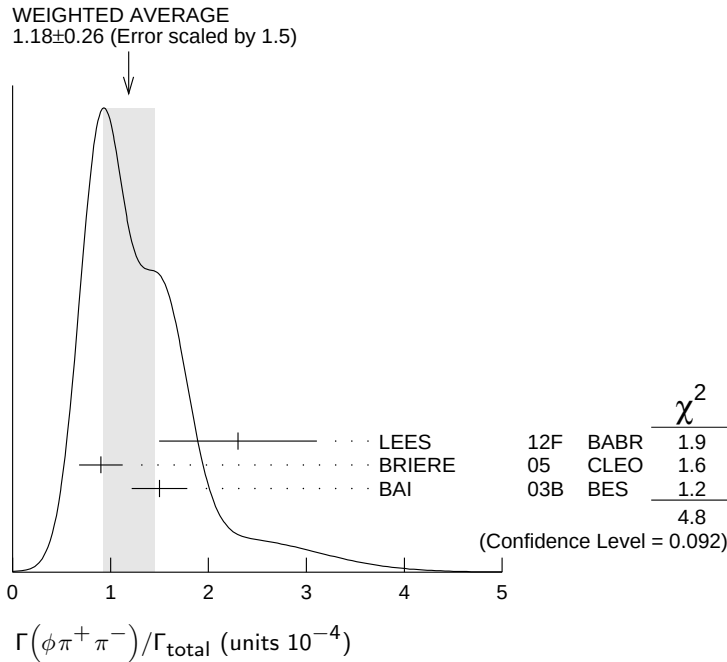
¹ Normalized to $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = 0.305 \pm 0.016$.

² Superseded by LEES 12F. AUBERT 07AK reports $[\Gamma(\psi(2S) \rightarrow \phi \pi^+ \pi^-)/\Gamma_{\text{total}}] \times [\Gamma(\psi(2S) \rightarrow e^+ e^-)] = (0.57 \pm 0.22 \pm 0.04) \times 10^{-3}$ keV which we divide by our best value $\Gamma(\psi(2S) \rightarrow e^+ e^-) = 2.34 \pm 0.04$ keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.

³ Using $B(\phi \rightarrow K^+ K^-) = (49.3 \pm 0.6)\%$.

NODE=M071R80;LINKAGE=B3
NODE=M071R80;LINKAGE=BE

NODE=M071R80;LINKAGE=UB



$\Gamma(\phi f_0(980) \rightarrow \pi^+\pi^-)/\Gamma_{\text{total}}$

Γ_{112}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
0.75±0.33 OUR AVERAGE				Error includes scale factor of 1.6. $[(0.68 \pm 0.25) \times 10^{-4}]$ OUR 2016 AVERAGE Scale factor = 1.2]
1.5 ± 0.5 ± 0.1	12 ± 4	LEES	12F BABR	10.6 $e^+e^- \rightarrow \pi^+\pi^- K^+K^-\gamma$
0.6 ± 0.2 ± 0.1	18.4 ± 6.4	¹ BAI	03B BES	$\psi(2S) \rightarrow K^+K^-\pi^+\pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1.45±0.70±0.02	6 ± 3	^{2,3} AUBERT	07AK BABR	10.6 $e^+e^- \rightarrow \pi^+\pi^- K^+K^-\gamma$

¹ Normalized to $B(\psi(2S) \rightarrow J/\psi\pi^+\pi^-) = 0.305 \pm 0.016$.

² Superseded by LEES 12F. AUBERT 07AK reports $[\Gamma(\psi(2S) \rightarrow \phi f_0(980) \rightarrow \pi^+\pi^-)/\Gamma_{\text{total}}] \times [\Gamma(\psi(2S) \rightarrow e^+e^-)] = (0.34 \pm 0.16 \pm 0.04) \times 10^{-3}$ keV which we divide by our best value $\Gamma(\psi(2S) \rightarrow e^+e^-) = 2.34 \pm 0.04$ keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.

³ Using $B(\phi \rightarrow K^+K^-) = (49.3 \pm 0.6)\%$.

NODE=M071R83
NODE=M071R83

NEW

NODE=M071R83;LINKAGE=B3
NODE=M071R83;LINKAGE=BE

NODE=M071R83;LINKAGE=UB

$\Gamma(2(K^+K^-))/\Gamma_{\text{total}}$

Γ_{113}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
0.63±0.13 OUR AVERAGE				$[(0.60 \pm 0.14) \times 10^{-4}]$ OUR 2016 AVERAGE]
0.9 ± 0.4 ± 0.1	13 ± 6	LEES	12F BABR	10.6 $e^+e^- \rightarrow 2(K^+K^-)\gamma$
0.6 ± 0.1 ± 0.1	59.2	BRIERE	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow 2(K^+K^-)$

NODE=M071S12
NODE=M071S12

NEW

$\Gamma(\phi K^+K^-)/\Gamma_{\text{total}}$

Γ_{114}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
0.70±0.16 OUR AVERAGE				
0.8 ± 0.2 ± 0.1	36.8	BRIERE	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow 2(K^+K^-)$
0.6 ± 0.2 ± 0.1	16.1 ± 5.0	¹ BAI	03B BES	$\psi(2S) \rightarrow 2(K^+K^-)$

¹ Normalized to $B(\psi(2S) \rightarrow J/\psi\pi^+\pi^-) = 0.305 \pm 0.016$.

NODE=M071R81
NODE=M071R81

NODE=M071R81;LINKAGE=B3

$\Gamma(2(K^+K^-)\pi^0)/\Gamma_{\text{total}}$

Γ_{115}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.1±0.2±0.2	44.7	BRIERE	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow 2(K^+K^-)\pi^0$

NODE=M071S13
NODE=M071S13

$\Gamma(\phi\eta)/\Gamma_{\text{total}}$ Γ_{116}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
3.10 ± 0.31 OUR 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	$e^+e^- \rightarrow \psi(2S)$

NODE=M071R89
NODE=M071R89

$\Gamma(\phi\eta')/\Gamma_{\text{total}}$ Γ_{117}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
$3.1 \pm 1.4 \pm 0.7$	8	¹ ABLIKIM	04K BES	$e^+e^- \rightarrow \psi(2S)$

NODE=M071R90
NODE=M071R90

¹ Calculated combining $\eta' \rightarrow \gamma\rho$ and $\eta\pi^+\pi^-$ channels.

NODE=M071R;LINKAGE=AI

$\Gamma(\omega\eta')/\Gamma_{\text{total}}$ Γ_{118}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
$3.2^{+2.4}_{-2.0} \pm 0.7$	4	¹ ABLIKIM	04K BES	$e^+e^- \rightarrow \psi(2S)$

NODE=M071R91
NODE=M071R91

¹ Calculated combining $\eta' \rightarrow \gamma\rho$ and $\eta\pi^+\pi^-$ channels.

NODE=M071R91;LINKAGE=AI

$\Gamma(\omega\pi^0)/\Gamma_{\text{total}}$ Γ_{119}/Γ

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	$e^+e^- \rightarrow \psi(2S)$

NODE=M071R92
NODE=M071R92

$\Gamma(\rho\eta')/\Gamma_{\text{total}}$ Γ_{120}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.87^{+1.64}_{-1.11} \pm 0.33$	2	ABLIKIM	04L BES	$e^+e^- \rightarrow \psi(2S)$

NODE=M071R93
NODE=M071R93

$\Gamma(\rho\eta)/\Gamma_{\text{total}}$ Γ_{121}/Γ

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	$e^+e^- \rightarrow \psi(2S)$

NODE=M071R94
NODE=M071R94

$\Gamma(\omega\eta)/\Gamma_{\text{total}}$ Γ_{122}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<1.1	90	ADAM	05 CLEO	$e^+e^- \rightarrow \psi(2S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<3.1	90	ABLIKIM	04K BES	$e^+e^- \rightarrow \psi(2S)$

NODE=M071R95
NODE=M071R95

$\Gamma(\phi\pi^0)/\Gamma_{\text{total}}$ Γ_{123}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<0.04	90	ABLIKIM	12L BES3	$e^+e^- \rightarrow \psi(2S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.7	90	ADAM	05 CLEO	$e^+e^- \rightarrow \psi(2S)$
<0.4	90	ABLIKIM	04K BES	$e^+e^- \rightarrow \psi(2S)$

NODE=M071R96
NODE=M071R96

$\Gamma(\eta_c\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{124}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<1.0	90	PEDLAR	07 CLEO	$e^+e^- \rightarrow \psi(2S)$

NODE=M071R03
NODE=M071R03

$\Gamma(p\bar{p}K^+K^-)/\Gamma_{\text{total}}$ Γ_{125}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
$2.7 \pm 0.6 \pm 0.4$	30.1	BRIERE	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow p\bar{p}K^+K^-$

NODE=M071S16
NODE=M071S16

$\Gamma(\bar{\Lambda}nK_S^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{126}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$0.81 \pm 0.11 \pm 0.14$	50	¹ ABLIKIM	08C BES2	$e^+e^- \rightarrow J/\psi$

NODE=M071R08
NODE=M071R08

¹ Using $B(\bar{\Lambda} \rightarrow \bar{p}\pi^+) = 63.9\%$ and $B(K_S^0 \rightarrow \pi^+\pi^-) = 69.2\%$.

NODE=M071R08;LINKAGE=AB

$\Gamma(\phi f'_2(1525))/\Gamma_{\text{total}}$ Γ_{127}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$0.44 \pm 0.12 \pm 0.11$		20 ± 6	BAI	04C	$\psi(2S) \rightarrow 2(K^+ K^-)$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.45		90	BAI	98J BES	$e^+ e^- \rightarrow 2(K^+ K^-)$

NODE=M071R67
 NODE=M071R67

 $\Gamma(\Theta(1540)\bar{\Theta}(1540) \rightarrow K_S^0 p K^- \bar{n} + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{128}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<0.88	90	BAI	04G BES2	$e^+ e^-$

NODE=M071S01
 NODE=M071S01

 $\Gamma(\Theta(1540)K^- \bar{n} \rightarrow K_S^0 p K^- \bar{n})/\Gamma_{\text{total}}$ Γ_{129}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<1.0	90	BAI	04G BES2	$e^+ e^-$

NODE=M071S02
 NODE=M071S02

 $\Gamma(\Theta(1540)K_S^0 \bar{p} \rightarrow K_S^0 \bar{p} K^+ n)/\Gamma_{\text{total}}$ Γ_{130}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<0.70	90	BAI	04G BES2	$e^+ e^-$

NODE=M071S03
 NODE=M071S03

 $\Gamma(\bar{\Theta}(1540)K^+ n \rightarrow K_S^0 \bar{p} K^+ n)/\Gamma_{\text{total}}$ Γ_{131}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<2.6	90	BAI	04G BES2	$e^+ e^-$

NODE=M071S04
 NODE=M071S04

 $\Gamma(\bar{\Theta}(1540)K_S^0 p \rightarrow K_S^0 p K^- \bar{n})/\Gamma_{\text{total}}$ Γ_{132}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<0.60	90	BAI	04G BES2	$e^+ e^-$

NODE=M071S05
 NODE=M071S05

 $\Gamma(K_S^0 K_S^0)/\Gamma_{\text{total}}$ Γ_{133}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
<0.046	¹ BAI	04D BES	$e^+ e^-$

NODE=M071R88
 NODE=M071R88

¹ Forbidden by CP.

NODE=M071R;LINKAGE=BA

RADIATIVE DECAYS

 $\Gamma(\gamma \chi_{c0}(1P))/\Gamma_{\text{total}}$ Γ_{134}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
9.99 ± 0.27 OUR 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=M071R55
 NODE=M071R55

NODE=M071R;LINKAGE=A

 $\Gamma(\gamma \chi_{c1}(1P))/\Gamma_{\text{total}}$ Γ_{135}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
9.55 ± 0.31 OUR FIT				
8.9 ± 0.5 OUR AVERAGE				
$9.07 \pm 0.11 \pm 0.54$	76700	ATHAR	04 CLEO	$e^+ e^- \rightarrow \gamma X$
$9.0 \pm 0.5 \pm 0.7$		¹ GAISER	86 CBAL	$e^+ e^- \rightarrow \gamma X$
7.1 ± 1.9		² BIDDICK	77 CNTR	$e^+ e^- \rightarrow \gamma X$

¹ Angular distribution $(1-0.189 \cos^2\theta)$ assumed.² Valid for isotropic distribution of the photon.

NODE=M071R58
 NODE=M071R58

NODE=M071R;LINKAGE=G
 NODE=M071R;LINKAGE=B

 $\Gamma(\gamma \chi_{c2}(1P))/\Gamma_{\text{total}}$ Γ_{136}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
9.11 ± 0.31 OUR FIT				
8.8 ± 0.5 OUR AVERAGE				Error includes scale factor of 1.1.
$9.33 \pm 0.14 \pm 0.61$	79300	ATHAR	04 CLEO	$e^+ e^- \rightarrow \gamma X$
$8.0 \pm 0.5 \pm 0.7$		¹ GAISER	86 CBAL	$e^+ e^- \rightarrow \gamma X$
7.0 ± 2.0		² BIDDICK	77 CNTR	$e^+ e^- \rightarrow \gamma X$

¹ Angular distribution $(1-0.052 \cos^2\theta)$ assumed.² Valid for isotropic distribution of the photon.

NODE=M071R59
 NODE=M071R59

NODE=M071R;LINKAGE=F
 NODE=M071R59;LINKAGE=B

$$\frac{[\Gamma(\gamma\chi_{c0}(1P)) + \Gamma(\gamma\chi_{c1}(1P)) + \Gamma(\gamma\chi_{c2}(1P))]}{\Gamma_{\text{total}}} \quad \frac{\Gamma_{134} + \Gamma_{135} + \Gamma_{136}}{\Gamma}$$

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

$$\frac{\Gamma(\gamma\chi_{c0}(1P))}{\Gamma(\gamma\chi_{c1}(1P))} \quad \frac{\Gamma_{134}}{\Gamma_{135}}$$

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

$$\frac{\Gamma(\gamma\chi_{c2}(1P))}{\Gamma(\gamma\chi_{c1}(1P))} \quad \frac{\Gamma_{136}}{\Gamma_{135}}$$

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

$$\frac{\Gamma(\gamma\chi_{c0}(1P))}{\Gamma(\gamma\chi_{c2}(1P))} \quad \frac{\Gamma_{134}}{\Gamma_{136}}$$

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

$$\frac{\Gamma(\gamma\eta_c(1S))}{\Gamma_{\text{total}}} \quad \frac{\Gamma_{137}}{\Gamma}$$

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.

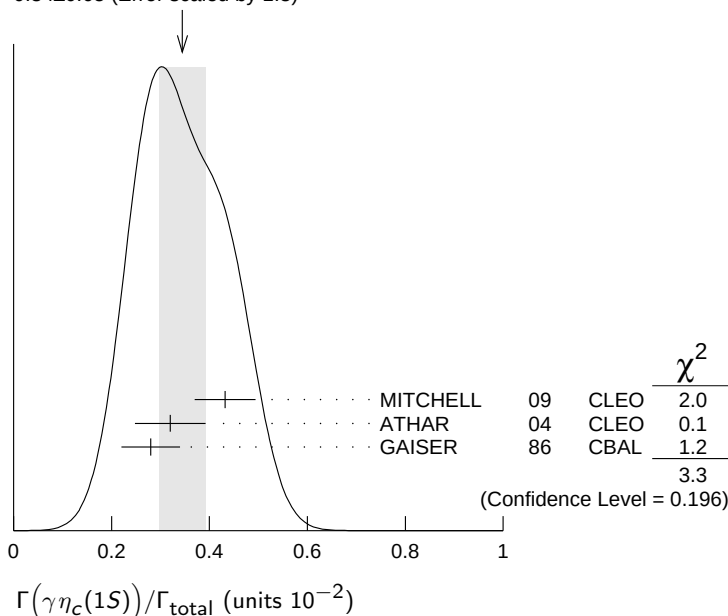
² GAISER 86 used $\Gamma_{\eta_c(1S)} = 11.5 \pm 4.5$ MeV to obtain this result.

NODE=M071R60
NODE=M071R60

NODE=M071R60;LINKAGE=AT

NODE=M071R60;LINKAGE=GA

WEIGHTED AVERAGE
0.34 ± 0.05 (Error scaled by 1.3)



$$\frac{\Gamma(\gamma\eta_c(2S))}{\Gamma_{\text{total}}} \quad \frac{\Gamma_{138}}{\Gamma}$$

VALUE (units 10 ⁻⁴)	CL%	DOCUMENT ID	TECN	COMMENT

7 ± 2 ± 4

¹ ABLIKIM 12G BES3 $\psi(2S) \rightarrow \gamma K^0 K \pi, K K \pi^0$

NODE=M071R62
NODE=M071R62

• • • 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.

NODE=M071R62;LINKAGE=AB

² CRONIN-HENNESSY 10 reports $[\Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S))/\Gamma_{\text{total}}] \times [B(\eta_c(2S) \rightarrow K \bar{K} \pi)] < 14.5 \times 10^{-6}$ which we divide by our best value $B(\eta_c(2S) \rightarrow K \bar{K} \pi) = 1.9 \times 10^{-2}$. This measurement assumes $\Gamma(\eta_c(2S)) = 14$ MeV. CRONIN-HENNESSY 10 gives the analytic dependence of limits on width.

NODE=M071R62;LINKAGE=CR

$\Gamma(\gamma \pi^0)/\Gamma_{\text{total}}$

Γ_{139}/Γ

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
1.58±0.40±0.13		37	ABLIKIM	10F BES3	$\psi(2S) \rightarrow \gamma \pi^0$

NODE=M071R42
NODE=M071R42

• • • 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=M071R;LINKAGE=U

$\Gamma(\gamma \eta'(958))/\Gamma_{\text{total}}$

Γ_{140}/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	$\psi(2S) \rightarrow \pi^+ \pi^- 2\gamma$, $\pi^+ \pi^- 3\gamma$

NODE=M071R44
NODE=M071R44

• • • 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;LINKAGE=AB
NODE=M071R;LINKAGE=R
NODE=M071R;LINKAGE=C

$\Gamma(\gamma f_2(1270))/\Gamma_{\text{total}}$

Γ_{141}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.73^{+0.29}_{-0.25} OUR AVERAGE				Error includes scale factor of 1.8.

NODE=M071R84
NODE=M071R84

2.84±0.15 ^{+0.03} _{-0.10}	1.9k	^{1,2} DOBBS	15	$\psi(2S) \rightarrow \gamma \pi \pi$
2.12±0.19±0.32		^{3,4} BAI	03C BES	$\psi(2S) \rightarrow \gamma \pi \pi$

• • • We do not use the following data for averages, fits, limits, etc. • • •

2.08±0.19±0.33	200.6 ± 18.8	³ BAI	03C BES	$\psi(2S) \rightarrow \gamma \pi^+ \pi^-$
2.90±1.08±1.07	29.9 ± 11.1	³ BAI	03C BES	$\psi(2S) \rightarrow \gamma \pi^0 \pi^0$

OCCUR=2
OCCUR=3

¹ Using CLEO-c data but not authored by the CLEO Collaboration.

² DOBBS 15 reports $[\Gamma(\psi(2S) \rightarrow \gamma f_2(1270))/\Gamma_{\text{total}}] \times [B(f_2(1270) \rightarrow \pi \pi)] = (2.39 \pm 0.09 \pm 0.09) \times 10^{-4}$ which we divide by our best value $B(f_2(1270) \rightarrow \pi \pi) = (84.2^{+2.9}_{-0.9}) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M071R84;LINKAGE=A
NODE=M071R84;LINKAGE=B

³ Normalized to $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = 0.305 \pm 0.016$.

⁴ Combining the results from $\pi^+ \pi^-$ and $\pi^0 \pi^0$ decay modes.

NODE=M071R;LINKAGE=3B
NODE=M071R;LINKAGE=B9

$\Gamma(\gamma f_0(1370) \rightarrow \gamma K \bar{K})/\Gamma_{\text{total}}$

Γ_{142}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	COMMENT
3.1±1.0±1.4	175	¹ DOBBS 15	$\psi(2S) \rightarrow \gamma K \bar{K}$

NODE=M071S75
NODE=M071S75

¹ Using CLEO-c data but not authored by the CLEO Collaboration.

NODE=M071S75;LINKAGE=A

$\Gamma(\gamma f_0(1500))/\Gamma_{\text{total}}$ Γ_{143}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	COMMENT
$9.2 \pm 1.8 \pm 0.6$	274	^{1,2} DOBBS 15	$\psi(2S) \rightarrow \gamma \pi \pi$

NODE=M071S76
 NODE=M071S76

- ¹ DOBBS 15 reports $[\Gamma(\psi(2S) \rightarrow \gamma f_0(1500))/\Gamma_{\text{total}}] \times [B(f_0(1500) \rightarrow \pi \pi)] = (3.2 \pm 0.6 \pm 0.2) \times 10^{-5}$ which we divide by our best value $B(f_0(1500) \rightarrow \pi \pi) = (34.9 \pm 2.3) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.
- ² Using CLEO-c data but not authored by the CLEO Collaboration.

NODE=M071S76;LINKAGE=A

NODE=M071S76;LINKAGE=B

 $\Gamma(\gamma f'_2(1525))/\Gamma_{\text{total}}$ Γ_{144}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	COMMENT
$3.3 \pm 0.8 \pm 0.1$	136	^{1,2} DOBBS 15	$\psi(2S) \rightarrow \gamma K \bar{K}$

NODE=M071S77
 NODE=M071S77

- ¹ DOBBS 15 reports $[\Gamma(\psi(2S) \rightarrow \gamma f'_2(1525))/\Gamma_{\text{total}}] \times [B(f'_2(1525) \rightarrow K \bar{K})] = (2.9 \pm 0.6 \pm 0.3) \times 10^{-5}$ which we divide by our best value $B(f'_2(1525) \rightarrow K \bar{K}) = (88.7 \pm 2.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.
- ² Using CLEO-c data but not authored by the CLEO Collaboration.

NODE=M071S77;LINKAGE=A

NODE=M071S77;LINKAGE=B

 $\Gamma(\gamma f_0(1710) \rightarrow \gamma \pi \pi)/\Gamma_{\text{total}}$ Γ_{146}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
3.5 ± 0.6 OUR AVERAGE				
$3.6 \pm 0.4 \pm 0.5$	290	¹ DOBBS 15		$\psi(2S) \rightarrow \gamma \pi \pi$
$3.01 \pm 0.41 \pm 1.24$	35.6 ± 4.8	² BAI 03C BES		$\psi(2S) \rightarrow \gamma \pi^+ \pi^-$

NODE=M071R85
 NODE=M071R85

- ¹ Using CLEO-c data but not authored by the CLEO Collaboration.
- ² Normalized to $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = 0.305 \pm 0.016$.

NODE=M071R85;LINKAGE=A

NODE=M071R85;LINKAGE=3B

 $\Gamma(\gamma f_0(1710) \rightarrow \gamma K \bar{K})/\Gamma_{\text{total}}$ Γ_{147}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
6.6 ± 0.7 OUR AVERAGE					
$6.7 \pm 0.6 \pm 0.6$		375	¹ DOBBS 15		$\psi(2S) \rightarrow \gamma K \bar{K}$
$6.04 \pm 0.90 \pm 1.32$		39.6 ± 5.9	^{2,3} BAI 03C BES		$\psi(2S) \rightarrow \gamma K^+ K^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 15.6		90	6.8 ± 3.1	^{2,3} BAI 03C BES	$\psi(2S) \rightarrow \gamma K_S^0 K_S^0$

NODE=M071R86
 NODE=M071R86

- ¹ Using CLEO-c data but not authored by the CLEO Collaboration.
- ² Includes unknown branching fractions to $K^+ K^-$ or $K_S^0 K_S^0$. We have multiplied the $K^+ K^-$ result by a factor of 2 and the $K_S^0 K_S^0$ result by a factor of 4 to obtain the $K \bar{K}$ result.
- ³ Normalized to $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = 0.305 \pm 0.016$.

OCCUR=2

NODE=M071R86;LINKAGE=A

NODE=M071R;LINKAGE=CK

NODE=M071R86;LINKAGE=3B

 $\Gamma(\gamma f_0(2100) \rightarrow \gamma \pi \pi)/\Gamma_{\text{total}}$ Γ_{148}/Γ

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	COMMENT
$4.8 \pm 0.5 \pm 0.9$	373	¹ DOBBS 15	$\psi(2S) \rightarrow \gamma \pi \pi$

NODE=M071S78
 NODE=M071S78

- ¹ Using CLEO-c data but not authored by the CLEO Collaboration.

NODE=M071S78;LINKAGE=A

 $\Gamma(\gamma f_0(2200) \rightarrow \gamma K \bar{K})/\Gamma_{\text{total}}$ Γ_{149}/Γ

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	COMMENT
$3.2 \pm 0.6 \pm 0.8$	207	¹ DOBBS 15	$\psi(2S) \rightarrow \gamma K \bar{K}$

NODE=M071S79
 NODE=M071S79

- ¹ Using CLEO-c data but not authored by the CLEO Collaboration.

NODE=M071S79;LINKAGE=A

 $\Gamma(\gamma f_J(2220) \rightarrow \gamma \pi \pi)/\Gamma_{\text{total}}$ Γ_{150}/Γ

VALUE	CL%	DOCUMENT ID	COMMENT
$< 5.8 \times 10^{-6}$	90	^{1,2} DOBBS 15	$\psi(2S) \rightarrow \gamma \pi \pi$

NODE=M071S80
 NODE=M071S80

- ¹ Using CLEO-c data but not authored by the CLEO Collaboration.
- ² For $\Gamma = 20/50$ MeV, the 90% CL upper limits for $\pi^+ \pi^-$ and $\pi^0 \pi^0$ are $3.2/4.3 \times 10^{-6}$ and $2.6/4.0 \times 10^{-6}$, respectively.

NODE=M071S80;LINKAGE=A

NODE=M071S80;LINKAGE=DO

 $\Gamma(\gamma f_J(2220) \rightarrow \gamma K \bar{K})/\Gamma_{\text{total}}$ Γ_{151}/Γ

VALUE	CL%	DOCUMENT ID	COMMENT
$< 9.5 \times 10^{-6}$	90	^{1,2} DOBBS 15	$\psi(2S) \rightarrow \gamma K \bar{K}$

NODE=M071S81
 NODE=M071S81

- ¹ Using CLEO-c data but not authored by the CLEO Collaboration.
- ² For $\Gamma = 20/50$ MeV, the 90% CL upper limits for $K^+ K^-$ and $K_S^0 K_S^0$ are $2.1/4.3 \times 10^{-6}$ and $3.7/5.5 \times 10^{-6}$, respectively.

NODE=M071S81;LINKAGE=A

NODE=M071S81;LINKAGE=DO

$\Gamma(\gamma\eta)/\Gamma_{\text{total}}$ Γ_{153}/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_{154}/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_{156}/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_{157}/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_{159}/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_{160}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 0.88	90	ABLIKIM	06R BES2	$\psi(2S) \rightarrow \gamma \eta \pi^+ \pi^-$

NODE=M071R07
NODE=M071R07

$\Gamma(\gamma 2(\pi^+ \pi^-))/\Gamma_{\text{total}}$ Γ_{161}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
$39.6 \pm 2.8 \pm 5.0$	583	ABLIKIM	07D BES2	$e^+ e^- \rightarrow \psi(2S)$

NODE=M071S28
NODE=M071S28

$\Gamma(\gamma K^{*0} K^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{162}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
$37.0 \pm 6.1 \pm 7.2$	237	ABLIKIM	07D BES2	$e^+ e^- \rightarrow \psi(2S)$

NODE=M071S29
NODE=M071S29

$\Gamma(\gamma K^{*0} \bar{K}^{*0})/\Gamma_{\text{total}}$ Γ_{163}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
$24.0 \pm 4.5 \pm 5.0$	41	ABLIKIM	07D BES2	$e^+ e^- \rightarrow \psi(2S)$

NODE=M071S30
NODE=M071S30

$\Gamma(\gamma K_S^0 K^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{164}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
$25.6 \pm 3.6 \pm 3.6$	115	ABLIKIM	07D BES2	$e^+ e^- \rightarrow \psi(2S)$

NODE=M071S31
NODE=M071S31

$\Gamma(\gamma K^+ K^- \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{165}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
$19.1 \pm 2.7 \pm 4.3$	132	ABLIKIM	07D BES2	$e^+ e^- \rightarrow \psi(2S)$

NODE=M071S32
NODE=M071S32

$\Gamma(\gamma p \bar{p})/\Gamma_{\text{total}}$ Γ_{166}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
3.9 ± 0.5 OUR AVERAGE				Error includes scale factor of 2.0.

$4.18 \pm 0.26 \pm 0.18$	348	¹ ALEXANDER	10 CLEO	$\psi(2S) \rightarrow \gamma p \bar{p}$
$2.9 \pm 0.4 \pm 0.4$	142	ABLIKIM	07D BES2	$e^+ e^- \rightarrow \psi(2S)$

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
NODE=M071S33

NODE=M071S33;LINKAGE=AL

$\Gamma(\gamma f_2(1950) \rightarrow \gamma p \bar{p})/\Gamma_{\text{total}}$ Γ_{167}/Γ

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT
$1.2 \pm 0.2 \pm 0.1$	111	¹ ALEXANDER	10 CLEO	$\psi(2S) \rightarrow \gamma p \bar{p}$

NODE=M071S46
 NODE=M071S46

¹ From a fit of the $p\bar{p}$ mass distribution to a combination of $\gamma f_2(1950)$, $\gamma f_2(2150)$, and $\gamma p\bar{p}$ phase space, for $M(p\bar{p}) < 2.85$ GeV, and accounting for backgrounds from $\psi(2S) \rightarrow \pi^0 p\bar{p}$ and continuum.

NODE=M071S46;LINKAGE=AL

 $\Gamma(\gamma f_2(2150) \rightarrow \gamma p \bar{p})/\Gamma_{\text{total}}$ Γ_{168}/Γ

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT
$0.72 \pm 0.18 \pm 0.03$	73	¹ ALEXANDER	10 CLEO	$\psi(2S) \rightarrow \gamma p \bar{p}$

NODE=M071S47
 NODE=M071S47

¹ From a fit of the $p\bar{p}$ mass distribution to a combination of $\gamma f_2(1950)$, $\gamma f_2(2150)$, and $\gamma p\bar{p}$ phase space, for $M(p\bar{p}) < 2.85$ GeV, and accounting for backgrounds from $\psi(2S) \rightarrow \pi^0 p\bar{p}$ and continuum.

NODE=M071S47;LINKAGE=AL

 $\Gamma(\gamma X(1835) \rightarrow \gamma p \bar{p})/\Gamma_{\text{total}}$ Γ_{169}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
$4.57 \pm 0.36^{+1.77}_{-4.26}$		ABLIKIM	12D BES3	$J/\psi \rightarrow \gamma p \bar{p}$

NODE=M071S48
 NODE=M071S48

• • • We do not use the following data for averages, fits, limits, etc. • • •

<1.6	90	ALEXANDER	10 CLEO	$\psi(2S) \rightarrow \gamma p \bar{p}$
<5.4	90	ABLIKIM	07D BES	$\psi(2S) \rightarrow \gamma p \bar{p}$

 $\Gamma(\gamma X \rightarrow \gamma p \bar{p})/\Gamma_{\text{total}}$ Γ_{170}/Γ

For a narrow resonance in the range $2.2 < M(X) < 2.8$ GeV.

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<2	90	ALEXANDER	10 CLEO	$\psi(2S) \rightarrow \gamma p \bar{p}$

NODE=M071S49
 NODE=M071S49
 NODE=M071S49

 $\Gamma(\gamma \pi^+ \pi^- p \bar{p})/\Gamma_{\text{total}}$ Γ_{171}/Γ

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT
$2.8 \pm 1.2 \pm 0.7$	17	ABLIKIM	07D BES2	$e^+ e^- \rightarrow \psi(2S)$

NODE=M071S34
 NODE=M071S34

 $\Gamma(\gamma 2(\pi^+ \pi^-) K^+ K^-)/\Gamma_{\text{total}}$ Γ_{172}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<22	90	ABLIKIM	07D BES2	$e^+ e^- \rightarrow \psi(2S)$

NODE=M071S35
 NODE=M071S35

 $\Gamma(\gamma 3(\pi^+ \pi^-))/\Gamma_{\text{total}}$ Γ_{173}/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_{174}/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_{175}/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

OTHER DECAYS

NODE=M071320

 $\Gamma(\text{invisible})/\Gamma(e^+ e^-)$ Γ_{176}/Γ_6

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<2.0	90	LEES	13i BABR	$B \rightarrow K^{(*)} \psi(2S)$

NODE=M071S64
 NODE=M071S64

 $\psi(2S)$ CROSS-PARTICLE BRANCHING RATIOS

NODE=M071240

For measurements involving $B(\psi(2S) \rightarrow \gamma \chi_{cJ}(1P)) \times B(\chi_{cJ}(1P) \rightarrow X)$ see the corresponding entries in the $\chi_{cJ}(1P)$ sections.

NODE=M071240

MULTIPOLE AMPLITUDE RATIOS IN RADIATIVE DECAYS

$$\psi(2S) \rightarrow \gamma \chi_{cJ}(1P) \text{ and } \chi_{cJ} \rightarrow \gamma J/\psi(1S)$$

$a_2(\chi_{c1})/a_2(\chi_{c2})$ Magnetic quadrupole transition amplitude ratio

VALUE (units 10^{-2})	EVTs	DOCUMENT ID	TECN	COMMENT
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.

$b_2(\chi_{c2})/b_2(\chi_{c1})$ Magnetic quadrupole transition amplitude ratio

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.

$\psi(2S)$ REFERENCES

ABLIKIM	16L	PR D93 072003	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=57510
ABLIKIM	15L	PR D91 092006	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=56774
ABLIKIM	15V	PL B749 414	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=56787
ANASHIN	15	PL B749 50	V.V. Anashin <i>et al.</i>	(KEDR Collab.)	REFID=56792
DOBBS	15	PR D91 052006	S. Dobbs <i>et al.</i>	(NWES)	REFID=56805
LEES	15J	PR D92 072008	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=56988
ABLIKIM	14G	PR D89 112006	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=55898
DOBBS	14	PL B739 90	S. Dobbs <i>et al.</i>	(NWES, WAYN)	REFID=56333
ABLIKIM	13A	PRL 110 022001	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=54834
ABLIKIM	13D	PR D87 012007	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=54879
ABLIKIM	13F	PR D87 052007	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=54920
ABLIKIM	13M	PR D87 092006	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=55386
ABLIKIM	13R	PR D88 032007	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=55402
ABLIKIM	13S	PR D88 032010	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=55403
ABLIKIM	13W	PR D88 112007	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=55634
LEES	13I	PR D87 112005	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=55161
LEES	13O	PR D87 092005	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=55293
LEES	13Q	PR D88 032013	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=55404
LEES	13Y	PR D88 072009	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=55589
AAIJ	12H	EPJ C72 1972	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=54056
ABLIKIM	12D	PRL 108 112003	M. Ablikim <i>et al.</i>	(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
ABLIKIM	12Q	CP C36 1040	M. Ablikim <i>et al.</i>	(BES II Collab.)	REFID=54864
ANASHIN	12	PL B711 280	V.V. Anashin <i>et al.</i>	(KEDR Collab.)	REFID=54038
LEES	12E	PR D85 112009	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=54297
LEES	12F	PR D86 012008	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=54298
METREVELI	12	PR D85 092007	Z. Metreveli <i>et al.</i>	(NWES, FLOR, WAYN+)	REFID=54304
GE	11	PR D84 032008	J.Y. Ge <i>et al.</i>	(CLEO Collab.)	REFID=53960
ABLIKIM	10B	PRL 104 132002	M. Ablikim <i>et al.</i>	(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
ANDREOTTI	07	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=14
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

NODE=M071250

NODE=M071QAR
NODE=M071QAR

NODE=M071QAR;LINKAGE=AR

NODE=M071QBR
NODE=M071QBR

NODE=M071QBR;LINKAGE=AR

NODE=M071

ABLIKIM	05E	PR D71 072006	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50757
ABLIKIM	05H	PR D72 012002	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50759
ABLIKIM	05I	PL B614 37	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50758
ABLIKIM	05J	PL B619 247	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50760
ABLIKIM	05O	PL B630 21	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50846
ADAM	05	PRL 94 012005	N.E. Adam <i>et al.</i>	(CLEO Collab.)	REFID=50451
ADAM	05A	PRL 94 232002	N.E. Adam <i>et al.</i>	(CLEO Collab.)	REFID=50763
ANDREOTTI	05	PR D71 032006	M. Andreotti <i>et al.</i>	(FNAL E835 Collab.)	REFID=50497
AUBERT	05D	PR D71 052001	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=50509
BRIERE	05	PRL 95 062001	R.A. Briere <i>et al.</i>	(CLEO Collab.)	REFID=50785
PEDLAR	05	PR D72 051108	T.K. Pedlar <i>et al.</i>	(CLEO Collab.)	REFID=50808
ROSNER	05	PRL 95 102003	J.L. Rosner <i>et al.</i>	(CLEO Collab.)	REFID=50812
ABLIKIM	04B	PR D70 012003	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=49741
ABLIKIM	04K	PR D70 112003	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50327
ABLIKIM	04L	PR D70 112007	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50328
ATHAR	04	PR D70 112002	S.B. Athar <i>et al.</i>	(CLEO Collab.)	REFID=50331
BAI	04B	PRL 92 052001	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49608
BAI	04C	PR D69 072001	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49749
BAI	04D	PL B589 7	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49750
BAI	04G	PR D70 012004	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49753
BAI	04I	PR D70 012006	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49755
PDG	04	PL B592 1	S. Eidelman <i>et al.</i>	(PDG Collab.)	REFID=49653
SETH	04	PR D69 097503	K.K. Seth		REFID=49779
AULCHENKO	03	PL B573 63	V.M. Aulchenko <i>et al.</i>	(KEDR Collab.)	REFID=49579
BAI	03B	PR D67 052002	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49186
BAI	03C	PR D67 032004	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49190
AUBERT	02B	PR D65 031101	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=48548
BAI	02	PR D65 052004	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=48578
BAI	02B	PL B550 24	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49171
BAI	02C	PRL 88 101802	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=50506
PDG	02	PR D66 010001	K. Hagiwara <i>et al.</i>	(PDG Collab.)	REFID=48632
BAI	01	PR D63 032002	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=48003
AMBROGIANI	00A	PR D62 032004	M. Ambrogiani <i>et al.</i>	(FNAL E835 Collab.)	REFID=47939
ARTAMONOV	00	PL B474 427	A.S. Artamonov <i>et al.</i>		REFID=47424
BAI	00	PRL 84 594	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=50503
BAI	99C	PRL 83 1918	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=47420
BAI	98E	PR D57 3854	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=46339
BAI	98F	PR D58 097101	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=46340
BAI	98J	PRL 81 5080	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=46554
ARMSTRONG	97	PR D55 1153	T.A. Armstrong <i>et al.</i>	(E760 Collab.)	REFID=45416
GRIBUSHIN	96	PR D53 4723	A. Gribushin <i>et al.</i>	(E672 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	PRL 51 963	M.E.B. Franklin <i>et al.</i>	(LBL, SLAC)	REFID=22216
EDWARDS	82C	PRL 48 70	C. Edwards <i>et al.</i>	(CIT, HARV, PRIN+)	REFID=22173
LEMOIGNE	82	PL 113B 509	Y. Lemoigne <i>et al.</i>	(SACL, LOIC, SHMP+)	REFID=22084
HIMEL	80	PRL 44 920	T. Himel <i>et al.</i>	(LBL, SLAC)	REFID=22119
OREGLIA	80	PRL 45 959	M.J. Oreglia <i>et al.</i>	(SLAC, CIT, HARV+)	REFID=22207
SCHARRE	80	PL 97B 329	D.L. Scharre <i>et al.</i>	(SLAC, LBL)	REFID=21329
ZHOLENTZ	80	PL 96B 214	A.A. Zholents <i>et al.</i>	(NOVO)	REFID=10320
Also		SJNP 34 814	A.A. Zholents <i>et al.</i>	(NOVO)	REFID=10321
BRANDELIK	79B	NP B160 426	R. Brandelik <i>et al.</i>	(DASP Collab.)	REFID=22115
BRANDELIK	79C	ZPHY C1 233	R. Brandelik <i>et al.</i>	(DASP Collab.)	REFID=22114
BARTEL	78B	PL 79B 492	W. Bartel <i>et al.</i>	(DESY, HEIDP)	REFID=22111
TANENBAUM	78	PR D17 1731	W.M. Tanenbaum <i>et al.</i>	(SLAC, LBL)	REFID=22112
BIDDICK	77	PRL 38 1324	C.J. Biddick <i>et al.</i>	(UCSD, UMD, PAVI+)	REFID=22059
BRAUNSCH...	77	PL 67B 249	W. Braunschweig <i>et al.</i>	(DASP Collab.)	REFID=22197
BURMESTER	77	PL 66B 395	J. Burmester <i>et al.</i>	(DESY, HAMB, SIEG+)	REFID=22198
FELDMAN	77	PRPL 33C 285	G.J. Feldman, M.L. Perl	(LBL, SLAC)	REFID=22062
YAMADA	77	Hamburg Conf. 69	S. Yamada	(DASP Collab.)	REFID=22064
BARTEL	76	PL 64B 483	W. Bartel <i>et al.</i>	(DESY, HEIDP)	REFID=22192
TANENBAUM	76	PRL 36 402	W.M. Tanenbaum <i>et al.</i>	(SLAC, LBL) IG	REFID=22194
WHITAKER	76	PRL 37 1596	J.S. Whitaker <i>et al.</i>	(SLAC, LBL)	REFID=22151
ABRAMS	75	Stanford Symp. 25	G.S. Abrams	(LBL)	REFID=22176
ABRAMS	75B	PRL 34 1181	G.S. Abrams <i>et al.</i>	(LBL, SLAC)	REFID=22177
BOYARSKI	75C	Palermo Conf. 54	A.M. Boyarski <i>et al.</i>	(SLAC, LBL)	REFID=22179
HILGER	75	PRL 35 625	E. Hilger <i>et al.</i>	(STAN, PENN)	REFID=22186
LIBERMAN	75	Stanford Symp. 55	A.D. Liberman	(STAN)	REFID=22046
LUTH	75	PRL 35 1124	V. Luth <i>et al.</i>	(SLAC, LBL) JPC	REFID=22188
WIIK	75	Stanford Symp. 69	B.H. Wiik	(DESY)	REFID=22050

$\psi(3770)$

$$J^{PC} = 0^{-}(1^{-}-)$$

NODE=M053

 $\psi(3770)$ MASS (MeV)

NODE=M053M

OUR FIT includes measurements of $m_{\psi(2S)}$, $m_{\psi(3770)}$, and $m_{\psi(3770)} - m_{\psi(2S)}$.

NODE=M053M

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
3773.13±0.35 OUR FIT Error includes scale factor of 1.1.				
3778.1 ±1.2 OUR AVERAGE				
3779.2 $\begin{smallmatrix} +1.8 & +0.6 \\ -1.7 & -0.8 \end{smallmatrix}$		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±0.35 OUR FIT Error includes scale factor of 1.1.			
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

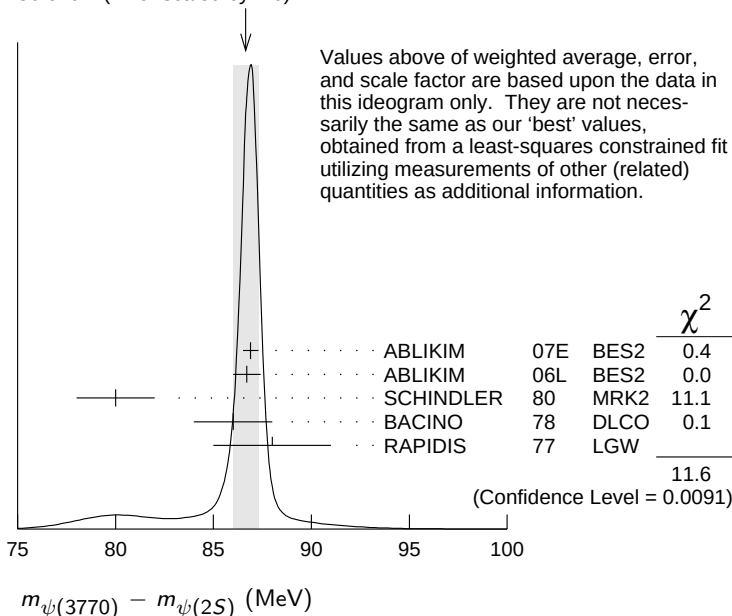
⁴ BES-II $\psi(2S)$ mass subtracted (see ABLIKIM 06L).

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 $^{+4}_{-5}$) %	S=2.0
Γ_3 D^+D^-	(41 ± 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 ± 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^+K^-			
Γ_{21} $K^*(892)^+K^- + \text{c.c.}$	< 1.4	$\times 10^{-5}$	CL=90%
Γ_{22} $K^*(892)^0\bar{K}^0 + \text{c.c.}$	< 1.2	$\times 10^{-3}$	CL=90%
Γ_{23} $K_S^0 K_L^0$	< 1.2	$\times 10^{-5}$	CL=90%
Γ_{24} $2(\pi^+\pi^-)$	< 1.12	$\times 10^{-3}$	CL=90%
Γ_{25} $2(\pi^+\pi^-)\pi^0$	< 1.06	$\times 10^{-3}$	CL=90%
Γ_{26} $2(\pi^+\pi^-\pi^0)$	< 5.85	%	CL=90%
Γ_{27} $\omega\pi^+\pi^-$	< 6.0	$\times 10^{-4}$	CL=90%
Γ_{28} $3(\pi^+\pi^-)$	< 9.1	$\times 10^{-3}$	CL=90%
Γ_{29} $3(\pi^+\pi^-)\pi^0$	< 1.37	%	CL=90%
Γ_{30} $3(\pi^+\pi^-)2\pi^0$	< 11.74	%	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=234

DESIG=19

DESIG=18

DESIG=3

DESIG=21

DESIG=22

DESIG=208

DESIG=24

DESIG=52

DESIG=55

DESIG=210

「31	$\eta\pi^+\pi^-$	< 1.24	$\times 10^{-3}$	CL=90%	DESIG=23
「32	$\pi^+\pi^-2\pi^0$	< 8.9	$\times 10^{-3}$	CL=90%	DESIG=206
「33	$\rho^0\pi^+\pi^-$	< 6.9	$\times 10^{-3}$	CL=90%	DESIG=64
「34	$\eta3\pi$	< 1.34	$\times 10^{-3}$	CL=90%	DESIG=25
「35	$\eta2(\pi^+\pi^-)$	< 2.43	%	CL=90%	DESIG=53
「36	$\eta\rho^0\pi^+\pi^-$	< 1.45	%	CL=90%	DESIG=221
「37	$\eta'3\pi$	< 2.44	$\times 10^{-3}$	CL=90%	DESIG=26
「38	$K^+K^-\pi^+\pi^-$	< 9.0	$\times 10^{-4}$	CL=90%	DESIG=27
「39	$\phi\pi^+\pi^-$	< 4.1	$\times 10^{-4}$	CL=90%	DESIG=28
「40	$K^+K^-2\pi^0$	< 4.2	$\times 10^{-3}$	CL=90%	DESIG=207
「41	$4(\pi^+\pi^-)$	< 1.67	%	CL=90%	DESIG=62
「42	$4(\pi^+\pi^-)\pi^0$	< 3.06	%	CL=90%	DESIG=63
「43	$\phi f_0(980)$	< 4.5	$\times 10^{-4}$	CL=90%	DESIG=29
「44	$K^+K^-\pi^+\pi^-\pi^0$	< 2.36	$\times 10^{-3}$	CL=90%	DESIG=30
「45	$K^+K^-\rho^0\pi^0$	< 8	$\times 10^{-4}$	CL=90%	DESIG=67
「46	$K^+K^-\rho^+\pi^-$	< 1.46	%	CL=90%	DESIG=68
「47	ωK^+K^-	< 3.4	$\times 10^{-4}$	CL=90%	DESIG=32
「48	$\phi\pi^+\pi^-\pi^0$	< 3.8	$\times 10^{-3}$	CL=90%	DESIG=69
「49	$K^{*0}K^-\pi^+\pi^0 + \text{c.c.}$	< 1.62	%	CL=90%	DESIG=70
「50	$K^{*+}K^-\pi^+\pi^- + \text{c.c.}$	< 3.23	%	CL=90%	DESIG=71
「51	$K^+K^-\pi^+\pi^-2\pi^0$	< 2.67	%	CL=90%	DESIG=209
「52	$K^+K^-2(\pi^+\pi^-)$	< 1.03	%	CL=90%	DESIG=57
「53	$K^+K^-2(\pi^+\pi^-)\pi^0$	< 3.60	%	CL=90%	DESIG=58
「54	ηK^+K^-	< 4.1	$\times 10^{-4}$	CL=90%	DESIG=31
「55	$\eta K^+K^-\pi^+\pi^-$	< 1.24	%	CL=90%	DESIG=222
「56	$\rho^0 K^+K^-$	< 5.0	$\times 10^{-3}$	CL=90%	DESIG=65
「57	$2(K^+K^-)$	< 6.0	$\times 10^{-4}$	CL=90%	DESIG=33
「58	ϕK^+K^-	< 7.5	$\times 10^{-4}$	CL=90%	DESIG=34
「59	$2(K^+K^-)\pi^0$	< 2.9	$\times 10^{-4}$	CL=90%	DESIG=35
「60	$2(K^+K^-)\pi^+\pi^-$	< 3.2	$\times 10^{-3}$	CL=90%	DESIG=59
「61	$K_S^0 K^-\pi^+$	< 3.2	$\times 10^{-3}$	CL=90%	DESIG=200
「62	$K_S^0 K^-\pi^+\pi^0$	< 1.33	%	CL=90%	DESIG=201
「63	$K_S^0 K^-\rho^+$	< 6.6	$\times 10^{-3}$	CL=90%	DESIG=214
「64	$K_S^0 K^-2\pi^+\pi^-$	< 8.7	$\times 10^{-3}$	CL=90%	DESIG=202
「65	$K_S^0 K^-\pi^+\rho^0$	< 1.6	%	CL=90%	DESIG=215
「66	$K_S^0 K^-\pi^+\eta$	< 1.3	%	CL=90%	DESIG=216
「67	$K_S^0 K^-2\pi^+\pi^-\pi^0$	< 4.18	%	CL=90%	DESIG=203
「68	$K_S^0 K^-2\pi^+\pi^-\eta$	< 4.8	%	CL=90%	DESIG=217
「69	$K_S^0 K^-\pi^+2(\pi^+\pi^-)$	< 1.22	%	CL=90%	DESIG=204
「70	$K_S^0 K^-\pi^+2\pi^0$	< 2.65	%	CL=90%	DESIG=205
「71	$K_S^0 K^-K^+K^-\pi^+$	< 4.9	$\times 10^{-3}$	CL=90%	DESIG=218
「72	$K_S^0 K^-K^+K^-\pi^+\pi^0$	< 3.0	%	CL=90%	DESIG=219
「73	$K_S^0 K^-K^+K^-\pi^+\eta$	< 2.2	%	CL=90%	DESIG=220
「74	$K^{*0}K^-\pi^+ + \text{c.c.}$	< 9.7	$\times 10^{-3}$	CL=90%	DESIG=60
「75	$p\bar{p}$				DESIG=233
「76	$p\bar{p}\pi^0$	< 4	$\times 10^{-5}$	CL=90%	DESIG=54
「77	$p\bar{p}\pi^+\pi^-$	< 5.8	$\times 10^{-4}$	CL=90%	DESIG=36
「78	$\Lambda\bar{\Lambda}$	< 1.2	$\times 10^{-4}$	CL=90%	DESIG=42
「79	$p\bar{p}\pi^+\pi^-\pi^0$	< 1.85	$\times 10^{-3}$	CL=90%	DESIG=37
「80	$\omega p\bar{p}$	< 2.9	$\times 10^{-4}$	CL=90%	DESIG=39
「81	$\Lambda\bar{\Lambda}\pi^0$	< 7	$\times 10^{-5}$	CL=90%	DESIG=72
「82	$p\bar{p}2(\pi^+\pi^-)$	< 2.6	$\times 10^{-3}$	CL=90%	DESIG=61
「83	$\eta p\bar{p}$	< 5.4	$\times 10^{-4}$	CL=90%	DESIG=38
「84	$\eta p\bar{p}\pi^+\pi^-$	< 3.3	$\times 10^{-3}$	CL=90%	DESIG=223
「85	$\rho^0 p\bar{p}$	< 1.7	$\times 10^{-3}$	CL=90%	DESIG=66
「86	$p\bar{p}K^+K^-$	< 3.2	$\times 10^{-4}$	CL=90%	DESIG=40
「87	$\eta p\bar{p}K^+K^-$	< 6.9	$\times 10^{-3}$	CL=90%	DESIG=224

Γ_{88}	$\pi^0 p \bar{p} K^+ K^-$	< 1.2	$\times 10^{-3}$	CL=90%	DESIG=225
Γ_{89}	$\phi p \bar{p}$	< 1.3	$\times 10^{-4}$	CL=90%	DESIG=41
Γ_{90}	$\Lambda \Lambda \pi^+ \pi^-$	< 2.5	$\times 10^{-4}$	CL=90%	DESIG=43
Γ_{91}	$\Lambda \bar{p} K^+$	< 2.8	$\times 10^{-4}$	CL=90%	DESIG=44
Γ_{92}	$\Lambda \bar{p} K^+ \pi^+ \pi^-$	< 6.3	$\times 10^{-4}$	CL=90%	DESIG=45
Γ_{93}	$\Lambda \Lambda \eta$	< 1.9	$\times 10^{-4}$	CL=90%	DESIG=226
Γ_{94}	$\Sigma^+ \bar{\Sigma}^-$	< 1.0	$\times 10^{-4}$	CL=90%	DESIG=227
Γ_{95}	$\Sigma^0 \bar{\Sigma}^0$	< 4	$\times 10^{-5}$	CL=90%	DESIG=228
Γ_{96}	$\Xi^+ \bar{\Xi}^-$	< 1.5	$\times 10^{-4}$	CL=90%	DESIG=229
Γ_{97}	$\Xi^0 \bar{\Xi}^0$	< 1.4	$\times 10^{-4}$	CL=90%	DESIG=230

Radiative decays

Γ_{98}	$\gamma \chi_{c2}$	< 6.4	$\times 10^{-4}$	CL=90%	DESIG=51
Γ_{99}	$\gamma \chi_{c1}$	$(2.48 \pm 0.23) \times 10^{-3}$			DESIG=50
Γ_{100}	$\gamma \chi_{c0}$	$(7.0 \pm 0.6) \times 10^{-3}$			DESIG=49
Γ_{101}	$\gamma \eta_c$	< 7	$\times 10^{-4}$	CL=90%	DESIG=231
Γ_{102}	$\gamma \eta_c(2S)$	< 9	$\times 10^{-4}$	CL=90%	DESIG=232
Γ_{103}	$\gamma \eta'$	< 1.8	$\times 10^{-4}$	CL=90%	DESIG=213
Γ_{104}	$\gamma \eta$	< 1.5	$\times 10^{-4}$	CL=90%	DESIG=212
Γ_{105}	$\gamma \pi^0$	< 2	$\times 10^{-4}$	CL=90%	DESIG=211

CONSTRAINED FIT INFORMATION

An overall fit to the total width, a partial width, and 3 branching ratios uses 23 measurements and one constraint to determine 5 parameters. The overall fit has a $\chi^2 = 20.1$ for 19 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta p_i \delta p_j \rangle / (\delta p_i \delta p_j)$, in percent, from the fit to parameters p_i , including the branching fractions, $x_i \equiv \Gamma_i / \Gamma_{\text{total}}$. The fit constrains the x_i whose labels appear in this array to sum to one.

x_3	99		
x_8	0	0	
Γ	0	0	-44
	x_2	x_3	x_8

	Mode	Rate (MeV)	Scale factor
Γ_2	$D^0 \bar{D}^0$	14.0 ± 1.4	1.8
Γ_3	$D^+ D^-$	11.2 ± 1.1	1.7
Γ_8	$e^+ e^-$	$(2.62 \pm 0.18) \times 10^{-4}$	1.4

$\psi(3770)$ PARTIAL WIDTHS

$\Gamma(e^+ e^-)$

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	BESSON	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	$e^+ e^-$

NODE=M053225

NODE=M053W1
NODE=M053W1

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 BESSON 06 (as corrected in BESSON 10) measure $\sigma(e^+e^- \rightarrow \psi(3770) \rightarrow \text{hadrons}) = 6.36 \pm 0.08^{+0.41}_{-0.30}$ nb at $\sqrt{s} = 3773 \pm 1$ MeV, and obtain Γ_{ee} from the Born-level cross section calculated using $\psi(3770)$ mass and width from our 2004 edition, PDG 04.
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

$\Gamma(D\bar{D})/\Gamma_{\text{total}}$ $\Gamma_1/\Gamma = (\Gamma_2 + \Gamma_3)/\Gamma$
 VALUE EVTS DOCUMENT ID TECN COMMENT

0.93 $^{+0.08}_{-0.09}$ OUR FIT Error includes scale factor of 2.0.

0.93 $^{+0.08}_{-0.09}$ OUR AVERAGE Error includes scale factor of 2.1.

0.849 $\pm 0.056 \pm 0.018$ ¹⁶ ABLIKIM 08B BES2 $e^+e^- \rightarrow \text{non-}D\bar{D}$
 1.033 $\pm 0.014^{+0.048}_{-0.066}$ 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

0.52 $^{+0.04}_{-0.05}$ OUR FIT Error includes scale factor of 2.0.

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.467 $\pm 0.047 \pm 0.023$ ABLIKIM 06L BES2 $e^+e^- \rightarrow D^0\bar{D}^0$
 0.499 $\pm 0.013 \pm 0.038$ 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

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

1.253 ± 0.016 OUR FIT

1.253 ± 0.016 OUR AVERAGE

1.252 $\pm 0.009 \pm 0.013$ 5.3M BONVICINI 14 CLEO $e^+e^- \rightarrow D\bar{D}$ |
 1.39 $\pm 0.31 \pm 0.12$ PAKHLOVA 08 BELL 10.6 $e^+e^- \rightarrow D\bar{D}\gamma$
 1.78 $\pm 0.33 \pm 0.24$ AUBERT 07BE BABR $e^+e^- \rightarrow D\bar{D}\gamma$
 1.27 $\pm 0.12 \pm 0.08$ ABLIKIM 06L BES2 $e^+e^- \rightarrow D\bar{D}$
 2.43 $\pm 1.50 \pm 0.43$ 34 ²¹ CHISTOV 04 BELL $B^+ \rightarrow \psi(3770)K^+$

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.258 $\pm 0.016 \pm 0.014$ ²² DOBBS 07 CLEO $e^+e^- \rightarrow D\bar{D}$

$\Gamma(J/\psi\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_4/Γ
 VALUE (units 10^{-3}) EVTS DOCUMENT ID TECN COMMENT

1.93 ± 0.28 OUR AVERAGE

1.89 $\pm 0.20 \pm 0.20$ 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

0.080 $\pm 0.025 \pm 0.016$ 39 ± 14 ADAM 06 CLEO $e^+e^- \rightarrow \psi(3770)$

NODE=M053R4
 NODE=M053R4

NODE=M053R7
 NODE=M053R7

$\Gamma(J/\psi\eta)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
$87 \pm 33 \pm 22$	22 ± 10	ADAM	06 CLEO	$e^+e^- \rightarrow \psi(3770)$

NODE=M053R8
NODE=M053R8

 $\Gamma(J/\psi\pi^0)/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<28	90	<10	ADAM	06 CLEO	$e^+e^- \rightarrow \psi(3770)$

NODE=M053R9
NODE=M053R9

 $\Gamma(e^+e^-)/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
0.96 ± 0.07 OUR FIT			Error includes scale factor of 1.3.
1.3 ± 0.2	RAPIDIS	77 LGW	e^+e^-

NODE=M053R2
NODE=M053R2

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 $\sigma_{\text{obs}} = 7.07 \pm 0.58$ 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.

²² Superseded by BONVICINI 14.

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=M053R5;LINKAGE=DO

DECAYS TO LIGHT HADRONS

 $\Gamma(b_1(1235)\pi)/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<1.4	90	²³ ADAMS	06 CLEO	$e^+e^- \rightarrow \psi(3770)$

NODE=M053R82
NODE=M053R82

 $\Gamma(\phi\eta')/\Gamma_{\text{total}}$ Γ_{10}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<7	90	²³ ADAMS	06 CLEO	$e^+e^- \rightarrow \psi(3770)$

NODE=M053R83
NODE=M053R83

 $\Gamma(\omega\eta')/\Gamma_{\text{total}}$ Γ_{11}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<4	90	²³ ADAMS	06 CLEO	$e^+e^- \rightarrow \psi(3770)$

NODE=M053R84
NODE=M053R84

 $\Gamma(\rho^0\eta')/\Gamma_{\text{total}}$ Γ_{12}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<6	90	²³ ADAMS	06 CLEO	$e^+e^- \rightarrow \psi(3770)$

NODE=M053R85
NODE=M053R85

 $\Gamma(\phi\eta)/\Gamma_{\text{total}}$ Γ_{13}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
$3.1 \pm 0.6 \pm 0.3$		²³ ADAMS	06 CLEO	$3.773 e^+e^- \rightarrow \phi\eta$

NODE=M053R6
NODE=M053R6

• • • We do not use the following data for averages, fits, limits, etc. • • •

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<19	90	²⁴ ABLIKIM	07B BES2	$e^+e^- \rightarrow \psi(3770)$

 $\Gamma(\omega\eta)/\Gamma_{\text{total}}$ Γ_{14}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<1.4	90	²³ ADAMS	06 CLEO	$e^+e^- \rightarrow \psi(3770)$

NODE=M053R86
NODE=M053R86

 $\Gamma(\rho^0\eta)/\Gamma_{\text{total}}$ Γ_{15}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<5	90	²³ ADAMS	06 CLEO	$e^+e^- \rightarrow \psi(3770)$

NODE=M053R87
NODE=M053R87

 $\Gamma(\phi\pi^0)/\Gamma_{\text{total}}$ Γ_{16}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<3	90	²³ ADAMS	06 CLEO	$e^+e^- \rightarrow \psi(3770)$

NODE=M053R11
NODE=M053R11

• • • We do not use the following data for averages, fits, limits, etc. • • •

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<50	90	²⁴ ABLIKIM	07B BES2	$e^+e^- \rightarrow \psi(3770)$

 $\Gamma(\omega\pi^0)/\Gamma_{\text{total}}$ Γ_{17}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<6	90	²³ ADAMS	06 CLEO	$e^+e^- \rightarrow \psi(3770)$

NODE=M053R88
NODE=M053R88

$\Gamma(\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{18}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<5	90	23,25 ADAMS 06	CLEO	$e^+e^- \rightarrow \psi(3770)$

NODE=M053R89
NODE=M053R89

 $\Gamma(\rho\pi)/\Gamma_{\text{total}}$ Γ_{19}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<5	90	23,25 ADAMS 06	CLEO	$e^+e^- \rightarrow \psi(3770)$

NODE=M053R90
NODE=M053R90

 $\Gamma(K^+K^-)/\Gamma_{\text{total}}$ Γ_{20}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT

NODE=M053R00
NODE=M053R00

• • • We do not use the following data for averages, fits, limits, etc. • • •

$\sim 10^{-5}$	26 DRUZHININ 15	RVUE	$e^+e^- \rightarrow \psi(3770)$

 $\Gamma(K^*(892)^+K^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{21}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<1.4	90	23 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_{22}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<1.2	90	23 ADAMS 06	CLEO	$e^+e^- \rightarrow \psi(3770)$

NODE=M053R92
NODE=M053R92

 $\Gamma(K_S^0 K_L^0)/\Gamma_{\text{total}}$ Γ_{23}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
< 1.2	90	27 CRONIN-HEN..06	CLEO	$e^+e^- \rightarrow \psi(3770)$

NODE=M053R3
NODE=M053R3

• • • We do not use the following data for averages, fits, limits, etc. • • •

<21	90	28 ABLIKIM 04F	BES	$e^+e^- \rightarrow \psi(3770)$

 $\Gamma(2(\pi^+\pi^-))/\Gamma_{\text{total}}$ Γ_{24}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<11.2	90	29 HUANG 06A	CLEO	$e^+e^- \rightarrow \psi(3770)$

NODE=M053R21
NODE=M053R21

• • • We do not use the following data for averages, fits, limits, etc. • • •

<48	90	24 ABLIKIM 07B	BES2	$e^+e^- \rightarrow \psi(3770)$

 $\Gamma(2(\pi^+\pi^-\pi^0))/\Gamma_{\text{total}}$ Γ_{25}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<10.6	90	29 HUANG 06A	CLEO	$e^+e^- \rightarrow \psi(3770)$

NODE=M053R22
NODE=M053R22

• • • We do not use the following data for averages, fits, limits, etc. • • •

<62	90	24 ABLIKIM 07B	BES2	$e^+e^- \rightarrow \psi(3770)$

 $\Gamma(2(\pi^+\pi^-\pi^0))/\Gamma_{\text{total}}$ Γ_{26}/Γ

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<58.5	90	305	ABLIKIM 08N	BES2	$e^+e^- \rightarrow \psi(3770)$

NODE=M053R72
NODE=M053R72

 $\Gamma(\omega\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{27}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 6.0	90	29 HUANG 06A	CLEO	$e^+e^- \rightarrow \psi(3770)$

NODE=M053R24
NODE=M053R24

• • • We do not use the following data for averages, fits, limits, etc. • • •

<55	90	24 ABLIKIM 07I	BES2	$3.77 e^+e^-$

 $\Gamma(3(\pi^+\pi^-))/\Gamma_{\text{total}}$ Γ_{28}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<91	90	24 ABLIKIM 07B	BES2	$e^+e^- \rightarrow \psi(3770)$

NODE=M053R07
NODE=M053R07

 $\Gamma(3(\pi^+\pi^-\pi^0))/\Gamma_{\text{total}}$ Γ_{29}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<137	90	24 ABLIKIM 07B	BES2	$e^+e^- \rightarrow \psi(3770)$

NODE=M053R10
NODE=M053R10

 $\Gamma(3(\pi^+\pi^-)2\pi^0)/\Gamma_{\text{total}}$ Γ_{30}/Γ

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<117.4	90	59	ABLIKIM 08N	BES2	$e^+e^- \rightarrow \psi(3770)$

NODE=M053R74
NODE=M053R74

$\Gamma(\eta\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{31}/Γ NODE=M053R23
NODE=M053R23

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<1.24	90	29 HUANG 06A	CLEO	$e^+e^- \rightarrow \psi(3770)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<2.3	90	24 ABLIKIM 10D	BES2	$e^+e^- \rightarrow \psi(3770)$

 $\Gamma(\pi^+\pi^-2\pi^0)/\Gamma_{\text{total}}$ Γ_{32}/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_{33}/Γ NODE=M053R53
NODE=M053R53

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<6.9	90	24 ABLIKIM 07F	BES2	$e^+e^- \rightarrow \psi(3770)$

 $\Gamma(\eta3\pi)/\Gamma_{\text{total}}$ Γ_{34}/Γ NODE=M053R25
NODE=M053R25

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<13.4	90	29 HUANG 06A	CLEO	$e^+e^- \rightarrow \psi(3770)$

 $\Gamma(\eta2(\pi^+\pi^-))/\Gamma_{\text{total}}$ Γ_{35}/Γ NODE=M053R08
NODE=M053R08

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<243	90	24 ABLIKIM 07B	BES2	$e^+e^- \rightarrow \psi(3770)$

 $\Gamma(\eta\rho^0\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{36}/Γ NODE=M053R77
NODE=M053R77

VALUE (units 10^{-2})	CL%	DOCUMENT ID	TECN	COMMENT
<1.45	90	24 ABLIKIM 10D	BES2	$e^+e^- \rightarrow \psi(3770)$

 $\Gamma(\eta'3\pi)/\Gamma_{\text{total}}$ Γ_{37}/Γ NODE=M053R26
NODE=M053R26

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<24.4	90	29 HUANG 06A	CLEO	$e^+e^- \rightarrow \psi(3770)$

 $\Gamma(K^+K^-\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{38}/Γ NODE=M053R27
NODE=M053R27

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 9.0	90	29 HUANG 06A	CLEO	$e^+e^- \rightarrow \psi(3770)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<48	90	24 ABLIKIM 07B	BES2	$e^+e^- \rightarrow \psi(3770)$

 $\Gamma(\phi\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{39}/Γ NODE=M053R28
NODE=M053R28

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 4.1	90	29 HUANG 06A	CLEO	$e^+e^- \rightarrow \psi(3770)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<16	90	24 ABLIKIM 07B	BES2	$e^+e^- \rightarrow \psi(3770)$

 $\Gamma(K^+K^-2\pi^0)/\Gamma_{\text{total}}$ Γ_{40}/Γ NODE=M053R71
NODE=M053R71

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<4.2	90	14	ABLIKIM 08N	BES2	$e^+e^- \rightarrow \psi(3770)$

 $\Gamma(4(\pi^+\pi^-))/\Gamma_{\text{total}}$ Γ_{41}/Γ NODE=M053R50
NODE=M053R50

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<16.7	90	24 ABLIKIM 07F	BES2	$e^+e^- \rightarrow \psi(3770)$

 $\Gamma(4(\pi^+\pi^-)\pi^0)/\Gamma_{\text{total}}$ Γ_{42}/Γ NODE=M053R52
NODE=M053R52

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<30.6	90	24 ABLIKIM 07F	BES2	$e^+e^- \rightarrow \psi(3770)$

 $\Gamma(\phi f_0(980))/\Gamma_{\text{total}}$ Γ_{43}/Γ NODE=M053R29
NODE=M053R29

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<4.5	90	29 HUANG 06A	CLEO	$e^+e^- \rightarrow \psi(3770)$

 $\Gamma(K^+K^-\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{44}/Γ NODE=M053R30
NODE=M053R30

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 23.6	90	29 HUANG 06A	CLEO	$e^+e^- \rightarrow \psi(3770)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<111	90	24 ABLIKIM 07B	BES2	$e^+e^- \rightarrow \psi(3770)$

$\Gamma(K^+ K^- \rho^0 \pi^0)/\Gamma_{\text{total}}$ Γ_{45}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<8	90	24 ABLIKIM	07I BES2	$3.77 e^+ e^-$

NODE=M053R58
NODE=M053R58

 $\Gamma(K^+ K^- \rho^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{46}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<146	90	24 ABLIKIM	07I BES2	$3.77 e^+ e^-$

NODE=M053R59
NODE=M053R59

 $\Gamma(\omega K^+ K^-)/\Gamma_{\text{total}}$ Γ_{47}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 3.4	90	29 HUANG	06A CLEO	$e^+ e^- \rightarrow \psi(3770)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<66	90	24 ABLIKIM	07I BES2	$3.77 e^+ e^-$

NODE=M053R32
NODE=M053R32

 $\Gamma(\phi \pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}$ Γ_{48}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<38	90	24 ABLIKIM	07I BES2	$3.77 e^+ e^-$

NODE=M053R60
NODE=M053R60

 $\Gamma(K^{*0} K^- \pi^+ \pi^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{49}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<162	90	24 ABLIKIM	07I BES2	$3.77 e^+ e^-$

NODE=M053R61
NODE=M053R61

 $\Gamma(K^{*+} K^- \pi^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{50}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<323	90	24 ABLIKIM	07I BES2	$3.77 e^+ e^-$

NODE=M053R62
NODE=M053R62

 $\Gamma(K^+ K^- \pi^+ \pi^- 2\pi^0)/\Gamma_{\text{total}}$ Γ_{51}/Γ

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<26.7	90	24	ABLIKIM	08N BES2	$e^+ e^- \rightarrow \psi(3770)$

NODE=M053R73
NODE=M053R73

 $\Gamma(K^+ K^- 2(\pi^+ \pi^-))/\Gamma_{\text{total}}$ Γ_{52}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<10.3	90	24 ABLIKIM	07F BES2	$e^+ e^- \rightarrow \psi(3770)$

NODE=M053R57
NODE=M053R57

 $\Gamma(K^+ K^- 2(\pi^+ \pi^-) \pi^0)/\Gamma_{\text{total}}$ Γ_{53}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<36.0	90	24 ABLIKIM	07F BES2	$e^+ e^- \rightarrow \psi(3770)$

NODE=M053R51
NODE=M053R51

 $\Gamma(\eta K^+ K^-)/\Gamma_{\text{total}}$ Γ_{54}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 4.1	90	29 HUANG	06A CLEO	$e^+ e^- \rightarrow \psi(3770)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<31	90	24 ABLIKIM	10D BES2	$e^+ e^- \rightarrow \psi(3770)$

NODE=M053R31
NODE=M053R31

 $\Gamma(\eta K^+ K^- \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{55}/Γ

VALUE (units 10^{-2})	CL%	DOCUMENT ID	TECN	COMMENT
<1.24	90	24 ABLIKIM	10D BES2	$e^+ e^- \rightarrow \psi(3770)$

NODE=M053R78
NODE=M053R78

 $\Gamma(\rho^0 K^+ K^-)/\Gamma_{\text{total}}$ Γ_{56}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<5.0	90	24 ABLIKIM	07F BES2	$e^+ e^- \rightarrow \psi(3770)$

NODE=M053R54
NODE=M053R54

 $\Gamma(2(K^+ K^-))/\Gamma_{\text{total}}$ Γ_{57}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 6.0	90	29 HUANG	06A CLEO	$e^+ e^- \rightarrow \psi(3770)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<17	90	24 ABLIKIM	07B BES2	$e^+ e^- \rightarrow \psi(3770)$

NODE=M053R33
NODE=M053R33

 $\Gamma(\phi K^+ K^-)/\Gamma_{\text{total}}$ Γ_{58}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 7.5	90	29 HUANG	06A CLEO	$e^+ e^- \rightarrow \psi(3770)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<24	90	24 ABLIKIM	07B BES2	$e^+ e^- \rightarrow \psi(3770)$

NODE=M053R34
NODE=M053R34

$\Gamma(2(K^+ K^-)\pi^0)/\Gamma_{\text{total}}$ Γ_{59}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 2.9	90	29 HUANG 06A	CLEO	$e^+ e^- \rightarrow \psi(3770)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<46	90	24 ABLIKIM 07B	BES2	$e^+ e^- \rightarrow \psi(3770)$

NODE=M053R35
 NODE=M053R35

 $\Gamma(2(K^+ K^-)\pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{60}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<3.2	90	24 ABLIKIM 07F	BES2	$e^+ e^- \rightarrow \psi(3770)$

NODE=M053R48
 NODE=M053R48

 $\Gamma(K_S^0 K^- \pi^+)/\Gamma_{\text{total}}$ Γ_{61}/Γ

VALUE (units 10^{-3})	CL%	EPTS	DOCUMENT ID	TECN	COMMENT
<3.2	90	18	ABLIKIM 08M	BES2	$e^+ e^- \rightarrow \psi(3770)$

NODE=M053R64
 NODE=M053R64

 $\Gamma(K_S^0 K^- \pi^+ \pi^0)/\Gamma_{\text{total}}$ Γ_{62}/Γ

VALUE (units 10^{-3})	CL%	EPTS	DOCUMENT ID	TECN	COMMENT
<13.3	90	40	ABLIKIM 08M	BES2	$e^+ e^- \rightarrow \psi(3770)$

NODE=M053R65
 NODE=M053R65

 $\Gamma(K_S^0 K^- \rho^+)/\Gamma_{\text{total}}$ Γ_{63}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<6.6	90	ABLIKIM 09C	BES2	$e^+ e^- \rightarrow \psi(3770)$

NODE=M053R15
 NODE=M053R15

 $\Gamma(K_S^0 K^- 2\pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{64}/Γ

VALUE (units 10^{-3})	CL%	EPTS	DOCUMENT ID	TECN	COMMENT
<8.7	90	39	ABLIKIM 08M	BES2	$e^+ e^- \rightarrow \psi(3770)$

NODE=M053R66
 NODE=M053R66

 $\Gamma(K_S^0 K^- \pi^+ \rho^0)/\Gamma_{\text{total}}$ Γ_{65}/Γ

VALUE (units 10^{-2})	CL%	DOCUMENT ID	TECN	COMMENT
<1.6	90	ABLIKIM 09C	BES2	$e^+ e^- \rightarrow \psi(3770)$

NODE=M053R16
 NODE=M053R16

 $\Gamma(K_S^0 K^- \pi^+ \eta)/\Gamma_{\text{total}}$ Γ_{66}/Γ

VALUE (units 10^{-2})	CL%	DOCUMENT ID	TECN	COMMENT
<1.3	90	ABLIKIM 09C	BES2	$e^+ e^- \rightarrow \psi(3770)$

NODE=M053R17
 NODE=M053R17

 $\Gamma(K_S^0 K^- 2\pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}$ Γ_{67}/Γ

VALUE (units 10^{-3})	CL%	EPTS	DOCUMENT ID	TECN	COMMENT
<41.8	90	23	ABLIKIM 08M	BES2	$e^+ e^- \rightarrow \psi(3770)$

NODE=M053R67
 NODE=M053R67

 $\Gamma(K_S^0 K^- 2\pi^+ \pi^- \eta)/\Gamma_{\text{total}}$ Γ_{68}/Γ

VALUE (units 10^{-2})	CL%	DOCUMENT ID	TECN	COMMENT
<4.8	90	ABLIKIM 09C	BES2	$e^+ e^- \rightarrow \psi(3770)$

NODE=M053R18
 NODE=M053R18

 $\Gamma(K_S^0 K^- \pi^+ 2(\pi^+ \pi^-))/\Gamma_{\text{total}}$ Γ_{69}/Γ

VALUE (units 10^{-3})	CL%	EPTS	DOCUMENT ID	TECN	COMMENT
<12.2	90	4	ABLIKIM 08M	BES2	$e^+ e^- \rightarrow \psi(3770)$

NODE=M053R68
 NODE=M053R68

 $\Gamma(K_S^0 K^- \pi^+ 2\pi^0)/\Gamma_{\text{total}}$ Γ_{70}/Γ

VALUE (units 10^{-3})	CL%	EPTS	DOCUMENT ID	TECN	COMMENT
<26.5	90	17	ABLIKIM 08M	BES2	$e^+ e^- \rightarrow \psi(3770)$

NODE=M053R69
 NODE=M053R69

 $\Gamma(K_S^0 K^- K^+ K^- \pi^+)/\Gamma_{\text{total}}$ Γ_{71}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<4.9	90	ABLIKIM 09C	BES2	$e^+ e^- \rightarrow \psi(3770)$

NODE=M053R19
 NODE=M053R19

 $\Gamma(K_S^0 K^- K^+ K^- \pi^+ \pi^0)/\Gamma_{\text{total}}$ Γ_{72}/Γ

VALUE (units 10^{-2})	CL%	DOCUMENT ID	TECN	COMMENT
<3.0	90	ABLIKIM 09C	BES2	$e^+ e^- \rightarrow \psi(3770)$

NODE=M053R75
 NODE=M053R75

 $\Gamma(K_S^0 K^- K^+ K^- \pi^+ \eta)/\Gamma_{\text{total}}$ Γ_{73}/Γ

VALUE (units 10^{-2})	CL%	DOCUMENT ID	TECN	COMMENT
<2.2	90	ABLIKIM 09C	BES2	$e^+ e^- \rightarrow \psi(3770)$

NODE=M053R76
 NODE=M053R76

$\Gamma(K^*0 K^- \pi^+ + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{74}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<9.7	90	24 ABLIKIM	07F BES2	$e^+ e^- \rightarrow \psi(3770)$

NODE=M053R55
 NODE=M053R55

 $\Gamma(p\bar{p})/\Gamma_{\text{total}}$ Γ_{75}/Γ

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

$7.1^{+8.6}_{-2.9}$	684	30 ABLIKIM	14L BES3	$e^+ e^- \rightarrow \psi(3770)$
310 ± 30	684	31 ABLIKIM	14L BES3	$e^+ e^- \rightarrow \psi(3770)$

NODE=M053R98
 NODE=M053R98

OCCUR=2

 $\Gamma(p\bar{p}\pi^0)/\Gamma_{\text{total}}$ Γ_{76}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT

< 0.4 90 32,33 ABLIKIM 14O BES3 $e^+ e^- \rightarrow \psi(3770)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

59 $^{+3}_{-2} \pm 5$	32,34	ABLIKIM	14O BES3	$e^+ e^- \rightarrow \psi(3770)$
<12	90	24 ABLIKIM	07B BES2	$e^+ e^- \rightarrow \psi(3770)$

NODE=M053R09
 NODE=M053R09

OCCUR=2

 $\Gamma(p\bar{p}\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{77}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT

< 5.8 90 29 HUANG 06A CLEO $e^+ e^- \rightarrow \psi(3770)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<16 90 24 ABLIKIM 07B BES2 $e^+ e^- \rightarrow \psi(3770)$

NODE=M053R36
 NODE=M053R36

 $\Gamma(\Lambda\bar{\Lambda})/\Gamma_{\text{total}}$ Γ_{78}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT

<1.2 90 29 HUANG 06A CLEO $e^+ e^- \rightarrow \psi(3770)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<4 90 24 ABLIKIM 07F BES2 $e^+ e^- \rightarrow \psi(3770)$

NODE=M053R42
 NODE=M053R42

 $\Gamma(p\bar{p}\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{79}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT

<18.5 90 29 HUANG 06A CLEO $e^+ e^- \rightarrow \psi(3770)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<73 90 24 ABLIKIM 07B BES2 $e^+ e^- \rightarrow \psi(3770)$

NODE=M053R37
 NODE=M053R37

 $\Gamma(\omega p\bar{p})/\Gamma_{\text{total}}$ Γ_{80}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT

< 2.9 90 29 HUANG 06A CLEO $e^+ e^- \rightarrow \psi(3770)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<30 90 35 ABLIKIM 07I BES2 $3.77 e^+ e^-$

NODE=M053R39
 NODE=M053R39

 $\Gamma(\Lambda\bar{\Lambda}\pi^0)/\Gamma_{\text{total}}$ Γ_{81}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT

< 0.7 90 36 ABLIKIM 13Q BES3 $e^+ e^- \rightarrow \psi(3770)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<12 90 24 ABLIKIM 07I BES2 $3.77 e^+ e^-$

NODE=M053R63
 NODE=M053R63

 $\Gamma(p\bar{p}2(\pi^+\pi^-))/\Gamma_{\text{total}}$ Γ_{82}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT

<2.6 90 24 ABLIKIM 07F BES2 $e^+ e^- \rightarrow \psi(3770)$

NODE=M053R49
 NODE=M053R49

 $\Gamma(\eta p\bar{p})/\Gamma_{\text{total}}$ Γ_{83}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT

< 5.4 90 29 HUANG 06A CLEO $e^+ e^- \rightarrow \psi(3770)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<11 90 24 ABLIKIM 10D BES2 $e^+ e^- \rightarrow \psi(3770)$

NODE=M053R38
 NODE=M053R38

 $\Gamma(\eta p\bar{p}\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{84}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT

<3.3 90 24 ABLIKIM 10D BES2 $e^+ e^- \rightarrow \psi(3770)$

NODE=M053R79
 NODE=M053R79

$\Gamma(\rho^0 \rho \bar{\rho})/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<1.7	90	24 ABLIKIM	07F BES2	$e^+ e^- \rightarrow \psi(3770)$

 Γ_{85}/Γ

NODE=M053R56
 NODE=M053R56

 $\Gamma(\rho \bar{\rho} K^+ K^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 3.2	90	29 HUANG	06A CLEO	$e^+ e^- \rightarrow \psi(3770)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<11	90	24 ABLIKIM	07B BES2	$e^+ e^- \rightarrow \psi(3770)$

 Γ_{86}/Γ

NODE=M053R40
 NODE=M053R40

 $\Gamma(\eta \rho \bar{\rho} K^+ K^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<6.9	90	24 ABLIKIM	10D BES2	$e^+ e^- \rightarrow \psi(3770)$

 Γ_{87}/Γ

NODE=M053R80
 NODE=M053R80

 $\Gamma(\pi^0 \rho \bar{\rho} K^+ K^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<1.2	90	24 ABLIKIM	10D BES2	$e^+ e^- \rightarrow \psi(3770)$

 Γ_{88}/Γ

NODE=M053R81
 NODE=M053R81

 $\Gamma(\phi \rho \bar{\rho})/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.3	90	29 HUANG	06A CLEO	$e^+ e^- \rightarrow \psi(3770)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<9	90	24 ABLIKIM	07B BES2	$e^+ e^- \rightarrow \psi(3770)$

 Γ_{89}/Γ

NODE=M053R41
 NODE=M053R41

 $\Gamma(\Lambda \bar{\Lambda} \pi^+ \pi^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 2.5	90	29 HUANG	06A CLEO	$e^+ e^- \rightarrow \psi(3770)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
< 4.7	90	36 ABLIKIM	13Q BES3	$e^+ e^- \rightarrow \psi(3770)$
<39	90	24 ABLIKIM	07F BES2	$e^+ e^- \rightarrow \psi(3770)$

 Γ_{90}/Γ

NODE=M053R43
 NODE=M053R43

 $\Gamma(\Lambda \bar{\rho} K^+)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<2.8	90	29 HUANG	06A CLEO	$e^+ e^- \rightarrow \psi(3770)$

 Γ_{91}/Γ

NODE=M053R44
 NODE=M053R44

 $\Gamma(\Lambda \bar{\rho} K^+ \pi^+ \pi^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<6.3	90	29 HUANG	06A CLEO	$e^+ e^- \rightarrow \psi(3770)$

 Γ_{92}/Γ

NODE=M053R45
 NODE=M053R45

 $\Gamma(\Lambda \bar{\Lambda} \eta)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.9	90	36 ABLIKIM	13Q BES3	$e^+ e^- \rightarrow \psi(3770)$

 Γ_{93}/Γ

NODE=M053R93
 NODE=M053R93

 $\Gamma(\Sigma^+ \bar{\Sigma}^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.0	90	36 ABLIKIM	13Q BES3	$e^+ e^- \rightarrow \psi(3770)$

 Γ_{94}/Γ

NODE=M053R94
 NODE=M053R94

 $\Gamma(\Sigma^0 \bar{\Sigma}^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<0.4	90	36 ABLIKIM	13Q BES3	$e^+ e^- \rightarrow \psi(3770)$

 Γ_{95}/Γ

NODE=M053R95
 NODE=M053R95

 $\Gamma(\Xi^+ \bar{\Xi}^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.5	90	36 ABLIKIM	13Q BES3	$e^+ e^- \rightarrow \psi(3770)$

 Γ_{96}/Γ

NODE=M053R96
 NODE=M053R96

 $\Gamma(\Xi^0 \bar{\Xi}^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.4	90	36 ABLIKIM	13Q BES3	$e^+ e^- \rightarrow \psi(3770)$

 Γ_{97}/Γ

NODE=M053R97
 NODE=M053R97

- ²³ 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.
- ²⁴ 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.
- ²⁵ Data suggest possible destructive interference with continuum.
- ²⁶ DRUZHININ 15 uses BABAR and CLEO data taking into account interference of the processes $e^+e^- \rightarrow K^+K^-$ and $e^+e^- \rightarrow K_S^0 K_L^0$.
- ²⁷ Using $\sigma(e^+e^- \rightarrow \psi(3770) \rightarrow \text{hadrons}) = (6.38 \pm 0.08_{-0.30}^{+0.41})$ nb from BESSON 06 and $B(K_S^0 \rightarrow \pi^+\pi^-) = 0.6895 \pm 0.0014$.
- ²⁸ Using $B(K_S^0 \rightarrow \pi^+\pi^-) = 0.6860 \pm 0.0027$.
- ²⁹ Using $\sigma_{tot}(e^+e^- \rightarrow \psi(3770)) = 7.9 \pm 0.6$ nb at the resonance.
- ³⁰ Solution I of two equivalent solutions in a fit with a resonance interfering with continuum.
- ³¹ Solution II of two equivalent solutions in a fit with a resonance interfering with continuum.
- ³² Calculated by the authors using $\sigma(e^+e^- \rightarrow \psi(3770) \rightarrow \text{hadrons}) = 6.36 \pm 0.08_{-0.30}^{+0.41}$ nb from BESSON 10.
- ³³ Solution I of two equivalent solutions in a fit with a resonance interfering with continuum.
- ³⁴ Solution II of two equivalent solutions in a fit with a resonance interfering with continuum.
- ³⁵ Using $\sigma^{obs} = 7.15 \pm 0.27 \pm 0.27$ nb and neglecting interference.
- ³⁶ Assuming that interference effects between resonance and continuum can be neglected.

NODE=M053R6;LINKAGE=AD

NODE=M053R10;LINKAGE=AK

NODE=M053R89;LINKAGE=AD

NODE=M053R00;LINKAGE=A

NODE=M053R3;LINKAGE=CR

NODE=M053R3;LINKAGE=AB

NODE=M053R;LINKAGE=HU

NODE=M053R98;LINKAGE=A

NODE=M053R98;LINKAGE=B

NODE=M053R09;LINKAGE=A

NODE=M053R09;LINKAGE=B

NODE=M053R09;LINKAGE=C

NODE=M053R24;LINKAGE=AB

NODE=M053R43;LINKAGE=A

NODE=M053240

NODE=M053R03
NODE=M053R03

RADIATIVE DECAYS

$\Gamma(\gamma\chi_{c2})/\Gamma_{\text{total}}$						Γ_{98}/Γ
VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT		
<0.64	90	37 ABLIKIM	15J	BES3 $e^+e^- \rightarrow \psi(3770) \rightarrow \gamma\gamma J/\psi$		
• • • We do not use the following data for averages, fits, limits, etc. • • •						
<2.0	90	38 BRIERE	06	CLEO $e^+e^- \rightarrow \psi(3770) \rightarrow \gamma + \text{hadrons}$		
<0.9	90	39 COAN	06A	CLEO $e^+e^- \rightarrow \psi(3770) \rightarrow \gamma\gamma J/\psi$		

$\Gamma(\gamma\chi_{c1})/\Gamma_{\text{total}}$						Γ_{99}/Γ
VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT		
2.48±0.23 OUR AVERAGE						
1.9 ±0.4 ±0.6	202	40 ABLIKIM	16B	BES3 $e^+e^- \rightarrow \psi(3770) \rightarrow \gamma + \text{hadrons}$		
2.48±0.15±0.23	0.6k	ABLIKIM	15J	BES3 $e^+e^- \rightarrow \psi(3770) \rightarrow \gamma\gamma J/\psi$		
2.4 ±0.8 ±0.2		41 ABLIKIM	14H	BES3 $e^+e^- \rightarrow \psi(3770) \rightarrow K_S^0 K^\pm \pi^\mp$		
2.9 ±0.5 ±0.4		42 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	43 BRIERE	06	CLEO $e^+e^- \rightarrow \psi(3770) \rightarrow \gamma + \text{hadrons}$		
2.8 ±0.5 ±0.4	53	39 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_{99}/Γ_4
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT		
1.49±0.31±0.26	53 ± 10	44 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_{100}/Γ
VALUE (units 10^{-3})	CL% EVTS	DOCUMENT ID	TECN	COMMENT		
7.0±0.6 OUR AVERAGE						
6.9±0.3±0.7	2.2K	45 ABLIKIM	16B	BES3 $e^+e^- \rightarrow \psi(3770) \rightarrow \gamma + \text{hadrons}$		
7.3±0.7±0.6	274	BRIERE	06	CLEO $e^+e^- \rightarrow \psi(3770) \rightarrow \gamma + \text{hadrons}$		
• • • We do not use the following data for averages, fits, limits, etc. • • •						
< 44	90	39 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_{100}/Γ_{98}

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

>8	90	46 BRIERE	06	CLEO $e^+e^- \rightarrow \psi(3770)$

NODE=M053R06
 NODE=M053R06

 $\Gamma(\gamma\chi_{c0})/\Gamma(\gamma\chi_{c1})$ Γ_{100}/Γ_{99}

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

2.5 ± 0.6		46 BRIERE	06	CLEO $e^+e^- \rightarrow \psi(3770)$

NODE=M053R05
 NODE=M053R05

 $\Gamma(\gamma\eta_c)/\Gamma_{\text{total}}$ Γ_{101}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

$<7 \times 10^{-4}$	90	47 ABLIKIM	14H	BES3

NODE=M053R99
 NODE=M053R99

 $\Gamma(\gamma\eta_c(2S))/\Gamma_{\text{total}}$ Γ_{102}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

$<9 \times 10^{-4}$	90	48 ABLIKIM	14H	BES3

NODE=M053R20
 NODE=M053R20

 $\Gamma(\gamma\eta')/\Gamma_{\text{total}}$ Γ_{103}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT

<1.8	90	49 PEDLAR	09	CLE3 $\psi(2S) \rightarrow \gamma X$

NODE=M053R14
 NODE=M053R14

 $\Gamma(\gamma\eta)/\Gamma_{\text{total}}$ Γ_{104}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT

<1.5	90	49 PEDLAR	09	CLE3 $\psi(2S) \rightarrow \gamma X$

NODE=M053R13
 NODE=M053R13

 $\Gamma(\gamma\pi^0)/\Gamma_{\text{total}}$ Γ_{105}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT

<2	90	PEDLAR	09	CLE3 $\psi(2S) \rightarrow \gamma X$

NODE=M053R12
 NODE=M053R12

37 This limit is equivalent to $(0.25 \pm 0.21 \pm 0.18) \times 10^{-3}$ branching fraction value.

38 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.

39 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 $\sigma(e^+e^- \rightarrow \psi(3770))$.

40 ABLIKIM 16B reports $(1.94 \pm 0.42 \pm 0.64) \times 10^{-3}$ from a measurement of $[\Gamma(\psi(3770) \rightarrow \gamma\chi_{c1})/\Gamma_{\text{total}}] / [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$.

41 ABLIKIM 14H reports $[\Gamma(\psi(3770) \rightarrow \gamma\chi_{c1})/\Gamma_{\text{total}}] \times [B(\chi_{c1}(1P) \rightarrow K_S^0 K^\pm \pi^\mp)] = (8.51 \pm 2.39 \pm 1.42) \times 10^{-6}$ which we divide by our best value $B(\chi_{c1}(1P) \rightarrow K_S^0 K^\pm \pi^\mp) = 0.00356 \pm 0.00030$. Our first error is their experiment's error and our second error is the systematic error from using our best value. We have calculated the best value of $B(\chi_{c1}(1P) \rightarrow K_S^0 K^\pm \pi^\mp)$ as 1/2 of $B(\chi_{c1}(1P) \rightarrow \bar{K}^0 K^+ \pi^- + \text{c.c.}) = (7.1 \pm 0.6) \times 10^{-3}$.

42 Averages the two measurements from COAN 06A and BRIERE 06.

43 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.

44 Using $B(\psi(3770) \rightarrow J/\psi \pi^+ \pi^-) = (1.89 \pm 0.20 \pm 0.20) \times 10^{-3}$ from ADAM 06.

45 ABLIKIM 16B reports $(6.88 \pm 0.28 \pm 0.67) \times 10^{-3}$ from a measurement of $[\Gamma(\psi(3770) \rightarrow \gamma\chi_{c0})/\Gamma_{\text{total}}] / [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.99 \pm 0.27) \times 10^{-2}$.

46 Not independent of other results in BRIERE 06.

47 ABLIKIM 14H reports $[\Gamma(\psi(3770) \rightarrow \gamma\eta_c)/\Gamma_{\text{total}}] \times [B(\eta_c(1S) \rightarrow K_S^0 K^\pm \pi^\mp)] < 16 \times 10^{-6}$ which we divide by our best value $B(\eta_c(1S) \rightarrow K_S^0 K^\pm \pi^\mp) = 2.43 \times 10^{-2}$. We have calculated the best value of $B(\eta_c(1S) \rightarrow K_S^0 K^\pm \pi^\mp)$ as 1/3 of $B(\eta_c(1S) \rightarrow K \bar{K} \pi) = 7.3 \times 10^{-2}$.

48 ABLIKIM 14H reports $[\Gamma(\psi(3770) \rightarrow \gamma\eta_c(2S))/\Gamma_{\text{total}}] \times [B(\eta_c(2S) \rightarrow K_S^0 K^\pm \pi^\mp)] < 5.6 \times 10^{-6}$ which we divide by our best value $B(\eta_c(2S) \rightarrow K_S^0 K^\pm \pi^\mp) = 6 \times 10^{-3}$. We have calculated the best value of $B(\eta_c(2S) \rightarrow K_S^0 K^\pm \pi^\mp)$ as 1/3 of $B(\eta_c(2S) \rightarrow K \bar{K} \pi) = 1.9 \times 10^{-2}$.

49 Assuming maximal destructive interference between $\psi(3770)$ and continuum sources.

NODE=M053R03;LINKAGE=A
 NODE=M053R03;LINKAGE=BR

NODE=M053R0;LINKAGE=CO

NODE=M053R02;LINKAGE=A

NODE=M053R02;LINKAGE=AB

NODE=M053R02;LINKAGE=BI
 NODE=M053R02;LINKAGE=BR

NODE=M053R04;LINKAGE=CO
 NODE=M053R01;LINKAGE=B

NODE=M053R05;LINKAGE=BR
 NODE=M053R99;LINKAGE=AB

NODE=M053R20;LINKAGE=AB

NODE=M053R13;LINKAGE=PE

$\psi(3770)$ REFERENCES

NODE=M053

ABLIKIM	16B	PL B753 103	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=57126
ABLIKIM	15J	PR D91 092009	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=56775
DRUZHININ	15	PR D92 054024	V.P. Druzhinin	(NOVO)	REFID=56962
ABLIKIM	14H	PR D89 112005	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=55899
ABLIKIM	14L	PL B735 101	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=55903
ABLIKIM	14O	PR D90 032007	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=55906
BONVICINI	14	PR D89 072002	G. Bonvicini <i>et al.</i>	(CLEO Collab.)	REFID=55798
ABLIKIM	13Q	PR D87 112011	Ablikim M. <i>et al.</i>	(BES III Collab.)	REFID=55393
ANASHIN	12A	PL B711 292	V.V. Anashin <i>et al.</i>	(KEDR Collab.)	REFID=54055
ABLIKIM	10D	EPJ C66 11	M. Ablikim <i>et al.</i>	(BES II Collab.)	REFID=53350
BESSION	10	PRL 104 159901 (errat.)	D. Besson <i>et al.</i>	(CLEO Collab.)	REFID=53245
ABLIKIM	09C	EPJ C64 243	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=53134
PEDLAR	09	PR D79 111101	T.K. Pedlar <i>et al.</i>	(CLEO Collab.)	REFID=52998
ABLIKIM	08B	PL B659 74	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52129
ABLIKIM	08D	PL B660 315	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52142
ABLIKIM	08M	PL B670 179	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52569
ABLIKIM	08N	PL B670 184	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52570
AUBERT	08B	PR D77 011102	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52120
BRODZICKA	08	PRL 100 092001	J. Brodzicka <i>et al.</i>	(BELLE Collab.)	REFID=52144
PAKHLOVA	08	PR D77 011103	G. Pakhlova <i>et al.</i>	(BELLE Collab.)	REFID=52132
ABLIKIM	07B	PL B650 111	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51704
ABLIKIM	07E	PL B652 238	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51882
ABLIKIM	07F	PL B656 30	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51940
ABLIKIM	07I	EPJ C52 805	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52045
ABLIKIM	07K	PR D76 122002	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52073
AUBERT	07BE	PR D76 111105	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52074
DOBBS	07	PR D76 112001	S. Dobbs <i>et al.</i>	(CLEO Collab.)	REFID=52075
ABLIKIM	06L	PRL 97 121801	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51129
ABLIKIM	06N	PL B641 145	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51131
ADAM	06	PRL 96 082004	N.E. Adam <i>et al.</i>	(CLEO Collab.)	REFID=50989
ADAMS	06	PR D73 012002	G.S. Adams <i>et al.</i>	(CLEO Collab.)	REFID=50990
BESSION	06	PRL 96 092002	D. Besson <i>et al.</i>	(CLEO Collab.)	REFID=51041
Also		PRL 104 159901 (errat.)	D. Besson <i>et al.</i>	(CLEO Collab.)	REFID=53245
BRIERE	06	PR D74 031106	R.A. Briere <i>et al.</i>	(CLEO Collab.)	REFID=51149
COAN	06A	PRL 96 182002	T.E. Coan <i>et al.</i>	(CLEO Collab.)	REFID=51155
CRONIN-HEN...	06	PR D74 012005	D. Cronin-Hennessy <i>et al.</i>	(CLEO Collab.)	REFID=51156
HUANG	06A	PRL 96 032003	G.S. Huang <i>et al.</i>	(CLEO Collab.)	REFID=50999
BAI	05	PL B605 63	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=50332
HE	05	PRL 95 121801	Q. He <i>et al.</i>	(CLEO Collab.)	REFID=50924
Also		PRL 96 199903 (errat.)	Q. He <i>et al.</i>	(CLEO Collab.)	REFID=51211
ABLIKIM	04F	PR D70 077101	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50185
ATHAR	04	PR D70 112002	S.B. Athar <i>et al.</i>	(CLEO Collab.)	REFID=50331
CHISTOV	04	PRL 93 051803	R. Chistov <i>et al.</i>	(BELLE Collab.)	REFID=50002
PDG	04	PL B592 1	S. Eidelman <i>et al.</i>	(PDG Collab.)	REFID=49653
BAI	02C	PRL 88 101802	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=50506
ADLER	88C	PRL 60 89	J. Adler <i>et al.</i>	(Mark III Collab.)	REFID=40361
SCHINDLER	80	PR D21 2716	R.H. Schindler <i>et al.</i>	(Mark II Collab.)	REFID=22222
BACINO	78	PRL 40 671	W.J. Bacino <i>et al.</i>	(SLAC, UCLA, UCI)	REFID=11437
RAPIDIS	77	PRL 39 526	P.A. Rapidis <i>et al.</i>	(LGW Collab.)	REFID=22220

$\psi(3823)$
was $X(3823)$

$$I^G(J^{PC}) = ?^?(2^{--})$$

J, P need confirmation.

Seen by BHARDWAJ 13 in $B \rightarrow \chi_{c1} \gamma K$ and ABLIKIM 15S in $e^+ e^- \rightarrow \pi^+ \pi^- \gamma \chi_{c1}$ decays as a narrow peak in the invariant mass distribution of the $\chi_{c1} \gamma$ system. Properties consistent with the $\psi_2(1^3D_2)$ $c\bar{c}$ state.

NODE=M212

NODE=M212

$\psi(3823)$ MASS

NODE=M212M

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
3822.2 ± 1.2 OUR AVERAGE				
3821.7 ± 1.3 ± 0.7	19 ± 5	¹ ABLIKIM	15S BES3	$e^+ e^- \rightarrow \pi^+ \pi^- \chi_{c1} \gamma$
3823.1 ± 1.8 ± 0.7	33 ± 10	² BHARDWAJ	13 BELL	$B \rightarrow \chi_{c1} \gamma K$

NODE=M212M

¹ From a simultaneous unbinned maximum likelihood fit of $e^+ e^- \rightarrow \pi^+ \pi^- \chi_{c1} \gamma$ data (the $\pi^+ \pi^-$ recoil mass) taken at $\sqrt{s}$ values of 4.23, 4.26, 4.36, 4.42, and 4.60 GeV to simulated events including both $\psi(2S) \rightarrow \chi_{c1} \gamma$ and $\psi(3823) \rightarrow \chi_{c1} \gamma$ together, with floating mass scale offset for $\psi(2S)$, floating $\psi(3823)$ mass, and zero $\psi(3823)$ width, resulting in a significance of 5.9σ when including systematic uncertainties.

NODE=M212M;LINKAGE=B

² From a simultaneous fit to $B^\pm \rightarrow (\chi_{c1} \gamma) K^\pm$ and $B^0 \rightarrow (\chi_{c1} \gamma) K_S^0$ with significance 4.0σ including systematics. Corrected for the measured $\psi(2S)$ mass using $B \rightarrow \psi(2S) K \rightarrow (\gamma \chi_{c1}) K$ decays.

NODE=M212M;LINKAGE=A

$\psi(3823)$ WIDTH

NODE=M212W

VALUE (MeV)	CL%	DOCUMENT ID	TECN	COMMENT
<16	90	¹ ABLIKIM	15S BES3	$e^+ e^- \rightarrow \pi^+ \pi^- \chi_{c1} \gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<24	90	² BHARDWAJ	13 BELL	$B \rightarrow \chi_{c1} \gamma K$

NODE=M212W

¹ From a fit of $e^+ e^- \rightarrow \pi^+ \pi^- \chi_{c1} \gamma$ data (the $\pi^+ \pi^-$ recoil mass) taken at $\sqrt{s}$ values of 4.23, 4.26, 4.36, 4.42, and 4.60 GeV to a Breit-Wigner function with the mass fixed from the likelihood fit above, Gaussian resolution smearing, and floating width.

NODE=M212W;LINKAGE=B

² From a simultaneous fit to $B^\pm \rightarrow (\chi_{c1} \gamma) K^\pm$ and $B^0 \rightarrow (\chi_{c1} \gamma) K_S^0$ with significance 4.0σ including systematics.

NODE=M212W;LINKAGE=A

$\psi(3823)$ DECAY MODES

NODE=M212215;NODE=M212

Mode	Fraction (Γ_i/Γ)
Γ_1 $\chi_{c1} \gamma$	seen
Γ_2 $\chi_{c2} \gamma$	not seen

DESIG=1

DESIG=2

$\psi(3823)$ BRANCHING RATIOS

NODE=M212225

$\Gamma(\chi_{c1} \gamma)/\Gamma_{\text{total}}$					Γ_1/Γ
VALUE	EVTs	DOCUMENT ID	TECN	COMMENT	
seen	33 ± 10	¹ BHARDWAJ	13	BELL	$B^+ \rightarrow \chi_{c1} \gamma K^+$
¹ Reported $B(B^\pm \rightarrow \psi(3823) K^\pm) \times B(\psi(3823) \rightarrow \gamma \chi_{c1}) = (9.7 \pm 2.8 \pm 1.1) \times 10^{-6}$ with statistical significance 3.8σ .					

NODE=M212R01
NODE=M212R01

NODE=M212R01;LINKAGE=A

$\Gamma(\chi_{c2}\gamma)/\Gamma_{\text{total}}$				Γ_2/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
not seen	¹ ABLIKIM	15S	BES3	$e^+e^- \rightarrow \pi^+\pi^-\chi_{c2}\gamma$
not seen	² BHARDWAJ	13	BELL	$B^+ \rightarrow \chi_{c2}\gamma K^+$

NODE=M212R02
NODE=M212R02

¹ From a simultaneous unbinned maximum likelihood fit of $e^+ e^- \rightarrow \pi^+ \pi^- \chi_{c2} \gamma$ data (the $\pi^+ \pi^-$ recoil mass) taken at $\sqrt{s}$ values of 4.23, 4.26, 4.36, 4.42, and 4.60 GeV to simulated events including both $\psi(2S) \rightarrow \chi_{c2} \gamma$ and $\psi(3823) \rightarrow \chi_{c2} \gamma$ together, with floating mass scale offset for $\psi(2S)$, $\psi(3823)$ mass floating (fixed to that above), and zero $\psi(3823)$ width.

NODE=M212R02;LINKAGE=B

² Reported $B(B^\pm \rightarrow \psi(3823) K^\pm) \times B(\psi(3823) \rightarrow \gamma \chi_{c2}) < 3.6 \times 10^{-6}$ at 90% CL.

NODE=M212R02;LINKAGE=A

$\Gamma(\chi_{c2}\gamma)/\Gamma(\chi_{c1}\gamma)$ Γ_2/Γ_1

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.41	90	BHARDWAJ 13	BELL	$B^+ \rightarrow \chi_{c1/c2} \gamma K^+$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.42	90	¹ ABLIKIM	15S BES3	$e^+e^- \rightarrow \pi^+\pi^-\chi_{c1}\gamma$

¹ From a simultaneous unbinned maximum likelihood fit of $e^+e^- \rightarrow \pi^+\pi^-\chi_{c1(2)}\gamma$ data (the $\pi^+\pi^-$ recoil mass) taken at $\sqrt{s}$ values of 4.23, 4.26, 4.36, 4.42, and 4.60 GeV to simulated events including both $\psi(2S) \rightarrow \chi_{c1(2)}\gamma$ and $\psi(3823) \rightarrow \chi_{c1(2)}\gamma$ together, with floating mass scale offset for $\psi(2S)$, $\psi(3823)$ mass floating (fixed to that above), and zero $\psi(3823)$ width.

NODE=M212R03
NODE=M212R03

NODE=M212R03;LINKAGE=A

$\psi(3823)$ REFERENCES

ABLIKIM 15S	PRL 115 011803	M. Ablikim <i>et al.</i>	(BES III Collab.)
BHARDWAJ 13	PRL 111 032001	V. Bhardwaj <i>et al.</i>	(BELLE Collab.)

NODE=M212

REFID=56784
REFID=55412

NODE=M176

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.

NODE=M176

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 under the assumption that the $\pi^+\pi^-$ and J/ψ are in an S -wave. AAIJ 15AO extend this analysis with more data to limit D -wave contributions to $< 4\%$ at 95% CL.

See our note on "Developments in Heavy Quarkonium Spectroscopy".

X(3872) MASS FROM $J/\psi X$ MODE

NODE=M176M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
3871.69 ± 0.17 OUR AVERAGE				
3871.9 ± 0.7 ± 0.2	20 ± 5	ABLIKIM 14	BES3	$e^+e^- \rightarrow J/\psi\pi^+\pi^-\gamma$
3871.95 ± 0.48 ± 0.12	0.6k	AAIJ 12H	LHCB	$p\bar{p} \rightarrow J/\psi\pi^+\pi^- X$
3871.85 ± 0.27 ± 0.19	~ 170	¹ CHOI 11	BELL	$B \rightarrow K\pi^+\pi^- J/\psi$
3873 ± 1.8 ± 1.6	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	$300 \pi^\pm Li \rightarrow J/\psi\pi^+\pi^- X$

NODE=M176M

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.

NODE=M176M;LINKAGE=CO

NODE=M176M;LINKAGE=AC

NODE=M176M;LINKAGE=AA

NODE=M176M;LINKAGE=AB

NODE=M176M;LINKAGE=AE

⁶ Calculated from the corresponding $m_{X(3872)} - m_{\psi(2S)}$ using $m_{\psi(2S)} = 3685.96 \text{ MeV}$.

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=AU

NODE=M176M;LINKAGE=AT

NODE=M176M;LINKAGE=CH

NODE=M176M;LINKAGE=AN

NODE=M176MD0

NODE=M176MD0

$X(3872)$ MASS FROM $\bar{D}^{*0} D^0$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

$3872.9^{+0.6+0.4}_{-0.4-0.5}$	50	^{1,2} AUSHEV	10	BELL $B \rightarrow \bar{D}^{*0} D^0 K$
$3875.1^{+0.7}_{-0.5} \pm 0.5$	33 ± 6	² AUBERT	08B	BABR $B \rightarrow \bar{D}^{*0} D^0 K$
$3875.2 \pm 0.7^{+0.9}_{-1.8}$	24 ± 6	^{2,3} GOKHROO	06	BELL $B \rightarrow D^0 \bar{D}^0 \pi^0 K$

¹ Calculated from the measured $m_{X(3872)} - m_{D^{*0}} - m_{\bar{D}^0} = 1.1^{+0.6+0.1}_{-0.4-0.3} \text{ MeV}$.

² Experiments report $D^{*0} \bar{D}^0$ invariant mass above $D^{*0} \bar{D}^0$ threshold because D^{*0} decay products are kinematically constrained to the D^{*0} mass, even though the D^{*0} may decay off-shell.

³ Superseded by AUSHEV 10.

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 $p\bar{p} \rightarrow J/\psi \pi^+ \pi^- X$

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 ¹ AUBERT 05R BABR $B^+ \rightarrow K^+ J/\psi \pi^+ \pi^-$

¹ 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. • • •

<2.4	90	ABLIKIM	14	BES3	$e^+ e^- \rightarrow J/\psi \pi^+ \pi^- \gamma$
<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 ¹ CHOI	03	BELL	$B \rightarrow K \pi^+ \pi^- J/\psi$

¹ 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	¹ AUSHEV	10	BELL $B \rightarrow \bar{D}^{*0} D^0 K$
$3.0^{+1.9}_{-1.4} \pm 0.9$	33 ± 6	AUBERT	08B	BABR $B \rightarrow \bar{D}^{*0} D^0 K$

¹ 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

NODE=M176215;NODE=M176

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} $\gamma\chi_{c2}$	
Γ_{12} $\gamma J/\psi$	> 6×10^{-3}
Γ_{13} $\gamma\psi(2S)$	> 3.0 %
Γ_{14} $\pi^+\pi^-\eta_c(1S)$	not seen
Γ_{15} $\pi^+\pi^-\chi_{c1}$	not seen
Γ_{16} $p\bar{p}$	not seen

DESIG=1
 DESIG=2
 DESIG=10
 DESIG=13
 DESIG=8
 DESIG=12
 DESIG=5
 DESIG=6
 DESIG=7
 DESIG=3
 DESIG=15
 DESIG=9
 DESIG=11
 DESIG=14;OUR EVAL;→ UNCHECKED ←
 DESIG=17
 DESIG=16;OUR EVAL;→ UNCHECKED ←

C-violating decays Γ_{17} $\eta J/\psi$

NODE=M176;CLUMP=A
 DESIG=4

X(3872) PARTIAL WIDTHS

NODE=M176220

 $\Gamma(e^+e^-)$ Γ_1

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT

● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●

< 4.3	90	¹ ABLIKIM	15V BES3	4.0–4.4 $e^+e^- \rightarrow \pi^+\pi^- J/\psi$

<280	90	² YUAN	04 RVUE	$e^+e^- \rightarrow \pi^+\pi^- J/\psi$

¹ ABLIKIM 15V reports this limit from the measurement of $\Gamma(X(3872) \rightarrow \pi^+\pi^- J/\psi(1S)) \times \Gamma(X(3872) \rightarrow e^+e^-)/\Gamma < 0.13$ eV using $\Gamma(X(3872) \rightarrow \pi^+\pi^- J/\psi(1S))/\Gamma = 3\%$.

² 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=M176W1
 NODE=M176W1

NODE=M176W1;LINKAGE=B

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

< 0.13	90	ABLIKIM	15V BES3	4.0–4.4 $e^+e^- \rightarrow \pi^+\pi^- J/\psi$

● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●

< 6.2	90	^{1,2} AUBERT	05D BABR	10.6 $e^+e^- \rightarrow K^+K^-\pi^+\pi^-\gamma$

< 8.3	90	² DOBBS	05 CLE3	$e^+e^- \rightarrow \pi^+\pi^- J/\psi$

<10	90	³ YUAN	04 RVUE	$e^+e^- \rightarrow \pi^+\pi^- J/\psi$

¹ Using $B(X(3872) \rightarrow J/\psi\pi^+\pi^-) \cdot B(J/\psi \rightarrow \mu^+\mu^-) \cdot \Gamma(X(3872) \rightarrow e^+e^-) < 0.37$ eV from AUBERT 05D and $B(J/\psi \rightarrow \mu^+\mu^-) = 0.0588 \pm 0.0010$ from the PDG 04.

² Assuming X(3872) has $J^{PC} = 1^{--}$.

³ Using BAI 98E data on $e^+e^- \rightarrow \pi^+\pi^-\ell^+\ell^-$. From theoretical calculation of the production cross section and using $B(J/\psi \rightarrow \mu^+\mu^-) = (5.88 \pm 0.10)\%$.

NODE=M176G1
 NODE=M176G1

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

● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●

<12.9	90	¹ DOBBS	05 CLE3	$e^+e^- \rightarrow \pi^+\pi^- J/\psi\gamma$

¹ Assuming X(3872) has positive C parity and spin 0.

NODE=M176H1
 NODE=M176H1

NODE=M176H1;LINKAGE=DO

$$\Gamma(\omega J/\psi(1S)) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_4\Gamma_7/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

<1.7	90	¹ LEES	12AD BABR	$e^+e^- \rightarrow e^+e^- \omega J/\psi$

¹ Assuming $X(3872)$ has spin 2.

NODE=M176G01
NODE=M176G01

NODE=M176G01;LINKAGE=LE

$$\Gamma(\pi^+\pi^-\eta_c(1S)) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{14}\Gamma_7/\Gamma$$

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

$$\Gamma(\pi^+\pi^- J/\psi(1S))/\Gamma_{\text{total}} \quad \Gamma_2/\Gamma$$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

>0.026	93 ± 17	¹ AUBERT	08Y BABR	$B \rightarrow X(3872)K$

• • • We do not use the following data for averages, fits, limits, etc. • • •

seen	151	² BALA	15 BELL	$B \rightarrow X(3872)K\pi$
>0.04	30	³ AUBERT	05R BABR	$B^+ \rightarrow K^+\pi^+\pi^- J/\psi$
>0.04	36 ± 7	⁴ CHOI	03 BELL	$B^+ \rightarrow K^+\pi^+\pi^- J/\psi$

¹ 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 $B(B^+ \rightarrow X(3872)K^+) < 3.2 \times 10^{-4}$.

² BALA 15 reports $B(X(3872) \rightarrow \pi^+\pi^- J/\psi) \times B(B^0 \rightarrow X(3872)K^+\pi^-) = (7.9 \pm 1.3 \pm 0.4) \times 10^{-6}$ and $B(X(3872) \rightarrow \pi^+\pi^- J/\psi) \times B(B^+ \rightarrow X(3872)K^0\pi^+) = (10.6 \pm 3.0 \pm 0.9) \times 10^{-6}$.

³ 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 $B(B^+ \rightarrow X(3872)K^+) < 3.2 \times 10^{-4}$.

⁴ 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 $B(B^+ \rightarrow X(3872)K^+) < 3.2 \times 10^{-4}$, $B(B^+ \rightarrow \psi(2S)K^+) = (6.26 \pm 0.24) \times 10^{-4}$, $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (34.49 \pm 0.30) \times 10^{-2}$.

NODE=M176R6
NODE=M176R6

NODE=M176R6;LINKAGE=AB

NODE=M176R6;LINKAGE=A

NODE=M176R6;LINKAGE=AE

NODE=M176R6;LINKAGE=CH

$$\Gamma(\omega J/\psi(1S))/\Gamma_{\text{total}} \quad \Gamma_4/\Gamma$$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

>0.019	21 ± 7	¹ DEL-AMO-SA..10B	BABR	$B^+ \rightarrow \omega J/\psi K^+$

¹ 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
NODE=M176R14

NODE=M176R14;LINKAGE=DE

$$\Gamma(\omega J/\psi(1S))/\Gamma(\pi^+\pi^- J/\psi(1S)) \quad \Gamma_4/\Gamma_2$$

VALUE	DOCUMENT ID	TECN	COMMENT

0.8 ± 0.3	¹ DEL-AMO-SA..10B	BABR	$B \rightarrow \omega J/\psi K$

¹ 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
NODE=M176R15

NODE=M176R15;LINKAGE=DE

$$\Gamma(D^0\bar{D}^0\pi^0)/\Gamma_{\text{total}} \quad \Gamma_5/\Gamma$$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

>0.32	17 ± 5	¹ GOKHROO	06 BELL	$B^+ \rightarrow D^0\bar{D}^0\pi^0 K^+$

¹ 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
NODE=M176R12

NODE=M176R12;LINKAGE=GO

$$\Gamma(\bar{D}^{*0}D^0)/\Gamma_{\text{total}} \quad \Gamma_6/\Gamma$$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

>0.24	41 ⁺⁹ ₋₈	¹ 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	² AUBERT	08B BABR	$B^+ \rightarrow \bar{D}^{*0}D^0 K^+$

NODE=M176R13
NODE=M176R13

- ¹ 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 $B(B^+ \rightarrow X(3872) K^+) < 3.2 \times 10^{-4}$.
- ² 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 $B(B^+ \rightarrow X(3872) K^+) < 3.2 \times 10^{-4}$.

 $\Gamma(D^0 \bar{D}^0 \pi^0)/\Gamma(\pi^+ \pi^- J/\psi(1S))$ **Γ_5/Γ_2**

VALUE	DOCUMENT ID	TECN	COMMENT
seen	¹ GOKHROO 06	BELL	$B \rightarrow D^0 \bar{D}^0 \pi^0 K$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
seen	AUSHEV 10	BELL	$B \rightarrow D^0 \bar{D}^0 \pi^0 K$

¹ May not necessarily be the same state as that observed in the $J/\psi \pi^+ \pi^-$ mode. Supersedes CHISTOV 04.

NODE=M176R13;LINKAGE=AS
 NODE=M176R13;LINKAGE=AU

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
• • • We do not use the following data for averages, fits, limits, etc. • • •			
not seen	CHISTOV 04	BELL	$B \rightarrow K D^0 \bar{D}^0$

NODE=M176R3
 NODE=M176R3

 $\Gamma(D^+ D^-)/\Gamma(\pi^+ \pi^- J/\psi(1S))$ **Γ_9/Γ_2**

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
not seen	CHISTOV 04	BELL	$B \rightarrow K D^+ D^-$

NODE=M176R4
 NODE=M176R4

 $\Gamma(\gamma \chi_{c1})/\Gamma(\pi^+ \pi^- J/\psi(1S))$ **Γ_{10}/Γ_2**

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
not seen		¹ BHARDWAJ 13	BELL	$B^+ \rightarrow \chi_{c1} \gamma K^+$
<0.89	90	CHOI 03	BELL	$B \rightarrow K \pi^+ \pi^- J/\psi$

¹ Reported $B(B^\pm \rightarrow X(3872) K^\pm) \times B(X(3872) \rightarrow \gamma \chi_{c1}) < 1.9 \times 10^{-6}$ at 90% CL.

NODE=M176R1
 NODE=M176R1

NODE=M176R1;LINKAGE=A

 $\Gamma(\gamma \chi_{c2})/\Gamma(\pi^+ \pi^- J/\psi(1S))$ **Γ_{11}/Γ_2**

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	¹ BHARDWAJ 13	BELL	$B^\pm \rightarrow \chi_{c2} \gamma K^+$

¹ Reported $B(B^\pm \rightarrow X(3872) K^\pm) \times B(X(3872) \rightarrow \gamma \chi_{c2}) < 6.7 \times 10^{-6}$ at 90% CL.

NODE=M176R01
 NODE=M176R01

NODE=M176R01;LINKAGE=A

 $\Gamma(\gamma J/\psi)/\Gamma_{\text{total}}$ **Γ_{12}/Γ**

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
>6 $\times 10^{-3}$		¹ BHARDWAJ 11	BELL	$B^\pm \rightarrow \gamma J/\psi K^\pm$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
>9 $\times 10^{-3}$	20	² AUBERT 09B	BABR	$B^+ \rightarrow \gamma J/\psi K^+$
>0.010	19	³ AUBERT,BE 06M	BABR	$B^+ \rightarrow \gamma J/\psi K^+$

¹ 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 $B(B^+ \rightarrow X(3872) K^+) < 3.2 \times 10^{-4}$.

² 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 $B(B^+ \rightarrow X(3872) K^+) < 3.2 \times 10^{-4}$.

³ 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
seen	36 $\pm$ 9	¹ AAIJ 14AH	LHCB	$B^+ \rightarrow \gamma \psi(2S) K^+$
>0.030	25 $\pm$ 7	² AUBERT 09B	BABR	$B^+ \rightarrow \gamma \psi(2S) K^+$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
not seen		³ BHARDWAJ 11	BELL	$B^+ \rightarrow \gamma \psi(2S) K^+$

¹ From 36.4 ± 9.0 events of $X(3872) \rightarrow J/\psi \gamma$ decays with a statistical significance of 4.4σ .

² 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 $B(B^+ \rightarrow X(3872) K^+) < 3.2 \times 10^{-4}$.

³ BHARDWAJ 11 reports $B(B^+ \rightarrow K^+ X(3872)) \times B(X \rightarrow \gamma \psi(2S)) < 3.45 \times 10^{-6}$ at 90% CL.

NODE=M176R10
 NODE=M176R10

NODE=M176R10;LINKAGE=A

NODE=M176R10;LINKAGE=AU

NODE=M176R10;LINKAGE=BH

$\Gamma(\gamma\psi(2S))/\Gamma(\gamma J/\psi)$ Γ_{13}/Γ_{12}

VALUE	CL%	EVTS	DOCUMENT ID	TECN	COMMENT

2.6 ± 0.6 OUR AVERAGE

2.46 ± 0.64 ± 0.29	36 ± 9	¹ AAIJ	14AH LHCb	$B^+ \rightarrow \gamma\psi(2S)K^+$	

3.4 ± 1.4		AUBERT	09B BABR	$B^+ \rightarrow \gamma c\bar{c}K'$	

• • • We do not use the following data for averages, fits, limits, etc. • • •

<2.1	90	BHARDWAJ	11 BELL	$B^+ \rightarrow \gamma\psi(2S)K^+$	

¹ From 36.4 ± 9.0 events of $X(3872) \rightarrow J/\psi\gamma$ decays with a statistical significance of 4.4σ. $\Gamma(\pi^+\pi^-\chi_{c1})/\Gamma_{\text{total}}$ Γ_{15}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT

not seen ¹ BHARDWAJ 16 BELL $B^+ \rightarrow \pi^+\pi^-\chi_{c1}K^+$ ¹ BHARDWAJ 16 quotes $B(B^+ \rightarrow X(3872)K^+) \cdot B(X(3872) \rightarrow \pi^+\pi^-\chi_{c1}) < 1.5 \times 10^{-6}$ at 90% CL. $\Gamma(\rho\bar{\rho})/\Gamma(\pi^+\pi^-J/\psi(1S))$ Γ_{16}/Γ_2

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<2.0 × 10⁻³ 95 ¹ AAIJ 13S LHCb $B^+ \rightarrow \rho\bar{\rho}K^+$ ¹ AAIJ 13S reports $[\Gamma(X(3872) \rightarrow \rho\bar{\rho})/\Gamma(X(3872) \rightarrow \pi^+\pi^-J/\psi(1S))] \times [B(B^+ \rightarrow X(3872)K^+, X \rightarrow J/\psi\pi^+\pi^-)] < 1.7 \times 10^{-8}$ which we divide by our best value $B(B^+ \rightarrow X(3872)K^+, X \rightarrow J/\psi\pi^+\pi^-) = 8.6 \times 10^{-6}$.

C-violating decays

 $\Gamma(\eta J/\psi)/\Gamma(\pi^+\pi^-J/\psi(1S))$ Γ_{17}/Γ_2

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<0.4 90 ^{1,2} IWASHITA 14 BELL $B \rightarrow K\eta J/\psi$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.6 90 AUBERT 04Y BABR $B \rightarrow K\eta J/\psi$ ¹ IWASHITA 14 reports $[\Gamma(X(3872) \rightarrow \eta J/\psi)/\Gamma(X(3872) \rightarrow \pi^+\pi^-J/\psi(1S))] \times [B(B^+ \rightarrow X(3872)K^+, X \rightarrow J/\psi\pi^+\pi^-)] < 3.8 \times 10^{-6}$ which we divide by our best value $B(B^+ \rightarrow X(3872)K^+, X \rightarrow J/\psi\pi^+\pi^-) = 8.6 \times 10^{-6}$.² IWASHITA 14 also scans the $\eta J/\psi$ mass range 3.8–4.75 GeV and sets upper limits for $B(B^\pm \rightarrow X(3872)K^\pm) \times B(X(3872) \rightarrow \eta J/\psi)$ in 5 MeV intervals.

X(3872) REFERENCES

BHARDWAJ	16	PR D93 052016	V. Bhardwaj <i>et al.</i>	(BELLE Collab.)	REFID=57272
AAIJ	15AO	PR D92 011102	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=56771
ABLIKIM	15V	PL B749 414	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=56787
BALA	15	PR D91 051101	A. Bala <i>et al.</i>	(BELLE Collab.)	REFID=56408
AAIJ	14AH	NP B886 665	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=55897
ABLIKIM	14	PRL 112 092001	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=55647
IWASHITA	14	PTEP 2014 043C01	T. Iwashita <i>et al.</i>	(BELLE Collab.)	REFID=55925
AAIJ	13Q	PRL 110 222001	R. Aaij <i>et al.</i>	(LHCb Collab.) JP	REFID=54985
AAIJ	13S	EPJ C73 2462	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=55008
BHARDWAJ	13	PRL 111 032001	V. Bhardwaj <i>et al.</i>	(BELLE Collab.)	REFID=55412
AAIJ	12H	EPJ C72 1972	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=54056
LEES	12AD	PR D86 072002	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=54751
LEES	12AE	PR D86 092005	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=54752
BHARDWAJ	11	PRL 107 091803	V. Bhardwaj <i>et al.</i>	(BELLE Collab.)	REFID=53779
CHOI	11	PR D84 052004	S.-K. Choi <i>et al.</i>	(BELLE Collab.)	REFID=53934
AUSHEV	10	PR D81 031103	T. Aushev <i>et al.</i>	(BELLE Collab.)	REFID=53225
DEL-AMO-SA...	10B	PR D82 011101	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)	REFID=53362
AALTONEN	09AU	PRL 103 152001	T. Aaltonen <i>et al.</i>	(CDF Collab.)	REFID=53098
AUBERT	09B	PRL 102 132001	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52722
AUBERT	08B	PR D77 011102	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52120
AUBERT	08Y	PR D77 111101	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52265
AUBERT	06	PR D73 011101	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51017
AUBERT,BE	06M	PR D74 071101	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51454
GOKHROO	06	PRL 97 162002	G. Gokhroo <i>et al.</i>	(BELLE Collab.)	REFID=51432
AUBERT	05B	PR D71 031501	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=50498
AUBERT	05D	PR D71 052001	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=50509
AUBERT	05R	PR D71 071103	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=50627
DOBBS	05	PRL 94 032004	S. Dobbs <i>et al.</i>	(CLEO Collab.)	REFID=50458
ABAZOV	04F	PRL 93 162002	V.M. Abazov <i>et al.</i>	(D0 Collab.)	REFID=50200
ACOSTA	04	PRL 93 072001	D. Acosta <i>et al.</i>	(CDF Collab.)	REFID=49742
AUBERT	04Y	PRL 93 041801	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=49997
CHISTOV	04	PRL 93 051803	R. Chistov <i>et al.</i>	(BELLE Collab.)	REFID=50002
PDG	04	PL B592 1	S. Eidelman <i>et al.</i>	(PDG Collab.)	REFID=49653
YUAN	04	PL B579 74	C.Z. Yuan <i>et al.</i>		REFID=49677
CHOI	03	PRL 91 262001	S.-K. Choi <i>et al.</i>	(BELLE Collab.)	REFID=49628
BAI	98E	PR D57 3854	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=46339
ANTONIAZZI	94	PR D50 4258	L. Antoniazzi <i>et al.</i>	(E705 Collab.)	REFID=44074

NODE=M176R11
NODE=M176R11

NODE=M176R11;LINKAGE=A

NODE=M176R00
NODE=M176R00

NODE=M176R00;LINKAGE=A

NODE=M176R02
NODE=M176R02

NODE=M176R02;LINKAGE=A

NODE=M176405

NODE=M176R2
NODE=M176R2

NODE=M176R2;LINKAGE=A

NODE=M176R2;LINKAGE=C

NODE=M176

X(3900)

$$J^{PC} = 1^+(1^+ -)$$

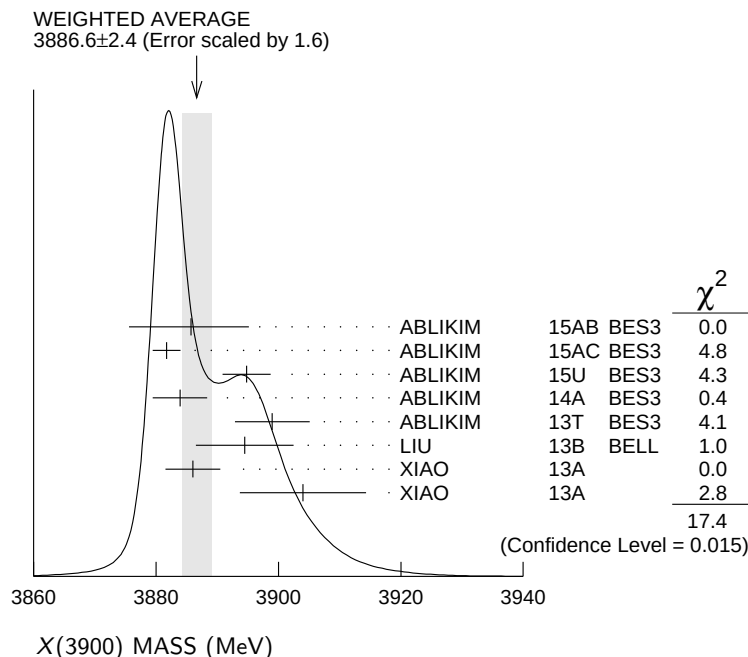
Charged X(3900) seen as a peak in the invariant mass distribution of the $J/\psi \pi^\pm$ system by BES III (ABLIKIM 13T) in $e^+e^- \rightarrow \pi^+\pi^- J/\psi$ at c.m. energy of 4.26 GeV and by radiative return from e^+e^- collisions at $\sqrt{s}$ from 9.46 to 10.86 GeV at Belle (LIU 13B). Angular analysis of ABLIKIM 14A and ABLIKIM 15AC favor the $J^P = 1^+$ assignment. Neutral X(3900) seen in the $J/\psi \pi^0$ invariant mass distribution in $e^+e^- \rightarrow \pi^0 \pi^0 J/\psi$ at c.m. energies of 4.23, 4.26, and 4.36 GeV by BES III (ABLIKIM 15U) and at 4.17 GeV by XIAO 13A. Peaks in $(D\bar{D}^*)^{0,\pm}$ reported by BES III (ABLIKIM 14A, ABLIKIM 15AB) are assumed to be related.

X(3900) MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
3886.6 ± 2.4 OUR AVERAGE		Error includes scale factor of 1.6. See the ideogram below.			
3885.7 ^{+4.3} _{-5.7} ± 8.4		¹ ABLIKIM 15AB	BES3	0	$e^+e^- \rightarrow \pi^0(D\bar{D}^*)^0$
3881.7 ± 1.6 ± 1.6	1248	¹ ABLIKIM 15AC	BES3	±	$e^+e^- \rightarrow \pi^\pm(D\bar{D}^*)^\mp$
3894.8 ± 2.3 ± 3.2	356	¹ ABLIKIM 15U	BES3	0	$e^+e^- \rightarrow \pi^0 \pi^0 J/\psi$
3883.9 ± 1.5 ± 4.2	1212	¹ ABLIKIM 14A	BES3	±	$e^+e^- \rightarrow \pi^\pm(D\bar{D}^*)^\mp$
3899.0 ± 3.6 ± 4.9	307	¹ ABLIKIM 13T	BES3	±	$e^+e^- \rightarrow \pi^+\pi^- J/\psi$
3894.5 ± 6.6 ± 4.5	159	¹ LIU 13B	BELL	±	$e^+e^- \rightarrow \gamma \pi^+\pi^- J/\psi$
3886 ± 4 ± 2	81	^{1,2} XIAO 13A		±	4.17 $e^+e^- \rightarrow \pi^+\pi^- J/\psi$
3904 ± 9 ± 5	25	^{1,2} XIAO 13A		0	4.17 $e^+e^- \rightarrow \pi^0 \pi^0 J/\psi$

¹ Neglecting interference between the X(3900) and non-resonant continuum.

² For $M^2(\pi^+\pi^-) < 0.65 \text{ GeV}^2$. Obtained by analyzing CLEO-c data but not authored by the CLEO Collaboration.

**X(3900) WIDTH**

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
28.1 ± 2.6 OUR AVERAGE					
35 ⁺¹¹ ₋₁₂ ± 15		¹ ABLIKIM 15AB	BES3	0	$e^+e^- \rightarrow \pi^0(D\bar{D}^*)^0$
26.6 ± 2.0 ± 2.1	1248	¹ ABLIKIM 15AC	BES3	±	$e^+e^- \rightarrow \pi^\pm(D\bar{D}^*)^\mp$

29.6 ± 8.2 ± 8.2	356	¹ ABLIKIM	15U	BES3	0	$e^+e^- \rightarrow \pi^0\pi^0 J/\psi$
24.8 ± 3.3 ± 11.0	1212	¹ ABLIKIM	14A	BES3	±	$e^+e^- \rightarrow \pi^\pm (D\bar{D}^*)^\mp$
46 ± 10 ± 20	307	¹ ABLIKIM	13T	BES3	±	$e^+e^- \rightarrow \pi^+\pi^- J/\psi$
63 ± 24 ± 26	159	¹ LIU	13B	BELL	±	$e^+e^- \rightarrow \gamma\pi^+\pi^- J/\psi$
37 ± 4 ± 8	81	^{1,2} XIAO	13A		±	$4.17 e^+e^- \rightarrow \pi^+\pi^- J/\psi$

¹ Neglecting interference between the $X(3900)$ and non-resonant continuum.

² For $M^2(\pi^+\pi^-) < 0.65 \text{ GeV}^2$. Obtained by analyzing CLEO-c data but not authored by the CLEO Collaboration.

NODE=M210W;LINKAGE=A

NODE=M210W;LINKAGE=B

$X(3900)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $J/\psi\pi$	seen
Γ_2 $h_c\pi^\pm$	not seen
Γ_3 $\eta_c\pi^+\pi^-$	not seen
Γ_4 $(D\bar{D}^*)^\pm$	seen
Γ_5 $D^0 D^{*-} + \text{c.c.}$	seen
Γ_6 $D^- D^{*0} + \text{c.c.}$	seen
Γ_7 $\omega\pi^\pm$	not seen
Γ_8 $J/\psi\eta$	not seen
Γ_9 $D^+ D^{*-} + \text{c.c.}$	seen
Γ_{10} $D^0 \bar{D}^{*0} + \text{c.c.}$	seen

NODE=M210215;NODE=M210

DESIG=1

DESIG=2

DESIG=10

DESIG=3;OUR EVAL;→ UNCHECKED ←

DESIG=8

DESIG=9

DESIG=4

DESIG=5

DESIG=6

DESIG=7

$X(3900)$ BRANCHING RATIOS

$\Gamma(J/\psi\pi)/\Gamma_{\text{total}}$						Γ_1/Γ	
VALUE	CL%	EVTS	DOCUMENT ID	TECN	CHG	COMMENT	
seen		356	ABLIKIM	15U	BES3	0	$e^+e^- \rightarrow \pi^0\pi^0 J/\psi$
seen		307	ABLIKIM	13T	BES3	$\pm$	$e^+e^- \rightarrow \pi^+\pi^- J/\psi$
seen		25	¹ XIAO	13A		0	$4.17 e^+e^- \rightarrow \pi^0\pi^0 J/\psi$

NODE=M210225

NODE=M210R01

NODE=M210R01

• • • We do not use the following data for averages, fits, limits, etc. • • •

not seen 90 ² ADOLPH 15D COMP ± $\gamma N \rightarrow J/\psi\pi^\pm N$

¹ Obtained by analyzing CLEO-c data but not authored by the CLEO Collaboration.

² ADOLPH 15D measure $B(X(3900)^\pm \rightarrow J/\psi\pi^\pm) \sigma(\gamma N \rightarrow X(3900)^\pm N) / \sigma(\gamma N \rightarrow J/\psi N) < 3.7 \times 10^{-3}$ at 90% CL.

NODE=M210R01;LINKAGE=XI

NODE=M210R01;LINKAGE=A

$\Gamma(h_c\pi^\pm)/\Gamma_{\text{total}}$	Γ_2/Γ				
<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>CHG</u>	<u>COMMENT</u>	
not seen	ABLIKIM	13X	BES3	$\pm$	$e^+e^- \rightarrow h_c\pi^+\pi^-$

NODE=M210R02

NODE=M210R02

$\Gamma(\eta_c \pi^+ \pi^-)/\Gamma_{\text{total}}$					Γ_3/Γ
VALUE	DOCUMENT ID	TECN	CHG	COMMENT	
not seen	¹ VINOKUROVA 15	BELL	0	$B^+ \rightarrow K^+ \eta_c \pi^+ \pi^-$	

NODE=M210R11

NODE=M210R11

¹ VINOKUROVA 15 reports $B(B^+ \rightarrow K^+ X(3900)^0) \times B(X \rightarrow \eta_c\pi^+\pi^-) < 4.7 \times 10^{-5}$ at 90% CL.

NODE=M210R11;LINKAGE=VI

$\Gamma((D\bar{D}^*)^\pm)/\Gamma(J/\psi\pi)$	Γ_4/Γ_1				
VALUE	DOCUMENT ID	TECN	CHG	COMMENT	
6.2±1.1±2.7	¹ ABLIKIM	14A	BES3	±	$e^+e^- \rightarrow \pi^\pm (D\bar{D}^*)^\mp$

NODE=M210R03

NODE=M210R03

¹ Assuming the same origin of the $(D\bar{D}^*)^\pm$ and $\pi^\pm J/\psi$ decay modes.

NODE=M210R03;LINKAGE=A

$\Gamma(D^0 D^{*-} + \text{c.c.})/\Gamma_{\text{total}}$						Γ_5/Γ
VALUE	DOCUMENT ID	TECN	CHG	COMMENT		
seen	ABLIKIM	15AC	BES3	±	$e^+ e^- \rightarrow \pi^+ D^0 D^{*-} + \text{c.c.}$	
seen	ABLIKIM	14A	BES3	±	$e^+ e^- \rightarrow \pi^+ D^0 D^{*-} + \text{c.c.}$	

NODE=M210R09

NODE=M210R09

$\Gamma(D^- D^{*0} + \text{c.c.})/\Gamma_{\text{total}}$						Γ_6/Γ
VALUE	DOCUMENT ID	TECN	CHG	COMMENT		
seen	ABLIKIM	15AC	BES3	$\pm$	$e^+ e^- \rightarrow \pi^+ D^- D^{*0} + \text{c.c.}$	
seen	ABLIKIM	14A	BES3	$\pm$	$e^+ e^- \rightarrow \pi^+ D^- D^{*0} + \text{c.c.}$	

NODE=M210R10

NODE=M210R10

$\Gamma(\omega\pi^\pm)/\Gamma_{\text{total}}$					Γ_7/Γ	
VALUE	DOCUMENT ID	TECN	CHG	COMMENT		NODE=M210R00 NODE=M210R00
not seen	ABLIKIM	15R	BES3	$\pm e^+e^- \rightarrow \omega\pi^+\pi^-$		
$\Gamma(J/\psi\eta)/\Gamma_{\text{total}}$					Γ_8/Γ	
VALUE	DOCUMENT ID	TECN	CHG	COMMENT		NODE=M210R04 NODE=M210R04
not seen	ABLIKIM	15Q	BES3	0 $4.0\text{--}4.6 e^+e^- \rightarrow J/\psi\eta\pi^0$		
$\Gamma(J/\psi\eta)/\Gamma(J/\psi\pi)$					Γ_8/Γ_1	
VALUE	CL%	DOCUMENT ID	TECN	CHG	COMMENT	NODE=M210R05 NODE=M210R05
<0.15	90	ABLIKIM	15Q	BES3	0 $4.226 e^+e^- \rightarrow J/\psi\eta\pi^0$	
• • • We do not use the following data for averages, fits, limits, etc. • • •						
<0.65	90	ABLIKIM	15Q	BES3	0 $4.257 e^+e^- \rightarrow J/\psi\eta\pi^0$	OCCUR=2
$\Gamma(D^+D^{*-} + c.c.)/\Gamma_{\text{total}}$					Γ_9/Γ	
VALUE	DOCUMENT ID	TECN	CHG	COMMENT		NODE=M210R06 NODE=M210R06
seen	ABLIKIM	15AB	BES3	0 $e^+e^- \rightarrow \pi^0(D\bar{D}^*)^0$		
$\Gamma(D^0\bar{D}^{*0} + c.c.)/\Gamma_{\text{total}}$					Γ_{10}/Γ	
VALUE	DOCUMENT ID	TECN	CHG	COMMENT		NODE=M210R07 NODE=M210R07
seen	ABLIKIM	15AB	BES3	0 $e^+e^- \rightarrow \pi^0(D\bar{D}^*)^0$		
$\Gamma(D^+D^{*-} + c.c.)/\Gamma(D^0\bar{D}^{*0} + c.c.)$					Γ_9/Γ_{10}	
VALUE	DOCUMENT ID	TECN	CHG	COMMENT		NODE=M210R08 NODE=M210R08
0.96±0.18±0.12	ABLIKIM	15AB	BES3	0 $e^+e^- \rightarrow \pi^0(D\bar{D}^*)^0$		

X(3900) REFERENCES

ABLIKIM	15AB	PRL 115 222002	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=56954
ABLIKIM	15AC	PR D92 092006	M. Ablikim <i>et al.</i>	(BES III Collab.) JP	REFID=56967
ABLIKIM	15Q	PR D92 012008	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=56782
ABLIKIM	15R	PR D92 032009	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=56783
ABLIKIM	15U	PRL 115 112003	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=56786
ADOLPH	15D	PL B742 330	C. Adolph <i>et al.</i>	(COMPASS Collab.)	REFID=56791
VINOKUROVA	15	JHEP 1506 132	A. Vinokurova <i>et al.</i>	(BELLE Collab.)	REFID=56706
ABLIKIM	14A	PRL 112 022001	M. Ablikim <i>et al.</i>	(BES III Collab.) JP	REFID=55648
ABLIKIM	13T	PRL 110 252001	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=55409
ABLIKIM	13X	PRL 111 242001	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=55635
LIU	13B	PRL 110 252002	Z.Q. Liu <i>et al.</i>	(BELLE Collab.)	REFID=55410
XIAO	13A	PL B727 366	T. Xiao <i>et al.</i>	(NWES)	REFID=55593

NODE=M159

X(3915)
was $\chi_{c0}(3915)$

$$I^G(J^{PC}) = 0^+(0 \text{ or } 2^{++})$$

The experimental analysis prefers $J^{PC} = 0^{++}$. However, a re-analysis presented in ZHOU 15C shows that if helicity-2 dominance assumption is abandoned and a sizable helicity-0 component is allowed, a $J^{PC} = 2^{++}$ assignment is possible.

NODE=M159

X(3915) MASS

NODE=M159M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT	NODE=M159M
3918.4± 1.9 OUR AVERAGE					
3919.4± 2.2± 1.6	59 ± 10	LEES	12AD BABR	$e^+e^- \rightarrow e^+e^- \omega J/\psi$	
3919.1 ⁺ _{− 3.4} ± 3.8 ± 2.0		DEL-AMO-SA..10B	BABR	$B \rightarrow \omega J/\psi K$	
3915 ± 3 ± 2	49 ± 15	UEHARA	10 BELL	$10.6 e^+e^- \rightarrow e^+e^- \omega J/\psi$	
3943 ±11 ±13	58 ± 11	¹ CHOI	05 BELL	$B \rightarrow \omega J/\psi K$	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
3914.6 ⁺ _{− 3.4} ± 3.8 ± 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.

X(3915) WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
20 ± 5 OUR AVERAGE	Error includes scale factor of 1.1.			
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=M159M;LINKAGE=CH

NODE=M159W

NODE=M159W

NODE=M159W;LINKAGE=CH

NODE=M159215;NODE=M159

X(3915) DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $\omega J/\psi$	seen
Γ_2 $\bar{D}^{*0} D^0$	
Γ_3 $\pi^+ \pi^- \eta_c(1S)$	not seen
Γ_4 $\eta_c \eta$	not seen
Γ_5 $\eta_c \pi^0$	not seen
Γ_6 $K \bar{K}$	not seen
Γ_7 $\gamma \gamma$	seen

DESIG=1;OUR EST;→ UNCHECKED ←
DESIG=3
DESIG=4;OUR EVAL;→ UNCHECKED ←
DESIG=6
DESIG=7
DESIG=5;OUR EVAL;→ UNCHECKED ←
DESIG=2

X(3915) $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT	$\Gamma_1 \Gamma_7 / \Gamma$
54 ± 9 OUR 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=M159220

NODE=M159G01
NODE=M159G01

OCCUR=2

NODE=M159G01;LINKAGE=UH
NODE=M159G01;LINKAGE=UR

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT	$\Gamma_3 \Gamma_7 / \Gamma$
<16	90	LEES	12AE BABR	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^- \eta_c$	

NODE=M159G02
NODE=M159G02

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT	$\Gamma_6 \Gamma_7 / \Gamma$
<1.96	90	UEHARA	13 BELL	$\gamma \gamma \rightarrow K_S^0 K_S^0$	

NODE=M159G03
NODE=M159G03

X(3915) BRANCHING RATIOS

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_1 / Γ
seen	⁵ DEL-AMO-SA...10B	BABR	$B \rightarrow \omega J/\psi K$	
seen	⁶ CHOI	05 BELL	$B \rightarrow \omega J/\psi K$	

NODE=M159225

NODE=M159R03
NODE=M159R03

⁵ DEL-AMO-SANCHEZ 10B reports $B(B^\pm \rightarrow X(3915)K^\pm) \times B(X(3915) \rightarrow J/\psi \omega) = (3.0_{-0.6}^{+0.7+0.5}) \times 10^{-5}$ and $B(B^0 \rightarrow X(3915)K^0) \times B(X(3915) \rightarrow J/\psi \omega) = (2.1 \pm 0.9 \pm 0.3) \times 10^{-5}$.

NODE=M159R03;LINKAGE=DE

⁶ CHOI 05 reports $B(B \rightarrow X(3915)K) \times B(X(3915) \rightarrow J/\psi \omega) = (7.1 \pm 1.3 \pm 3.1) \times 10^{-5}$.

NODE=M159R03;LINKAGE=CH

VALUE	CL%	DOCUMENT ID	TECN	COMMENT	Γ_1 / Γ_2
>0.71	90	⁷ AUSHEV	10 BELL	$B \rightarrow \bar{D}^{*0} D^0 K$	

NODE=M159R02
NODE=M159R02

⁷ By combining the upper limit $B(B \rightarrow X(3915)K) \times B(X(3915) \rightarrow \bar{D}^{*0} D^0) < 0.67 \times 10^{-4}$ from AUSHEV 10 with the average of CHOI 05 and AUBERT 08W measurements $B(B \rightarrow X(3915)K) \times B(X(3915) \rightarrow \omega J/\psi) = (0.51 \pm 0.11) \times 10^{-4}$.

NODE=M159R02;LINKAGE=AU

$\Gamma(\eta_c \eta)/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	⁸ VINOKUROVA 15	BELL	$B^+ \rightarrow K^+ \eta_c \eta$
⁸ VINOKUROVA 15 reports $B(B^+ \rightarrow K^+ X(3915)^0) \times B(X \rightarrow \eta_c \eta) < 3.3 \times 10^{-5}$ at 90% CL.			

NODE=M159R00
 NODE=M159R00

NODE=M159R00;LINKAGE=VI

 $\Gamma(\eta_c \pi^0)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	⁹ VINOKUROVA 15	BELL	$B^+ \rightarrow K^+ \eta_c \pi^0$
⁹ VINOKUROVA 15 reports $B(B^+ \rightarrow K^+ X(3915)^0) \times B(X \rightarrow \eta_c \pi^0) < 1.8 \times 10^{-5}$ at 90% CL.			

NODE=M159R04
 NODE=M159R04

NODE=M159R04;LINKAGE=VI

 $\Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
seen	59 ± 10	LEES	12AD BABR	$e^+ e^- \rightarrow e^+ e^- \omega J/\psi$
seen		UEHARA	10 BELL	10.6 $e^+ e^- \rightarrow e^+ e^- \omega J/\psi$

NODE=M159R01
 NODE=M159R01

X(3915) REFERENCES

VINOKUROVA 15	JHEP 1506 132	A. Vinokurova <i>et al.</i>	(BELLE Collab.)
ZHOU 15C	PRL 115 022001	Z.-Y. Zhou, Z. Xiao, H.-Q. Zhou	(BEIJT, NANJ)
UEHARA 13	PTEP 2013 123C01	S. Uehara <i>et al.</i>	(BELLE Collab.)
LEES 12AD	PR D86 072002	J.P. Lees <i>et al.</i>	(BABAR Collab.)
LEES 12AE	PR D86 092005	J.P. Lees <i>et al.</i>	(BABAR Collab.)
AUSHEV 10	PR D81 031103	T. Aushev <i>et al.</i>	(BELLE Collab.)
DEL-AMO-SA... 10B	PR D82 011101	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)
UEHARA 10	PRL 104 092001	S. Uehara <i>et al.</i>	(BELLE Collab.)
AUBERT 08W	PRL 101 082001	B. Aubert <i>et al.</i>	(BABAR Collab.)
CHOI 05	PRL 94 182002	S.-K. Choi <i>et al.</i>	(BELLE Collab.)

NODE=M159

REFID=56706
 REFID=56842
 REFID=55592
 REFID=54751
 REFID=54752
 REFID=53225
 REFID=53362
 REFID=53232
 REFID=52263
 REFID=50737

 $\chi_{c2}(2P)$

$$I^G(J^{PC}) = 0^+(2^{++})$$

NODE=M050

 $\chi_{c2}(2P)$ 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 $e^+ e^- \rightarrow e^+ e^- D\bar{D}$

NODE=M050M

NODE=M050M

 $\chi_{c2}(2P)$ 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 $e^+ e^- \rightarrow e^+ e^- D\bar{D}$

NODE=M050W

NODE=M050W

 $\chi_{c2}(2P)$ 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
Γ_8 $K\bar{K}$	not seen

NODE=M050215;NODE=M050

DESIG=1;OUR EVAL;→ UNCHECKED ←
 DESIG=5

DESIG=6

DESIG=2;OUR EVAL;→ UNCHECKED ←
 DESIG=3;OUR EVAL;→ UNCHECKED ←

DESIG=4;OUR EVAL;→ UNCHECKED ←

DESIG=7;OUR EVAL;→ UNCHECKED ←

DESIG=8;OUR EVAL;→ UNCHECKED ←

 $\chi_{c2}(2P)$ PARTIAL WIDTHS

———— $\chi_{c2}(2P) \Gamma(i) \Gamma(\gamma\gamma)/\Gamma(\text{total})$ ————

 $\Gamma(K\bar{K}\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_2 \Gamma_1/\Gamma$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<2.1	90	DEL-AMO-SA...11M	BABR	$\gamma\gamma \rightarrow K_S^0 K^\pm \pi^\mp$

NODE=M050220

NODE=M050222

NODE=M050G01
 NODE=M050G01

$$\Gamma(K^+ K^- \pi^+ \pi^- \pi^0) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_3 \Gamma_1 / \Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<3.4	90	DEL-AMO-SA..11M	BABR	$\gamma\gamma \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$

NODE=M050G02
NODE=M050G02

$$\Gamma(D\bar{D}) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_4 \Gamma_1 / \Gamma$$

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
0.21±0.04 OUR AVERAGE				
0.24±0.05±0.04	76 ± 17	AUBERT	10G BABR	10.6 $e^+ e^- \rightarrow e^+ e^- D\bar{D}$
0.18±0.05±0.03	64	¹ UEHARA	06 BELL	10.6 $e^+ e^- \rightarrow e^+ e^- D\bar{D}$

NODE=M050G1
NODE=M050G1

¹ Assuming $B(D^+ D^-) = 0.89 B(D^0 \bar{D}^0)$.

NODE=M050G1;LINKAGE=UE

$$\Gamma(\pi^+ \pi^- \eta_c(1S)) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_7 \Gamma_1 / \Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<18	90	LEES	12AE BABR	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^- \eta_c$

NODE=M050G03
NODE=M050G03

$$\Gamma(K\bar{K}) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_8 \Gamma_1 / \Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<0.256	90	UEHARA	13 BELL	$\gamma\gamma \rightarrow K_S^0 K_S^0$

NODE=M050G04
NODE=M050G04

$\chi_{c2}(2P)$ BRANCHING RATIOS

NODE=M050225

$$\Gamma(D^+ D^-)/\Gamma(D^0 \bar{D}^0) \quad \Gamma_5/\Gamma_6$$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.74±0.43±0.16	64	UEHARA	06 BELL	10.6 $e^+ e^- \rightarrow e^+ e^- D\bar{D}$

NODE=M050R01
NODE=M050R01

$\chi_{c2}(2P)$ REFERENCES

NODE=M050

UEHARA	13	PTEP 2013 123C01	S. Uehara <i>et al.</i>	(BELLE Collab.)
LEES	12AE	PR D86 092005	J.P. Lees <i>et al.</i>	(BABAR Collab.)
DEL-AMO-SA... 11M	PR D84 012004	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)	
AUBERT	10G	PR D81 092003	B. Aubert <i>et al.</i>	(BABAR Collab.)
UEHARA	06	PRL 96 082003	S. Uehara <i>et al.</i>	(BELLE Collab.)

REFID=55592
REFID=54752
REFID=16751
REFID=53357
REFID=51039

X(3940)

$$I^G(J^{PC}) = ?^?(??)$$

NODE=M029

OMITTED FROM SUMMARY TABLE

Reported by ABE 07, observed in $e^+ e^- \rightarrow J/\psi X$.

NODE=M029

X(3940) MASS

NODE=M029M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
3942⁺⁷₋₆ ± 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

NODE=M029215;NODE=M029

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

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 $e^+e^- \rightarrow J/\psi X$

³For X(3940) decaying to final states with more than two tracks.

⁴PAKHLOV 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 $e^+e^- \rightarrow J/\psi X$

⁵For X(3940) decaying to final states with more than two tracks.

⁶PAKHLOV 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 $e^+e^- \rightarrow J/\psi X$

⁷For X(3940) decaying to final states with more than two tracks.

⁸PAKHLOV 08 finds that the inclusive peak near 3940 MeV/c² may consist of several states.

 NODE=M029R03
 NODE=M029R03

 NODE=M029R03;LINKAGE=AB
 NODE=M029R03;LINKAGE=AE
X(3940) REFERENCES

PAKHLOV	08	PRL 100 202001	P. Pakhlov <i>et al.</i>	(BELLE Collab.)
ABE	07	PRL 98 082001	K. Abe <i>et al.</i>	(BELLE Collab.)

NODE=M029

 REFID=52302
 REFID=51627

NODE=M213

X(4020)

$$I(J^P) = 1(?)^?$$

Charged X(4020) seen by ABLIKIM 13X from $e^+e^- \rightarrow \pi^+\pi^-h_c(1P)$ at c.m. energy from 3.90 to 4.42 GeV as a peak in the invariant mass distribution of the $\pi^\pm h_c(1P)$ system, and by ABLIKIM 14B from $e^+e^- \rightarrow (D^*\bar{D}^*)^\pm\pi^\mp$ events in $(D^*\bar{D}^*)^\pm$ mass. A neutral X(4020) seen by ABLIKIM 14P at three c.m. energies in the same range in $e^+e^- \rightarrow \pi^0\pi^0h_c(1P)$ as a peak in the larger of the two masses recoiling against a π^0 . ABLIKIM 15AA observes a 5.9 σ signal in $(D^*\bar{D}^*)^0$ in $e^+e^- \rightarrow (D^*\bar{D}^*)^0\pi^0$ events using collisions at two c.m. energies. Production rates and mass values support grouping neutral and charged X(4020) together as manifestations of a single $I = 1$ particle.

NODE=M213

X(4020) MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

4024.1 ± 1.9 OUR AVERAGE

4025.5 ^{+2.0} _{-4.7} ± 3.1	116	¹ ABLIKIM	15AA	BES3	0 $e^+e^- \rightarrow (D^*\bar{D}^*)^0\pi^0$
4026.3 ± 2.6 ± 3.7	401	¹ ABLIKIM	14B	BES3	± $e^+e^- \rightarrow (D^*\bar{D}^*)^\pm\pi^\mp$
4023.9 ± 2.2 ± 3.8	61	^{1,2} ABLIKIM	14P	BES3	0 $e^+e^- \rightarrow \pi^0\pi^0h_c$
4022.9 ± 0.8 ± 2.7	253	¹ ABLIKIM	13X	BES3	± $e^+e^- \rightarrow \pi^+\pi^-h_c$

¹Neglecting interference between the X(4020) and non-resonant continuum.

²Assuming $J^P = 1^+$ and width of 7.9 ± 2.6 MeV.

NODE=M213M

NODE=M213M

 NODE=M213M;LINKAGE=AB
 NODE=M213M;LINKAGE=B
X(4020) WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

13 ± 5 OUR AVERAGE

23.0 ± 6.0 ± 1.0	116	¹ ABLIKIM	15AA	BES3	0 $e^+e^- \rightarrow (D^*\bar{D}^*)^0\pi^0$
24.8 ± 5.6 ± 7.7	401	¹ ABLIKIM	14B	BES3	± $e^+e^- \rightarrow (D^*\bar{D}^*)^\pm\pi^\mp$
7.9 ± 2.7 ± 2.6	253	¹ ABLIKIM	13X	BES3	± $e^+e^- \rightarrow \pi^+\pi^-h_c$

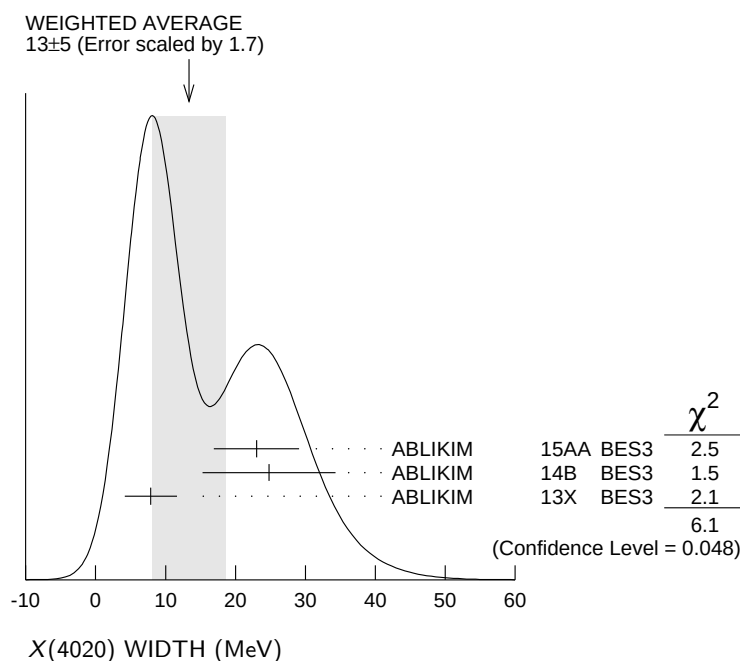
Error includes scale factor of 1.7. See the ideogram below.

NODE=M213W

NODE=M213W

¹ Neglecting interference between the $X(4020)$ and non-resonant continuum.

NODE=M213W;LINKAGE=AB



$X(4020)$ DECAY MODES

NODE=M213215;NODE=M213

Mode	Fraction (Γ_i/Γ)
Γ_1 $h_c(1P)\pi$	seen
Γ_2 $D^*\bar{D}^*$	seen
Γ_3 $D\bar{D}^* + \text{c.c.}$	not seen
Γ_4 $\eta_c\pi^+\pi^-$	not seen

DESIG=1

DESIG=2

DESIG=4

DESIG=3

$X(4020)$ BRANCHING RATIOS

NODE=M213225

$\Gamma(h_c(1P)\pi)/\Gamma_{\text{total}}$						Γ_1/Γ
VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT	
seen	61	ABLIKIM	14P BES3	0	$e^+e^- \rightarrow \pi^0\pi^0 h_c$	
seen	253	ABLIKIM	13X BES3	$\pm$	$e^+e^- \rightarrow \pi^+\pi^- h_c$	

NODE=M213R01
NODE=M213R01

$\Gamma(D^*\bar{D}^*)/\Gamma_{\text{total}}$						Γ_2/Γ
VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT	
seen	116	¹ ABLIKIM	15AA BES3	0	$e^+e^- \rightarrow (D^*\bar{D}^*)^0\pi^0$	
seen	401	¹ ABLIKIM	14B BES3	$\pm$	$e^+e^- \rightarrow (D^*\bar{D}^*)^\pm\pi^\mp$	

NODE=M213R02
NODE=M213R02

¹ Neglecting interference between the $X(4020)$ and non-resonant continuum.

NODE=M213R02;LINKAGE=A

$\Gamma(D\bar{D}^* + \text{c.c.})/\Gamma_{\text{total}}$						Γ_3/Γ
VALUE	DOCUMENT ID	TECN	CHG	COMMENT		
not seen	ABLIKIM	15AC	BES3	$\pm$	$e^+e^- \rightarrow \pi^\pm(D\bar{D}^*)^\mp$	

NODE=M213R03
NODE=M213R03

$\Gamma(\eta_c \pi^+ \pi^-)/\Gamma_{\text{total}}$				Γ_4/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
not seen	¹ VINOKUROVA 15	BELL	$B^+ \rightarrow K^+ \eta_c \pi^+ \pi^-$	

NODE=M213R00
NODE=M213R00

¹ VINOKUROVA 15 reports $B(B^+ \rightarrow K^+X(4020)^0) \times B(X \rightarrow \eta_c\pi^+\pi^-) < 1.6 \times 10^{-5}$ at 90% CL.

NODE=M213R00;LINKAGE=VI

$X(4020)$ REFERENCES

NODE=M213

ABLIKIM	15AA	PRL 115 182002	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=56951
ABLIKIM	15AC	PR D92 092006	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=56967
VINOKUROVA	15	JHEP 1506 132	A. Vinokurova <i>et al.</i>	(BELLE Collab.)	REFID=56706
ABLIKIM	14B	PRL 112 132001	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=55654
ABLIKIM	14P	PRL 113 212002	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=56118
ABLIKIM	13X	PRL 111 242001	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=55635

$\psi(4040)$

$$J^{PC} = 0^{-}(1^{-}-)$$

NODE=M072

 $\psi(4040)$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
4039 ± 1 OUR ESTIMATE			
4039.6 ± 4.3	¹ ABLIKIM	08D BES2	$e^+e^- \rightarrow \text{hadrons}$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
4034 ± 6	² MO	10 RVUE	$e^+e^- \rightarrow \text{hadrons}$
4037 ± 2	³ SETH	05A RVUE	$e^+e^- \rightarrow \text{hadrons}$
4040 ± 1	⁴ SETH	05A RVUE	$e^+e^- \rightarrow \text{hadrons}$
4040 ± 10	BRANDELIK	78C DASP	e^+e^-
¹ Reanalysis of data presented in BAI 02C. From a global fit over the center-of-mass energy region 3.7–5.0 GeV covering the $\psi(3770)$, $\psi(4040)$, $\psi(4160)$, and $\psi(4415)$ resonances. Phase angle fixed in the fit to $\delta = (130 \pm 46)^\circ$.			
² Reanalysis of data presented in BAI 00 and BAI 02C. From a global fit over the center-of-mass energy 3.8–4.8 GeV covering the $\psi(4040)$, $\psi(4160)$ and $\psi(4415)$ resonances and including interference effects.			
³ From a fit to Crystal Ball (OSTERHELD 86) data.			
⁴ From a fit to BES (BAI 02C) data.			

NODE=M072M

NODE=M072M
→ UNCHECKED ←

OCCUR=2

NODE=M072M;LINKAGE=AB

NODE=M072M;LINKAGE=MO

NODE=M072M;LINKAGE=ST
NODE=M072M;LINKAGE=SE **$\psi(4040)$ WIDTH**

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
80 ± 10 OUR ESTIMATE			
84.5 ± 12.3	⁵ ABLIKIM	08D BES2	$e^+e^- \rightarrow \text{hadrons}$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
87 ± 11	⁶ MO	10 RVUE	$e^+e^- \rightarrow \text{hadrons}$
85 ± 10	⁷ SETH	05A RVUE	$e^+e^- \rightarrow \text{hadrons}$
89 ± 6	⁸ SETH	05A RVUE	$e^+e^- \rightarrow \text{hadrons}$
52 ± 10	BRANDELIK	78C DASP	e^+e^-
⁵ Reanalysis of data presented in BAI 02C. From a global fit over the center-of-mass energy region 3.7–5.0 GeV covering the $\psi(3770)$, $\psi(4040)$, $\psi(4160)$, and $\psi(4415)$ resonances. Phase angle fixed in the fit to $\delta = (130 \pm 46)^\circ$.			
⁶ Reanalysis of data presented in BAI 00 and BAI 02C. From a global fit over the center-of-mass energy 3.8–4.8 GeV covering the $\psi(4040)$, $\psi(4160)$ and $\psi(4415)$ resonances and including interference effects.			
⁷ From a fit to Crystal Ball (OSTERHELD 86) data.			
⁸ From a fit to BES (BAI 02C) data.			

NODE=M072W

NODE=M072W
→ UNCHECKED ←

OCCUR=2

NODE=M072W;LINKAGE=AB

NODE=M072W;LINKAGE=MO

NODE=M072W;LINKAGE=ST
NODE=M072W;LINKAGE=SE **$\psi(4040)$ DECAY MODES**

Due to the complexity of the $c\bar{c}$ threshold region, in this listing, “seen” (“not seen”) means that a cross section for the mode in question has been measured at effective $\sqrt{s}$ near this particle’s central mass value, more (less) than 2σ above zero, without regard to any peaking behavior in $\sqrt{s}$ or absence thereof. See mode listing(s) for details and references.

NODE=M072215;NODE=M072

NODE=M072

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 e^+e^-	$(1.07 \pm 0.16) \times 10^{-5}$	DESIG=5
Γ_2 $D\bar{D}$	seen	DESIG=17;OUR EST;→ UNCHECKED ←
Γ_3 $D^0\bar{D}^0$	seen	DESIG=1
Γ_4 D^+D^-	seen	DESIG=18
Γ_5 $D^*\bar{D} + \text{c.c.}$	seen	DESIG=19;OUR EST;→ UNCHECKED ←
Γ_6 $D^*(2007)^0\bar{D}^0 + \text{c.c.}$	seen	DESIG=2
Γ_7 $D^*(2010)^+D^- + \text{c.c.}$	seen	DESIG=20
Γ_8 $D^*\bar{D}^*$	seen	DESIG=21;OUR EST;→ UNCHECKED ←
Γ_9 $D^*(2007)^0\bar{D}^*(2007)^0$	seen	DESIG=3
Γ_{10} $D^*(2010)^+D^*(2010)^-$	seen	DESIG=22
Γ_{11} $D\bar{D}\pi$ (excl. $D^*\bar{D}$)		DESIG=23
Γ_{12} $D^0D^-\pi^+ + \text{c.c.}$ (excl. $D^*(2007)^0\bar{D}^0 + \text{c.c.}$, $D^*(2010)^+D^- + \text{c.c.}$)	not seen	DESIG=24
Γ_{13} $D\bar{D}^*\pi$ (excl. $D^*\bar{D}^*$)	not seen	DESIG=25

Γ_{14}	$D^0 \bar{D}^{*-} \pi^+ + \text{c.c. (excl. } D^{*+}(2010) D^{*-}(2010) \text{)}$	seen			DESIG=26
Γ_{15}	$D_s^+ D_s^-$	seen			DESIG=27
Γ_{16}	$J/\psi(1S) \text{ hadrons}$				DESIG=4
Γ_{17}	$J/\psi \pi^+ \pi^-$	< 4	$\times 10^{-3}$	90%	DESIG=7
Γ_{18}	$J/\psi \pi^0 \pi^0$	< 2	$\times 10^{-3}$	90%	DESIG=8
Γ_{19}	$J/\psi \eta$	$(5.2 \pm 0.7) \times 10^{-3}$			DESIG=9
Γ_{20}	$J/\psi \pi^0$	< 2.8	$\times 10^{-4}$	90%	DESIG=10
Γ_{21}	$J/\psi \pi^+ \pi^- \pi^0$	< 2	$\times 10^{-3}$	90%	DESIG=11
Γ_{22}	$\chi_{c1} \gamma$	< 3.4	$\times 10^{-3}$	90%	DESIG=12
Γ_{23}	$\chi_{c2} \gamma$	< 5	$\times 10^{-3}$	90%	DESIG=13
Γ_{24}	$\chi_{c1} \pi^+ \pi^- \pi^0$	< 1.1	%	90%	DESIG=14
Γ_{25}	$\chi_{c2} \pi^+ \pi^- \pi^0$	< 3.2	%	90%	DESIG=15
Γ_{26}	$h_c(1P) \pi^+ \pi^-$	< 3	$\times 10^{-3}$	90%	DESIG=28
Γ_{27}	$\phi \pi^+ \pi^-$	< 3	$\times 10^{-3}$	90%	DESIG=16
Γ_{28}	$\Lambda \bar{\Lambda} \pi^+ \pi^-$	< 2.9	$\times 10^{-4}$	90%	DESIG=29
Γ_{29}	$\Lambda \bar{\Lambda} \pi^0$	< 9	$\times 10^{-5}$	90%	DESIG=30
Γ_{30}	$\Lambda \bar{\Lambda} \eta$	< 3.0	$\times 10^{-4}$	90%	DESIG=31
Γ_{31}	$\Sigma^+ \bar{\Sigma}^-$	< 1.3	$\times 10^{-4}$	90%	DESIG=32
Γ_{32}	$\Sigma^0 \bar{\Sigma}^0$	< 7	$\times 10^{-5}$	90%	DESIG=33
Γ_{33}	$\Xi^+ \bar{\Xi}^-$	< 1.6	$\times 10^{-4}$	90%	DESIG=34
Γ_{34}	$\Xi^0 \bar{\Xi}^0$	< 1.8	$\times 10^{-4}$	90%	DESIG=35
Γ_{35}	$\mu^+ \mu^-$				DESIG=6

$\psi(4040)$ PARTIAL WIDTHS

$\Gamma(e^+ e^-)$

VALUE (keV)

0.86 ± 0.07 OUR ESTIMATE

0.83 ± 0.20

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.6 to 1.4

0.88 ± 0.11

0.91 ± 0.13

0.75 ± 0.15

⁹ ABLIKIM 08D BES2 $e^+ e^- \rightarrow \text{hadrons}$

¹⁰ MO 10 RVUE $e^+ e^- \rightarrow \text{hadrons}$

¹¹ SETH 05A RVUE $e^+ e^- \rightarrow \text{hadrons}$

¹² SETH 05A RVUE $e^+ e^- \rightarrow \text{hadrons}$

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.

$\psi(4040) \Gamma(i) \times \Gamma(e^+ e^-) / \Gamma(\text{total})$

$\Gamma(\chi_{c1} \gamma) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$

VALUE (eV)

CL%

DOCUMENT ID

TECN

COMMENT

< 2.9

90

¹³ HAN

15

BELL

$10.58 e^+ e^- \rightarrow \chi_{c1} \gamma$

¹³ Using $B(\eta \rightarrow \gamma \gamma) = (39.41 \pm 0.21)\%$.

$\Gamma(\chi_{c2} \gamma) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$

VALUE (eV)

CL%

DOCUMENT ID

TECN

COMMENT

< 4.6

90

¹⁴ HAN

15

BELL

$10.58 e^+ e^- \rightarrow \chi_{c2} \gamma$

¹⁴ Using $B(\eta \rightarrow \gamma \gamma) = (39.41 \pm 0.21)\%$.

Γ_1

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

NODE=M072235

NODE=M072G01

NODE=M072G01

NODE=M072G01;LINKAGE=A

NODE=M072G02

NODE=M072G02

NODE=M072G02;LINKAGE=A

$\psi(4040) \Gamma(i) \times \Gamma(e^+ e^-) / \Gamma^2(\text{total})$

NODE=M072230

 $\Gamma(J/\psi\eta) / \Gamma_{\text{total}} \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{19} / \Gamma \times \Gamma_1 / \Gamma$ NODE=M072R25
NODE=M072R25

VALUE (units 10^{-8})	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

$5.1 \pm 1.4 \pm 1.5$	¹⁵ WANG	13B	BELL $e^+ e^- \rightarrow J/\psi \eta \gamma$
$12.8 \pm 2.1 \pm 1.9$	¹⁶ WANG	13B	BELL $e^+ e^- \rightarrow J/\psi \eta \gamma$

OCCUR=2

¹⁵ Solution I of two equivalent solutions in a fit using two interfering resonances. Mass and width fixed at 4039 MeV and 80 MeV, respectively.

NODE=M072R25;LINKAGE=A

¹⁶ Solution II of two equivalent solutions in a fit using two interfering resonances. Mass and width fixed at 4039 MeV and 80 MeV, respectively.

NODE=M072R25;LINKAGE=B

 $\psi(4040) \text{ BRANCHING RATIOS}$

NODE=M072225

 $\Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_1 / \Gamma$ NODE=M072R4
NODE=M072R4

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 $e^+ e^-$

 $\Gamma(D^0 \bar{D}^0) / \Gamma_{\text{total}} \quad \Gamma_3 / \Gamma$ NODE=M072R14
NODE=M072R14

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 $e^+ e^- \rightarrow D^0 \bar{D}^0 \gamma$

 $\Gamma(D^+ D^-) / \Gamma_{\text{total}} \quad \Gamma_4 / \Gamma$ NODE=M072R15
NODE=M072R15

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 $e^+ e^- \rightarrow D^+ D^- \gamma$

 $\Gamma(D \bar{D}) / \Gamma(D^* \bar{D} + \text{c.c.}) \quad \Gamma_2 / \Gamma_5$ NODE=M072R12
NODE=M072R12

VALUE	DOCUMENT ID	TECN	COMMENT

$0.24 \pm 0.05 \pm 0.12$	AUBERT	09M	BABR $e^+ e^- \rightarrow \gamma D^{(*)} \bar{D}$

 $\Gamma(D^0 \bar{D}^0) / \Gamma(D^*(2007)^0 \bar{D}^0 + \text{c.c.}) \quad \Gamma_3 / \Gamma_6$ NODE=M072R1
NODE=M072R1

VALUE	DOCUMENT ID	TECN	COMMENT

0.05 ± 0.03	¹⁷ GOLDBABER	77	MRK1 $e^+ e^-$

¹⁷ Phase-space factor (p^3) explicitly removed.

NODE=M072R;LINKAGE=P

 $\Gamma(D^*(2007)^0 \bar{D}^0 + \text{c.c.}) / \Gamma_{\text{total}} \quad \Gamma_6 / \Gamma$ NODE=M072R16
NODE=M072R16

VALUE	DOCUMENT ID	TECN	COMMENT

seen	AUBERT	09M	BABR $e^+ e^- \rightarrow D^{*0} \bar{D}^0 \gamma$
seen	CRONIN-HEN..09	CLEO	$e^+ e^- \rightarrow D^{*0} \bar{D}^0$

 $\Gamma(D^*(2010)^+ D^- + \text{c.c.}) / \Gamma_{\text{total}} \quad \Gamma_7 / \Gamma$ NODE=M072R17
NODE=M072R17

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 $e^+ e^- \rightarrow D^{*+} D^- \gamma$

 $\Gamma(D^*(2010)^+ D^- + \text{c.c.}) / \Gamma(D^*(2007)^0 \bar{D}^0 + \text{c.c.}) \quad \Gamma_7 / \Gamma_6$ NODE=M072R11
NODE=M072R11

VALUE	DOCUMENT ID	TECN	COMMENT

$0.95 \pm 0.09 \pm 0.10$	AUBERT	09M	BABR $e^+ e^- \rightarrow \gamma D^* \bar{D}$

 $\Gamma(D^* \bar{D}^*) / \Gamma(D^* \bar{D} + \text{c.c.}) \quad \Gamma_8 / \Gamma_5$ NODE=M072R13
NODE=M072R13

VALUE	DOCUMENT ID	TECN	COMMENT

$0.18 \pm 0.14 \pm 0.03$	AUBERT	09M	BABR $e^+ e^- \rightarrow \gamma D^{(*)} \bar{D}^{(*)}$

 $\Gamma(D^*(2007)^0 \bar{D}^*(2007)^0) / \Gamma_{\text{total}} \quad \Gamma_9 / \Gamma$ NODE=M072R18
NODE=M072R18

VALUE	DOCUMENT ID	TECN	COMMENT

seen	AUBERT	09M	BABR $e^+ e^- \rightarrow D^{*0} \bar{D}^{*0} \gamma$
seen	CRONIN-HEN..09	CLEO	$e^+ e^- \rightarrow D^{*0} \bar{D}^{*0}$

$$\Gamma(D^*(2007)^0 \bar{D}^*(2007)^0) / \Gamma(D^*(2007)^0 \bar{D}^0 + \text{c.c.}) \quad \Gamma_9 / \Gamma_6$$

VALUE	DOCUMENT ID	TECN	COMMENT
32.0 ± 12.0	¹⁸ GOLDHABER 77	MRK1	$e^+ e^-$

¹⁸ Phase-space factor (p^3) explicitly removed.

NODE=M072R2
NODE=M072R2

NODE=M072R2;LINKAGE=P

$$\Gamma(D^*(2010)^+ D^*(2010)^-) / \Gamma_{\text{total}} \quad \Gamma_{10} / \Gamma$$

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=M072R19
NODE=M072R19

$$\Gamma(D^0 D^- \pi^+ + \text{c.c. (excl. } D^*(2007)^0 \bar{D}^0 + \text{c.c., } D^*(2010)^+ D^- + \text{c.c.})) / \Gamma_{\text{total}} \quad \Gamma_{12} / \Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	PAKHLOVA 08A	BELL	$e^+ e^- \rightarrow D^0 D^- \pi^+ \gamma$

NODE=M072R20
NODE=M072R20

$$\Gamma(D \bar{D}^* \pi (\text{excl. } D^* \bar{D}^*)) / \Gamma_{\text{total}} \quad \Gamma_{13} / \Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	CRONIN-HEN..09	CLEO	$e^+ e^- \rightarrow D \bar{D}^* \pi$

NODE=M072R21
NODE=M072R21

$$\Gamma(D^0 \bar{D}^{*-} \pi^+ + \text{c.c. (excl. } D^*(2010)^+ D^*(2010)^-) / \Gamma_{\text{total}} \quad \Gamma_{14} / \Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
seen	PAKHLOVA 09	BELL	$e^+ e^- \rightarrow D^0 D^{*-} \pi^+ \gamma$

NODE=M072R22
NODE=M072R22

$$\Gamma(D_s^+ D_s^-) / \Gamma_{\text{total}} \quad \Gamma_{15} / \Gamma$$

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=M072R23
NODE=M072R23

$$\Gamma(J/\psi \pi^+ \pi^-) / \Gamma_{\text{total}} \quad \Gamma_{17} / \Gamma$$

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<4	90	COAN 06	CLEO	$3.97-4.06 e^+ e^- \rightarrow \text{hadrons}$

NODE=M072R01
NODE=M072R01

$$\Gamma(J/\psi \pi^0 \pi^0) / \Gamma_{\text{total}} \quad \Gamma_{18} / \Gamma$$

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<2	90	COAN 06	CLEO	$3.97-4.06 e^+ e^- \rightarrow \text{hadrons}$

NODE=M072R02
NODE=M072R02

$$\Gamma(J/\psi \eta) / \Gamma_{\text{total}} \quad \Gamma_{19} / \Gamma$$

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
5.2 ± 0.5 ± 0.5		¹⁹ ABLIKIM 12K	BES3	$e^+ e^- \rightarrow \ell^+ \ell^- 2\gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<7 90 COAN 06 CLEO $3.97-4.06 e^+ e^- \rightarrow \text{hadrons}$

¹⁹ ABLIKIM 12K measure $\sigma(e^+ e^- \rightarrow J/\psi \eta) = 32.1 \pm 2.8 \pm 1.3$ pb. They assume the $\eta J/\psi$ fully originates from $\psi(4040)$ decays.

NODE=M072R03
NODE=M072R03

NODE=M072R03;LINKAGE=AB

$$\Gamma(J/\psi \pi^0) / \Gamma_{\text{total}} \quad \Gamma_{20} / \Gamma$$

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<0.28	90	²⁰ ABLIKIM 12K	BES3	$e^+ e^- \rightarrow \ell^+ \ell^- 2\gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<2 90 COAN 06 CLEO $3.97-4.06 e^+ e^- \rightarrow \text{hadrons}$

²⁰ ABLIKIM 12K measure $\sigma(e^+ e^- \rightarrow J/\psi \pi^0) < 1.6$ pb. They assume the $\eta J/\psi$ fully originates from $\psi(4040)$ decays.

NODE=M072R04
NODE=M072R04

NODE=M072R04;LINKAGE=AB

$$\Gamma(J/\psi \pi^+ \pi^- \pi^0) / \Gamma_{\text{total}} \quad \Gamma_{21} / \Gamma$$

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<2	90	COAN 06	CLEO	$3.97-4.06 e^+ e^- \rightarrow \text{hadrons}$

NODE=M072R05
NODE=M072R05

$$\Gamma(\chi_{c1} \gamma) / \Gamma_{\text{total}} \quad \Gamma_{22} / \Gamma$$

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

<11 90 COAN 06 CLEO $3.97-4.06 e^+ e^- \rightarrow \text{hadrons}$

NODE=M072R06
NODE=M072R06

$\Gamma(\chi_{c2}\gamma)/\Gamma_{\text{total}}$ Γ_{23}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

<17	90	COAN	06	CLEO	$3.97\text{--}4.06\ e^+e^- \rightarrow \text{hadrons}$

NODE=M072R07
NODE=M072R07

 $\Gamma(\chi_{c1}\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{24}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT

<11	90	COAN	06	CLEO	$3.97\text{--}4.06\ e^+e^- \rightarrow \text{hadrons}$

NODE=M072R08
NODE=M072R08

 $\Gamma(\chi_{c2}\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{25}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT

<32	90	COAN	06	CLEO	$3.97\text{--}4.06\ e^+e^- \rightarrow \text{hadrons}$

NODE=M072R09
NODE=M072R09

 $\Gamma(h_c(1P)\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{26}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT

<3	90	²¹ PEDLAR	11	CLEO	$e^+e^- \rightarrow h_c(1P)\pi^+\pi^-$

NODE=M072R24
NODE=M072R24

²¹ From several values of $\sqrt{s}$ near the peak of the $\psi(4040)$, PEDLAR 11 measures $\sigma(e^+e^- \rightarrow h_c(1P)\pi^+\pi^-) = 1.0 \pm 8.0 \pm 5.4 \pm 0.2\text{ pb}$, 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

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT

<3	90	COAN	06	CLEO	$3.97\text{--}4.06\ e^+e^- \rightarrow \text{hadrons}$

NODE=M072R10
NODE=M072R10

 $\Gamma(\Lambda\bar{\Lambda}\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{28}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT

<2.9	90	²² ABLIKIM	13Q	BES3	$e^+e^- \rightarrow \psi(4040)$

NODE=M072R26
NODE=M072R26

²² Assuming that interference effects between resonance and continuum can be neglected.

NODE=M072R26;LINKAGE=A

 $\Gamma(\Lambda\bar{\Lambda}\pi^0)/\Gamma_{\text{total}}$ Γ_{29}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT

<0.9	90	²³ ABLIKIM	13Q	BES3	$e^+e^- \rightarrow \psi(4040)$

NODE=M072R27
NODE=M072R27

²³ Assuming that interference effects between resonance and continuum can be neglected.

NODE=M072R27;LINKAGE=A

 $\Gamma(\Lambda\bar{\Lambda}\eta)/\Gamma_{\text{total}}$ Γ_{30}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT

<3.0	90	²⁴ ABLIKIM	13Q	BES3	$e^+e^- \rightarrow \psi(4040)$

NODE=M072R28
NODE=M072R28

²⁴ Assuming that interference effects between resonance and continuum can be neglected.

NODE=M072R28;LINKAGE=A

 $\Gamma(\Sigma^+\bar{\Sigma}^-)/\Gamma_{\text{total}}$ Γ_{31}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT

<1.3	90	²⁵ ABLIKIM	13Q	BES3	$e^+e^- \rightarrow \psi(4040)$

NODE=M072R29
NODE=M072R29

²⁵ Assuming that interference effects between resonance and continuum can be neglected.

NODE=M072R29;LINKAGE=A

 $\Gamma(\Sigma^0\bar{\Sigma}^0)/\Gamma_{\text{total}}$ Γ_{32}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT

<0.7	90	²⁶ ABLIKIM	13Q	BES3	$e^+e^- \rightarrow \psi(4040)$

NODE=M072R30
NODE=M072R30

²⁶ Assuming that interference effects between resonance and continuum can be neglected.

NODE=M072R30;LINKAGE=A

 $\Gamma(\Xi^+\bar{\Xi}^-)/\Gamma_{\text{total}}$ Γ_{33}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT

<1.6	90	²⁷ ABLIKIM	13Q	BES3	$e^+e^- \rightarrow \psi(4040)$

NODE=M072R31
NODE=M072R31

²⁷ Assuming that interference effects between resonance and continuum can be neglected.

NODE=M072R31;LINKAGE=A

 $\Gamma(\Xi^0\bar{\Xi}^0)/\Gamma_{\text{total}}$ Γ_{34}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT

<1.8	90	²⁸ ABLIKIM	13Q	BES3	$e^+e^- \rightarrow \psi(4040)$

NODE=M072R32
NODE=M072R32

²⁸ Assuming that interference effects between resonance and continuum can be neglected.

NODE=M072R32;LINKAGE=A

$\psi(4040)$ REFERENCES

HAN	15	PR D92 012011	Y.L. Han <i>et al.</i>	(BELLE Collab.)
ABLIKIM	13Q	PR D87 112011	Ablikim M. <i>et al.</i>	(BES III Collab.)
WANG	13B	PR D87 051101	X.L. Wang <i>et al.</i>	(BELLE Collab.)
ABLIKIM	12K	PR D86 071101	M. Ablikim <i>et al.</i>	(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.)

NODE=M072

REFID=56816
REFID=55393
REFID=55377
REFID=54738
REFID=53638
REFID=16787
REFID=53532
REFID=53540
REFID=52724
REFID=53114
REFID=53143
REFID=52142
REFID=52132
REFID=52134
REFID=51628
REFID=51075
REFID=50813
REFID=50506
REFID=50503
REFID=51064
REFID=22232
REFID=22114
REFID=22062
REFID=11434

 $X(4050)^\pm$

$$I(J^P) = ?(??)$$

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=M191

NODE=M191

 $X(4050)^\pm$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$4051 \pm 14^{+20}_{-41}$	¹ MIZUK	08	BELL $\bar{B}^0 \rightarrow K^- \pi^+ \chi_{c1}(1P)$

¹ From a Dalitz plot analysis with two Breit-Wigner amplitudes.

NODE=M191M

NODE=M191M

NODE=M191M;LINKAGE=MI

 $X(4050)^\pm$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
82^{+21+47}_{-17-22}	¹ MIZUK	08	BELL $\bar{B}^0 \rightarrow K^- \pi^+ \chi_{c1}(1P)$

¹ From a Dalitz plot analysis with two Breit-Wigner amplitudes.

NODE=M191W

NODE=M191W

NODE=M191W;LINKAGE=MI

 $X(4050)^\pm$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \pi^+ \chi_{c1}(1P)$	seen

NODE=M191215;NODE=M191

DESIG=1

 $X(4050)^\pm$ BRANCHING RATIOS

$\Gamma(\pi^+\chi_{c1}(1P))/\Gamma_{\text{total}}$	Γ_1/Γ			
VALUE	DOCUMENT ID	TECN	COMMENT	
seen	¹ MIZUK	08	BELL	$\bar{B}^0 \rightarrow K^- \pi^+ \chi_{c1}(1P)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
not seen	² LEES	12B	BABR	$B \rightarrow K \pi \chi_{c1}(1P)$

¹ With a product branching fraction measurement of $B(\bar{B}^0 \rightarrow K^- X(4050)^+) \times B(X(4050)^+ \rightarrow \pi^+ \chi_{c1}(1P)) = (3.0^{+1.5+3.7}_{-0.8-1.6}) \times 10^{-5}$.

² With a product branching fraction limit of $B(\bar{B}^0 \rightarrow X(4050)^+ K^-) \times B(X(4050)^+ \rightarrow \chi_{c1} \pi^+) < 1.8 \times 10^{-5}$ at 90% CL.

NODE=M191225

NODE=M191R01
NODE=M191R01

NODE=M191R01;LINKAGE=MI

NODE=M191R01;LINKAGE=LE

 $X(4050)^\pm$ REFERENCES

LEES	12B	PR D85 052003	J.P. Lees <i>et al.</i>	(BABAR Collab.)
MIZUK	08	PR D78 072004	R. Mizuk <i>et al.</i>	(BELLE Collab.)

NODE=M191

REFID=54042
REFID=52535

$X(4055)^\pm$

$$I(J^P) = ?(?)$$

OMITTED FROM SUMMARY TABLE

Needs confirmation. Seen by WANG 15A in the $\psi(2S)\pi^+$ invariant mass distribution in $X(4360) \rightarrow \psi(2S)\pi^+\pi^-$ decay.

NODE=M223

NODE=M223

 $X(4055)^\pm$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$4054 \pm 3 \pm 1$	¹ WANG	15A BELL	$10.58 e^+ e^- \rightarrow \gamma \pi^+ \pi^- \psi(2S)$

¹ Statistical significance of 3.5 σ .

NODE=M223M

NODE=M223M

NODE=M223M;LINKAGE=A

 $X(4055)^\pm$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$45 \pm 11 \pm 6$	¹ WANG	15A BELL	$10.58 e^+ e^- \rightarrow \gamma \pi^+ \pi^- \psi(2S)$

¹ Statistical significance of 3.5 σ .

NODE=M223W

NODE=M223W

NODE=M223W;LINKAGE=A

 $X(4055)^\pm$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \pi^+ \psi(2S)$	seen

NODE=M223215;NODE=M223

DESIG=1

 $X(4055)^\pm$ BRANCHING RATIOS

$\Gamma(\pi^+\psi(2S))/\Gamma_{\text{total}}$	Γ_1/Γ		
VALUE	DOCUMENT ID	TECN	COMMENT
seen	¹ WANG	15A BELL	$10.58\ e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$

¹ Statistical significance of 3.5 σ .

NODE=M223225

NODE=M223R01
NODE=M223R01

NODE=M223R01;LINKAGE=A

 $X(4055)^\pm$ REFERENCES

WANG 15A PR D91 112007 X.L. Wang et al. (BELLE Collab.)

NODE=M223

REFID=56839

NODE=M193

 $X(4140)$

$$I^G(J^{PC}) = 0^+(1^{++})$$

Seen by AALTONEN 09AH, ABAZOV 14A, CHATRCHYAN 14M, AAIJ 17C in $B^+ \rightarrow X K^+$, $X \rightarrow J/\psi \phi$, and by ABAZOV 15M separately in both prompt (4.7 σ) and non-prompt (5.6 σ) production in $p\bar{p} \rightarrow J/\psi \phi + \text{anything}$. Not seen by SHEN 10 in $\gamma\gamma \rightarrow J/\psi \phi$ and ABLIKIM 15 in $e^+ e^- \rightarrow \gamma J/\psi \phi$ at $\sqrt{s} = 4.23, 4.26, 4.36$ GeV.

NODE=M193

 $X(4140)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
4146.8 ± 2.5 OUR AVERAGE		Error includes scale factor of 1.1. [4146.9 $\pm$ 3.1 MeV OUR 2016 AVERAGE Scale factor = 1.3]		
$4146.5 \pm 4.5^{+4.6}_{-2.8}$	4289	¹ AAIJ	17C LHCB	$B^+ \rightarrow J/\psi \phi K^+$
$4152.5 \pm 1.7^{+6.2}_{-5.4}$	616	² ABAZOV	15M D0	$p\bar{p} \rightarrow J/\psi \phi + \text{anything}$
$4159.0 \pm 4.3 \pm 6.6$	52	³ ABAZOV	14A D0	$B^+ \rightarrow J/\psi \phi K^+$
$4148.0 \pm 2.4 \pm 6.3$	0.3k	⁴ CHATRCHYAN 14M	CMS	$B^+ \rightarrow J/\psi \phi K^+$
$4143.0 \pm 2.9 \pm 1.2$	14	⁵ AALTONEN	09AH CDF	$B^+ \rightarrow J/\psi \phi K^+$

NODE=M193M

NODE=M193M

NEW

- ¹ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 8.4σ .
- ² Statistical significance of more than 6σ .
- ³ Statistical significance of 3.1σ .
- ⁴ From a fit assuming an S -wave relativistic Breit-Wigner shape above a three-body phase-space non-resonant component with statistical significance of more than 5σ .
- ⁵ Statistical significance of 3.8σ .

NODE=M193M;LINKAGE=D
 NODE=M193M;LINKAGE=C
 NODE=M193M;LINKAGE=A
 NODE=M193M;LINKAGE=B

NODE=M193M;LINKAGE=AA

NODE=M193W

NODE=M193W

NEW

X(4140) WIDTH

VALUE (MeV) EVTS DOCUMENT ID TECN COMMENT

19 $\pm$ 8 $\pm$ 7 OUR AVERAGE Error includes scale factor of 1.4. See the ideogram below.

[15 $\pm$ 6 $\pm$ 5 MeV OUR 2016 AVERAGE]

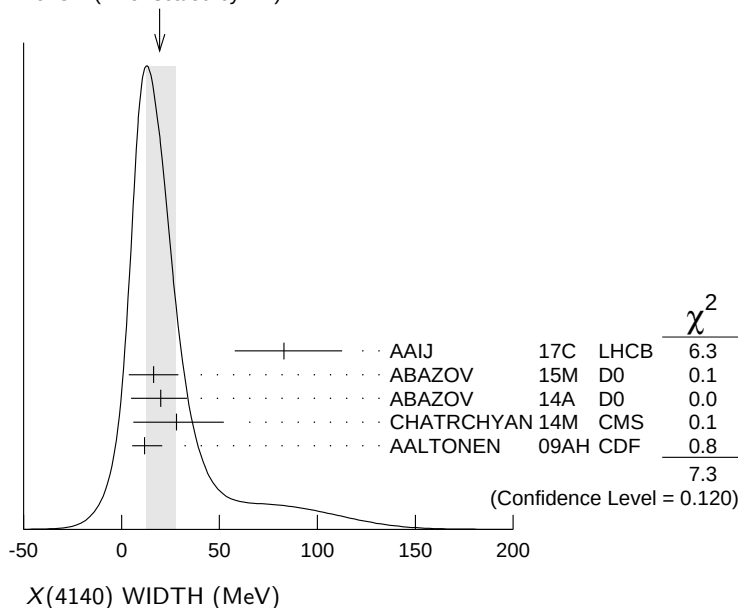
83 $\pm$ 21 $\pm$ 21 -14	4289	¹ AAIJ	17C LHCb	$B^+ \rightarrow J/\psi \phi K^+$
16.3 $\pm$ 5.6 $\pm$ 11.4	616	² ABAZOV	15M D0	$p\bar{p} \rightarrow J/\psi \phi + \text{anything}$
20 $\pm$ 13 $\pm$ 3 -8	52	³ ABAZOV	14A D0	$B^+ \rightarrow J/\psi \phi K^+$
28 $\pm$ 15 $\pm$ 19 -11	0.3k	⁴ CHATRCHYAN	14M CMS	$B^+ \rightarrow J/\psi \phi K^+$
11.7 $\pm$ 8.3 $\pm$ 3.7 -5.0	14	⁵ AALTONEN	09AH CDF	$B^+ \rightarrow J/\psi \phi K^+$

- ¹ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 8.4σ .
- ² Statistical significance of more than 6σ .
- ³ Statistical significance of 3.1σ .
- ⁴ From a fit assuming an S -wave relativistic Breit-Wigner shape above a three-body phase-space non-resonant component with statistical significance of more than 5σ .
- ⁵ Statistical significance of 3.8σ .

NODE=M193W;LINKAGE=D
 NODE=M193W;LINKAGE=C
 NODE=M193W;LINKAGE=A
 NODE=M193W;LINKAGE=B

NODE=M193W;LINKAGE=AA

WEIGHTED AVERAGE
 19 $\pm$ 8-7 (Error scaled by 1.4)



X(4140) DECAY MODES

NODE=M193215;NODE=M193

Mode	Fraction (Γ_i/Γ)
Γ_1 $J/\psi \phi$	seen
Γ_2 $\gamma\gamma$	not seen

DESIG=1

DESIG=2

X(4140) $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

NODE=M193220

$\Gamma(\gamma\gamma) \times \Gamma(J/\psi \phi)/\Gamma_{\text{total}}$ $\Gamma_2\Gamma_1/\Gamma$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<41	90	¹ SHEN	10 BELL	$10.6 e^+ e^- \rightarrow e^+ e^- J/\psi \phi$

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 6	90	² SHEN	10 BELL	$10.6 e^+ e^- \rightarrow e^+ e^- J/\psi \phi$

- ¹ For $J^P = 0^+$.
- ² For $J^P = 2^+$.

NODE=M193G01
 NODE=M193G01

OCCUR=2

NODE=M193G01;LINKAGE=S0
 NODE=M193G01;LINKAGE=S2

X(4140) BRANCHING RATIOS $\Gamma(J/\psi\phi)/\Gamma_{\text{total}}$ Γ_1/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
seen	4289	1 AAIJ	17C LHCb	$B^+ \rightarrow J/\psi\phi K^+$
seen	616	2 ABAZOV	15M D0	$p\bar{p} \rightarrow J/\psi\phi + \text{anything}$
seen	52	3 ABAZOV	14A D0	$B^+ \rightarrow J/\psi\phi K^+$
seen	0.3k	4 CHATRCHYAN	14M CMS	$B^+ \rightarrow J/\psi\phi K^+$
seen	14	5 AALTONEN	09AH CDF	$B^+ \rightarrow J/\psi\phi K^+$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
not seen		6 ABLIKIM	15 BES3	$e^+e^- \rightarrow \gamma\phi J/\psi$
not seen		7 AAIJ	12AA LHCb	$p\bar{p} \rightarrow B^+ X$ at 7 TeV

¹ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi\phi K^+$ with a significance of 8.4σ .

² Statistical significance of more than 6σ .

³ ABAZOV 14A reports $B(B^+ \rightarrow X(4140)K^+ \rightarrow J/\psi\phi K^+)/B(B^+ \rightarrow J/\psi\phi K^+) = (19 \pm 7 \pm 4)\%$ with 3.1σ significance.

⁴ From a fit assuming an S -wave relativistic Breit-Wigner shape above a three-body phase-space non-resonant component with statistical significance of more than 5σ .

⁵ Statistical significance of 3.8σ .

⁶ Reported $\sigma(e^+e^- \rightarrow \gamma X(4140)) \cdot B(X(4140) \rightarrow J/\psi\phi) < 0.35, 0.28$, and 0.33 pb at 4.23, 4.26, and 4.36 GeV, respectively, at 90% CL.

⁷ 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.

 $\Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	SHEN	10 BELL	$10.6 e^+e^- \rightarrow e^+e^- J/\psi\phi$

X(4140) REFERENCES

AAIJ	17C	PRL 118 022003	R. Aaij <i>et al.</i>	(LHCb Collab.) JP
Also		PR D95 012002	R. Aaij <i>et al.</i>	(LHCb Collab.)
ABAZOV	15M	PRL 115 232001	V.M. Abazov <i>et al.</i>	(D0 Collab.)
ABLIKIM	15	PR D91 032002	M. Ablikim <i>et al.</i>	(BES III Collab.)
ABAZOV	14A	PR D89 012004	V.M. Abazov <i>et al.</i>	(D0 Collab.)
CHATRCHYAN	14M	PL B734 261	S. Chatrchyan <i>et al.</i>	(CMS Collab.)
AAIJ	12AA	PR D85 091103	R. Aaij <i>et al.</i>	(LHCb Collab.)
SHEN	10	PRL 104 112004	C.P. Shen <i>et al.</i>	(Belle Collab.)
AALTONEN	09AH	PRL 102 242002	T. Aaltonen <i>et al.</i>	(CDF Collab.)

 $\psi(4160)$

$$J^{PC} = 0^-(1^--)$$

 $\psi(4160)$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
4191 $\pm$ 5 OUR AVERAGE			
4191 $\begin{smallmatrix} +9 \\ -8 \end{smallmatrix}$	AAIJ	13BC LHCb	$B^+ \rightarrow K^+ \mu^+ \mu^-$
4191.7 $\pm$ 6.5	¹ ABLIKIM	08D BES2	$e^+e^- \rightarrow \text{hadrons}$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
4193 $\pm$ 7	² MO	10 RVUE	$e^+e^- \rightarrow \text{hadrons}$
4151 $\pm$ 4	³ SETH	05A RVUE	$e^+e^- \rightarrow \text{hadrons}$
4155 $\pm$ 5	⁴ SETH	05A RVUE	$e^+e^- \rightarrow \text{hadrons}$
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.

 $\psi(4160)$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
70 $\pm$ 10 OUR AVERAGE			
65 $\begin{smallmatrix} +22 \\ -16 \end{smallmatrix}$	AAIJ	13BC LHCb	$B^+ \rightarrow K^+ \mu^+ \mu^-$
71.8 $\pm$ 12.3	⁵ ABLIKIM	08D BES2	$e^+e^- \rightarrow \text{hadrons}$

NODE=M193225

NODE=M193R01
NODE=M193R01

NODE=M193R01;LINKAGE=E
NODE=M193R01;LINKAGE=D
NODE=M193R01;LINKAGE=A

NODE=M193R01;LINKAGE=C

NODE=M193R01;LINKAGE=AA
NODE=M193R01;LINKAGE=B

NODE=M193R01;LINKAGE=AI

NODE=M193R02
NODE=M193R02

NODE=M193

REFID=57657
REFID=57636
REFID=56957
REFID=56368
REFID=55650
REFID=55753
REFID=54263
REFID=53235
REFID=52968

NODE=M025

NODE=M025M

NODE=M025M

OCCUR=2

NODE=M025M;LINKAGE=AB

NODE=M025M;LINKAGE=MO

NODE=M025M;LINKAGE=ST
NODE=M025M;LINKAGE=SE

NODE=M025W

NODE=M025W

• • • We do not use the following data for averages, fits, limits, etc. • • •

79 ± 14	⁶ MO	10 RVUE	$e^+ e^- \rightarrow \text{hadrons}$
107 ± 10	⁷ SETH	05A RVUE	$e^+ e^- \rightarrow \text{hadrons}$
107 ± 16	⁸ SETH	05A RVUE	$e^+ e^- \rightarrow \text{hadrons}$
78 ± 20	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 $\delta = (293 \pm 57)^\circ$.

NODE=M025W;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=M025W;LINKAGE=MO

⁷ From a fit to Crystal Ball (OSTERHELD 86) data.

NODE=M025W;LINKAGE=ST

⁸ From a fit to BES (BAI 02C) data.

NODE=M025W;LINKAGE=SE

$\psi(4160)$ DECAY MODES

Due to the complexity of the $c\bar{c}$ threshold region, in this listing, “seen” (“not seen”) means that a cross section for the mode in question has been measured at effective $\sqrt{s}$ near this particle’s central mass value, more (less) than 2σ above zero, without regard to any peaking behavior in $\sqrt{s}$ or absence thereof. See mode listing(s) for details and references.

NODE=M025215;NODE=M025

NODE=M025

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 $e^+ e^-$	$(6.9 \pm 3.3) \times 10^{-6}$	
Γ_2 $\mu^+ \mu^-$	seen	
Γ_3 $D\bar{D}$	seen	
Γ_4 $D^0 \bar{D}^0$	seen	
Γ_5 $D^+ D^-$	seen	
Γ_6 $D^* \bar{D} + \text{c.c.}$	seen	
Γ_7 $D^*(2007)^0 \bar{D}^0 + \text{c.c.}$	seen	
Γ_8 $D^*(2010)^+ D^- + \text{c.c.}$	seen	
Γ_9 $D^* \bar{D}^*$	seen	
Γ_{10} $D^*(2007)^0 \bar{D}^*(2007)^0$	seen	
Γ_{11} $D^*(2010)^+ D^*(2010)^-$	seen	
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} $D\bar{D}^* \pi + \text{c.c. (excl. } D^* \bar{D}^*)$	seen	
Γ_{14} $D^0 D^{*-} \pi^+ + \text{c.c. (excl. } D^*(2010)^+ D^*(2010)^-)$	not seen	
Γ_{15} $D_s^+ D_s^-$	not seen	
Γ_{16} $D_s^{*+} D_s^- + \text{c.c.}$	seen	
Γ_{17} $J/\psi \pi^+ \pi^-$	$< 3 \times 10^{-3}$	90%
Γ_{18} $J/\psi \pi^0 \pi^0$	$< 3 \times 10^{-3}$	90%
Γ_{19} $J/\psi K^+ K^-$	$< 2 \times 10^{-3}$	90%
Γ_{20} $J/\psi \eta$	$< 8 \times 10^{-3}$	90%
Γ_{21} $J/\psi \pi^0$	$< 1 \times 10^{-3}$	90%
Γ_{22} $J/\psi \eta'$	$< 5 \times 10^{-3}$	90%
Γ_{23} $J/\psi \pi^+ \pi^- \pi^0$	$< 1 \times 10^{-3}$	90%
Γ_{24} $\psi(2S) \pi^+ \pi^-$	$< 4 \times 10^{-3}$	90%
Γ_{25} $\chi_{c1} \gamma$	$< 5 \times 10^{-3}$	90%
Γ_{26} $\chi_{c2} \gamma$	$< 1.3 \%$	90%
Γ_{27} $\chi_{c1} \pi^+ \pi^- \pi^0$	$< 2 \times 10^{-3}$	90%
Γ_{28} $\chi_{c2} \pi^+ \pi^- \pi^0$	$< 8 \times 10^{-3}$	90%
Γ_{29} $h_c(1P) \pi^+ \pi^-$	$< 5 \times 10^{-3}$	90%
Γ_{30} $h_c(1P) \pi^0 \pi^0$	$< 2 \times 10^{-3}$	90%
Γ_{31} $h_c(1P) \eta$	$< 2 \times 10^{-3}$	90%
Γ_{32} $h_c(1P) \pi^0$	$< 4 \times 10^{-4}$	90%
Γ_{33} $\phi \pi^+ \pi^-$	$< 2 \times 10^{-3}$	90%

DESIG=1

DESIG=33

DESIG=15;OUR EVAL;→ UNCHECKED ←

DESIG=16

DESIG=17

DESIG=18;OUR EVAL;→ UNCHECKED ←

DESIG=19

DESIG=20

DESIG=21;OUR EVAL;→ UNCHECKED ←

DESIG=22

DESIG=23

DESIG=24

DESIG=25

DESIG=26

DESIG=27

DESIG=28

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=29

DESIG=30

DESIG=31

DESIG=32

DESIG=14

Γ_{34}	$\gamma X(3872) \rightarrow \gamma J/\psi \pi^+ \pi^-$	< 6.8	$\times 10^{-5}$	90%	DESIG=34
Γ_{35}	$\gamma X(3915) \rightarrow \gamma J/\psi \pi^+ \pi^-$	< 1.36	$\times 10^{-4}$	90%	DESIG=35
Γ_{36}	$\gamma X(3930) \rightarrow \gamma J/\psi \pi^+ \pi^-$	< 1.18	$\times 10^{-4}$	90%	DESIG=36
Γ_{37}	$\gamma X(3940) \rightarrow \gamma J/\psi \pi^+ \pi^-$	< 1.47	$\times 10^{-4}$	90%	DESIG=37
Γ_{38}	$\gamma X(3872) \rightarrow \gamma \gamma J/\psi$	< 1.05	$\times 10^{-4}$	90%	DESIG=38
Γ_{39}	$\gamma X(3915) \rightarrow \gamma \gamma J/\psi$	< 1.26	$\times 10^{-4}$	90%	DESIG=39
Γ_{40}	$\gamma X(3930) \rightarrow \gamma \gamma J/\psi$	< 8.8	$\times 10^{-5}$	90%	DESIG=40
Γ_{41}	$\gamma X(3940) \rightarrow \gamma \gamma J/\psi$	< 1.79	$\times 10^{-4}$	90%	DESIG=41
Γ_{42}	$K^+ K^-$				DESIG=42

$\psi(4160)$ PARTIAL WIDTHS

NODE=M025220

$\Gamma(e^+ e^-)$

 Γ_1 NODE=M025W1
NODE=M025W1

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
0.48 ± 0.22	⁹ ABLIKIM	08D BES2	$e^+ e^- \rightarrow$ hadrons
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.4 to 1.1	¹⁰ MO	10 RVUE	$e^+ e^- \rightarrow$ hadrons
0.83 ± 0.08	¹¹ SETH	05A RVUE	$e^+ e^- \rightarrow$ hadrons
0.84 ± 0.13	¹² SETH	05A RVUE	$e^+ e^- \rightarrow$ 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

$\psi(4160) \Gamma(i) \times \Gamma(e^+ e^-) / \Gamma(\text{total})$

NODE=M025235

$\Gamma(\chi_{c1} \gamma) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$	CL%	DOCUMENT ID	TECN	COMMENT	$\Gamma_{25} \Gamma_1 / \Gamma$
< 2.2	90	¹³ HAN	15 BELL	$10.58 e^+ e^- \rightarrow \chi_{c1} \gamma$	

NODE=M025G01
NODE=M025G01

¹³ Using $B(\eta \rightarrow \gamma \gamma) = (39.41 \pm 0.21)\%$.

NODE=M025G01;LINKAGE=A

$\Gamma(\chi_{c2} \gamma) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$	CL%	DOCUMENT ID	TECN	COMMENT	$\Gamma_{26} \Gamma_1 / \Gamma$

NODE=M025G02
NODE=M025G02

< 6.1	90	¹⁴ HAN	15 BELL	$10.58 e^+ e^- \rightarrow \chi_{c2} \gamma$	

¹⁴ Using $B(\eta \rightarrow \gamma \gamma) = (39.41 \pm 0.21)\%$.

NODE=M025G02;LINKAGE=A

$\psi(4160) \Gamma(i) \times \Gamma(e^+ e^-) / \Gamma^2(\text{total})$

NODE=M025230

$\Gamma(J/\psi \eta) / \Gamma_{\text{total}} \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$	DOCUMENT ID	TECN	COMMENT	$\Gamma_{20} / \Gamma \times \Gamma_1 / \Gamma$

NODE=M025R32
NODE=M025R32

• • • We do not use the following data for averages, fits, limits, etc. • • •				
$2.8 \pm 0.9 \pm 0.9$	¹⁵ WANG	13B BELL	$e^+ e^- \rightarrow J/\psi \eta \gamma$	
$12.8 \pm 1.7 \pm 2.0$	¹⁶ WANG	13B BELL	$e^+ e^- \rightarrow J/\psi \eta \gamma$	

OCCUR=2

¹⁵ Solution I of two equivalent solutions in a fit using two interfering resonances. Mass and width fixed at 4153 MeV and 103 MeV, respectively.

NODE=M025R32;LINKAGE=A

¹⁶ Solution II of two equivalent solutions in a fit using two interfering resonances. Mass and width fixed at 4153 MeV and 103 MeV, respectively.

NODE=M025R32;LINKAGE=B

$\psi(4160)$ BRANCHING RATIOS

NODE=M025225

$\Gamma(\mu^+ \mu^-) / \Gamma_{\text{total}}$	DOCUMENT ID	TECN	COMMENT	Γ_2 / Γ

NODE=M025R31
NODE=M025R31

seen	¹⁷ AAIJ	13BC LHCB	$B^+ \rightarrow K^+ \mu^+ \mu^-$	

¹⁷ AAIJ 13BC report $B(B^+ \rightarrow K^+ \psi(4160)) B(\psi(4160) \rightarrow \mu^+ \mu^-) = (3.5^{+0.9}_{-0.8}) \times 10^{-9}$.

NODE=M025R31;LINKAGE=A

$$\Gamma(D\bar{D})/\Gamma(D^*\bar{D}^*)$$

VALUE	DOCUMENT ID	TECN	COMMENT
0.02±0.03±0.02	AUBERT	09M	BABR $e^+e^- \rightarrow \gamma D^{(*)}\bar{D}^{(*)}$

$$\Gamma_3/\Gamma_9$$

NODE=M025R14
NODE=M025R14

$$\Gamma(D^0\bar{D}^0)/\Gamma_{\text{total}}$$

VALUE	DOCUMENT ID	TECN	COMMENT
seen	CRONIN-HEN..09	CLEO	$e^+e^- \rightarrow D^0\bar{D}^0$
seen	PAKHLOVA 08	BELL	$e^+e^- \rightarrow D^0\bar{D}^0\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
not seen	AUBERT	09M	BABR $e^+e^- \rightarrow D^0\bar{D}^0\gamma$

$$\Gamma_4/\Gamma$$

NODE=M025R16
NODE=M025R16

$$\Gamma(D^+D^-)/\Gamma_{\text{total}}$$

VALUE	DOCUMENT ID	TECN	COMMENT
seen	CRONIN-HEN..09	CLEO	$e^+e^- \rightarrow D^+D^-$
seen	PAKHLOVA 08	BELL	$e^+e^- \rightarrow D^+D^-\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
not seen	AUBERT	09M	BABR $e^+e^- \rightarrow D^+D^-\gamma$

$$\Gamma_5/\Gamma$$

NODE=M025R17
NODE=M025R17

$$\Gamma(D^*(2007)^0\bar{D}^0 + \text{c.c.})/\Gamma_{\text{total}}$$

VALUE	DOCUMENT ID	TECN	COMMENT
seen	AUBERT	09M	BABR $e^+e^- \rightarrow D^{*0}\bar{D}^0\gamma$
seen	CRONIN-HEN..09	CLEO	$e^+e^- \rightarrow D^{*0}\bar{D}^0$

$$\Gamma_7/\Gamma$$

NODE=M025R18
NODE=M025R18

$$\Gamma(D^*(2010)^+D^- + \text{c.c.})/\Gamma_{\text{total}}$$

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	$e^+e^- \rightarrow D^{*+}D^-\gamma$

$$\Gamma_8/\Gamma$$

NODE=M025R19
NODE=M025R19

$$\Gamma(D^*\bar{D} + \text{c.c.})/\Gamma(D^*\bar{D}^*)$$

VALUE	DOCUMENT ID	TECN	COMMENT
0.34±0.14±0.05	AUBERT	09M	BABR $e^+e^- \rightarrow \gamma D^{(*)}\bar{D}^{(*)}$

$$\Gamma_6/\Gamma_9$$

NODE=M025R15
NODE=M025R15

$$\Gamma(D^*(2007)^0\bar{D}^*(2007)^0)/\Gamma_{\text{total}}$$

VALUE	DOCUMENT ID	TECN	COMMENT
seen	AUBERT	09M	BABR $e^+e^- \rightarrow D^{*0}\bar{D}^{*0}\gamma$
seen	CRONIN-HEN..09	CLEO	$e^+e^- \rightarrow D^{*0}\bar{D}^{*0}$

$$\Gamma_{10}/\Gamma$$

NODE=M025R20
NODE=M025R20

$$\Gamma(D^*(2010)^+D^*(2010)^-)/\Gamma_{\text{total}}$$

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	$e^+e^- \rightarrow D^{*+}D^{*-}\gamma$

$$\Gamma_{11}/\Gamma$$

NODE=M025R21
NODE=M025R21

$$\Gamma(D^0D^-\pi^+ + \text{c.c. (excl. } D^*(2007)^0\bar{D}^0 + \text{c.c., } D^*(2010)^+D^- + \text{c.c.}))/\Gamma_{\text{total}}$$

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	PAKHLOVA 08A	BELL	$e^+e^- \rightarrow D^0D^-\pi^+\gamma$

$$\Gamma_{12}/\Gamma$$

NODE=M025R22
NODE=M025R22

$$\Gamma(D\bar{D}^*\pi + \text{c.c. (excl. } D^*\bar{D}^*))/\Gamma_{\text{total}}$$

VALUE	DOCUMENT ID	TECN	COMMENT
seen	CRONIN-HEN..09	CLEO	$e^+e^- \rightarrow D\bar{D}^*\pi$

$$\Gamma_{13}/\Gamma$$

NODE=M025R23
NODE=M025R23

$$\Gamma(D^0D^{*-}\pi^+ + \text{c.c. (excl. } D^*(2010)^+D^*(2010)^-))/\Gamma_{\text{total}}$$

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	PAKHLOVA 09	BELL	$e^+e^- \rightarrow D^0D^{*-}\pi^+\gamma$

$$\Gamma_{14}/\Gamma$$

NODE=M025R24
NODE=M025R24

$$\Gamma(D_s^+D_s^-)/\Gamma_{\text{total}}$$

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	$e^+e^- \rightarrow D_s^+D_s^-$

$$\Gamma_{15}/\Gamma$$

NODE=M025R25
NODE=M025R25

$\Gamma(D_s^{*+} D_s^- + \text{c.c.})/\Gamma_{\text{total}}$
 Γ_{16}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	PAKHLOVA 11	BELL	$e^+ e^- \rightarrow D_s^{*+} D_s^- \gamma$
seen	DEL-AMO-SA..10N	BABR	$e^+ e^- \rightarrow D_s^{*+} D_s^- \gamma$
seen	CRONIN-HEN..09	CLEO	$e^+ e^- \rightarrow D_s^{*+} D_s^-$

NODE=M025R26
NODE=M025R26

 $\Gamma(J/\psi \pi^+ \pi^-)/\Gamma_{\text{total}}$
 Γ_{17}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<3	90	COAN	06	CLEO 4.12-4.2 $e^+ e^- \rightarrow$ hadrons

NODE=M025R01
NODE=M025R01

 $\Gamma(J/\psi \pi^0 \pi^0)/\Gamma_{\text{total}}$
 Γ_{18}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<3	90	COAN	06	CLEO 4.12-4.2 $e^+ e^- \rightarrow$ hadrons

NODE=M025R02
NODE=M025R02

 $\Gamma(J/\psi K^+ K^-)/\Gamma_{\text{total}}$
 Γ_{19}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<2	90	COAN	06	CLEO 4.12-4.2 $e^+ e^- \rightarrow$ hadrons

NODE=M025R03
NODE=M025R03

 $\Gamma(J/\psi \eta)/\Gamma_{\text{total}}$
 Γ_{20}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<8	90	COAN	06	CLEO 4.12-4.2 $e^+ e^- \rightarrow$ hadrons

NODE=M025R04
NODE=M025R04

• • • We do not use the following data for averages, fits, limits, etc. • • •

possibly seen	¹⁸ ABLIKIM	15L	BES3	$e^+ e^- \rightarrow J/\psi \eta$
seen	WANG	13B	BELL	$e^+ e^- \rightarrow J/\psi \eta \gamma$

¹⁸ An enhancement around 4.2 GeV is observed.

NODE=M025R04;LINKAGE=A

 $\Gamma(J/\psi \pi^0)/\Gamma_{\text{total}}$
 Γ_{21}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<1	90	COAN	06	CLEO 4.12-4.2 $e^+ e^- \rightarrow$ hadrons

NODE=M025R05
NODE=M025R05

 $\Gamma(J/\psi \eta')/\Gamma_{\text{total}}$
 Γ_{22}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<5	90	COAN	06	CLEO 4.12-4.2 $e^+ e^- \rightarrow$ hadrons

NODE=M025R06
NODE=M025R06

 $\Gamma(J/\psi \pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}$
 Γ_{23}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<1	90	COAN	06	CLEO 4.12-4.2 $e^+ e^- \rightarrow$ hadrons

NODE=M025R07
NODE=M025R07

 $\Gamma(\psi(2S) \pi^+ \pi^-)/\Gamma_{\text{total}}$
 Γ_{24}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<4	90	COAN	06	CLEO 4.12-4.2 $e^+ e^- \rightarrow$ hadrons

NODE=M025R08
NODE=M025R08

 $\Gamma(\chi_{c1} \gamma)/\Gamma_{\text{total}}$
 Γ_{25}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<7	90	COAN	06	CLEO 4.12-4.2 $e^+ e^- \rightarrow$ hadrons

NODE=M025R09
NODE=M025R09

 $\Gamma(\chi_{c2} \gamma)/\Gamma_{\text{total}}$
 Γ_{26}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<13	90	COAN	06	CLEO 4.12-4.2 $e^+ e^- \rightarrow$ hadrons

NODE=M025R10
NODE=M025R10

 $\Gamma(\chi_{c1} \pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}$
 Γ_{27}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<2	90	COAN	06	CLEO 4.12-4.2 $e^+ e^- \rightarrow$ hadrons

NODE=M025R11
NODE=M025R11

 $\Gamma(\chi_{c2} \pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}$
 Γ_{28}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<8	90	COAN	06	CLEO 4.12-4.2 $e^+ e^- \rightarrow$ hadrons

NODE=M025R12
NODE=M025R12

$\Gamma(h_c(1P)\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{29}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<5	90	19 PEDLAR	11 CLEO	$e^+e^- \rightarrow h_c(1P)\pi^+\pi^-$
¹⁹ At $\sqrt{s} = 4170$ MeV, PEDLAR 11 measures $\sigma(e^+e^- \rightarrow h_c(1P)\pi^+\pi^-) = 15.6 \pm 2.3 \pm 1.9 \pm 3.0$ pb, where the errors are statistical, systematic, and due to uncertainty in $B(\psi(2S) \rightarrow \pi^0 h_c(1P))$, respectively.				

NODE=M025R27
NODE=M025R27

NODE=M025R27;LINKAGE=PE

 $\Gamma(h_c(1P)\pi^0\pi^0)/\Gamma_{\text{total}}$ Γ_{30}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<2	90	20 PEDLAR	11 CLEO	$e^+e^- \rightarrow h_c(1P)\pi^0\pi^0$
²⁰ At $\sqrt{s} = 4170$ MeV, PEDLAR 11 measures $\sigma(e^+e^- \rightarrow h_c(1P)\pi^0\pi^0) = 3.0 \pm 3.3 \pm 1.1 \pm 0.6$ pb, where the errors are statistical, systematic, and due to uncertainty in $B(\psi(2S) \rightarrow \pi^0 h_c(1P))$, respectively.				

NODE=M025R28
NODE=M025R28

NODE=M025R28;LINKAGE=PE

 $\Gamma(h_c(1P)\eta)/\Gamma_{\text{total}}$ Γ_{31}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<2	90	21 PEDLAR	11 CLEO	$e^+e^- \rightarrow h_c(1P)\eta$
²¹ 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
NODE=M025R29

NODE=M025R29;LINKAGE=PE

 $\Gamma(h_c(1P)\pi^0)/\Gamma_{\text{total}}$ Γ_{32}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<0.4	90	22 PEDLAR	11 CLEO	$e^+e^- \rightarrow h_c(1P)\pi^0$
²² At $\sqrt{s} = 4170$ MeV, PEDLAR 11 measures $\sigma(e^+e^- \rightarrow h_c(1P)\pi^0) = -0.7 \pm 1.8 \pm 0.7 \pm 0.1$ pb, where the errors are statistical, systematic, and due to uncertainty in $B(\psi(2S) \rightarrow \pi^0 h_c(1P))$, respectively.				

NODE=M025R30
NODE=M025R30

NODE=M025R30;LINKAGE=PE

 $\Gamma(\phi\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{33}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<2	90	COAN	06 CLEO	$4.12\text{--}4.2 e^+e^- \rightarrow \text{hadrons}$

NODE=M025R13
NODE=M025R13

 $\Gamma(\gamma X(3872) \rightarrow \gamma J/\psi \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{34}/Γ

VALUE	CL%	DOCUMENT ID	COMMENT
<0.68 $\times 10^{-4}$	90	23 XIAO	$\psi(4160) \rightarrow \gamma J/\psi \pi^+ \pi^-$
²³ Obtained by analyzing CLEO data but not authored by the CLEO Collaboration.			

NODE=M025R34
NODE=M025R34

NODE=M025R34;LINKAGE=A

 $\Gamma(\gamma X(3915) \rightarrow \gamma J/\psi \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{35}/Γ

VALUE	CL%	DOCUMENT ID	COMMENT
<1.36 $\times 10^{-4}$	90	24 XIAO	$\psi(4160) \rightarrow \gamma J/\psi \pi^+ \pi^-$
²⁴ Obtained by analyzing CLEO data but not authored by the CLEO Collaboration.			

NODE=M025R35
NODE=M025R35

NODE=M025R35;LINKAGE=A

 $\Gamma(\gamma X(3930) \rightarrow \gamma J/\psi \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{36}/Γ

VALUE	CL%	DOCUMENT ID	COMMENT
<1.18 $\times 10^{-4}$	90	25 XIAO	$\psi(4160) \rightarrow \gamma J/\psi \pi^+ \pi^-$
²⁵ Obtained by analyzing CLEO data but not authored by the CLEO Collaboration.			

NODE=M025R36
NODE=M025R36

NODE=M025R36;LINKAGE=A

 $\Gamma(\gamma X(3940) \rightarrow \gamma J/\psi \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{37}/Γ

VALUE	CL%	DOCUMENT ID	COMMENT
<1.47 $\times 10^{-4}$	90	26 XIAO	$\psi(4160) \rightarrow \gamma J/\psi \pi^+ \pi^-$
²⁶ Obtained by analyzing CLEO data but not authored by the CLEO Collaboration.			

NODE=M025R37
NODE=M025R37

NODE=M025R37;LINKAGE=A

 $\Gamma(\gamma X(3872) \rightarrow \gamma\gamma J/\psi)/\Gamma_{\text{total}}$ Γ_{38}/Γ

VALUE	CL%	DOCUMENT ID	COMMENT
<1.05 $\times 10^{-4}$	90	27 XIAO	$\psi(4160) \rightarrow \gamma\gamma J/\psi$
²⁷ Obtained by analyzing CLEO data but not authored by the CLEO Collaboration.			

NODE=M025R38
NODE=M025R38

NODE=M025R38;LINKAGE=A

 $\Gamma(\gamma X(3915) \rightarrow \gamma\gamma J/\psi)/\Gamma_{\text{total}}$ Γ_{39}/Γ

VALUE	CL%	DOCUMENT ID	COMMENT
<1.26 $\times 10^{-4}$	90	28 XIAO	$\psi(4160) \rightarrow \gamma\gamma J/\psi$
²⁸ Obtained by analyzing CLEO data but not authored by the CLEO Collaboration.			

NODE=M025R39
NODE=M025R39

NODE=M025R39;LINKAGE=A

$\Gamma(\gamma X(3930) \rightarrow \gamma\gamma J/\psi)/\Gamma_{\text{total}}$ Γ_{40}/Γ

VALUE	CL%	DOCUMENT ID	COMMENT
$<0.88 \times 10^{-4}$	90	²⁹ XIAO 13	$\psi(4160) \rightarrow \gamma\gamma J/\psi$
²⁹ Obtained by analyzing CLEO data but not authored by the CLEO Collaboration.			

NODE=M025R40
 NODE=M025R40

NODE=M025R40;LINKAGE=A

 $\Gamma(\gamma X(3940) \rightarrow \gamma\gamma J/\psi)/\Gamma_{\text{total}}$ Γ_{41}/Γ

VALUE	CL%	DOCUMENT ID	COMMENT
$<1.79 \times 10^{-4}$	90	³⁰ XIAO 13	$\psi(4160) \rightarrow \gamma\gamma J/\psi$
³⁰ Obtained by analyzing CLEO data but not authored by the CLEO Collaboration.			

NODE=M025R41
 NODE=M025R41

NODE=M025R41;LINKAGE=A

 $\Gamma(K^+ K^-)/\Gamma_{\text{total}}$ Γ_{42}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$<2 \times 10^{-5}$	90	³¹ DRUZHININ 15	RVUE	$e^+ e^- \rightarrow \psi(3770)$
³¹ DRUZHININ 15 uses BABAR and CLEO data takitaking into account interference of the processes $e^+ e^- \rightarrow K^+ K^-$ and $e^+ e^- \rightarrow K_S^0 K_L^0$.				

NODE=M025R33
 NODE=M025R33

NODE=M025R33;LINKAGE=A

 $\psi(4160)$ REFERENCES

NODE=M025

ABLIKIM 15L PR D91 112005	M. Ablikim <i>et al.</i>	(BES III Collab.)
DRUZHININ 15 PR D92 054024	V.P. Druzhinin	(NOVO)
HAN 15 PR D92 012011	Y.L. Han <i>et al.</i>	(BELLE Collab.)
AAIJ 13BC PRL 111 112003	R. Aaij <i>et al.</i>	(LHCb Collab.)
WANG 13B PR D87 051101	X.L. Wang <i>et al.</i>	(BELLE Collab.)
XIAO 13 PR D87 057501	T. Xiao <i>et al.</i>	(NWES, WAYN)
PAKHLOVA 11 PR D83 011101	G. Pakhlova <i>et al.</i>	(BELLE Collab.)
PEDLAR 11 PRL 107 041803	T. Pedlar <i>et al.</i>	(CLEO Collab.)
DEL-AMO-SA... 10N PR D82 052004	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)
MO 10 PR D82 077501	X.H. Mo, C.Z. Yuan, P. Wang	(BHEP)
AUBERT 09M PR D79 092001	B. Aubert <i>et al.</i>	(BABAR Collab.)
CRONIN-HEN... 09 PR D80 072001	D. Cronin-Hennessy <i>et al.</i>	(CLEO Collab.)
PAKHLOVA 09 PR D80 091101	G. Pakhlova <i>et al.</i>	(BELLE Collab.)
ABLIKIM 08D PL B660 315	M. Ablikim <i>et al.</i>	(BES Collab.)
PAKHLOVA 08 PR D77 011103	G. Pakhlova <i>et al.</i>	(BELLE Collab.)
PAKHLOVA 08A PRL 100 062001	G. Pakhlova <i>et al.</i>	(BELLE Collab.)
PAKHLOVA 07 PRL 98 092001	G. Pakhlova <i>et al.</i>	(BELLE Collab.)
COAN 06 PRL 96 162003	T.E. Coan <i>et al.</i>	(CLEO Collab.)
SETH 05A PR D72 017501	K.K. Seth	
BAI 02C PRL 88 101802	J.Z. Bai <i>et al.</i>	(BES Collab.)
BAI 00 PRL 84 594	J.Z. Bai <i>et al.</i>	(BES Collab.)
OSTERHELD 86 SLAC-PUB-4160	A. Osterheld <i>et al.</i>	(SLAC Crystal Ball Collab.)
BRANDELIK 78C PL 76B 361	R. Brandelik <i>et al.</i>	(DASP Collab.)

REFID=56777
 REFID=56962
 REFID=56816
 REFID=55229
 REFID=55377
 REFID=55381
 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

NODE=M190

 $X(4160)$

$$I^G(J^{PC}) = ?^?(??)$$

OMITTED FROM SUMMARY TABLE

Seen by PAKHLOV 08 in $e^+ e^- \rightarrow J/\psi X$, $X \rightarrow D^* \bar{D}^*$

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

$\Gamma(D\bar{D})/\Gamma(D^*\bar{D}^*)$					Γ_1/Γ_3
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
<0.09	90	PAKHLOV	08	BELL $e^+e^- \rightarrow J/\psi X$	
$\Gamma(D^*\bar{D} + c.c.)/\Gamma(D^*\bar{D}^*)$					Γ_2/Γ_3
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
<0.22	90	PAKHLOV	08	BELL $e^+e^- \rightarrow J/\psi X$	

NODE=M190225

NODE=M190R01
NODE=M190R01

NODE=M190R02
NODE=M190R02

X(4160) REFERENCES

PAKHLOV 08 PRL 100 202001 P. Pakhlov *et al.* (BELLE Collab.)

NODE=M190

REFID=52302

NODE=M231

$X(4200)^\pm$

$I(J^P) = ?(1^+)$

OMITTED FROM SUMMARY TABLE

Reported by CHILIKIN 14 in $J/\psi\pi^+$ at a significance of 6.2σ . Assignments of 0^- , 1^- , 2^- , and 2^+ excluded at 6.1σ , 7.4σ , 4.4σ , and 7.0σ level, respectively. Needs confirmation.

NODE=M231

X(4200)[±] MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
4196^{+31+17}_{-29-13}	CHILIKIN 14	BELL	$\bar{B}^0 \rightarrow J/\psi K^- \pi^+$

NODE=M231M

NODE=M231M

X(4200)[±] WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$370 \pm 70^{+70}_{-132}$	CHILIKIN 14	BELL	$\bar{B}^0 \rightarrow J/\psi K^- \pi^+$

NODE=M231W

NODE=M231W

X(4200)[±] DECAY MODES

NODE=M231215;NODE=M231

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad J/\psi\pi^+$	seen

DESIG=1

X(4200)[±] BRANCHING RATIOS

NODE=M231220

$\Gamma(J/\psi\pi^+)/\Gamma_{\text{total}}$					Γ_1/Γ
VALUE		DOCUMENT ID	TECN	COMMENT	
seen		CHILIKIN 14	BELL	$\bar{B}^0 \rightarrow J/\psi K^- \pi^+$	

NODE=M231R01
NODE=M231R01

X(4200)[±] REFERENCES

NODE=M231

REFID=56344

CHILIKIN 14 PR D90 112009 K. Chilikin *et al.* (BELLE Collab.)

X(4230)

$$J^{PC} = ?(1^{--})$$

OMITTED FROM SUMMARY TABLE

Enhancement reported by ABLIKIM 15C in $e^+e^- \rightarrow \omega\chi_{c0}$ at $\sqrt{s} = 4.23\text{--}4.26$ GeV at 9σ significance. Lineshape found to be inconsistent with origination from X(4260). NEEDS CONFIRMATION.

NODE=M222

NODE=M222

X(4230) MASS

NODE=M222M

NODE=M222M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$4230 \pm 8 \pm 6$	180	¹ ABLIKIM	15C BES3	$e^+e^- \rightarrow \omega\chi_{c0}$
¹ From a 3-parameter fit of measured cross sections from $\sqrt{s} = 4.21\text{--}4.42$ GeV to a phase-space modified Breit-Wigner function, using the decays $\chi_{c0} \rightarrow \pi^+\pi^-$, $\chi_{c0} \rightarrow K^+K^-$, and $\omega \rightarrow \pi^+\pi^-\pi^0$.				

NODE=M222M;LINKAGE=A

X(4230) WIDTH

NODE=M222W

NODE=M222W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$38 \pm 12 \pm 2$	180	¹ ABLIKIM	15C BES3	$e^+e^- \rightarrow \omega\chi_{c0}$
¹ From a 3-parameter fit of measured cross sections from $\sqrt{s} = 4.21\text{--}4.42$ GeV to a phase-space modified Breit-Wigner function, using the decays $\chi_{c0} \rightarrow \pi^+\pi^-$, $\chi_{c0} \rightarrow K^+K^-$, and $\omega \rightarrow \pi^+\pi^-\pi^0$.				

NODE=M222W;LINKAGE=A

X(4230) DECAY MODES

NODE=M222215;NODE=M222

Mode	Fraction (Γ_i/Γ)
Γ_1 e^+e^-	
Γ_2 $\omega\chi_{c0}$	seen

DESIG=1

DESIG=2

X(4230) $\Gamma(i)\Gamma(e^+e^-)/\Gamma(\text{total})$

NODE=M222220

$\Gamma(\omega\chi_{c0}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$	$\Gamma_2\Gamma_1/\Gamma$				
VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT	
$2.7\pm0.5\pm0.4$	180	¹ ABLIKIM	15C	BES3	$e^+e^- \rightarrow \omega\chi_{c0}$

¹ From a 3-parameter fit of measured cross sections from $\sqrt{s} = 4.21\text{--}4.42$ GeV to a phase-space modified Breit-Wigner function, using the decays $\chi_{c0} \rightarrow \pi^+\pi^-$, $\chi_{c0} \rightarrow K^+K^-$, and $\omega \rightarrow \pi^+\pi^-\pi^0$.

NODE=M222G01
NODE=M222G01

NODE=M222G01;LINKAGE=A

X(4230) BRANCHING RATIOS

NODE=M222225

$\Gamma(\omega\chi_{c0})/\Gamma_{\text{total}}$					Γ_2/Γ
<i>VALUE</i>	<i>EVTS</i>	<i>DOCUMENT ID</i>	<i>TECN</i>	<i>COMMENT</i>	
seen	180	¹ ABLIKIM	15C	BES3	$e^+e^- \rightarrow \omega\chi_{c0}$

¹ From a 3-parameter fit of measured cross sections from $\sqrt{s} = 4.21\text{--}4.42$ GeV to a phase-space modified Breit-Wigner function, using the decays $\chi_{c0} \rightarrow \pi^+\pi^-$, $\chi_{c0} \rightarrow K^+K^-$, and $\omega \rightarrow \pi^+\pi^-\pi^0$.

NODE=M222R01
NODE=M222R01

NODE=M222R01;LINKAGE=A

X(4230) REFERENCES

NODE=M222

ABLIKIM 15C PRL 114 092003 M. Ablikim *et al.* (BES III Collab.)

REFID=56401

NODE=M216

$X(4240)^\pm$

$I^G(J^P) = ?^?(0^-)$

OMITTED FROM SUMMARY TABLE

Spin and parity assignment $J^P = 0^-$ is favored over 1^- , 2^- , and 2^+ by 8σ and over 1^+ by 1σ , according to the four-dimensional amplitude analysis of AAIJ 14AG.

NODE=M216

$X(4240)^\pm$ MASS

NODE=M216M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$4239 \pm 18^{+45}_{-10}$	¹ AAIJ	14AG LHCB	$B^0 \rightarrow K^+ \pi^- \psi(2S)$

NODE=M216M

¹ From a 4-dimensional analysis when a second, lower mass resonance is allowed in the $X(4430)^\pm$ fit, with significance 6σ including systematic variations.

NODE=M216M;LINKAGE=AA

$X(4240)^\pm$ WIDTH

NODE=M216W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$220 \pm 47^{+108}_{-74}$	² AAIJ	14AG LHCB	$B^0 \rightarrow K^+ \pi^- \psi(2S)$

NODE=M216W

² From a 4-dimensional analysis when a second, lower mass resonance is allowed in the $X(4430)^\pm$ fit, with significance 6σ including systematic variations.

NODE=M216W;LINKAGE=AA

$X(4240)^\pm$ DECAY MODES

NODE=M216215;NODE=M216

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \pi^- \psi(2S)$	seen

DESIG=1

$X(4240)^\pm$ BRANCHING RATIOS

NODE=M216225

$\Gamma(\pi^- \psi(2S))/\Gamma_{\text{total}}$				Γ_1/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
seen	³ AAIJ	14AG LHCB	$B^0 \rightarrow K^+ \pi^- \psi(2S)$	

NODE=M216R01
NODE=M216R01

³ From a 4-dimensional analysis when a second, lower mass resonance is allowed in the $X(4430)^\pm$ fit. No partial branching fraction quoted.

NODE=M216R01;LINKAGE=AA

$X(4240)^\pm$ REFERENCES

NODE=M216

AAIJ	14AG PRL 112 222002	R. Aaij <i>et al.</i>	(LHCb Collab.)

REFID=55896

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

NODE=M074M

NEW

VALUE (MeV) EVTS DOCUMENT ID TECN COMMENT
4230 $\pm$ 8 OUR AVERAGE Error includes scale factor of 2.9. See the ideogram below.
 [4251 $\pm$ 9 MeV OUR 2016 AVERAGE Scale factor = 1.6]

4222.0 $\pm$ 3.1 $\pm$ 1.4	1	ABLIKIM	17B	BES3	$e^+e^- \rightarrow \pi^+\pi^- J/\psi$
4258.6 $\pm$ 8.3 $\pm$ 12.1	2	LIU	13B	BELL	$e^+e^- \rightarrow \gamma\pi^+\pi^- J/\psi$
4245 $\pm$ 5 $\pm$ 4	3	LEES	12AC	BABR	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^- J/\psi$
4284 $^{+17}_{-16}$ $\pm$ 413.6		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. • • •

4247 $\pm$ 12 $^{+17}_{-32}$	2,4	YUAN	07	BELL	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^- J/\psi$
4259 $\pm$ 8 $^{+2}_{-6}$ 125	5	AUBERT,B	05I	BABR	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^- J/\psi$

¹ From a three-resonance fit.

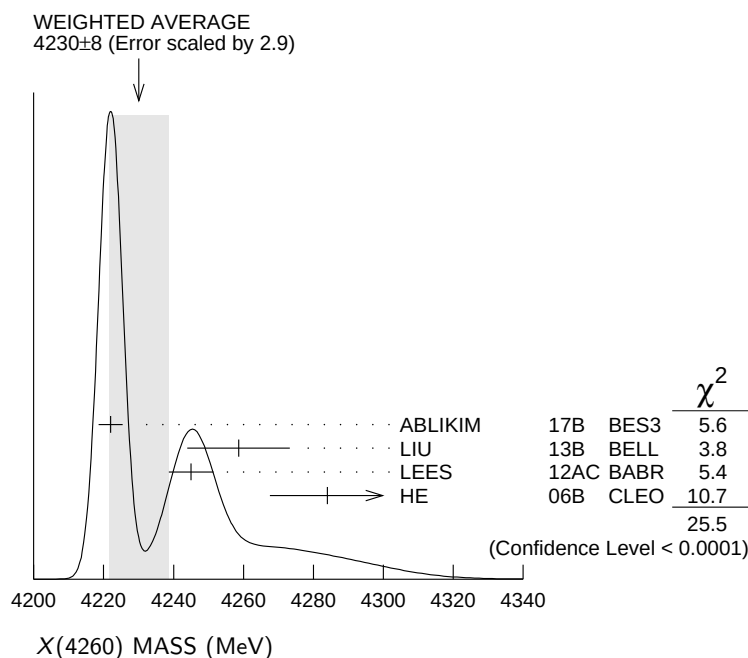
² From a two-resonance fit.

³ From a single-resonance fit. Supersedes AUBERT,B 05I.

⁴ Superseded by LIU 13B.

⁵ From a single-resonance fit. Two interfering resonances are not excluded. Superseded by LEES 12AC.

NODE=M074M;LINKAGE=A
 NODE=M074M;LINKAGE=YU
 NODE=M074M;LINKAGE=LE
 NODE=M074M;LINKAGE=YN
 NODE=M074M;LINKAGE=AU

**X(4260) WIDTH**

NODE=M074W

NODE=M074W

NEW

VALUE (MeV) EVTS DOCUMENT ID TECN COMMENT
55 $\pm$ 19 OUR AVERAGE Error includes scale factor of 4.4. See the ideogram below.
 [120 $\pm$ 12 MeV OUR 2016 AVERAGE Scale factor = 1.1]

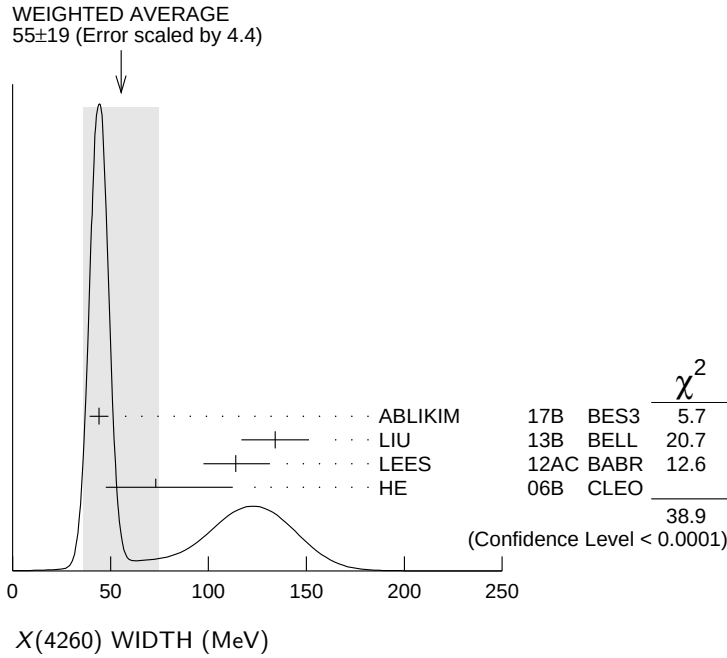
44.1 $\pm$ 4.3 $\pm$ 2.0	1	ABLIKIM	17B	BES3	$e^+e^- \rightarrow \pi^+\pi^- J/\psi$
134.1 $\pm$ 16.4 $\pm$ 5.5	2	LIU	13B	BELL	$e^+e^- \rightarrow \gamma\pi^+\pi^- J/\psi$
114 $^{+16}_{-15}$ $\pm$ 7	3	LEES	12AC	BABR	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^- J/\psi$
73 $^{+39}_{-25}$ $\pm$ 5 13.6		HE	06B	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. • • •

108 $\pm$ 19 $\pm$ 10	2,4	YUAN	07	BELL	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^- J/\psi$
88 $\pm$ 23 $^{+6}_{-4}$ 125	5	AUBERT,B	05I	BABR	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^- J/\psi$

- 1 From a three-resonance fit.
- 2 From a two-resonance fit.
- 3 From a single-resonance fit. Supersedes AUBERT,B 05I.
- 4 Superseded by LIU 13B.
- 5 From a single-resonance fit. Two interfering resonances are not excluded. Superseded by LEES 12AC.

NODE=M074W;LINKAGE=A
 NODE=M074W;LINKAGE=YU
 NODE=M074W;LINKAGE=LE
 NODE=M074W;LINKAGE=YN
 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 $X(3900)^\pm \pi^\mp, X^\pm \rightarrow J/\psi \pi^\pm$	seen
Γ_5 $J/\psi \pi^0 \pi^0$	seen
Γ_6 $J/\psi K^+ K^-$	seen
Γ_7 $J/\psi K_S^0 K_S^0$	not seen
Γ_8 $X(3872) \gamma$	seen
Γ_9 $J/\psi \eta$	not seen
Γ_{10} $J/\psi \pi^0$	not seen
Γ_{11} $J/\psi \eta'$	not seen
Γ_{12} $J/\psi \pi^+ \pi^- \pi^0$	not seen
Γ_{13} $J/\psi \eta \pi^0$	not seen
Γ_{14} $J/\psi \eta \eta$	not seen
Γ_{15} $\psi(2S) \pi^+ \pi^-$	not seen
Γ_{16} $\psi(2S) \eta$	not seen
Γ_{17} $\chi_{c0} \omega$	not seen
Γ_{18} $\chi_{c1} \gamma$	not seen
Γ_{19} $\chi_{c2} \gamma$	not seen
Γ_{20} $\chi_{c1} \pi^+ \pi^- \pi^0$	not seen
Γ_{21} $\chi_{c2} \pi^+ \pi^- \pi^0$	not seen
Γ_{22} $h_c(1P) \pi^+ \pi^-$	not seen
Γ_{23} $\phi \pi^+ \pi^-$	not seen
Γ_{24} $\phi f_0(980) \rightarrow \phi \pi^+ \pi^-$	not seen
Γ_{25} $D \bar{D}$	not seen
Γ_{26} $D^0 \bar{D}^0$	not seen
Γ_{27} $D^+ D^-$	not seen
Γ_{28} $D^* \bar{D} + c.c.$	not seen

DESIG=1

DESIG=2;OUR EVAL;→ UNCHECKED ←

DESIG=41;OUR EVAL;→ UNCHECKED ←

DESIG=43;OUR EVAL;→ UNCHECKED ←

DESIG=4;OUR EVAL;→ UNCHECKED ←

DESIG=5;OUR EVAL;→ UNCHECKED ←

DESIG=44

DESIG=42

DESIG=6;OUR EVAL;→ UNCHECKED ←

DESIG=7;OUR EVAL;→ UNCHECKED ←

DESIG=8;OUR EVAL;→ UNCHECKED ←

DESIG=9;OUR EVAL;→ UNCHECKED ←

DESIG=45

DESIG=10;OUR EVAL;→ UNCHECKED ←

DESIG=11;OUR EVAL;→ UNCHECKED ←

DESIG=12;OUR EVAL;→ UNCHECKED ←

DESIG=13;OUR EVAL;→ UNCHECKED ←

DESIG=14;OUR EVAL;→ UNCHECKED ←

DESIG=15;OUR EVAL;→ UNCHECKED ←

DESIG=16;OUR EVAL;→ UNCHECKED ←

DESIG=17;OUR EVAL;→ UNCHECKED ←

DESIG=40;OUR EVAL;→ UNCHECKED ←

DESIG=18;OUR EVAL;→ UNCHECKED ←

DESIG=22;OUR EVAL;→ UNCHECKED ←

DESIG=19;OUR EVAL;→ UNCHECKED ←

DESIG=31

DESIG=32

DESIG=23;OUR EVAL;→ UNCHECKED ←

Γ ₂₉	$D^*(2007)^0 \bar{D}^0 + c.c.$	not seen	DESIG=33
Γ ₃₀	$D^*(2010)^+ D^- + c.c.$	not seen	DESIG=34
Γ ₃₁	$D^* \bar{D}^*$	not seen	DESIG=24;OUR EVAL;→ UNCHECKED ←
Γ ₃₂	$D^*(2007)^0 \bar{D}^*(2007)^0$	not seen	DESIG=35
Γ ₃₃	$\bar{D}^*(2010)^+ D^*(2010)^-$	not seen	DESIG=36
Γ ₃₄	$D \bar{D} \pi + c.c.$		DESIG=37
Γ ₃₅	$D^0 D^- \pi^+ + c.c. \text{ (excl. } D^*(2007)^0 \bar{D}^{*0} + c.c., D^*(2010)^+ D^- + c.c.)$	not seen	DESIG=38
Γ ₃₆	$D \bar{D}^* \pi + c.c. \text{ (excl. } D^* \bar{D}^*)$	not seen	DESIG=25
Γ ₃₇	$D^0 D^{*-} \pi^+ + c.c. \text{ (excl. } D^*(2010)^+ D^*(2010)^-)$	not seen	DESIG=39
Γ ₃₈	$D^0 D^*(2010)^- \pi^+ + c.c.$	not seen	DESIG=30;OUR EVAL;→ UNCHECKED ←
Γ ₃₉	$D^* \bar{D}^* \pi$	not seen	DESIG=26
Γ ₄₀	$D_s^+ D_s^-$	not seen	DESIG=27
Γ ₄₁	$D_s^{*+} D_s^- + c.c.$	not seen	DESIG=28
Γ ₄₂	$D_s^{*+} D_s^{*-}$	not seen	DESIG=29
Γ ₄₃	$p \bar{p}$	not seen	DESIG=3;OUR EVAL;→ UNCHECKED ←
Γ ₄₄	$K_S^0 K^\pm \pi^\mp$	not seen	DESIG=20;OUR EVAL;→ UNCHECKED ←
Γ ₄₅	$K^+ K^- \pi^0$	not seen	DESIG=21;OUR EVAL;→ UNCHECKED ←

$X(4260) \Gamma(i) \times \Gamma(e^+ e^-) / \Gamma(\text{total})$

NODE=M074230

$\Gamma(J/\psi \pi^+ \pi^-) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$

 $\Gamma_2 \Gamma_1 / \Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
9.2±1.0 OUR AVERAGE				
9.2±0.8±0.7	1	LEES	12AC BABR	10.58 $e^+ e^- \rightarrow \gamma \pi^+ \pi^- J/\psi$
8.9 ^{+3.9} _{-3.1} ±1.8	8.1	HE	06B CLEO	9.4–10.6 $e^+ e^- \rightarrow \gamma \pi^+ \pi^- J/\psi$

• • • We do not use the following data for averages, fits, limits, etc. • • •

6.4±0.8±0.6	2	LIU	13B BELL	$e^+ e^- \rightarrow \gamma \pi^+ \pi^- J/\psi$
20.5±1.4±2.0	3	LIU	13B BELL	$e^+ e^- \rightarrow \gamma \pi^+ \pi^- J/\psi$
6.0±1.2 ^{+4.7} _{-0.5}	2,4	YUAN	07 BELL	10.58 $e^+ e^- \rightarrow \gamma \pi^+ \pi^- J/\psi$
20.6±2.3 ^{+9.1} _{-1.7}	3,4	YUAN	07 BELL	10.58 $e^+ e^- \rightarrow \gamma \pi^+ \pi^- J/\psi$
5.5±1.0 ^{+0.8} _{-0.7}	125	5 AUBERT,B	05I BABR	10.58 $e^+ e^- \rightarrow \gamma \pi^+ \pi^- J/\psi$

OCCUR=2

OCCUR=2

¹ From a single-resonance fit. Supersedes AUBERT,B 05I.

² Solution I of two equivalent solutions in a fit using two interfering resonances.

³ Solution II of two equivalent solutions in a fit using two interfering resonances.

⁴ Superseded by LIU 13B.

⁵ From a single-resonance fit. Two interfering resonances are not excluded. Superseded by LEES 12AC.

NODE=M074G1;LINKAGE=LE
 NODE=M074G1;LINKAGE=YU
 NODE=M074G1;LINKAGE=YA
 NODE=M074G1;LINKAGE=YN
 NODE=M074G1;LINKAGE=AU

$\Gamma(J/\psi K^+ K^-) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$

 $\Gamma_6 \Gamma_1 / \Gamma$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<1.7	90	1 SHEN	14 BELL	9.4–10.9 $e^+ e^- \rightarrow \gamma K^+ K^- J/\psi$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<1.2	90	2 YUAN	08 BELL	$e^+ e^- \rightarrow \gamma K^+ K^- J/\psi$

¹ From a fit of the broad $K^+ K^- J/\psi$ enhancement including a coherent $X(4260)$ amplitude with mass and width from LIU 13B. Supersedes YUAN 08.

² From a fit of the broad $K^+ K^- J/\psi$ enhancement including a coherent $X(4260)$ amplitude with mass and width from YUAN 07.

NODE=M074G3;LINKAGE=A

NODE=M074G3;LINKAGE=YU

$\Gamma(J/\psi K_S^0 K_S^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$

 $\Gamma_7 \Gamma_1 / \Gamma$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<0.85	90	1 SHEN	14 BELL	9.4–10.9 $e^+ e^- \rightarrow \gamma K_S^0 K_S^0 J/\psi$

¹ From a fit of the $K_S^0 K_S^0 J/\psi$ mass range from 4.4 to 5.5 GeV including a coherent $X(4260)$ amplitude with mass and width from LIU 13B.

NODE=M074G02
 NODE=M074G02

NODE=M074G02;LINKAGE=A

$$\Gamma(J/\psi\eta) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$$

$$\Gamma_9\Gamma_1/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

<14.2	90	WANG	13B BELL	$e^+e^- \rightarrow J/\psi\eta\gamma$

NODE=M074G01
NODE=M074G01

$$\Gamma(\psi(2S)\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$$

$$\Gamma_{15}\Gamma_1/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

<4.3	90	1 LIU	08H RVUE	$10.58 e^+e^- \rightarrow \psi(2S)\pi^+\pi^-\gamma$
$7.4^{+2.1}_{-1.7}$		2 LIU	08H RVUE	$10.58 e^+e^- \rightarrow \psi(2S)\pi^+\pi^-\gamma$

NODE=M074G7
NODE=M074G7

OCCUR=2

¹ For constructive interference with the X(4360) in a combined fit of AUBERT 07S and WANG 07D data with three resonances.

NODE=M074G7;LINKAGE=LI

² For destructive interference with the X(4360) in a combined fit of AUBERT 07S and WANG 07D data with three resonances.

NODE=M074G7;LINKAGE=LU

$$\Gamma(\chi_{c1}\gamma) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$$

$$\Gamma_{18}\Gamma_1/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT

<1.4	90	1 HAN	15 BELL	$10.58 e^+e^- \rightarrow \chi_{c1}\gamma$

¹ Using $B(\eta \rightarrow \gamma\gamma) = (39.41 \pm 0.21)\%$.

NODE=M074G03
NODE=M074G03

NODE=M074G03;LINKAGE=A

$$\Gamma(\chi_{c2}\gamma) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$$

$$\Gamma_{19}\Gamma_1/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT

<4.0	90	1 HAN	15 BELL	$10.58 e^+e^- \rightarrow \chi_{c2}\gamma$

¹ Using $B(\eta \rightarrow \gamma\gamma) = (39.41 \pm 0.21)\%$.

NODE=M074G04
NODE=M074G04

NODE=M074G04;LINKAGE=A

$$\Gamma(\phi\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$$

$$\Gamma_{23}\Gamma_1/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT

<0.4	90	AUBERT,BE	06D BABR	$10.6 e^+e^- \rightarrow K^+K^-\pi^+\pi^-\gamma$

NODE=M074G2
NODE=M074G2

$$\Gamma(\phi f_0(980) \rightarrow \phi\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$$

$$\Gamma_{24}\Gamma_1/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT

<0.29	90	1 AUBERT	07AK BABR	$10.6 e^+e^- \rightarrow \pi^+\pi^-K^+K^-\gamma$

¹ 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 $B(\phi(1020) \rightarrow K^+K^-) = 49.0 \times 10^{-2}$.

NODE=M074G6
NODE=M074G6

NODE=M074G6;LINKAGE=AU

$$\Gamma(K_S^0 K^\pm \pi^\mp) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$$

$$\Gamma_{44}\Gamma_1/\Gamma$$

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	$10.6 e^+e^- \rightarrow K_S^0 K^\pm \pi^\mp \gamma$

NODE=M074G4
NODE=M074G4

$$\Gamma(K^+K^-\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$$

$$\Gamma_{45}\Gamma_1/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.6	90	AUBERT	08S BABR	$10.6 e^+e^- \rightarrow K^+K^-\pi^0\gamma$

NODE=M074G5
NODE=M074G5

X(4260) BRANCHING RATIOS

NODE=M074240

$$\Gamma(J/\psi f_0(980), f_0(980) \rightarrow \pi^+\pi^-)/\Gamma(J/\psi\pi^+\pi^-)$$

$$\Gamma_3/\Gamma_2$$

VALUE	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.17 ± 0.13	1 LEES	12AC BABR	$10.58 e^+e^- \rightarrow \gamma\pi^+\pi^- J/\psi$

¹ Systematic uncertainties not estimated.

NODE=M074R02
NODE=M074R02

NODE=M074R02;LINKAGE=LE

$$\Gamma(X(3900)^\pm \pi^\mp, X^\pm \rightarrow J/\psi\pi^\pm)/\Gamma(J/\psi\pi^+\pi^-)$$

$$\Gamma_4/\Gamma_2$$

VALUE	DOCUMENT ID	TECN	COMMENT

$0.215 \pm 0.033 \pm 0.075$	1 ABLIKIM	13T BES3	$e^+e^- \rightarrow \pi^+\pi^- J/\psi$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.29 ± 0.08	2 LIU	13B BELL	$e^+e^- \rightarrow \gamma\pi^+\pi^- J/\psi$

¹ Assuming that the cross section of $e^+e^- \rightarrow \pi^+\pi^- J/\psi$ is fully due to the X(4260).

² Systematic error not evaluated.

NODE=M074R01
NODE=M074R01

NODE=M074R01;LINKAGE=AB
NODE=M074R01;LINKAGE=A

$\Gamma(J/\psi K_S^0 \bar{K}_S^0)/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	SHEN	14	BELL 9.4–10.9 $e^+e^- \rightarrow \gamma K_S^0 \bar{K}_S^0 J/\psi$

NODE=M074R27
 NODE=M074R27

 $\Gamma(X(3872)\gamma)/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
seen	20 ± 5	ABLIKIM	14	BES3 $e^+e^- \rightarrow J/\psi \pi^+ \pi^- \gamma$

NODE=M074R26
 NODE=M074R26

 $\Gamma(J/\psi \eta \pi^0)/\Gamma_{\text{total}}$ Γ_{13}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	ABLIKIM	15Q	BES3 4.0–4.6 $e^+e^- \rightarrow J/\psi \eta \pi^0$

NODE=M074R28
 NODE=M074R28

 $\Gamma(h_c(1P)\pi^+\pi^-)/\Gamma(J/\psi \pi^+\pi^-)$ Γ_{22}/Γ_2

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<1.0	90	¹ PEDLAR	11	CLEO $e^+e^- \rightarrow h_c(1P)\pi^+\pi^-$

NODE=M074R25
 NODE=M074R25

¹ At $\sqrt{s} = 4260$ MeV, PEDLAR 11 measures $\sigma(e^+e^- \rightarrow h_c(1P)\pi^+\pi^-) = 32 \pm 17 \pm 6 \pm 6$ pb, where the errors are statistical, systematic, and due to uncertainty in $B(\psi(2S) \rightarrow \pi^0 h_c(1P))$, respectively.

NODE=M074R25;LINKAGE=PE

 $\Gamma(D\bar{D})/\Gamma(J/\psi \pi^+\pi^-)$ Γ_{25}/Γ_2

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<1.0	90	¹ AUBERT	07BE	BABR $e^+e^- \rightarrow D\bar{D}\gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<4.0	90	CRONIN-HEN..09	CLEO	e^+e^-

¹ Using 4259 ± 10 MeV for the mass and 88 ± 24 MeV for the width of $X(4260)$.

NODE=M074R2
 NODE=M074R2

NODE=M074R2;LINKAGE=AU

 $\Gamma(D^0 \bar{D}^0)/\Gamma_{\text{total}}$ Γ_{26}/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_{27}/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_{28}/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_{29}/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_{30}/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_{31}/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

$$\Gamma(D^*(2007)^0 \bar{D}^*(2007)^0) / \Gamma_{\text{total}} \quad \Gamma_{32} / \Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	CRONIN-HEN..09	CLEO	$e^+ e^- \rightarrow D^{*0} \bar{D}^{*0}$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
not seen	AUBERT	09M BABR	$e^+ e^- \rightarrow D^{*0} \bar{D}^{*0} \gamma$

NODE=M074R17
NODE=M074R17

$$\Gamma(D^*(2010)^+ D^*(2010)^-) / \Gamma_{\text{total}} \quad \Gamma_{33} / \Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	CRONIN-HEN..09	CLEO	$e^+ e^- \rightarrow D^{*+} D^{*-}$
not seen	PAKHLOVA 07	BELL	$e^+ e^- \rightarrow D^{*+} D^{*-} \gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
not seen	AUBERT	09M BABR	$e^+ e^- \rightarrow D^{*+} D^{*-} \gamma$

NODE=M074R18
NODE=M074R18

$$\Gamma(D^0 D^- \pi^+ + \text{c.c. (excl. } D^*(2007)^0 \bar{D}^{*0} + \text{c.c., } D^*(2010)^+ D^- + \text{c.c.})) / \Gamma_{\text{total}} \quad \Gamma_{35} / \Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	PAKHLOVA 08A	BELL	$10.6 e^+ e^- \rightarrow D^0 D^- \pi^+ \gamma$

NODE=M074R16
NODE=M074R16

$$\Gamma(D \bar{D}^* \pi + \text{c.c. (excl. } D^* \bar{D}^*)) / \Gamma_{\text{total}} \quad \Gamma_{36} / \Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	CRONIN-HEN..09	CLEO	$e^+ e^- \rightarrow D^* \bar{D} \pi$

NODE=M074R22
NODE=M074R22

$$\Gamma(D \bar{D}^* \pi + \text{c.c. (excl. } D^* \bar{D}^*)) / \Gamma(J/\psi \pi^+ \pi^-) \quad \Gamma_{36} / \Gamma_2$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<15	90	CRONIN-HEN..09	CLEO	$e^+ e^-$

NODE=M074R05
NODE=M074R05

$$\Gamma(D^0 D^{*-} \pi^+ + \text{c.c. (excl. } D^*(2010)^+ D^*(2010)^-) / \Gamma_{\text{total}} \quad \Gamma_{37} / \Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	PAKHLOVA 09	BELL	$e^+ e^- \rightarrow D^0 D^{*-} \pi^+ \gamma$

NODE=M074R23
NODE=M074R23

$$\Gamma(D^0 D^*(2010)^- \pi^+ + \text{c.c.}) / \Gamma(J/\psi \pi^+ \pi^-) \quad \Gamma_{38} / \Gamma_2$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<9	90	PAKHLOVA 09	BELL	$e^+ e^- \rightarrow D^0 D^{*-} \pi^+$

NODE=M074R10
NODE=M074R10

$$\Gamma(D^0 D^*(2010)^- \pi^+ + \text{c.c.}) / \Gamma_{\text{total}} \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{38} / \Gamma \times \Gamma_1 / \Gamma$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<0.42 \times 10^{-6}$	90	¹ PAKHLOVA 09	BELL	$e^+ e^- \rightarrow D^0 D^{*-} \pi^+$

NODE=M074R11
NODE=M074R11

¹ Using 4263^{+8}_{-9} MeV for the mass of $X(4260)$.

NODE=M074R11;LINKAGE=PA

$$\Gamma(D^* \bar{D}^* \pi) / \Gamma_{\text{total}} \quad \Gamma_{39} / \Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	CRONIN-HEN..09	CLEO	$e^+ e^- \rightarrow D^* \bar{D}^* \pi$

NODE=M074R24
NODE=M074R24

$$\Gamma(D^* \bar{D}^* \pi) / \Gamma(J/\psi \pi^+ \pi^-) \quad \Gamma_{39} / \Gamma_2$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<8.2	90	CRONIN-HEN..09	CLEO	$e^+ e^-$

NODE=M074R06
NODE=M074R06

$$\Gamma(D_s^+ D_s^-) / \Gamma_{\text{total}} \quad \Gamma_{40} / \Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	DEL-AMO-SA..10N	BABR	$e^+ e^- \rightarrow D_s^+ D_s^- \gamma$
not seen	CRONIN-HEN..09	CLEO	$e^+ e^- \rightarrow D_s^+ D_s^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
not seen	PAKHLOVA 11	BELL	$e^+ e^- \rightarrow D_s^+ D_s^- \gamma$

NODE=M074R19
NODE=M074R19

$$\Gamma(D_s^+ D_s^-) / \Gamma(J/\psi \pi^+ \pi^-) \quad \Gamma_{40} / \Gamma_2$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.7	95	DEL-AMO-SA..10N	BABR	$10.6 e^+ e^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<1.3	90	CRONIN-HEN..09	CLEO	$e^+ e^-$

NODE=M074R07
NODE=M074R07

$$\Gamma(D_s^{*+} D_s^- + \text{c.c.})/\Gamma_{\text{total}}$$

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_{41}/Γ
not seen	DEL-AMO-SA...10N	BABR	$e^+ e^- \rightarrow D_s^{*+} D_s^- \gamma$	
not seen	CRONIN-HEN...09	CLEO	$e^+ e^- \rightarrow D_s^{*+} D_s^-$	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
not seen	PAKHLOVA 11	BELL	$e^+ e^- \rightarrow D_s^{*+} D_s^- \gamma$	

NODE=M074R20
NODE=M074R20

$$\Gamma(D_s^{*+} D_s^- + \text{c.c.})/\Gamma(J/\psi \pi^+ \pi^-)$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT	Γ_{41}/Γ_2
< 0.8	90	CRONIN-HEN...09	CLEO	$e^+ e^-$	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<44	95	DEL-AMO-SA...10N	BABR	$10.6 e^+ e^-$	

NODE=M074R08
NODE=M074R08

$$\Gamma(D_s^{*+} D_s^{*-})/\Gamma_{\text{total}}$$

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_{42}/Γ
not seen	CRONIN-HEN...09	CLEO	$e^+ e^- \rightarrow D_s^{*+} D_s^{*-}$	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
not seen	PAKHLOVA 11	BELL	$e^+ e^- \rightarrow D_s^{*+} D_s^{*-} \gamma$	
not seen	DEL-AMO-SA...10N	BABR	$e^+ e^- \rightarrow D_s^{*+} D_s^{*-} \gamma$	

NODE=M074R21
NODE=M074R21

$$\Gamma(D_s^{*+} D_s^{*-})/\Gamma(J/\psi \pi^+ \pi^-)$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT	Γ_{42}/Γ_2
< 9.5	90	CRONIN-HEN...09	CLEO	$e^+ e^-$	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<30	95	DEL-AMO-SA...10N	BABR	$10.6 e^+ e^-$	

NODE=M074R09
NODE=M074R09

$$\Gamma(p\bar{p})/\Gamma(J/\psi \pi^+ \pi^-)$$

VALUE	CL%	DOCUMENT ID	COMMENT	Γ_{43}/Γ_2
<0.13	90	¹ AUBERT 06B	$e^+ e^- \rightarrow p\bar{p} \gamma$	

NODE=M074R1
NODE=M074R1

¹ Using 4259 ± 10 MeV for the mass and 88 ± 24 MeV for the width of $X(4260)$.

NODE=M074R1;LINKAGE=AU

X(4260) REFERENCES

ABLIKIM 17B	PRL 118 092001	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=57755
ABLIKIM 15Q	PR D92 012008	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=56782
HAN 15	PR D92 012011	Y.L. Han <i>et al.</i>	(BELLE Collab.)	REFID=56816
ABLIKIM 14	PRL 112 092001	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=55647
SHEN 14	PR D89 072015	C.P. Shen <i>et al.</i>	(BELLE Collab.)	REFID=55944
ABLIKIM 13T	PRL 110 252001	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=55409
LIU 13B	PRL 110 252002	Z.Q. Liu <i>et al.</i>	(BELLE Collab.)	REFID=55410
WANG 13B	PR D87 051101	X.L. Wang <i>et al.</i>	(BELLE Collab.)	REFID=55377
LEES 12AC	PR D86 051102	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=54750
PAKHLOVA 11	PR D83 011101	G. Pakhlova <i>et al.</i>	(BELLE Collab.)	REFID=53638
PEDLAR 11	PRL 107 041803	T. Pedlar <i>et al.</i>	(CLEO Collab.)	REFID=16787
DEL-AMO-SA... 10N	PR D82 052004	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)	REFID=53532
AUBERT 09M	PR D79 092001	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52724
CRONIN-HEN...09	PR D80 072001	D. Cronin-Hennessy <i>et al.</i>	(CLEO Collab.)	REFID=53114
PAKHLOVA 09	PR D80 091101	G. Pakhlova <i>et al.</i>	(BELLE Collab.)	REFID=53143
AUBERT 08S	PR D77 092002	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52242
LIU 08H	PR D78 014032	Z.Q. Liu, X.S. Qin, C.Z. Yuan	(BABAR Collab.)	REFID=52296
PAKHLOVA 08	PR D77 011103	G. Pakhlova <i>et al.</i>	(BELLE Collab.)	REFID=52132
PAKHLOVA 08A	PRL 100 062001	G. Pakhlova <i>et al.</i>	(BELLE Collab.)	REFID=52134
YUAN 08	PR D77 011105	C.Z. Yuan <i>et al.</i>	(BELLE Collab.)	REFID=52135
AUBERT 07AK	PR D76 012008	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51908
AUBERT 07BE	PR D76 111105	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52074
AUBERT 07S	PRL 98 212001	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51724
PAKHLOVA 07	PRL 98 092001	G. Pakhlova <i>et al.</i>	(BELLE Collab.)	REFID=51628
WANG 07D	PRL 99 142002	X.L. Wang <i>et al.</i>	(BELLE Collab.)	REFID=51959
YUAN 07	PRL 99 182004	C.Z. Yuan <i>et al.</i>	(BELLE Collab.)	REFID=51960
AUBERT 06	PR D73 011101	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51017
AUBERT 06B	PR D73 012005	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51026
AUBERT,BE 06D	PR D74 091103	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51511
COAN 06	PRL 96 162003	T.E. Coan <i>et al.</i>	(CLEO Collab.)	REFID=51075
HE 06B	PR D74 091104	Q. He <i>et al.</i>	(CLEO Collab.)	REFID=51523
AUBERT,B 05I	PRL 95 142001	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=50776

NODE=M074

X(4274)

$$J^G(J^{PC}) = 0^+(1^{++})$$

OMITTED FROM SUMMARY TABLE

Seen by AAIJ 17C in $B^+ \rightarrow X K^+$, $X \rightarrow J/\psi \phi$ using an amplitude analysis of $B^+ \rightarrow J/\psi \phi K^+$ with a significance (accounting for systematic uncertainties) of 6.0σ .

NODE=M233

NODE=M233

X(4274) MASS

NODE=M233M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$4273.3 \pm 8.3^{+17.2}_{-3.6}$	4289	¹ AAIJ	17C LHCb	$B^+ \rightarrow J/\psi \phi K^+$

NODE=M233M

¹ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 6.0σ .

NODE=M233M;LINKAGE=A

X(4274) WIDTH

NODE=M233W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$56 \pm 11^{+8}_{-11}$	4289	² AAIJ	17C LHCb	$B^+ \rightarrow J/\psi \phi K^+$

NODE=M233W

² From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 6.0σ .

NODE=M233W;LINKAGE=A

X(4274) DECAY MODES

NODE=M233215;NODE=M233

Mode

 $\Gamma_1 \quad J/\psi \phi$

DESIG=1

X(4274) BRANCHING RATIOS

NODE=M233220

$\Gamma(J/\psi \phi)/\Gamma_{\text{total}}$	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_1/Γ
seen	4289	³ AAIJ	17C LHCb	$B^+ \rightarrow J/\psi \phi K^+$	

NODE=M233R01
NODE=M233R01

³ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 6.0σ .

NODE=M233R01;LINKAGE=A

X(4274) REFERENCES

NODE=M233

AAIJ	17C	PRL 118 022003	R. Aaij <i>et al.</i>	(LHCb Collab.) JP
Also		PR D95 012002	R. Aaij <i>et al.</i>	(LHCb Collab.)

REFID=57657
REFID=57636

NODE=M194

X(4350)

$$J^G(J^{PC}) = 0^+(?^{?+})$$

OMITTED FROM SUMMARY TABLE

Seen by SHEN 10 in the $\gamma\gamma \rightarrow J/\psi \phi$. Needs confirmation.

NODE=M194

X(4350) MASS

NODE=M194M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$4350.6^{+4.6}_{-5.1} \pm 0.7$	$8.8^{+4.2}_{-3.2}$	¹ SHEN	10 BELL	$10.6 e^+ e^- \rightarrow e^+ e^- J/\psi \phi$

NODE=M194M

¹ Statistical significance of 3.2σ .

NODE=M194M;LINKAGE=SH

X(4350) WIDTH

NODE=M194W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$13^{+18}_{-9} \pm 4$	$8.8^{+4.2}_{-3.2}$	¹ SHEN	10 BELL	$10.6 e^+ e^- \rightarrow e^+ e^- J/\psi \phi$

NODE=M194W

¹ Statistical significance of 3.2σ .

NODE=M194W;LINKAGE=SH

X(4350) DECAY MODES

NODE=M194215;NODE=M194

Mode	Fraction (Γ_i/Γ)
Γ_1 $J/\psi\phi$	seen
Γ_2 $\gamma\gamma$	seen

DESIG=1

DESIG=2

X(4350) $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

NODE=M194220

$\Gamma(\gamma\gamma) \times \Gamma(J/\psi\phi)/\Gamma_{\text{total}}$					$\Gamma_2\Gamma_1/\Gamma$
VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT	
$6.7^{+3.2}_{-2.4} \pm 1.1$	$8.8^{+4.2}_{-3.2}$	¹ SHEN	10	BELL	$10.6 e^+ e^- \rightarrow e^+ e^- J/\psi\phi$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$1.5^{+0.7}_{-0.6} \pm 0.3$	$8.8^{+4.2}_{-3.2}$	² SHEN	10	BELL	$10.6 e^+ e^- \rightarrow e^+ e^- J/\psi\phi$
¹ For $J^P = 0^+$. Statistical significance of 3.2σ .					
² For $J^P = 2^+$. Statistical significance of 3.2σ .					

NODE=M194G01
NODE=M194G01

OCCUR=2

NODE=M194G01;LINKAGE=S0
NODE=M194G01;LINKAGE=S2**X(4350) BRANCHING RATIOS**

NODE=M194225

$\Gamma(J/\psi\phi)/\Gamma_{\text{total}}$				Γ_1/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
seen	¹ SHEN	10	BELL	10.6 $e^+e^- \rightarrow e^+e^- J/\psi\phi$
¹ Statistical significance of 3.2 σ .				

NODE=M194R01
NODE=M194R01

NODE=M194R01;LINKAGE=SH

$\Gamma(\gamma\gamma)/\Gamma_{\text{total}}$				Γ_2/Γ
<i>VALUE</i>	<i>DOCUMENT ID</i>	<i>TECN</i>	<i>COMMENT</i>	
seen	¹ SHEN	10	BELL	10.6 $e^+e^- \rightarrow e^+e^- J/\psi\phi$
¹ Statistical significance of 3.2 σ .				

NODE=M194R02
NODE=M194R02

NODE=M194R02;LINKAGE=SH

X(4350) REFERENCESSHEN 10 PRL 104 112004 C.P. Shen *et al.* (BELLE Collab.)

NODE=M194

REFID=53235

NODE=M181

X(4360)

$$I^G(J^PC) = ?^?(1^{--})$$

Seen in radiative return from $e^+ e^-$ collisions at $\sqrt{s} = 9.54\text{--}10.58$ GeV by AUBERT 07S, WANG 07D, and LEES 14F. See also the review under the X(3872) particle listings. (See the index for the page number.)

NODE=M181

X(4360) MASS

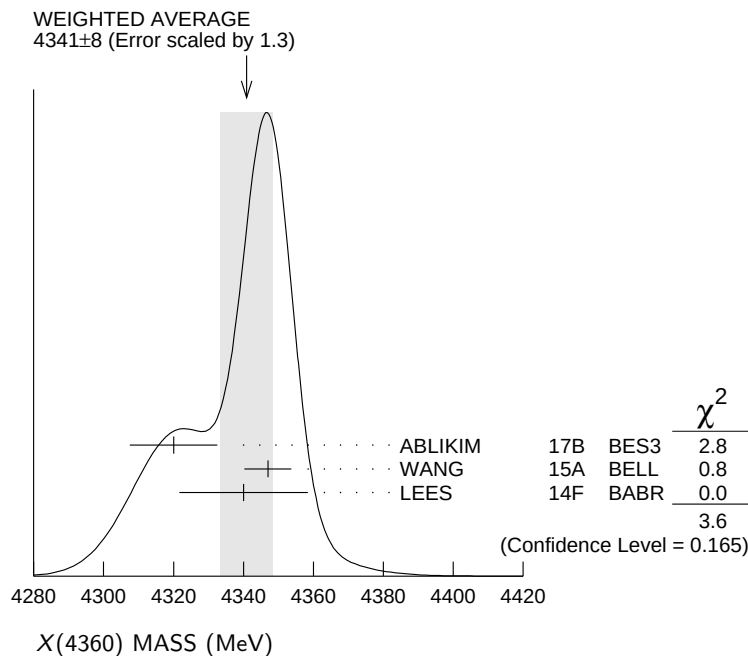
NODE=M181M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
4341 ± 8 OUR AVERAGE	Error includes scale factor of 1.3. See the ideogram below. [4346 ± 6 MeV OUR 2016 AVERAGE]			
4320.0±10.4±7.0		¹ ABLIKIM	17B	BES3 e ⁺ e ⁻ → π ⁺ π ⁻ J/ψ
4347 ± 6 ±3	279	² WANG	15A	BELL 10.58 e ⁺ e ⁻ → γπ ⁺ π ⁻ ψ(2S)
4340 ±16 ±9	37	³ LEES	14F	BABR 10.58 e ⁺ e ⁻ → γπ ⁺ π ⁻ ψ(2S)
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
4355 ⁺⁹ ₋₁₀ ±9	74	⁴ LIU	08H	RVUE 10.58 e ⁺ e ⁻ → γπ ⁺ π ⁻ ψ(2S)
4324 ±24		⁵ AUBERT	07S	BABR 10.58 e ⁺ e ⁻ → γπ ⁺ π ⁻ ψ(2S)
4361 ± 9 ±9	47	³ WANG	07D	BELL 10.58 e ⁺ e ⁻ → γπ ⁺ π ⁻ ψ(2S)
¹ From a three-resonance fit.				
² From a two-resonance fit. Supersedes WANG 07D.				
³ From a two-resonance fit.				
⁴ From a combined fit of AUBERT 07S and WANG 07D data with two resonances.				
⁵ From a single-resonance fit. Systematic errors not estimated.				

NODE=M181M

NEW

NODE=M181M;LINKAGE=B
NODE=M181M;LINKAGE=A
NODE=M181M;LINKAGE=WA
NODE=M181M;LINKAGE=LI
NODE=M181M;LINKAGE=AU



X(4360) WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
102 ± 9 OUR AVERAGE				
[102 ± 10 MeV OUR 2016 AVERAGE]				
101.4 ^{+25.3} _{-19.7} ± 10.2		1 ABLIKIM	17B BES3	$e^+e^- \rightarrow \pi^+\pi^- J/\psi$
103 ± 9 ± 5	279	2 WANG	15A BELL	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$
94 ± 32 ± 13	37	3 LEES	14F BABR	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

103 ⁺¹⁷ ₋₁₅ ± 11	74	4 LIU	08H RVUE	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$
172 ± 33		5 AUBERT	07S BABR	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$
74 ± 15 ± 10	47	3 WANG	07D BELL	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$

¹ From a three-resonance fit.

² From a two-resonance fit. Supersedes WANG 07D.

³ From a two-resonance fit.

⁴ From a combined fit of AUBERT 07S and WANG 07D data with two resonances.

⁵ From a single-resonance fit. Systematic errors not estimated.

NODE=M181W

NODE=M181W

NEW

NODE=M181W;LINKAGE=B
NODE=M181W;LINKAGE=A
NODE=M181W;LINKAGE=WA
NODE=M181W;LINKAGE=LI
NODE=M181W;LINKAGE=AU

X(4360) DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 e^+e^-	
Γ_2 $\psi(2S)\pi^+\pi^-$	seen
Γ_3 $\psi(3823)\pi^+\pi^-$	possibly seen
Γ_4 $J/\psi\eta$	
Γ_5 $D^0D^{*-}\pi^+$	
Γ_6 $\chi_{c1}\gamma$	
Γ_7 $\chi_{c2}\gamma$	

DESIG=1

DESIG=2;OUR EVAL;→ UNCHECKED ←

DESIG=5

DESIG=4

DESIG=3

DESIG=6

DESIG=7

NODE=M181215;NODE=M181

X(4360) $\Gamma(i) \times \Gamma(e^+e^-)/\Gamma(\text{total})$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT	$\Gamma_2\Gamma_1/\Gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
9.2±0.6±0.6	279	1 WANG	15A BELL	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$	
10.9±0.6±0.7	279	2 WANG	15A BELL	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$	
6.0±1.0±0.5	37	3 LEES	14F BABR	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$	
7.2±1.0±0.6	37	4 LEES	14F BABR	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$	
11.1 ^{+1.3} _{-1.2}	74	5 LIU	08H RVUE	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$	
12.3±1.2	74	6 LIU	08H RVUE	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$	
10.4±1.7±1.5	47	3 WANG	07D BELL	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$	
11.8±1.8±1.4	47	4 WANG	07D BELL	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$	

NODE=M181230

NODE=M181G1

NODE=M181G1

OCCUR=2

OCCUR=2

OCCUR=2

OCCUR=2

- ¹ Solution I of two equivalent solutions from a fit using two interfering resonances. Supersedes WANG 07D.
² Solution II of two equivalent solutions from a fit using two interfering resonances. Supersedes WANG 07D.
³ Solution I of two equivalent solutions in a fit using two interfering resonances.
⁴ Solution II of two equivalent solutions in a fit using two interfering resonances.
⁵ Solution I in a combined fit of AUBERT 07S and WANG 07D data with two resonances.
⁶ Solution II in a combined fit of AUBERT 07S and WANG 07D data with two resonances.

$$\Gamma(J/\psi\eta) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_4\Gamma_1/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

<6.8	90	WANG	13B	BELL $e^+e^- \rightarrow J/\psi\eta\gamma$

$$\Gamma(\chi_{c1}\gamma) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_6\Gamma_1/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT

<0.57	90	¹ HAN	15	BELL $10.58 e^+e^- \rightarrow \chi_{c1}\gamma$

¹ Using $B(\eta \rightarrow \gamma\gamma) = (39.41 \pm 0.21)\%$.

$$\Gamma(\chi_{c2}\gamma) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_7\Gamma_1/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT

<1.9	90	¹ HAN	15	BELL $10.58 e^+e^- \rightarrow \chi_{c2}\gamma$

¹ Using $B(\eta \rightarrow \gamma\gamma) = (39.41 \pm 0.21)\%$.

X(4360) BRANCHING RATIOS

$$\Gamma(D^0 D^{*-} \pi^+)/\Gamma(\psi(2S)\pi^+\pi^-) \quad \Gamma_5/\Gamma_2$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<8	90	PAKHOVA	09	BELL $e^+e^- \rightarrow X(4360) \rightarrow D^0 D^{*-} \pi^+$

$$\Gamma(\psi(3823)\pi^+\pi^-)/\Gamma_{\text{total}} \quad \Gamma_3/\Gamma$$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

possibly seen	19	¹ ABLIKIM	15S	BES3 $e^+e^- \rightarrow \pi^+\pi^-\chi_{c1}\gamma$

¹ From a fit of $e^+e^- \rightarrow \pi^+\pi^-\psi(3823)$, $\psi(3823) \rightarrow \chi_{c1}\gamma$ cross sections taken at $\sqrt{s}$ values of 4.23, 4.26, 4.36, 4.42, and 4.60 GeV to the X(4360) line shape.

$$\Gamma(D^0 D^{*-} \pi^+)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_5/\Gamma \times \Gamma_1/\Gamma$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<0.72 $\times 10^{-6}$	90	¹ PAKHOVA	09	BELL $e^+e^- \rightarrow X(4360) \rightarrow D^0 D^{*-} \pi^+$

¹ Using $4355^{+9}_{-10} \pm 9$ MeV for the mass of X(4360).

X(4360) REFERENCES

ABLIKIM	17B	PRL 118 092001	M. Ablikim <i>et al.</i>	(BES III Collab.)
ABLIKIM	15S	PRL 115 011803	M. Ablikim <i>et al.</i>	(BES III Collab.)
HAN	15	PR D92 012011	Y.L. Han <i>et al.</i>	(BELLE Collab.)
WANG	15A	PR D91 112007	X.L. Wang <i>et al.</i>	(BELLE Collab.)
LEES	14F	PR D89 111103	J.P. Lees <i>et al.</i>	(BABAR Collab.)
WANG	13B	PR D87 051101	X.L. Wang <i>et al.</i>	(BELLE Collab.)
PAKHOVA	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=M181G1;LINKAGE=A

NODE=M181G1;LINKAGE=B

NODE=M181G1;LINKAGE=WA

NODE=M181G1;LINKAGE=WN

NODE=M181G1;LINKAGE=LI

NODE=M181G1;LINKAGE=LU

NODE=M181G01

NODE=M181G01

NODE=M181G02

NODE=M181G02

NODE=M181G02;LINKAGE=A

NODE=M181G03

NODE=M181G03

NODE=M181G03;LINKAGE=A

NODE=M181225

NODE=M181R01

NODE=M181R01

NODE=M181R03

NODE=M181R03

NODE=M181R03;LINKAGE=A

NODE=M181R02

NODE=M181R02

NODE=M181R02;LINKAGE=PA

NODE=M181

REFID=57755

REFID=56784

REFID=56816

REFID=56839

REFID=55938

REFID=55377

REFID=53143

REFID=52296

REFID=51724

REFID=51959

$\psi(4415)$

$$I^G(J^{PC}) = 0^-(1^{--})$$

NODE=M073

 $\psi(4415)$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
4421 $\pm$ 4 OUR ESTIMATE			
4415.1 $\pm$ 7.9	¹ ABLIKIM	08D BES2	$e^+e^- \rightarrow$ hadrons
• • • We do not use the following data for averages, fits, limits, etc. • • •			
4412 $\pm$ 15	² MO	10 RVUE	$e^+e^- \rightarrow$ hadrons
4411 $\pm$ 7	³ PAKHLOVA	08A BELL	$10.6 e^+e^- \rightarrow D^0 D^- \pi^+ \gamma$
4425 $\pm$ 6	⁴ SETH	05A RVUE	$e^+e^- \rightarrow$ hadrons
4429 $\pm$ 9	⁵ SETH	05A RVUE	$e^+e^- \rightarrow$ hadrons
4417 $\pm$ 10	BRANDELIK	78C DASP	e^+e^-
4414 $\pm$ 7	SIEGRIST	76 MRK1	e^+e^-
¹ Reanalysis of data presented in BAI 02C. From a global fit over the center-of-mass energy region 3.7–5.0 GeV covering the $\psi(3770)$, $\psi(4040)$, $\psi(4160)$, and $\psi(4415)$ resonances. Phase angle fixed in the fit to $\delta = (234 \pm 88)^\circ$.			
² Reanalysis of data presented in BAI 00 and BAI 02C. From a global fit over the center-of-mass energy 3.8–4.8 GeV covering the $\psi(4040)$, $\psi(4160)$ and $\psi(4415)$ resonances and including interference effects.			
³ Systematic uncertainties not estimated.			
⁴ From a fit to Crystal Ball (OSTERHELD 86) data.			
⁵ From a fit to BES (BAI 02C) data.			

NODE=M073M

NODE=M073M
→ UNCHECKED ←

OCCUR=2

NODE=M073M;LINKAGE=AB

NODE=M073M;LINKAGE=MO

NODE=M073M;LINKAGE=NS
NODE=M073M;LINKAGE=ST
NODE=M073M;LINKAGE=SE **$\psi(4415)$ WIDTH**

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
62 $\pm$ 20 OUR ESTIMATE			
71.5 $\pm$ 19.0	⁶ ABLIKIM	08D BES2	$e^+e^- \rightarrow$ hadrons
• • • We do not use the following data for averages, fits, limits, etc. • • •			
118 $\pm$ 32	⁷ MO	10 RVUE	$e^+e^- \rightarrow$ hadrons
77 $\pm$ 20	⁸ PAKHLOVA	08A BELL	$10.6 e^+e^- \rightarrow D^0 D^- \pi^+ \gamma$
119 $\pm$ 16	⁹ SETH	05A RVUE	$e^+e^- \rightarrow$ hadrons
118 $\pm$ 35	¹⁰ SETH	05A RVUE	$e^+e^- \rightarrow$ hadrons
66 $\pm$ 15	BRANDELIK	78C DASP	e^+e^-
33 $\pm$ 10	SIEGRIST	76 MRK1	e^+e^-
⁶ Reanalysis of data presented in BAI 02C. From a global fit over the center-of-mass energy region 3.7–5.0 GeV covering the $\psi(3770)$, $\psi(4040)$, $\psi(4160)$, and $\psi(4415)$ resonances. Phase angle fixed in the fit to $\delta = (234 \pm 88)^\circ$.			
⁷ Reanalysis of data presented in BAI 00 and BAI 02C. From a global fit over the center-of-mass energy 3.8–4.8 GeV covering the $\psi(4040)$, $\psi(4160)$ and $\psi(4415)$ resonances and including interference effects.			
⁸ Systematic uncertainties not estimated.			
⁹ From a fit to Crystal Ball (OSTERHELD 86) data.			
¹⁰ From a fit to BES (BAI 02C) data.			

NODE=M073W

NODE=M073W
→ UNCHECKED ←

OCCUR=2

NODE=M073W;LINKAGE=AB

NODE=M073W;LINKAGE=MO

NODE=M073W;LINKAGE=NS
NODE=M073W;LINKAGE=ST
NODE=M073W;LINKAGE=SE **$\psi(4415)$ DECAY MODES**

Due to the complexity of the $c\bar{c}$ threshold region, in this listing, “seen” (“not seen”) means that a cross section for the mode in question has been measured at effective $\sqrt{s}$ near this particle’s central mass value, more (less) than 2σ above zero, without regard to any peaking behavior in $\sqrt{s}$ or absence thereof. See mode listing(s) for details and references.

NODE=M073215;NODE=M073

NODE=M073

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 $D\bar{D}$	seen	
Γ_2 $D^0\bar{D}^0$	seen	
Γ_3 D^+D^-	seen	
Γ_4 $D^*\bar{D} + \text{c.c.}$	seen	
Γ_5 $D^*(2007)^0\bar{D}^0 + \text{c.c.}$	seen	
Γ_6 $D^*(2010)^+D^- + \text{c.c.}$	seen	
Γ_7 $D^*\bar{D}^*$	seen	
Γ_8 $D^*(2007)^0\bar{D}^*(2007)^0 + \text{c.c.}$	seen	
Γ_9 $D^*(2010)^+D^*(2010)^- + \text{c.c.}$	seen	

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

Γ_{10}	$D^0 D^- \pi^+ (\text{excl. } D^*(2007)^0 \bar{D}^0 + \text{c.c.}, D^*(2010)^+ D^- + \text{c.c.})$	< 2.3	%	90%	DESIG=4
Γ_{11}	$D \bar{D}_2^*(2460) \rightarrow D^0 D^- \pi^+ + \text{c.c.}$	(10 ± 4)	%		DESIG=5
Γ_{12}	$D^0 D^{*-} \pi^+ + \text{c.c.}$	< 11	%	90%	DESIG=6
Γ_{13}	$D_s^+ D_s^-$	not seen			DESIG=16
Γ_{14}	$\omega \chi_{c2}$	possibly seen			DESIG=20
Γ_{15}	$D_s^{*+} D_s^- + \text{c.c.}$	seen			DESIG=17
Γ_{16}	$D_s^{*+} D_s^{*-}$	not seen			DESIG=18
Γ_{17}	$\psi(3823) \pi^+ \pi^-$	possibly seen			DESIG=21
Γ_{18}	$J/\psi \eta$	< 6	$\times 10^{-3}$	90%	DESIG=19
Γ_{19}	$\chi_{c1} \gamma$	< 8	$\times 10^{-4}$	90%	DESIG=22
Γ_{20}	$\chi_{c2} \gamma$	< 4	$\times 10^{-3}$	90%	DESIG=23
Γ_{21}	$e^+ e^-$	$(9.4 \pm 3.2) \times 10^{-6}$			DESIG=1

$\psi(4415)$ PARTIAL WIDTHS

NODE=M073220

 $\Gamma(e^+ e^-)$ Γ_{21}

VALUE (keV)

DOCUMENT ID

TECN

COMMENT

0.58±0.07 OUR ESTIMATE**0.35±0.12**

11 ABLIKIM

08D

BES2

 $e^+ e^- \rightarrow \text{hadrons}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.4 to 0.8

12 MO

10

RVUE

 $e^+ e^- \rightarrow \text{hadrons}$

0.72±0.11

13 SETH

05A

RVUE

 $e^+ e^- \rightarrow \text{hadrons}$

0.64±0.23

14 SETH

05A

RVUE

 $e^+ e^- \rightarrow \text{hadrons}$

0.49±0.13

BRANDELIK

78C

DASP

 $e^+ e^-$

0.44±0.14

SIEGRIST

76

MRK1

 $e^+ e^-$

¹¹ Reanalysis of data presented in BAI 02C. From a global fit over the center-of-mass energy region 3.7–5.0 GeV covering the $\psi(3770)$, $\psi(4040)$, $\psi(4160)$, and $\psi(4415)$ resonances. Phase angle fixed in the fit to $\delta = (234 \pm 88)^\circ$.

¹² Reanalysis of data presented in BAI 00 and BAI 02C. From a global fit over the center-of-mass energy 3.8–4.8 GeV covering the $\psi(4040)$, $\psi(4160)$ and $\psi(4415)$ resonances and including interference effects. Four sets of solutions are obtained with the same fit quality, mass and total width, but with different $e^+ e^-$ partial widths. We quote only the range of values.

¹³ From a fit to Crystal Ball (OSTERHELD 86) data.

¹⁴ From a fit to BES (BAI 02C) data.

NODE=M073W1
NODE=M073W1
→ UNCHECKED ←

OCCUR=2

NODE=M073W1;LINKAGE=AB

NODE=M073W1;LINKAGE=MO

NODE=M073W1;LINKAGE=ST
NODE=M073W1;LINKAGE=SE

$\psi(4415) \Gamma(i) \times \Gamma(e^+ e^-) / \Gamma(\text{total})$

NODE=M073230

 $\Gamma(J/\psi \eta) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$ $\Gamma_{18} \Gamma_{21} / \Gamma$

VALUE (eV)

CL%

DOCUMENT ID

TECN

COMMENT

<3.6

90

WANG

13B

BELL

 $e^+ e^- \rightarrow J/\psi \eta \gamma$ $\Gamma(\chi_{c1} \gamma) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$ $\Gamma_{19} \Gamma_{21} / \Gamma$

VALUE (eV)

CL%

DOCUMENT ID

TECN

COMMENT

<0.47

90

15 HAN

15

BELL

 $10.58 e^+ e^- \rightarrow \chi_{c1} \gamma$

¹⁵ Using $B(\eta \rightarrow \gamma \gamma) = (39.41 \pm 0.21)\%$.

NODE=M073G01
NODE=M073G01

NODE=M073G02
NODE=M073G02

NODE=M073G02;LINKAGE=A

 $\Gamma(\chi_{c2} \gamma) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$ $\Gamma_{20} \Gamma_{21} / \Gamma$

VALUE (eV)

CL%

DOCUMENT ID

TECN

COMMENT

<2.3

90

16 HAN

15

BELL

 $10.58 e^+ e^- \rightarrow \chi_{c2} \gamma$

¹⁶ Using $B(\eta \rightarrow \gamma \gamma) = (39.41 \pm 0.21)\%$.

NODE=M073G03
NODE=M073G03

NODE=M073G03;LINKAGE=A

$\psi(4415)$ BRANCHING RATIOS

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

$$\Gamma(D^+ D^-)/\Gamma_{\text{total}} \quad \Gamma_3/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
seen	PAKHLOVA	08	BELL $e^+ e^- \rightarrow D^+ D^- \gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
not seen	AUBERT	09M	BABR $e^+ e^- \rightarrow D^+ D^- \gamma$

NODE=M073R05
NODE=M073R05

$$\Gamma(D\bar{D})/\Gamma(D^* \bar{D}^*) \quad \Gamma_1/\Gamma_7$$

VALUE	DOCUMENT ID	TECN	COMMENT
0.14 ± 0.12 ± 0.03	AUBERT	09M	BABR $e^+ e^- \rightarrow \gamma D^{(*)} \bar{D}^{(*)}$

NODE=M073R02
NODE=M073R02

$$\Gamma(D^*(2007)^0 \bar{D}^0 + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_5/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
seen	AUBERT	09M	BABR $e^+ e^- \rightarrow D^{*0} \bar{D}^0 \gamma$

NODE=M073R06
NODE=M073R06

$$\Gamma(D^*(2010)^+ D^- + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_6/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
seen	AUBERT	09M	BABR $e^+ e^- \rightarrow D^{*+} D^- \gamma$
seen	PAKHLOVA	07	BELL $e^+ e^- \rightarrow D^{*+} D^- \gamma$

NODE=M073R07
NODE=M073R07

$$\Gamma(D^* \bar{D} + \text{c.c.})/\Gamma(D^* \bar{D}^*) \quad \Gamma_4/\Gamma_7$$

VALUE	DOCUMENT ID	TECN	COMMENT
0.17 ± 0.25 ± 0.03	AUBERT	09M	BABR $e^+ e^- \rightarrow \gamma D^{(*)} \bar{D}^{(*)}$

NODE=M073R03
NODE=M073R03

$$\Gamma(D^*(2007)^0 \bar{D}^*(2007)^0 + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_8/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
seen	AUBERT	09M	BABR $e^+ e^- \rightarrow D^{*0} \bar{D}^{*0} \gamma$

NODE=M073R08
NODE=M073R08

$$\Gamma(D^*(2010)^+ D^*(2010)^- + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_9/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
seen	AUBERT	09M	BABR $e^+ e^- \rightarrow D^{*+} D^{*-} \gamma$
seen	PAKHLOVA	07	BELL $e^+ e^- \rightarrow D^{*+} D^{*-} \gamma$

NODE=M073R09
NODE=M073R09

$$\Gamma(D\bar{D}_2^*(2460) \rightarrow D^0 D^- \pi^+ + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_{11}/\Gamma$$

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
10.5 ± 2.4 ± 3.8	17 PAKHLOVA	08A	BELL 10.6 $e^+ e^- \rightarrow D^0 D^- \pi^+ \gamma$

¹⁷ 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

$$\Gamma(D^0 D^- \pi^+ (\text{excl. } D^*(2007)^0 \bar{D}^0 + \text{c.c.}, D^*(2010)^+ D^- + \text{c.c.})/\Gamma(D\bar{D}_2^*(2460) \rightarrow D^0 D^- \pi^+ + \text{c.c.}) \quad \Gamma_{10}/\Gamma_{11}$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.22	90	18 PAKHLOVA	08A	BELL 10.6 $e^+ e^- \rightarrow D^0 D^- \pi^+ \gamma$

¹⁸ 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

$$\Gamma(D^0 D^{*-} \pi^+ + \text{c.c.})/\Gamma_{\text{total}} \times \Gamma(e^+ e^-)/\Gamma_{\text{total}} \quad \Gamma_{12}/\Gamma \times \Gamma_{21}/\Gamma$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.99 × 10⁻⁶	90	19 PAKHLOVA	09	BELL $e^+ e^- \rightarrow D^0 D^{*-} \pi^+$

¹⁹ Using 4421 ± 4 MeV for the mass of $\psi(4415)$.

NODE=M073R01
NODE=M073R01

NODE=M073R01;LINKAGE=PA

$$\Gamma(D_s^+ D_s^-)/\Gamma_{\text{total}} \quad \Gamma_{13}/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	PAKHLOVA	11	BELL $e^+ e^- \rightarrow D_s^+ D_s^- \gamma$
not seen	DEL-AMO-SA..10N	BABR	$e^+ e^- \rightarrow D_s^+ D_s^- \gamma$

NODE=M073R10
NODE=M073R10

$$\Gamma(\omega \chi_{c2})/\Gamma_{\text{total}} \quad \Gamma_{14}/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
possibly seen	ABLIKIM	16A	BES3 $e^+ e^- \rightarrow \gamma \pi^+ \pi^- \pi^0 \ell^+ \ell^-$

NODE=M073R00
NODE=M073R00

$$\Gamma(D_s^{*+} D_s^- + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_{15}/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
seen	PAKHLOVA	11	BELL $e^+ e^- \rightarrow D_s^{*+} D_s^- \gamma$
seen	DEL-AMO-SA..10N	BABR	$e^+ e^- \rightarrow D_s^{*+} D_s^- \gamma$

NODE=M073R11
NODE=M073R11

$\Gamma(D_s^{*+} D_s^{*-})/\Gamma_{\text{total}}$	VALUE	DOCUMENT ID	TECN	COMMENT	Γ_{16}/Γ
not seen		PAKHLOVA 11	BELL	$e^+ e^- \rightarrow D_s^{*+} D_s^{*-} \gamma$	NODE=M073R12 NODE=M073R12
not seen		DEL-AMO-SA...10N	BABR	$e^+ e^- \rightarrow D_s^{*+} D_s^{*-} \gamma$	

$\Gamma(\psi(3823)\pi^+\pi^-)/\Gamma_{\text{total}}$	VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_{17}/Γ
possibly seen	19	20	ABLIKIM 155	BES3	$e^+ e^- \rightarrow \pi^+ \pi^- \chi_{c1} \gamma$	NODE=M073R13 NODE=M073R13

²⁰ From a fit of $e^+ e^- \rightarrow \pi^+ \pi^- \psi(3823)$, $\psi(3823) \rightarrow \chi_{c1} \gamma$ cross sections taken at $\sqrt{s}$ values of 4.23, 4.26, 4.36, 4.42, and 4.60 GeV to the $\psi(4415)$ line shape.

NODE=M073R13;LINKAGE=A

$\psi(4415)$ REFERENCES

ABLIKIM 16A	PR D93 011102	M. Ablikim <i>et al.</i>	(BES III Collab.)
ABLIKIM 15S	PRL 115 011803	M. Ablikim <i>et al.</i>	(BES III Collab.)
HAN 15	PR D92 012011	Y.L. Han <i>et al.</i>	(BELLE Collab.)
WANG 13B	PR D87 051101	X.L. Wang <i>et al.</i>	(BELLE Collab.)
PAKHLOVA 11	PR D83 011101	G. Pakhlova <i>et al.</i>	(BELLE Collab.)
DEL-AMO-SA...10N	PR D82 052004	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)
MO 10	PR D82 077501	X.H. Mo, C.Z. Yuan, P. Wang	(BHEP)
AUBERT 09M	PR D79 092001	B. Aubert <i>et al.</i>	(BABAR Collab.)
PAKHLOVA 09	PR D80 091101	G. Pakhlova <i>et al.</i>	(BELLE Collab.)
ABLIKIM 08D	PL B660 315	M. Ablikim <i>et al.</i>	(BES Collab.)
PAKHLOVA 08	PR D77 011103	G. Pakhlova <i>et al.</i>	(BELLE Collab.)
PAKHLOVA 08A	PRL 100 062001	G. Pakhlova <i>et al.</i>	(BELLE Collab.)
PAKHLOVA 07	PRL 98 092001	G. Pakhlova <i>et al.</i>	(BELLE Collab.)
SETH 05A	PR D72 017501	K.K. Seth	
BAI 02C	PRL 88 101802	J.Z. Bai <i>et al.</i>	(BES Collab.)
BAI 00	PRL 84 594	J.Z. Bai <i>et al.</i>	(BES Collab.)
OSTERHELD 86	SLAC-PUB-4160	A. Osterheld <i>et al.</i>	(SLAC Crystal Ball Collab.)
BRANDELIK 78C	PL 76B 361	R. Brandelik <i>et al.</i>	(DASP Collab.)
SIEGRIST 76	PRL 36 700	J.L. Siegrist <i>et al.</i>	(LBL, SLAC)

NODE=M073

REFID=57122
REFID=56784
REFID=56816
REFID=55377
REFID=53638
REFID=53532
REFID=53540
REFID=52724
REFID=53143
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REFID=52132
REFID=52134
REFID=51628
REFID=50813
REFID=50506
REFID=50503
REFID=51064
REFID=22232
REFID=22243

$X(4430)^\pm$

$$I(J^P) = ?(1^+)$$

First seen by CHOI 08 in $B \rightarrow K\pi^+\psi(2S)$ decays, confirmed by AAIJ 14AG, and confirmed in a model-independent way by AAIJ 15BH. Also seen by CHILIKIN 14 in $B \rightarrow K^+\pi J/\psi$ decays. J^P was determined by CHILIKIN 13 and AAIJ 14AG.

NODE=M195

NODE=M195

$X(4430)^\pm$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
4478⁺¹⁵₋₁₈ OUR AVERAGE			
4475 $\pm 7^{+15}_{-25}$	¹ AAIJ	14AG LHCb	$B^0 \rightarrow K^+\pi^-\psi(2S)$
4485 $\pm 22^{+28}_{-11}$	¹ CHILIKIN	13 BELL	$B^0 \rightarrow K^+\pi^-\psi(2S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
4443 $^{+15+19}_{-12-13}$	² MIZUK	09 BELL	$B \rightarrow K\pi^+\psi(2S)$
4433 $\pm 4 \pm 2$	³ CHOI	08 BELL	$B \rightarrow K\pi^+\psi(2S)$

¹ From a four-dimensional amplitude analysis.

² From a Dalitz plot analysis. Superseded by CHILIKIN 13.

³ Superseded by MIZUK 09 and CHILIKIN 13.

NODE=M195M

NODE=M195M

NODE=M195M;LINKAGE=A
NODE=M195M;LINKAGE=MI
NODE=M195M;LINKAGE=CH

$X(4430)^\pm$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
181± 31 OUR AVERAGE			
172 $\pm 13^{+37}_{-34}$	¹ AAIJ	14AG LHCb	$B^0 \rightarrow K^+\pi^-\psi(2S)$
200 $^{+41+26}_{-46-35}$	¹ CHILIKIN	13 BELL	$B^0 \rightarrow K^+\pi^-\psi(2S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
107 $^{+86+74}_{-43-56}$	² MIZUK	09 BELL	$B \rightarrow K\pi^+\psi(2S)$
45 $^{+18+30}_{-13-13}$	³ CHOI	08 BELL	$B \rightarrow K\pi^+\psi(2S)$

¹ From a four-dimensional amplitude analysis.

² From a Dalitz plot analysis. Superseded by CHILIKIN 13.

³ Superseded by MIZUK 09 and CHILIKIN 13.

NODE=M195W

NODE=M195W

NODE=M195W;LINKAGE=A
NODE=M195W;LINKAGE=MI
NODE=M195W;LINKAGE=CH

X(4430)[±] DECAY MODES

NODE=M195215;NODE=M195

Mode	Fraction (Γ_i/Γ)
Γ_1 $\pi^+\psi(2S)$	seen
Γ_2 π^+J/ψ	seen

DESIG=1
DESIG=2

X(4430)[±] BRANCHING RATIOS

NODE=M195225

$\Gamma(\pi^+\psi(2S))/\Gamma_{\text{total}}$				Γ_1/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
seen	¹ AAIJ	14AG LHCb	$B^0 \rightarrow K^+\pi^-\psi(2S)$	
seen	² CHILIKIN	13 BELL	$B^0 \rightarrow K^+\pi^-\psi(2S)$	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
not seen	³ AUBERT	09AA BABR	$B \rightarrow K\pi^+\psi(2S)$	
seen	⁴ MIZUK	09 BELL	$B \rightarrow K\pi^+\psi(2S)$	
¹ From a four-dimensional amplitude analysis. No product of branching fractions quoted.				
² From a four-dimensional amplitude analysis. Measured a product of branching fractions $B(B^0 \rightarrow X(4430)^-K^+) \times B(X(4430)^- \rightarrow \psi(2S)\pi^-) = (6.0^{+1.7+2.5}_{-2.0-1.4}) \times 10^{-5}$.				
³ AUBERT 09AA quotes $B(B^+ \rightarrow \bar{K}^0 X(4430)^+) \times B(X(4430)^+ \rightarrow \pi^+\psi(2S)) < 4.7 \times 10^{-5}$ 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.				
⁴ Measured a product of branching fractions $B(\bar{B}^0 \rightarrow K^- X(4430)^+) \times B(X(4430)^+ \rightarrow \pi^+\psi(2S)) = (3.2^{+1.8+5.3}_{-0.9-1.6}) \times 10^{-5}$. Superseded by CHILIKIN 13.				

NODE=M195R01
NODE=M195R01

NODE=M195R01;LINKAGE=AA
NODE=M195R01;LINKAGE=A

NODE=M195R01;LINKAGE=AU

NODE=M195R01;LINKAGE=MI

$\Gamma(\pi^+J/\psi)/\Gamma_{\text{total}}$				Γ_2/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
seen	¹ CHILIKIN	14 BELL	$\bar{B}^0 \rightarrow K^-\pi^+J/\psi$	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
not seen	² AUBERT	09AA BABR	$B \rightarrow K\pi^+J/\psi$	
¹ CHILIKIN 14 reports $B(\bar{B}^0 \rightarrow X(4430)^+K^-) \times B(X(4430)^+ \rightarrow J/\psi\pi^+) = (5.4^{+4.0+1.1}_{-1.0-0.9}) \times 10^{-6}$.				
² 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=A

NODE=M195R02;LINKAGE=AU

X(4430)[±] REFERENCES

NODE=M195

AAIJ	15BH PR D92 112009	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	14AG PRL 112 222002	R. Aaij <i>et al.</i>	(LHCb Collab.) JP
CHILIKIN	14 PR D90 112009	K. Chilikin <i>et al.</i>	(BELLE Collab.)
CHILIKIN	13 PR D88 074026	K. Chilikin <i>et al.</i>	(BELLE Collab.) JP
AUBERT	09AA PR D79 112001	B. Aubert <i>et al.</i>	(BABAR Collab.)
MIZUK	09 PR D80 031104	R. Mizuk <i>et al.</i>	(BELLE Collab.)
CHOI	08 PRL 100 142001	S.-K. Choi <i>et al.</i>	(BELLE Collab.)

REFID=57110
REFID=55896
REFID=56344
REFID=55551
REFID=52940
REFID=52960
REFID=52178

NODE=M234

X(4500)

$I^G(J^{PC}) = 0^+(0^{++})$

OMITTED FROM SUMMARY TABLE

Seen by AAIJ 17C in $B^+ \rightarrow X K^+$, $X \rightarrow J/\psi \phi$ using an amplitude analysis of $B^+ \rightarrow J/\psi \phi K^+$ with a significance (accounting for systematic uncertainties) of 6.1σ .

NODE=M234

X(4500) MASS

NODE=M234M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$4506 \pm 11^{+12}_{-15}$	4289	¹ AAIJ	17C LHCb	$B^+ \rightarrow J/\psi \phi K^+$

NODE=M234M

¹ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 6.1σ .

NODE=M234M;LINKAGE=A

X(4500) WIDTH

NODE=M234W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$92 \pm 21^{+21}_{-20}$	4289	² AAIJ	17C LHCb	$B^+ \rightarrow J/\psi \phi K^+$

NODE=M234W

² From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 6.1σ .

NODE=M234W;LINKAGE=A

X(4500) DECAY MODES

NODE=M234215;NODE=M234

Mode
$\Gamma_1 \quad J/\psi \phi$

DESIG=1

X(4500) BRANCHING RATIOS

NODE=M234220

$\Gamma(J/\psi \phi)/\Gamma_{\text{total}}$					Γ_1/Γ
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
seen	4289	³ AAIJ	17C LHCb	$B^+ \rightarrow J/\psi \phi K^+$	

NODE=M234R01
NODE=M234R01

³ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 6.1σ .

NODE=M234R01;LINKAGE=A

X(4500) REFERENCES

NODE=M234

AAIJ	17C	PRL 118 022003	R. Aaij <i>et al.</i>	(LHCb Collab.) JP
Also		PR D95 012002	R. Aaij <i>et al.</i>	(LHCb Collab.)

REFID=57657
REFID=57636

NODE=M189

X(4660)

$I^G(J^{PC}) = ?^?(1^{--})$

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, AUBERT 07S, and LEES 14F. See also the review under the X(3872) particle listings. (See the index for the page number.)

NODE=M189

X(4660) MASS

NODE=M189M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
4643 ± 9 OUR AVERAGE		Error includes scale factor of 1.2.		
$4652 \pm 10 \pm 11$	279	¹ WANG	15A BELL	$10.58 e^+ e^- \rightarrow \gamma \pi^+ \pi^- \psi(2S)$
$4669 \pm 21 \pm 3$	37	² LEES	14F BABR	$10.58 e^+ e^- \rightarrow \gamma \pi^+ \pi^- \psi(2S)$
$4634^{+8}_{-7}^{+5}_{-8}$	142	³ PAKHLOVA	08B BELL	$e^+ e^- \rightarrow \Lambda_c^+ \Lambda_c^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$4661^{+9}_{-8} \pm 6$	44	⁴ LIU	08H RVUE	$10.58 e^+ e^- \rightarrow \gamma \pi^+ \pi^- \psi(2S)$
$4664 \pm 11 \pm 5$	44	WANG	07D BELL	$10.58 e^+ e^- \rightarrow \gamma \pi^+ \pi^- \psi(2S)$

NODE=M189M

- ¹ From a two-resonance fit. Supersedes WANG 07D.
² From a two-resonance fit.
³ The $\pi^+\pi^-\psi(2S)$ and $\Lambda_c^+\Lambda_c^-$ states are not necessarily the same.
⁴ From a combined fit of AUBERT 07S and WANG 07D data with two resonances.

X(4660) WIDTH

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
72±11 OUR AVERAGE				
68±11±5	279	¹ WANG	15A BELL	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$
104±48±10	37	² LEES	14F BABR	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$
92 ⁺⁴⁰⁺¹⁰ ₋₂₄₋₂₁	142	³ PAKHLOVA	08B BELL	$e^+e^- \rightarrow \Lambda_c^+\Lambda_c^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
42 ⁺¹⁷ ₋₁₂ ±6	44	⁴ LIU	08H RVUE	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$
48±15±3	44	WANG	07D BELL	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$

- ¹ From a two-resonance fit. Supersedes WANG 07D.
² From a two-resonance fit.
³ The $\pi^+\pi^-\psi(2S)$ and $\Lambda_c^+\Lambda_c^-$ states are not necessarily the same.
⁴ From a combined fit of AUBERT 07S and WANG 07D data with two resonances.

X(4660) DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 e^+e^-	seen
Γ_2 $\psi(2S)\pi^+\pi^-$	
Γ_3 $J/\psi\eta$	
Γ_4 $D^0D^{*-}\pi^+$	
Γ_5 $\chi_{c1}\gamma$	
Γ_6 $\chi_{c2}\gamma$	
Γ_7 $\Lambda_c^+\Lambda_c^-$	

X(4660) $\Gamma(i) \times \Gamma(e^+e^-)/\Gamma(\text{total})$

$\Gamma(\psi(2S)\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$					$\Gamma_2\Gamma_1/\Gamma$
VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
2.0±0.3±0.2	279	¹ WANG	15A BELL	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$	OCCUR=2
8.1±1.1±1.0	279	² WANG	15A BELL	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$	
2.7±1.3±0.5	37	³ LEES	14F BABR	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$	OCCUR=2
7.5±1.7±0.7	37	⁴ LEES	14F BABR	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$	
2.2 ^{+0.7} _{-0.6}	44	⁵ LIU	08H RVUE	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$	OCCUR=2
5.9±1.6	44	⁶ LIU	08H RVUE	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$	
3.0±0.9±0.3	44	³ WANG	07D BELL	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$	OCCUR=2
7.6±1.8±0.8	44	⁴ WANG	07D BELL	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$	

- ¹ Solution I of two equivalent solutions from a fit using two interfering resonances. Supersedes WANG 07D.
² Solution II of two equivalent solutions from a fit using two interfering resonances. Supersedes WANG 07D.
³ Solution I of two equivalent solutions in a fit using two interfering resonances.
⁴ Solution II of two equivalent solutions in a fit using two interfering resonances.
⁵ Solution I in a combined fit of AUBERT 07S and WANG 07D data with two resonances.
⁶ Solution II in a combined fit of AUBERT 07S and WANG 07D data with two resonances.

$\Gamma(J/\psi\eta) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$					$\Gamma_3\Gamma_1/\Gamma$
VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.94	90	WANG	13B BELL	$e^+e^- \rightarrow J/\psi\eta\gamma$	

$\Gamma(\chi_{c1}\gamma) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$					$\Gamma_5\Gamma_1/\Gamma$
VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT	
<0.45	90	¹ HAN	15 BELL	10.58 $e^+e^- \rightarrow \chi_{c1}\gamma$	

- ¹ Using $B(\eta \rightarrow \gamma\gamma) = (39.41 \pm 0.21)\%$.

NODE=M189M;LINKAGE=A
 NODE=M189M;LINKAGE=LE
 NODE=M189M;LINKAGE=PA
 NODE=M189M;LINKAGE=LI

NODE=M189W

NODE=M189W

NODE=M189W;LINKAGE=A
 NODE=M189W;LINKAGE=LE
 NODE=M189W;LINKAGE=B
 NODE=M189W;LINKAGE=LI

NODE=M189215;NODE=M189

DESIG=1
 DESIG=2;OUR EVAL;→ UNCHECKED ←
 DESIG=4
 DESIG=3
 DESIG=6
 DESIG=7
 DESIG=5

NODE=M189230

NODE=M189G1
 NODE=M189G1

OCCUR=2

OCCUR=2

OCCUR=2

OCCUR=2

NODE=M189G1;LINKAGE=A

NODE=M189G1;LINKAGE=B

NODE=M189G1;LINKAGE=WA
 NODE=M189G1;LINKAGE=WN
 NODE=M189G1;LINKAGE=LI
 NODE=M189G1;LINKAGE=LU

NODE=M189G01
 NODE=M189G01

NODE=M189G02
 NODE=M189G02

NODE=M189G02;LINKAGE=A

$\Gamma(\chi_{c2}\gamma) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$					$\Gamma_6\Gamma_1/\Gamma$
VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT	
<2.1	90	¹ HAN	15	BELL	10.58 $e^+e^- \rightarrow \chi_{c2}\gamma$
¹ Using $B(\eta \rightarrow \gamma\gamma) = (39.41 \pm 0.21)\%$.					

NODE=M189G03
NODE=M189G03

NODE=M189G03;LINKAGE=A

X(4660) BRANCHING RATIOS

$\Gamma(D^0 D^{*-} \pi^+)/\Gamma(\psi(2S) \pi^+ \pi^-)$					Γ_4/Γ_2
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
<10	90	PAKHLOVA	09	BELL	$e^+e^- \rightarrow D^0 D^{*-} \pi^+$

NODE=M189225

NODE=M189R01
NODE=M189R01

$\Gamma(D^0 D^{*-} \pi^+)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$					$\Gamma_4/\Gamma \times \Gamma_1/\Gamma$
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
<0.37 $\times 10^{-6}$	90	¹ PAKHLOVA	09	BELL	$e^+e^- \rightarrow D^0 D^{*-} \pi^+$
¹ Using $4664 \pm 11 \pm 5$ MeV for the mass of X(4660).					

NODE=M189R02
NODE=M189R02

NODE=M189R02;LINKAGE=PA

$\Gamma(\Lambda_c^+ \Lambda_c^-)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$					$\Gamma_7/\Gamma \times \Gamma_1/\Gamma$
VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT	
0.68^{+0.16+0.29}_{-0.15-0.30}	142	¹ PAKHLOVA	08B	BELL	$e^+e^- \rightarrow \Lambda_c^+ \Lambda_c^-$
¹ The $\pi^+ \pi^- \psi(2S)$ and $\Lambda_c^+ \Lambda_c^-$ states are not necessarily the same.					

NODE=M189R03
NODE=M189R03

NODE=M189R03;LINKAGE=A

X(4660) REFERENCES

HAN	15	PR D92 012011	Y.L. Han <i>et al.</i>	(BELLE Collab.)
WANG	15A	PR D91 112007	X.L. Wang <i>et al.</i>	(BELLE Collab.)
LEES	14F	PR D89 111103	J.P. Lees <i>et al.</i>	(BABAR Collab.)
WANG	13B	PR D87 051101	X.L. Wang <i>et al.</i>	(BELLE Collab.)
PAKHLOVA	09	PR D80 091101	G. Pakhlova <i>et al.</i>	(BELLE Collab.)
LIU	08H	PR D78 014032	Z.Q. Liu, X.S. Qin, C.Z. Yuan	
PAKHLOVA	08B	PRL 101 172001	C. Pakhlova <i>et al.</i>	(BELLE Collab.)
AUBERT	07S	PRL 98 212001	B. Aubert <i>et al.</i>	(BABAR Collab.)
WANG	07D	PRL 99 142002	X.L. Wang <i>et al.</i>	(BELLE Collab.)

NODE=M189

REFID=56816
REFID=56839
REFID=55938
REFID=55377
REFID=53143
REFID=52296
REFID=52596
REFID=51724
REFID=51959

X(4700)	$I^G(J^{PC}) = 0^+(0^{++})$

NODE=M235

OMITTED FROM SUMMARY TABLE

Seen by AAIJ 17C in $B^+ \rightarrow X K^+$, $X \rightarrow J/\psi \phi$ using an amplitude analysis of $B^+ \rightarrow J/\psi \phi K^+$ with a significance (accounting for systematic uncertainties) of 5.6σ .

NODE=M235

X(4700) MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
4704 $\pm 10^{+14}_{-24}$	4289	¹ AAIJ	17C	LHCB $B^+ \rightarrow J/\psi \phi K^+$

NODE=M235M

NODE=M235M

¹ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 5.6σ .

NODE=M235M;LINKAGE=A

X(4700) WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
120 $\pm 31^{+42}_{-33}$	4289	² AAIJ	17C	LHCB $B^+ \rightarrow J/\psi \phi K^+$

NODE=M235W

NODE=M235W

² From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 5.6σ .

NODE=M235W;LINKAGE=A

X(4700) DECAY MODES

NODE=M235215;NODE=M235

Mode
$\Gamma_1 \quad J/\psi \phi$

DESIG=1

X(4700) BRANCHING RATIOS

$\Gamma(J/\psi\phi)/\Gamma_{\text{total}}$					Γ_1/Γ
VALUE	EVTs	DOCUMENT ID	TECN	COMMENT	
seen	4289	³ AAIJ	17C LHCb	$B^+ \rightarrow J/\psi\phi K^+$	
³ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi\phi K^+$ with a significance of 5.6σ .					

NODE=M235220

NODE=M235R01
NODE=M235R01

NODE=M235R01;LINKAGE=A

X(4700) REFERENCES

AAIJ	17C	PRL 118 022003	R. Aaij <i>et al.</i>	(LHCb Collab.) JP
Also		PR D95 012002	R. Aaij <i>et al.</i>	(LHCb Collab.)

NODE=M235

REFID=57657
REFID=57636

$b\bar{b}$ 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

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
9399.0 ± 2.3 OUR AVERAGE		Error includes scale factor of 1.6. See the ideogram below.		
9400.7 ± 1.7 ± 1.6	33.1k	TAMPONI	15 BELL	$e^+e^- \rightarrow \gamma\eta + \text{hadrons}$
9402.4 ± 1.5 ± 1.8	34k	¹ MIZUK	12 BELL	$e^+e^- \rightarrow \gamma\pi^+\pi^- + \text{hadrons}$
9391.8 ± 6.6 ± 2.0	2.3k	² BONVICINI	10 CLEO	$\Upsilon(3S) \rightarrow \gamma X$
9394.2 $^{+4.8}_{-4.9}$ ± 2.0	13k	² AUBERT	09AQ BABR	$\Upsilon(2S) \rightarrow \gamma X$
9388.9 $^{+3.1}_{-2.3}$ ± 2.7	19k	² AUBERT	08V BABR	$\Upsilon(3S) \rightarrow \gamma X$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
9393.2 ± 3.4 ± 2.3	10	^{2,3} DOBBS	12	$\Upsilon(2S) \rightarrow \gamma \text{hadrons}$
9300 ± 20 ± 20		HEISTER	02D ALEP	181–209 e^+e^-

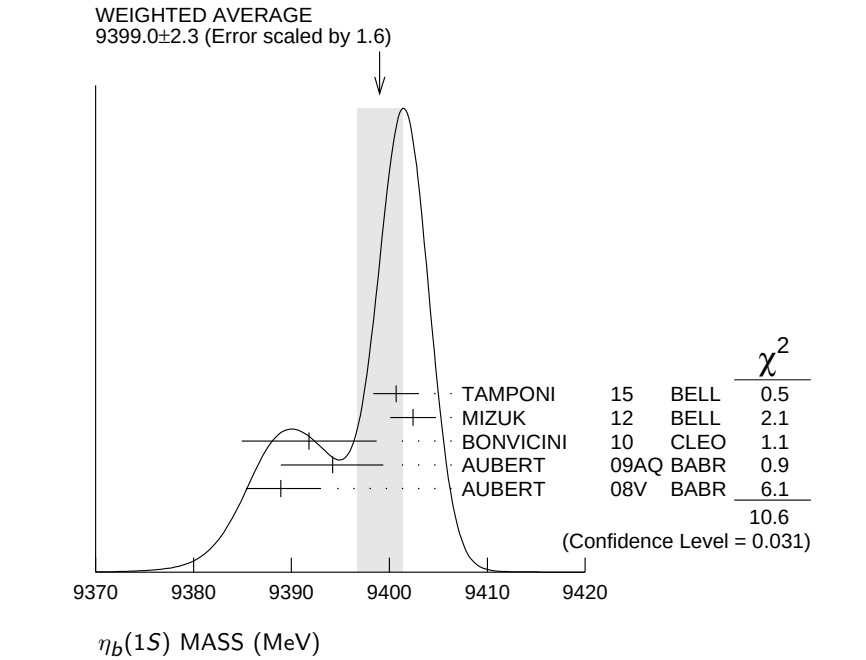
NODE=M171M

¹ With floating width. Not independent of the corresponding mass difference measurement.
² Assuming $\Gamma_{\eta_b(1S)} = 10$ MeV. Not independent of the corresponding γ energy or mass difference measurements.
³ Obtained by analyzing CLEO III data but not authored by the CLEO Collaboration.

NODE=M171M;LINKAGE=MI

NODE=M171M;LINKAGE=AU

NODE=M171M;LINKAGE=DO



$m_{\Upsilon(1S)} - m_{\eta_b}$

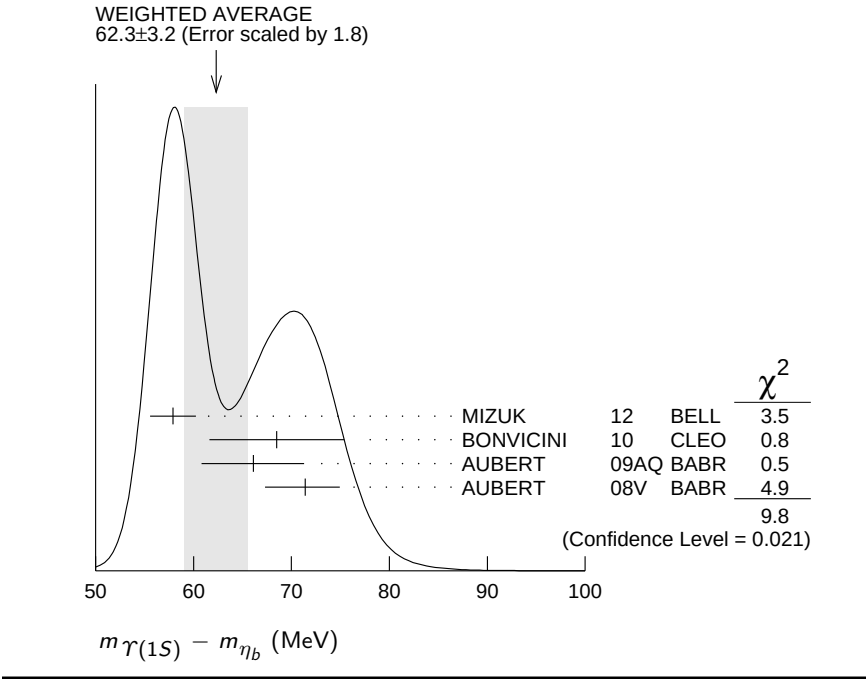
NODE=M171M2

NODE=M171M2

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
62.3±3.2 OUR AVERAGE	Error includes scale factor of 1.8. See the ideogram below.			
57.9±1.5±1.8	34k	⁴ MIZUK	12 BELL	$e^+e^- \rightarrow \gamma\pi^+\pi^-$
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

⁴With floating width. Not independent of the corresponding mass measurement.
⁵Assuming $\Gamma_{\eta_b(1S)} = 10$ MeV. Not independent of the corresponding γ energy or mass measurements.
⁶Obtained by analyzing CLEO III data but not authored by the CLEO Collaboration.

NODE=M171M2;LINKAGE=MI
NODE=M171M2;LINKAGE=AU
NODE=M171M2;LINKAGE=DO



γ ENERGY IN $\Upsilon(3S)$ DECAY

NODE=M171DM

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
920.6$^{+2.8}_{-3.2}$ OUR AVERAGE				
918.6 $\pm 6.0 \pm 1.9$	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

NODE=M171DM;LINKAGE=BO

 γ ENERGY IN $\Upsilon(2S)$ DECAY

NODE=M171U2S

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
609.3$^{+4.6}_{-4.5} \pm 1.9$				
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

NODE=M171U2S;LINKAGE=AU

 $\eta_b(1S)$ WIDTH

NODE=M171W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
10 $^{+5}_{-4}$ OUR AVERAGE				
8 $^{+6}_{-5} \pm 5$	33.1k	⁹ TAMPONI	15 BELL	$e^+e^- \rightarrow \gamma\eta + \text{hadrons}$
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

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	
• • • 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^-	

NODE=M171G1

NODE=M171G1

$\Gamma(2h^+2h^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$					$\Gamma_3\Gamma_5/\Gamma$
VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT	
• • • 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^-	

NODE=M171G2

NODE=M171G2

$\Gamma(4h^+4h^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$					$\Gamma_4\Gamma_5/\Gamma$
VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<660	95	ABDALLAH	06 DLPH	161–209 e^+e^-	

NODE=M171G3

NODE=M171G3

$\eta_b(1S)$ BRANCHING RATIOS

$\Gamma(\text{hadrons})/\Gamma_{\text{total}}$					Γ_1/Γ
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
seen	34k	MIZUK	12	BELL	$e^+e^- \rightarrow \gamma\pi^+\pi^- + \text{hadrons}$

NODE=M171235

NODE=M171R03
NODE=M171R03

$\Gamma(\mu^+\mu^-)/\Gamma_{\text{total}}$					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

TAMPONI	15	PRL 115 142001	U. Tamponi <i>et al.</i>	(BELLE Collab.)
DOBBS	12	PRL 109 082001	S. Dobbs <i>et al.</i>	
MIZUK	12	PRL 109 232002	R. Mizuk <i>et al.</i>	(BELLE Collab.)
BONVICINI	10	PR D81 031104	G. Bonvicini <i>et al.</i>	(CLEO Collab.)
AUBERT	09AQ	PRL 103 161801	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT	09P	PRL 103 181801	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT	09Z	PRL 103 081803	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT	08V	PRL 101 071801	B. Aubert <i>et al.</i>	(BABAR Collab.)
ABDALLAH	06	PL B634 340	J.M. Abdallah <i>et al.</i>	(DELPHI Collab.)
HEISTER	02D	PL B530 56	A. Heister <i>et al.</i>	(ALEPH Collab.)

NODE=M171

REFID=56996
REFID=54288
REFID=54718
REFID=53231
REFID=53106
REFID=53062
REFID=52930
REFID=52262
REFID=51042
REFID=48577 $\Upsilon(1S)$

$$J^{PC} = 0^-(1^--)$$

NODE=M049

 $\Upsilon(1S)$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
9460.30 ± 0.26 OUR AVERAGE	Error includes scale factor of 3.3.		
9460.51 ± 0.09 ± 0.05	¹ ARTAMONOV	00	MD1 $e^+e^- \rightarrow \text{hadrons}$
9459.97 ± 0.11 ± 0.07	MACKAY	84	REDE $e^+e^- \rightarrow \text{hadrons}$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
9460.60 ± 0.09 ± 0.05	^{2,3} BARU	92B	REDE $e^+e^- \rightarrow \text{hadrons}$
9460.59 ± 0.12	BARU	86	REDE $e^+e^- \rightarrow \text{hadrons}$
9460.6 ± 0.4	^{3,4} ARTAMONOV	84	REDE $e^+e^- \rightarrow \text{hadrons}$

NODE=M049M

NODE=M049M

- 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

VALUE (keV)	DOCUMENT ID
54.02 ± 1.25 OUR EVALUATION	See the Note on "Width Determinations of the Υ States"

NODE=M049W

NODE=M049W
→ UNCHECKED ← $\Upsilon(1S)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
$\Gamma_1 \quad \tau^+\tau^-$	(2.60 ± 0.10) %	DESIG=3
$\Gamma_2 \quad e^+e^-$	(2.38 ± 0.11) %	DESIG=2
$\Gamma_3 \quad \mu^+\mu^-$	(2.48 ± 0.05) %	DESIG=1

NODE=M049215;NODE=M049

Hadronic decays

NODE=M049;CLUMP=A

Γ_4	$g g g$	(81.7 $\pm$ 0.7) %			DESIG=117
Γ_5	$\gamma g g$	(2.2 $\pm$ 0.6) %			DESIG=118
Γ_6	$\eta'(958)$ anything	(2.94 $\pm$ 0.24) %			DESIG=73
Γ_7	$J/\psi(1S)$ anything	(5.4 $\pm$ 0.4) $\times 10^{-4}$	S=1.4		DESIG=12
Γ_8	$J/\psi(1S)\eta_c$	< 2.2	$\times 10^{-6}$	CL=90%	DESIG=146
Γ_9	$J/\psi(1S)\chi_{c0}$	< 3.4	$\times 10^{-6}$	CL=90%	DESIG=147
Γ_{10}	$J/\psi(1S)\chi_{c1}$	(3.9 $\pm$ 1.2) $\times 10^{-6}$			DESIG=148
Γ_{11}	$J/\psi(1S)\chi_{c2}$	< 1.4	$\times 10^{-6}$	CL=90%	DESIG=149
Γ_{12}	$J/\psi(1S)\eta_c(2S)$	< 2.2	$\times 10^{-6}$	CL=90%	DESIG=150
Γ_{13}	$J/\psi(1S)X(3940)$	< 5.4	$\times 10^{-6}$	CL=90%	DESIG=151
Γ_{14}	$J/\psi(1S)X(4160)$	< 5.4	$\times 10^{-6}$	CL=90%	DESIG=152
Γ_{15}	$X(4350)$ anything, $X \rightarrow J/\psi(1S)\phi$	< 8.1	$\times 10^{-6}$	CL=90%	DESIG=167
Γ_{16}	$X(3900)^\pm$ anything, $X \rightarrow J/\psi(1S)\pi^\pm$	< 1.3	$\times 10^{-5}$	CL=90%	DESIG=168
Γ_{17}	$X(4200)^\pm$ anything, $X \rightarrow J/\psi(1S)\pi^\pm$	< 6.0	$\times 10^{-5}$	CL=90%	DESIG=169
Γ_{18}	$X(4430)^\pm$ anything, $X \rightarrow J/\psi(1S)\pi^\pm$	< 4.9	$\times 10^{-5}$	CL=90%	DESIG=170
Γ_{19}	$X_{cs}^\pm$ anything, $X \rightarrow J/\psi K^\pm$	< 5.7	$\times 10^{-6}$	CL=90%	DESIG=173
Γ_{20}	$X(3872)$ anything, $X \rightarrow J/\psi(1S)\pi^+\pi^-$	< 9.5	$\times 10^{-6}$	CL=90%	DESIG=160
Γ_{21}	$X(4260)$ anything, $X \rightarrow J/\psi(1S)\pi^+\pi^-$	< 3.8	$\times 10^{-5}$	CL=90%	DESIG=161
Γ_{22}	$X(4260)$ anything, $X \rightarrow J/\psi(1S)K^+K^-$	< 7.5	$\times 10^{-6}$	CL=90%	DESIG=165
Γ_{23}	$X(4140)$ anything, $X \rightarrow J/\psi(1S)\phi$	< 5.2	$\times 10^{-6}$	CL=90%	DESIG=166
Γ_{24}	χ_{c0} anything	< 4	$\times 10^{-3}$	CL=90%	DESIG=5
Γ_{25}	χ_{c1} anything	(1.90 $\pm$ 0.35) $\times 10^{-4}$			DESIG=6
Γ_{26}	χ_{c2} anything	(2.8 $\pm$ 0.8) $\times 10^{-4}$			DESIG=7
Γ_{27}	$\psi(2S)$ anything	(1.23 $\pm$ 0.20) $\times 10^{-4}$			DESIG=8
Γ_{28}	$\psi(2S)\eta_c$	< 3.6	$\times 10^{-6}$	CL=90%	DESIG=153
Γ_{29}	$\psi(2S)\chi_{c0}$	< 6.5	$\times 10^{-6}$	CL=90%	DESIG=154
Γ_{30}	$\psi(2S)\chi_{c1}$	< 4.5	$\times 10^{-6}$	CL=90%	DESIG=155
Γ_{31}	$\psi(2S)\chi_{c2}$	< 2.1	$\times 10^{-6}$	CL=90%	DESIG=156
Γ_{32}	$\psi(2S)\eta_c(2S)$	< 3.2	$\times 10^{-6}$	CL=90%	DESIG=157
Γ_{33}	$\psi(2S)X(3940)$	< 2.9	$\times 10^{-6}$	CL=90%	DESIG=158
Γ_{34}	$\psi(2S)X(4160)$	< 2.9	$\times 10^{-6}$	CL=90%	DESIG=159
Γ_{35}	$X(4260)$ anything, $X \rightarrow \psi(2S)\pi^+\pi^-$	< 7.9	$\times 10^{-5}$	CL=90%	DESIG=162
Γ_{36}	$X(4360)$ anything, $X \rightarrow \psi(2S)\pi^+\pi^-$	< 5.2	$\times 10^{-5}$	CL=90%	DESIG=163
Γ_{37}	$X(4660)$ anything, $X \rightarrow \psi(2S)\pi^+\pi^-$	< 2.2	$\times 10^{-5}$	CL=90%	DESIG=164
Γ_{38}	$X(4050)^\pm$ anything, $X \rightarrow \psi(2S)\pi^\pm$	< 8.8	$\times 10^{-5}$	CL=90%	DESIG=171
Γ_{39}	$X(4430)^\pm$ anything, $X \rightarrow \psi(2S)\pi^\pm$	< 6.7	$\times 10^{-5}$	CL=90%	DESIG=172
Γ_{40}	$\rho\pi$	< 3.68	$\times 10^{-6}$	CL=90%	DESIG=11
Γ_{41}	$\omega\pi^0$	< 3.90	$\times 10^{-6}$	CL=90%	DESIG=131
Γ_{42}	$\pi^+\pi^-$	< 5	$\times 10^{-4}$	CL=90%	DESIG=23
Γ_{43}	K^+K^-	< 5	$\times 10^{-4}$	CL=90%	DESIG=24
Γ_{44}	$\rho\bar{\rho}$	< 5	$\times 10^{-4}$	CL=90%	DESIG=25
Γ_{45}	$\pi^+\pi^-\pi^0$	(2.1 $\pm$ 0.8) $\times 10^{-6}$			DESIG=72
Γ_{46}	ϕK^+K^-	(2.4 $\pm$ 0.5) $\times 10^{-6}$			DESIG=136
Γ_{47}	$\omega\pi^+\pi^-$	(4.5 $\pm$ 1.0) $\times 10^{-6}$			DESIG=137
Γ_{48}	$K^*(892)^0 K^-\pi^+ + \text{c.c.}$	(4.4 $\pm$ 0.8) $\times 10^{-6}$			DESIG=138

Γ ₄₉	$\phi f'_2(1525)$	$< 1.63 \times 10^{-6}$	CL=90%	DESIG=139
Γ ₅₀	$\omega f_2(1270)$	$< 1.79 \times 10^{-6}$	CL=90%	DESIG=140
Γ ₅₁	$\rho(770) a_2(1320)$	$< 2.24 \times 10^{-6}$	CL=90%	DESIG=141
Γ ₅₂	$K^*(892)^0 K_2^*(1430)^0 + \text{c.c.}$	$(3.0 \pm 0.8) \times 10^{-6}$		DESIG=142
Γ ₅₃	$K_1(1270)^\pm K^\mp$	$< 2.41 \times 10^{-6}$	CL=90%	DESIG=143
Γ ₅₄	$K_1(1400)^\pm K^\mp$	$(1.0 \pm 0.4) \times 10^{-6}$		DESIG=144
Γ ₅₅	$b_1(1235)^\pm \pi^\mp$	$< 1.25 \times 10^{-6}$	CL=90%	DESIG=145
Γ ₅₆	$\pi^+ \pi^- \pi^0 \pi^0$	$(1.28 \pm 0.30) \times 10^{-5}$		DESIG=132
Γ ₅₇	$K_S^0 K^+ \pi^- + \text{c.c.}$	$(1.6 \pm 0.4) \times 10^{-6}$		DESIG=133
Γ ₅₈	$K^*(892)^0 \bar{K}^0 + \text{c.c.}$	$(2.9 \pm 0.9) \times 10^{-6}$		DESIG=134
Γ ₅₉	$K^*(892)^- K^+ + \text{c.c.}$	$< 1.11 \times 10^{-6}$	CL=90%	DESIG=135
Γ ₆₀	$D^*(2010)^\pm \text{anything}$	$(2.52 \pm 0.20) \%$		DESIG=30
Γ ₆₁	$^2H \text{ anything}$	$(2.85 \pm 0.25) \times 10^{-5}$		DESIG=107
Γ ₆₂	Sum of 100 exclusive modes	$(1.200 \pm 0.017) \%$		DESIG=128

Radiative decays

NODE=M049;CLUMP=B

Γ ₆₃	$\gamma \pi^+ \pi^-$	$(6.3 \pm 1.8) \times 10^{-5}$		DESIG=70
Γ ₆₄	$\gamma \pi^0 \pi^0$	$(1.7 \pm 0.7) \times 10^{-5}$		DESIG=71
Γ ₆₅	$\gamma \pi^0 \eta$	$< 2.4 \times 10^{-6}$	CL=90%	DESIG=111
Γ ₆₆	$\gamma K^+ K^-$	[a] $(1.14 \pm 0.13) \times 10^{-5}$		DESIG=102
Γ ₆₇	$\gamma p \bar{p}$	[b] $< 6 \times 10^{-6}$	CL=90%	DESIG=103
Γ ₆₈	$\gamma 2h^+ 2h^-$	$(7.0 \pm 1.5) \times 10^{-4}$		DESIG=20
Γ ₆₉	$\gamma 3h^+ 3h^-$	$(5.4 \pm 2.0) \times 10^{-4}$		DESIG=21
Γ ₇₀	$\gamma 4h^+ 4h^-$	$(7.4 \pm 3.5) \times 10^{-4}$		DESIG=22
Γ ₇₁	$\gamma \pi^+ \pi^- K^+ K^-$	$(2.9 \pm 0.9) \times 10^{-4}$		DESIG=14
Γ ₇₂	$\gamma 2\pi^+ 2\pi^-$	$(2.5 \pm 0.9) \times 10^{-4}$		DESIG=13
Γ ₇₃	$\gamma 3\pi^+ 3\pi^-$	$(2.5 \pm 1.2) \times 10^{-4}$		DESIG=17
Γ ₇₄	$\gamma 2\pi^+ 2\pi^- K^+ K^-$	$(2.4 \pm 1.2) \times 10^{-4}$		DESIG=18
Γ ₇₅	$\gamma \pi^+ \pi^- p \bar{p}$	$(1.5 \pm 0.6) \times 10^{-4}$		DESIG=15
Γ ₇₆	$\gamma 2\pi^+ 2\pi^- p \bar{p}$	$(4 \pm 6) \times 10^{-5}$		DESIG=19
Γ ₇₇	$\gamma 2K^+ 2K^-$	$(2.0 \pm 2.0) \times 10^{-5}$		DESIG=16
Γ ₇₈	$\gamma \eta'(958)$	$< 1.9 \times 10^{-6}$	CL=90%	DESIG=55
Γ ₇₉	$\gamma \eta$	$< 1.0 \times 10^{-6}$	CL=90%	DESIG=54
Γ ₈₀	$\gamma f_0(980)$	$< 3 \times 10^{-5}$	CL=90%	DESIG=105
Γ ₈₁	$\gamma f'_2(1525)$	$(3.8 \pm 0.9) \times 10^{-5}$		DESIG=52
Γ ₈₂	$\gamma f_2(1270)$	$(1.01 \pm 0.09) \times 10^{-4}$		DESIG=51
Γ ₈₃	$\gamma \eta(1405)$	$< 8.2 \times 10^{-5}$	CL=90%	DESIG=65
Γ ₈₄	$\gamma f_0(1500)$	$< 1.5 \times 10^{-5}$	CL=90%	DESIG=108
Γ ₈₅	$\gamma f_0(1710)$	$< 2.6 \times 10^{-4}$	CL=90%	DESIG=53
Γ ₈₆	$\gamma f_0(1710) \rightarrow \gamma K^+ K^-$	$< 7 \times 10^{-6}$	CL=90%	DESIG=112
Γ ₈₇	$\gamma f_0(1710) \rightarrow \gamma \pi^0 \pi^0$	$< 1.4 \times 10^{-6}$	CL=90%	DESIG=109
Γ ₈₈	$\gamma f_0(1710) \rightarrow \gamma \eta \eta$	$< 1.8 \times 10^{-6}$	CL=90%	DESIG=110
Γ ₈₉	$\gamma f_4(2050)$	$< 5.3 \times 10^{-5}$	CL=90%	DESIG=104
Γ ₉₀	$\gamma f_0(2200) \rightarrow \gamma K^+ K^-$	$< 2 \times 10^{-4}$	CL=90%	DESIG=69
Γ ₉₁	$\gamma f_J(2220) \rightarrow \gamma K^+ K^-$	$< 8 \times 10^{-7}$	CL=90%	DESIG=60
Γ ₉₂	$\gamma f_J(2220) \rightarrow \gamma \pi^+ \pi^-$	$< 6 \times 10^{-7}$	CL=90%	DESIG=61
Γ ₉₃	$\gamma f_J(2220) \rightarrow \gamma p \bar{p}$	$< 1.1 \times 10^{-6}$	CL=90%	DESIG=62
Γ ₉₄	$\gamma \eta(2225) \rightarrow \gamma \phi \phi$	$< 3 \times 10^{-3}$	CL=90%	DESIG=68
Γ ₉₅	$\gamma \eta_c(1S)$	$< 5.7 \times 10^{-5}$	CL=90%	DESIG=119
Γ ₉₆	$\gamma \chi_{c0}$	$< 6.5 \times 10^{-4}$	CL=90%	DESIG=120
Γ ₉₇	$\gamma \chi_{c1}$	$< 2.3 \times 10^{-5}$	CL=90%	DESIG=121
Γ ₉₈	$\gamma \chi_{c2}$	$< 7.6 \times 10^{-6}$	CL=90%	DESIG=122
Γ ₉₉	$\gamma X(3872) \rightarrow \pi^+ \pi^- J/\psi$	$< 1.6 \times 10^{-6}$	CL=90%	DESIG=123
Γ ₁₀₀	$\gamma X(3872) \rightarrow \pi^+ \pi^- \pi^0 J/\psi$	$< 2.8 \times 10^{-6}$	CL=90%	DESIG=124
Γ ₁₀₁	$\gamma X(3915) \rightarrow \omega J/\psi$	$< 3.0 \times 10^{-6}$	CL=90%	DESIG=125
Γ ₁₀₂	$\gamma X(4140) \rightarrow \phi J/\psi$	$< 2.2 \times 10^{-6}$	CL=90%	DESIG=126
Γ ₁₀₃	γX	[c] $< 4.5 \times 10^{-6}$	CL=90%	DESIG=66
Γ ₁₀₄	$\gamma X \bar{X} (m_X < 3.1 \text{ GeV})$	[d] $< 1 \times 10^{-3}$	CL=90%	DESIG=67
Γ ₁₀₅	$\gamma X \bar{X} (m_X < 4.5 \text{ GeV})$	[e] $< 2.4 \times 10^{-4}$	CL=90%	DESIG=127
Γ ₁₀₆	$\gamma X \rightarrow \gamma + \geq 4 \text{ prongs}$	[f] $< 1.78 \times 10^{-4}$	CL=95%	DESIG=113
Γ ₁₀₇	$\gamma a_1^0 \rightarrow \gamma \mu^+ \mu^-$	[g] $< 9 \times 10^{-6}$	CL=90%	DESIG=114
Γ ₁₀₈	$\gamma a_1^0 \rightarrow \gamma \tau^+ \tau^-$	[a] $< 1.30 \times 10^{-4}$	CL=90%	DESIG=115
Γ ₁₀₉	$\gamma a_1^0 \rightarrow \gamma g g$	[h] $< 1 \%$	CL=90%	DESIG=129
Γ ₁₁₀	$\gamma a_1^0 \rightarrow \gamma s \bar{s}$	[h] $< 1 \times 10^{-3}$	CL=90%	DESIG=130

Lepton Family number (LF) violating modes
 $\Gamma_{111} \mu^\pm \tau^\mp$ LF < 6.0 $\times 10^{-6}$ CL=95%

 NODE=M049;CLUMP=C
 DESIG=116
Other decays
 Γ_{112} invisible < 3.0 $\times 10^{-4}$ CL=90%

 NODE=M049;CLUMP=D
 DESIG=106
[a] $2m_\tau < M(\tau^+ \tau^-) < 9.2$ GeV

LINKAGE=E49

[b] $2 \text{ GeV} < m_{K^+ K^-} < 3$ GeV

LINKAGE=G49

[c] $X = \text{scalar with } m < 8.0$ GeV

LINKAGE=A49

[d] $X \bar{X} = \text{vectors with } m < 3.1$ GeV

LINKAGE=B49

[e] X and $\bar{X} = \text{zero spin with } m < 4.5$ GeV

LINKAGE=F49

[f] $1.5 \text{ GeV} < m_X < 5.0$ GeV

LINKAGE=C49

[g] $201 \text{ MeV} < M(\mu^+ \mu^-) < 3565$ MeV

LINKAGE=D49

[h] $0.5 \text{ GeV} < m_X < 9.0$ GeV, where m_X is the invariant mass of the hadronic final state.

LINKAGE=I49

 $\mathcal{T}(1S) \Gamma(i) \Gamma(e^+ e^-) / \Gamma(\text{total})$

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±1.6±1.7	KOBEL	92	CBAL $e^+ e^- \rightarrow \mu^+ \mu^-$

 NODE=M049G1
 NODE=M049G1
 $\Gamma(\text{hadrons}) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$ **$\Gamma_0 \Gamma_2 / \Gamma$**

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
1.240±0.016 OUR AVERAGE			
1.252±0.004±0.019	⁵ ROSNER 06	CLEO	9.5 $e^+ e^- \rightarrow \text{hadrons}$
1.187±0.023±0.031	⁵ BARU 92B	MD1	$e^+ e^- \rightarrow \text{hadrons}$
1.23 ±0.02 ±0.05	⁵ JAKUBOWSKI 88	CBAL	$e^+ e^- \rightarrow \text{hadrons}$
1.37 ±0.06 ±0.09	⁶ GILES 84B	CLEO	$e^+ e^- \rightarrow \text{hadrons}$
1.23 ±0.08 ±0.04	⁶ ALBRECHT 82	DASP	$e^+ e^- \rightarrow \text{hadrons}$
1.13 ±0.07 ±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
 → UNCHECKED ←
 $\mathcal{T}(1S)$ 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±0.13±0.05	60k	⁸ BESSON 07	CLEO	$e^+ e^- \rightarrow \mathcal{T}(1S) \rightarrow \tau^+ \tau^-$
2.61±0.12 ^{+0.09} _{-0.13}	25k	CINABRO 94B	CLE2	$e^+ e^- \rightarrow \tau^+ \tau^-$
2.7 ±0.4 ±0.2		⁹ ALBRECHT 85C	ARG	$\mathcal{T}(2S) \rightarrow \pi^+ \pi^- \tau^+ \tau^-$
3.4 ±0.4 ±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**2.38±0.11 OUR AVERAGE**

2.29±0.08±0.11
 2.42±0.14±0.14 307
 2.8 ±0.3 ±0.2 826
 5.1 ±3.0

DOCUMENT ID TECN COMMENT

ALEXANDER 98 CLE2 $\Upsilon(2S) \rightarrow \pi^+\pi^-e^+e^-$
 ALBRECHT 87 ARG $\Upsilon(2S) \rightarrow \pi^+\pi^-e^+e^-$
 BESSON 84 CLEO $\Upsilon(2S) \rightarrow \pi^+\pi^-e^+e^-$
 BERGER 80C PLUT $e^+e^- \rightarrow e^+e^-$

NODE=M049R2
 NODE=M049R2

 $\Gamma(\mu^+\mu^-)/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE EVTS

0.0248±0.0005 OUR AVERAGE

0.0249±0.0002±0.0007 345k
 0.0249±0.0008±0.0013

DOCUMENT ID TECN COMMENT

ADAMS 05 CLEO $e^+e^- \rightarrow \mu^+\mu^-$
 ALEXANDER 98 CLE2 $\Upsilon(2S) \rightarrow$
 $\pi^+\pi^-\mu^+\mu^-$
¹⁰ BARU 92 MD1 $e^+e^- \rightarrow \mu^+\mu^-$
¹⁰ KOBEL 92 CBAL $e^+e^- \rightarrow \mu^+\mu^-$
 CHEN 89B CLEO $e^+e^- \rightarrow \mu^+\mu^-$
 KAARSBERG 89 CSB2 $e^+e^- \rightarrow \mu^+\mu^-$
 ALBRECHT 87 ARG $\Upsilon(2S) \rightarrow$
 $\pi^+\pi^-\mu^+\mu^-$
 BESSON 84 CLEO $\Upsilon(2S) \rightarrow$
 $\pi^+\pi^-\mu^+\mu^-$
 ANDREWS 83 CLEO $e^+e^- \rightarrow \mu^+\mu^-$
 ALBRECHT 82 DASP $e^+e^- \rightarrow \mu^+\mu^-$
 NICZYPORUK 82 LENA $e^+e^- \rightarrow \mu^+\mu^-$
 BOCK 80 CNTR $e^+e^- \rightarrow \mu^+\mu^-$
 BERGER 79 PLUT $e^+e^- \rightarrow \mu^+\mu^-$

NODE=M049R1
 NODE=M049R1

¹⁰ Taking into account interference between the resonance and continuum.

NODE=M049R1;LINKAGE=G

 $\Gamma(\tau^+\tau^-)/\Gamma(\mu^+\mu^-)$ Γ_1/Γ_3

VALUE EVTS

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 BESSON 07 CLEO $e^+e^- \rightarrow \Upsilon(1S)$

¹¹ Allows any number of extra photons with total energy < 500 MeV.

NODE=M049R43
 NODE=M049R43

NODE=M049R43;LINKAGE=DE

 $\Gamma(gg)/\Gamma_{\text{total}}$ Γ_4/Γ VALUE (units 10^{-2}) EVTS**81.7±0.7**

12 BESSON 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 BESSON 06A and PDG 08 values of $B(\mu^+\mu^-) = (2.48 \pm 0.05)\%$ and $R_{\text{hadrons}} = 3.51$. The statistical error is negligible and the systematic error is partially correlated with that of $\Gamma(\gamma gg)/\Gamma_{\text{total}}$ measurement of BESSON 06A.

NODE=M049R35
 NODE=M049R35

NODE=M049R35;LINKAGE=BE

 $\Gamma(\gamma gg)/\Gamma_{\text{total}}$ Γ_5/Γ VALUE (units 10^{-2}) EVTS**2.20±0.60**

¹³ BESSON 06A CLEO $\Upsilon(1S) \rightarrow \gamma + \text{hadrons}$
¹³ Calculated using BESSON 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 BESSON 06A.

NODE=M049R36
 NODE=M049R36

NODE=M049R36;LINKAGE=BE

 $\Gamma(\gamma gg)/\Gamma(gg)$ Γ_5/Γ_4 VALUE (units 10^{-2}) EVTS**2.70±0.01±0.27**

20M BESSON 06A CLEO $\Upsilon(1S) \rightarrow (\gamma +) \text{hadrons}$

NODE=M049R37
 NODE=M049R37

 $\Gamma(\eta'(958) \text{ anything})/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE

0.0294±0.0024 OUR AVERAGE

0.030 ±0.002 ±0.002 AQUINES 06A CLE3 $\Upsilon(1S) \rightarrow \eta' \text{ anything}$
 0.028 ±0.004 ±0.002 ARTUSO 03 CLE2 $\Upsilon(1S) \rightarrow \eta' \text{ anything}$

NODE=M049R73
 NODE=M049R73

$\Gamma(J/\psi(1S) \text{ anything})/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE (units 10^{-4})	CL%	EVTs	DOCUMENT ID	TECN	COMMENT

5.4 $\pm$ 0.4 OUR FIT Error includes scale factor of 1.4.**5.4 $\pm$ 0.4 OUR AVERAGE** Error includes scale factor of 1.5. $[(0.65 \pm 0.07) \times 10^{-3}$
OUR 2016 AVERAGE]

5.25 $\pm$ 0.13 $\pm$ 0.25	3k	SHEN	16	BELL	$e^+e^- \rightarrow J/\psi X$
6.4 $\pm$ 0.4 $\pm$ 0.6	730	BRIERE	04	CLEO	$e^+e^- \rightarrow J/\psi X$
11 $\pm$ 4 $\pm$ 2	14	FULTON	89	CLEO	$e^+e^- \rightarrow \mu^+\mu^- X$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<6.8	90	ALBRECHT	92J	ARG	$e^+e^- \rightarrow e^+e^- X$, $\mu^+\mu^- X$

<17	90	MASCHMANN	90	CBAL	$e^+e^- \rightarrow \text{hadrons}$

<200	90	NICZYPORUK	83	LENA	

¹⁴ Using $B((J/\psi) \rightarrow \mu^+\mu^-) = (6.9 \pm 0.9)\%$.NODE=M049R12
NODE=M049R12

NEW

NODE=M049R12;LINKAGE=K

 $\Gamma(J/\psi(1S)\eta_c)/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<2.2 $\times 10^{-6}$ 90 YANG 14 BELL $e^+e^- \rightarrow J/\psi X$ NODE=M049R85
NODE=M049R85 $\Gamma(J/\psi(1S)\chi_{c0})/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<3.4 $\times 10^{-6}$ 90 YANG 14 BELL $e^+e^- \rightarrow J/\psi X$ NODE=M049R86
NODE=M049R86 $\Gamma(J/\psi(1S)\chi_{c1})/\Gamma_{\text{total}}$ Γ_{10}/Γ

VALUE (units 10^{-6})	EVTs	DOCUMENT ID	TECN	COMMENT

3.90 $\pm$ 1.21 $\pm$ 0.23 20 YANG 14 BELL $e^+e^- \rightarrow J/\psi X$ NODE=M049R87
NODE=M049R87 $\Gamma(J/\psi(1S)\chi_{c2})/\Gamma_{\text{total}}$ Γ_{11}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<1.4 $\times 10^{-6}$ 90 YANG 14 BELL $e^+e^- \rightarrow J/\psi X$ NODE=M049R88
NODE=M049R88 $\Gamma(J/\psi(1S)\eta_c(2S))/\Gamma_{\text{total}}$ Γ_{12}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<2.2 $\times 10^{-6}$ 90 YANG 14 BELL $e^+e^- \rightarrow J/\psi X$ NODE=M049R89
NODE=M049R89 $\Gamma(J/\psi(1S)X(3940))/\Gamma_{\text{total}}$ Γ_{13}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<5.4 $\times 10^{-6}$ 90 YANG 14 BELL $e^+e^- \rightarrow J/\psi X$ NODE=M049R90
NODE=M049R90 $\Gamma(J/\psi(1S)X(4160))/\Gamma_{\text{total}}$ Γ_{14}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<5.4 $\times 10^{-6}$ 90 YANG 14 BELL $e^+e^- \rightarrow J/\psi X$ NODE=M049R91
NODE=M049R91 $\Gamma(X(4350) \text{ anything}, X \rightarrow J/\psi(1S)\phi)/\Gamma_{\text{total}}$ Γ_{15}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<8.1 $\times 10^{-6}$ 90 SHEN 16 BELL $\Upsilon(1S) \rightarrow J/\psi K^+ K^- X$ NODE=M049P05
NODE=M049P05 $\Gamma(X(3900)^\pm \text{ anything}, X \rightarrow J/\psi(1S)\pi^\pm)/\Gamma_{\text{total}}$ Γ_{16}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<1.3 $\times 10^{-5}$ 90 SHEN 16 BELL $\Upsilon(1S) \rightarrow J/\psi \pi^\pm X$ NODE=M049P06
NODE=M049P06 $\Gamma(X(4200)^\pm \text{ anything}, X \rightarrow J/\psi(1S)\pi^\pm)/\Gamma_{\text{total}}$ Γ_{17}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<6.0 $\times 10^{-5}$ 90 SHEN 16 BELL $\Upsilon(1S) \rightarrow J/\psi \pi^\pm X$ NODE=M049P07
NODE=M049P07 $\Gamma(X(4430)^\pm \text{ anything}, X \rightarrow J/\psi(1S)\pi^\pm)/\Gamma_{\text{total}}$ Γ_{18}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<4.9 $\times 10^{-5}$ 90 SHEN 16 BELL $\Upsilon(1S) \rightarrow J/\psi \pi^\pm X$ NODE=M049P08
NODE=M049P08 $\Gamma(X_{cs}^\pm \text{ anything}, X \rightarrow J/\psi K^\pm)/\Gamma_{\text{total}}$ Γ_{19}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<5.7 $\times 10^{-6}$ 90 SHEN 16 BELL $\Upsilon(1S) \rightarrow J/\psi K^- X$ NODE=M049P11
NODE=M049P11

$\Gamma(X(3872) \text{ anything}, X \rightarrow J/\psi(1S)\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{20}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<9.5 \times 10^{-6}$	90	SHEN	16	BELL $\Upsilon(1S) \rightarrow J/\psi\pi^+\pi^- X$

NODE=M049R00
NODE=M049R00

$\Gamma(X(4260) \text{ anything}, X \rightarrow J/\psi(1S)\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{21}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<3.8 \times 10^{-5}$	90	SHEN	16	BELL $\Upsilon(1S) \rightarrow J/\psi\pi^+\pi^- X$

NODE=M049R99
NODE=M049R99

$\Gamma(X(4260) \text{ anything}, X \rightarrow J/\psi(1S)K^+K^-)/\Gamma_{\text{total}}$ Γ_{22}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<7.5 \times 10^{-6}$	90	SHEN	16	BELL $\Upsilon(1S) \rightarrow J/\psi K^+K^- X$

NODE=M049P03
NODE=M049P03

$\Gamma(X(4140) \text{ anything}, X \rightarrow J/\psi(1S)\phi)/\Gamma_{\text{total}}$ Γ_{23}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<5.2 \times 10^{-6}$	90	SHEN	16	BELL $\Upsilon(1S) \rightarrow J/\psi K^+K^- X$

NODE=M049P04
NODE=M049P04

$\Gamma(\chi_{c0} \text{ anything})/\Gamma(J/\psi(1S) \text{ anything})$ Γ_{24}/Γ_7

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<7.4	90	BRIERE	04	CLEO $e^+e^- \rightarrow J/\psi X$

NODE=M049R25
NODE=M049R25

$\Gamma(\chi_{c1} \text{ anything})/\Gamma_{\text{total}}$ Γ_{25}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.90±0.35 OUR FIT				
1.90±0.43±0.14	215	JIA	17	LHCB $\Upsilon(1S) \rightarrow \gamma J/\psi(1S)$

NODE=M049P13
NODE=M049P13

$\Gamma(\chi_{c1} \text{ anything})/\Gamma(J/\psi(1S) \text{ anything})$ Γ_{25}/Γ_7

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.35±0.07 OUR FIT				
0.35±0.08±0.06	52 ± 12	BRIERE	04	CLEO $e^+e^- \rightarrow J/\psi X$

NODE=M049R26
NODE=M049R26

$\Gamma(\chi_{c2} \text{ anything})/\Gamma(J/\psi(1S) \text{ anything})$ Γ_{26}/Γ_7

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.52±0.12±0.09	47 ± 11	BRIERE	04	CLEO $e^+e^- \rightarrow J/\psi X$

NODE=M049R27
NODE=M049R27

$\Gamma(\psi(2S) \text{ anything})/\Gamma_{\text{total}}$ Γ_{27}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.23±0.17±0.11	215	SHEN	16	BELL $e^+e^- \rightarrow \psi(2S) X$

NODE=M049P12
NODE=M049P12

$\Gamma(\psi(2S) \text{ anything})/\Gamma(J/\psi(1S) \text{ anything})$ Γ_{27}/Γ_7

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.41±0.11±0.08	42 ± 11	BRIERE	04	CLEO $e^+e^- \rightarrow J/\psi\pi^+\pi^- X$

NODE=M049R28
NODE=M049R28

$\Gamma(\psi(2S)\eta_c)/\Gamma_{\text{total}}$ Γ_{28}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<3.6 \times 10^{-6}$	90	YANG	14	BELL $e^+e^- \rightarrow \psi(2S) X$

NODE=M049R92
NODE=M049R92

$\Gamma(\psi(2S)\chi_{c0})/\Gamma_{\text{total}}$ Γ_{29}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<6.5 \times 10^{-6}$	90	YANG	14	BELL $e^+e^- \rightarrow \psi(2S) X$

NODE=M049R93
NODE=M049R93

$\Gamma(\psi(2S)\chi_{c1})/\Gamma_{\text{total}}$ Γ_{30}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<4.5 \times 10^{-6}$	90	YANG	14	BELL $e^+e^- \rightarrow \psi(2S) X$

NODE=M049R94
NODE=M049R94

$\Gamma(\psi(2S)\chi_{c2})/\Gamma_{\text{total}}$ Γ_{31}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<2.1 \times 10^{-6}$	90	YANG	14	BELL $e^+e^- \rightarrow \psi(2S) X$

NODE=M049R95
NODE=M049R95

$\Gamma(\psi(2S)\eta_c(2S))/\Gamma_{\text{total}}$ Γ_{32}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<3.2 \times 10^{-6}$	90	YANG	14	BELL $e^+e^- \rightarrow \psi(2S) X$

NODE=M049R96
NODE=M049R96

$\Gamma(\psi(2S)X(3940))/\Gamma_{\text{total}}$ Γ_{33}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<2.9 \times 10^{-6}$	90	YANG	14	BELL $e^+e^- \rightarrow \psi(2S) X$

NODE=M049R97
NODE=M049R97

$\Gamma(\psi(2S)X(4160))/\Gamma_{\text{total}}$ Γ_{34}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<2.9 \times 10^{-6}$	90	YANG	14	BELL $e^+e^- \rightarrow \psi(2S)X$

NODE=M049R98
NODE=M049R98

 $\Gamma(X(4260) \text{ anything}, X \rightarrow \psi(2S)\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{35}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<7.9 \times 10^{-5}$	90	SHEN	16	BELL $\Upsilon(1S) \rightarrow \psi(2S)\pi^+\pi^-X$

NODE=M049P00
NODE=M049P00

 $\Gamma(X(4360) \text{ anything}, X \rightarrow \psi(2S)\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{36}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<5.2 \times 10^{-5}$	90	SHEN	16	BELL $\Upsilon(1S) \rightarrow \psi(2S)\pi^+\pi^-X$

NODE=M049P01
NODE=M049P01

 $\Gamma(X(4660) \text{ anything}, X \rightarrow \psi(2S)\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{37}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<2.2 \times 10^{-5}$	90	SHEN	16	BELL $\Upsilon(1S) \rightarrow \psi(2S)\pi^+\pi^-X$

NODE=M049P02
NODE=M049P02

 $\Gamma(X(4050)^\pm \text{ anything}, X \rightarrow \psi(2S)\pi^\pm)/\Gamma_{\text{total}}$ Γ_{38}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<8.8 \times 10^{-5}$	90	SHEN	16	BELL $\Upsilon(1S) \rightarrow \psi(2S)\pi^\pm X$

NODE=M049P09
NODE=M049P09

 $\Gamma(X(4430)^\pm \text{ anything}, X \rightarrow \psi(2S)\pi^\pm)/\Gamma_{\text{total}}$ Γ_{39}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<6.7 \times 10^{-5}$	90	SHEN	16	BELL $\Upsilon(1S) \rightarrow \psi(2S)\pi^\pm X$

NODE=M049P10
NODE=M049P10

 $\Gamma(\rho\pi)/\Gamma_{\text{total}}$ Γ_{40}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<3.68	90	SHEN	13	BELL $\Upsilon(1S) \rightarrow \pi^+\pi^-\pi^0$

NODE=M049R11
NODE=M049R11

• • • We do not use the following data for averages, fits, limits, etc. • • •

$<1 \times 10^3$	90	BLINOV	90	MD1 $\Upsilon(1S) \rightarrow \rho^0\pi^0$
$<2 \times 10^2$	90	FULTON	90B	$\Upsilon(1S) \rightarrow \rho^0\pi^0$
$<2.1 \times 10^3$	90	NICZYPORUK	83	LENA $\Upsilon(1S) \rightarrow \rho^0\pi^0$

 $\Gamma(\omega\pi^0)/\Gamma_{\text{total}}$ Γ_{41}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<3.90	90	SHEN	13	BELL $\Upsilon(1S) \rightarrow \pi^+\pi^-\pi^0\pi^0$

NODE=M049R05
NODE=M049R05

 $\Gamma(\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{42}/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_{43}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<5	90	BARU	92	MD1 $\Upsilon(1S) \rightarrow K^+K^-$

NODE=M049R58
NODE=M049R58

 $\Gamma(p\bar{p})/\Gamma_{\text{total}}$ Γ_{44}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<5	90	¹⁵ BARU	96	MD1 $\Upsilon(1S) \rightarrow p\bar{p}$

NODE=M049R59
NODE=M049R59

¹⁵ Supersedes BARU 92 in this node.

NODE=M049R59;LINKAGE=A

 $\Gamma(\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{45}/Γ

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$2.14 \pm 0.72 \pm 0.34$		26 ± 9	SHEN	13	BELL $\Upsilon(1S) \rightarrow \pi^+\pi^-\pi^0$

NODE=M049R72
NODE=M049R72

• • • We do not use the following data for averages, fits, limits, etc. • • •

<18.4	90	ANASTASSOV	99	CLE2 $e^+e^- \rightarrow \text{hadrons}$

 $\Gamma(\phi K^+K^-)/\Gamma_{\text{total}}$ Γ_{46}/Γ

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
$2.36 \pm 0.37 \pm 0.29$	56	SHEN	12A	BELL $\Upsilon(1S) \rightarrow 2(K^+K^-)$

NODE=M049R75
NODE=M049R75

 $\Gamma(\omega\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{47}/Γ

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
$4.46 \pm 0.67 \pm 0.72$	64	SHEN	12A	BELL $\Upsilon(1S) \rightarrow 2(\pi^+\pi^-)\pi^0$

NODE=M049R76
NODE=M049R76

$\Gamma(K^*(892)^0 K^- \pi^+ + \text{c.c.})/\Gamma_{\text{total}}$
 Γ_{48}/Γ

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
$4.42 \pm 0.50 \pm 0.58$	173	SHEN	12A	BELL $\Upsilon(1S) \rightarrow K^+ K^- \pi^+ \pi^-$

NODE=M049R77
NODE=M049R77

 $\Gamma(\phi f'_2(1525))/\Gamma_{\text{total}}$
 Γ_{49}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<1.63	90	SHEN	12A	BELL $\Upsilon(1S) \rightarrow 2(K^+ K^-)$

NODE=M049R78
NODE=M049R78

 $\Gamma(\omega f_2(1270))/\Gamma_{\text{total}}$
 Γ_{50}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<1.79	90	SHEN	12A	BELL $\Upsilon(1S) \rightarrow 2(\pi^+ \pi^-) \pi^0$

NODE=M049R79
NODE=M049R79

 $\Gamma(\rho(770) a_2(1320))/\Gamma_{\text{total}}$
 Γ_{51}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<2.24	90	SHEN	12A	BELL $\Upsilon(1S) \rightarrow 2(\pi^+ \pi^-) \pi^0$

NODE=M049R80
NODE=M049R80

 $\Gamma(K^*(892)^0 \bar{K}_2^*(1430)^0 + \text{c.c.})/\Gamma_{\text{total}}$
 Γ_{52}/Γ

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
$3.02 \pm 0.68 \pm 0.34$	42	SHEN	12A	BELL $\Upsilon(1S) \rightarrow K^+ K^- \pi^+ \pi^-$

NODE=M049R81
NODE=M049R81

 $\Gamma(K_1(1270)^\pm K^\mp)/\Gamma_{\text{total}}$
 Γ_{53}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<2.41	90	SHEN	12A	BELL $\Upsilon(1S) \rightarrow K^+ K^- \pi^+ \pi^-$

NODE=M049R82
NODE=M049R82

 $\Gamma(K_1(1400)^\pm K^\mp)/\Gamma_{\text{total}}$
 Γ_{54}/Γ

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.02 \pm 0.35 \pm 0.22$	24	SHEN	12A	BELL $\Upsilon(1S) \rightarrow K^+ K^- \pi^+ \pi^-$

NODE=M049R83
NODE=M049R83

 $\Gamma(b_1(1235)^\pm \pi^\mp)/\Gamma_{\text{total}}$
 Γ_{55}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<1.25	90	SHEN	12A	BELL $\Upsilon(1S) \rightarrow 2(\pi^+ \pi^-) \pi^0$

NODE=M049R84
NODE=M049R84

 $\Gamma(\pi^+ \pi^- \pi^0 \pi^0)/\Gamma_{\text{total}}$
 Γ_{56}/Γ

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
$12.8 \pm 2.0 \pm 2.3$	143 ± 22	SHEN	13	BELL $\Upsilon(1S) \rightarrow \pi^+ \pi^- \pi^0 \pi^0$

NODE=M049R06
NODE=M049R06

 $\Gamma(K_S^0 K^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}}$
 Γ_{57}/Γ

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$1.59 \pm 0.33 \pm 0.18$		37 ± 8	SHEN	13	BELL $\Upsilon(1S) \rightarrow K_S^0 K^- \pi^+$

NODE=M049R07
NODE=M049R07

• • • We do not use the following data for averages, fits, limits, etc. • • •

<3.4	90	¹⁶ DOBBS	12A	$\Upsilon(1S) \rightarrow K_S^0 K^- \pi^+$

¹⁶ Obtained by analyzing CLEO III data but not authored by the CLEO Collaboration.

NODE=M049R07;LINKAGE=DO

 $\Gamma(K^*(892)^0 \bar{K}^0 + \text{c.c.})/\Gamma_{\text{total}}$
 Γ_{58}/Γ

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
$2.92 \pm 0.85 \pm 0.37$	16 ± 5	SHEN	13	BELL $\Upsilon(1S) \rightarrow K_S^0 K^- \pi^+$

NODE=M049R08
NODE=M049R08

 $\Gamma(K^*(892)^- K^+ + \text{c.c.})/\Gamma_{\text{total}}$
 Γ_{59}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<1.11	90	SHEN	13	BELL $\Upsilon(1S) \rightarrow K_S^0 K^- \pi^+$

NODE=M049R09
NODE=M049R09

 $\Gamma(D^*(2010)^\pm \text{anything})/\Gamma_{\text{total}}$
 Γ_{60}/Γ

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$25.2 \pm 1.3 \pm 1.5$	$\approx 2k$	¹⁷	AUBERT	10C	BABR $\Upsilon(2S) \rightarrow \pi^+ \pi^- \Upsilon(1S)$

NODE=M049R32
NODE=M049R32

• • • We do not use the following data for averages, fits, limits, etc. • • •

<19	90	¹⁸ ALBRECHT	92J	ARG $e^+ e^- \rightarrow D^0 \pi^\pm X$

¹⁷ For $x_p > 0.1$.

¹⁸ For $x_p > 0.2$.

NODE=M049R32;LINKAGE=AU

NODE=M049R32;LINKAGE=B

$\Gamma(\overline{2H} \text{ anything})/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT
2.85±0.25 OUR AVERAGE				
2.81±0.49 ^{+0.20} _{-0.24}		LEES	14G BABR	$e^+e^- \rightarrow \overline{2H} X$
2.86±0.19±0.21	455	ASNER	07 CLEO	$e^+e^- \rightarrow \overline{2H} X$

 Γ_{61}/Γ

NODE=M049R33
NODE=M049R33

OCCUR=2

 $\Gamma(\text{Sum of 100 exclusive modes})/\Gamma_{\text{total}}$

VALUE (units 10^{-2})	DOCUMENT ID	COMMENT
1.200±0.017	19,20 DOBBS	12A $\Upsilon(1S) \rightarrow \text{hadrons}$

 Γ_{62}/Γ

NODE=M049R02
NODE=M049R02

¹⁹ DOBBS 12A presents individual exclusive branching fractions or upper limits for 100 modes of four to ten pions, kaons, or protons.

NODE=M049R02;LINKAGE=DO

²⁰ Obtained by analyzing CLEO III data but not authored by the CLEO Collaboration.

NODE=M049R02;LINKAGE=NC

 $\Gamma(ggg, \gamma gg \rightarrow \overline{d} \text{ anything})/\Gamma(ggg, \gamma gg \rightarrow \text{anything})$

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT
3.36±0.23±0.25	455	ASNER	07 CLEO	$e^+e^- \rightarrow \overline{d} X$

NODE=M049R34
NODE=M049R34

 $\Gamma(\gamma\pi^+\pi^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
6.3±1.2±1.3	²¹ ANASTASSOV 99	CLE2	$e^+e^- \rightarrow \text{hadrons}$

 Γ_{63}/Γ

NODE=M049R70
NODE=M049R70

²¹ For $m_{\pi\pi} > 1 \text{ GeV}$.

NODE=M049R70;LINKAGE=A

 $\Gamma(\gamma\pi^0\pi^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
1.7±0.6±0.3	²² ANASTASSOV 99	CLE2	$e^+e^- \rightarrow \text{hadrons}$

 Γ_{64}/Γ

NODE=M049R71
NODE=M049R71

²² For $m_{\pi\pi} > 1 \text{ GeV}$.

NODE=M049R71;LINKAGE=A

 $\Gamma(\gamma\pi^0\eta)/\Gamma_{\text{total}}$

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<2.4	90	²³ BESSON	07A CLEO	$e^+e^- \rightarrow \Upsilon(1S)$

 Γ_{65}/Γ

NODE=M049R47
NODE=M049R47

²³ BESSON 07A obtained this limit for $0.7 < m_{\pi^0\eta} < 3 \text{ GeV}$.

NODE=M049R47;LINKAGE=BE

 $\Gamma(\gamma K^+ K^-)/\Gamma_{\text{total}}$

($2 < m_{K^+ K^-} < 3 \text{ GeV}$)

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
1.14±0.08±0.10	90	ATHAR	06 CLE3	$\Upsilon(1S) \rightarrow \gamma K^+ K^-$

 Γ_{66}/Γ

NODE=M049R24

NODE=M049R24
NODE=M049R24

 $\Gamma(\gamma p \overline{p})/\Gamma_{\text{total}}$

($2 < m_{p\overline{p}} < 3 \text{ GeV}$)

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<0.6	90	ATHAR	06 CLE3	$\Upsilon(1S) \rightarrow \gamma p \overline{p}$

 Γ_{67}/Γ

NODE=M049R29

NODE=M049R29
NODE=M049R29

 $\Gamma(\gamma 2h^+ 2h^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
7.0±1.1±1.0	80 ± 12	FULTON	90B CLEO	$e^+e^- \rightarrow \text{hadrons}$

 Γ_{68}/Γ

NODE=M049R20
NODE=M049R20

 $\Gamma(\gamma 3h^+ 3h^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
5.4±1.5±1.3	39 ± 11	FULTON	90B CLEO	$e^+e^- \rightarrow \text{hadrons}$

 Γ_{69}/Γ

NODE=M049R21
NODE=M049R21

 $\Gamma(\gamma 4h^+ 4h^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
7.4±2.5±2.5	36 ± 12	FULTON	90B CLEO	$e^+e^- \rightarrow \text{hadrons}$

 Γ_{70}/Γ

NODE=M049R22
NODE=M049R22

 $\Gamma(\gamma\pi^+\pi^- K^+ K^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
2.9±0.7±0.6	29 ± 8	FULTON	90B CLEO	$e^+e^- \rightarrow \text{hadrons}$

 Γ_{71}/Γ

NODE=M049R14
NODE=M049R14

 $\Gamma(\gamma 2\pi^+ 2\pi^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
2.5±0.7±0.5	26 ± 7	FULTON	90B CLEO	$e^+e^- \rightarrow \text{hadrons}$

 Γ_{72}/Γ

NODE=M049R13
NODE=M049R13

$\Gamma(\gamma 3\pi^+ 3\pi^-)/\Gamma_{\text{total}}$ Γ_{73}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$2.5 \pm 0.9 \pm 0.8$	17 ± 5	FULTON	90B CLEO	$e^+ e^- \rightarrow \text{hadrons}$

NODE=M049R17
 NODE=M049R17

 $\Gamma(\gamma 2\pi^+ 2\pi^- K^+ K^-)/\Gamma_{\text{total}}$ Γ_{74}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$2.4 \pm 0.9 \pm 0.8$	18 ± 7	FULTON	90B CLEO	$e^+ e^- \rightarrow \text{hadrons}$

NODE=M049R18
 NODE=M049R18

 $\Gamma(\gamma \pi^+ \pi^- \rho \bar{\rho})/\Gamma_{\text{total}}$ Γ_{75}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.5 \pm 0.5 \pm 0.3$	22 ± 6	FULTON	90B CLEO	$e^+ e^- \rightarrow \text{hadrons}$

NODE=M049R15
 NODE=M049R15

 $\Gamma(\gamma 2\pi^+ 2\pi^- \rho \bar{\rho})/\Gamma_{\text{total}}$ Γ_{76}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$0.4 \pm 0.4 \pm 0.4$	7 ± 6	FULTON	90B CLEO	$e^+ e^- \rightarrow \text{hadrons}$

NODE=M049R19
 NODE=M049R19

 $\Gamma(\gamma 2K^+ 2K^-)/\Gamma_{\text{total}}$ Γ_{77}/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_{78}/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_{79}/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_{80}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
< 3	90	²⁴ ATHAR 06	CLE3	$\Upsilon(1S) \rightarrow \gamma \pi^+ \pi^-$
²⁴ 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_{81}/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	²⁵	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	²⁶	FULTON 90B	CLEO	$\Upsilon(1S) \rightarrow \gamma K^+ K^-$
< 19.4	90	²⁶	ALBRECHT 89	ARG	$\Upsilon(1S) \rightarrow \gamma K^+ K^-$

²⁵ 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 $B(f'_2(1525) \rightarrow K\bar{K}) = 4 B(f'_2(1525) \rightarrow K_S^0 K_S^0)$.

NODE=M049R52;LINKAGE=BE

²⁶ Assuming $B(f'_2(1525) \rightarrow K\bar{K}) = 0.71$.

NODE=M049R52;LINKAGE=D

 $\Gamma(\gamma f_2(1270))/\Gamma_{\text{total}}$ Γ_{82}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
10.1 ± 0.9 OUR AVERAGE				
$10.5 \pm 1.6^{+1.9}_{-1.8}$		²⁷	BESSON 07A	CLE3 $\Upsilon(1S) \rightarrow \gamma \pi^0 \pi^0$
$10.2 \pm 0.8 \pm 0.7$			ATHAR 06	CLE3 $\Upsilon(1S) \rightarrow \gamma \pi^+ \pi^-$
$8.1 \pm 2.3^{+2.9}_{-2.7}$		²⁸	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	28 FULTON	90B	CLEO	$\Upsilon(1S) \rightarrow \gamma \pi^+ \pi^-$
<13	90	28 ALBRECHT	89	ARG	$\Upsilon(1S) \rightarrow \gamma \pi^+ \pi^-$
<81	90	SCHMITT	88	CBAL	$\Upsilon(1S) \rightarrow \gamma X$
27 Using $B(f_2(1270) \rightarrow \pi^0 \pi^0) = B(f_2(1270) \rightarrow \pi \pi)/3$ and $B(f_2(1270) \rightarrow \pi \pi) = (0.845^{+0.025}_{-0.012})\%$.					
28 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_{83}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<8.2	90	29 FULTON	90B	CLEO $\Upsilon(1S) \rightarrow \gamma K^\pm \pi^\mp K_S^0$
29 Includes unknown branching ratio of $\eta(1405) \rightarrow K^\pm \pi^\mp K_S^0$.				

NODE=M049R23
NODE=M049R23

NODE=M049R23;LINKAGE=J

$\Gamma(\gamma f_0(1500))/\Gamma_{\text{total}}$

Γ_{84}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<1.5	90	30 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	31 BESSON	07A	CLEO $e^+ e^- \rightarrow \Upsilon(1S) \rightarrow \gamma \eta \eta$
30 Using $B(f_0(1500) \rightarrow \pi^0 \pi^0) = B(f_0(1500) \rightarrow \pi \pi)/3$ and $B(f_0(1500) \rightarrow \pi \pi) = (0.349 \pm 0.023)\%$.				
31 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_{85}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 2.6	90	32 ALBRECHT	89	ARG $\Upsilon(1S) \rightarrow \gamma K^+ K^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
< 6.3	90	32 FULTON	90B	CLEO $\Upsilon(1S) \rightarrow \gamma K^+ K^-$
<19	90	32 FULTON	90B	CLEO $\Upsilon(1S) \rightarrow \gamma K_S^0 K_S^0$
< 8	90	33 ALBRECHT	89	ARG $\Upsilon(1S) \rightarrow \gamma \pi^+ \pi^-$
<24	90	34 SCHMITT	88	CBAL $\Upsilon(1S) \rightarrow \gamma X$
32 Assuming $B(f_0(1710) \rightarrow K \bar{K}) = 0.38$.				
33 Assuming $B(f_0(1710) \rightarrow \pi \pi) = 0.04$.				
34 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_{86}/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_{87}/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_{88}/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_{89}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<5.3	90	35 ATHAR	06	CLE3 $\Upsilon(1S) \rightarrow \gamma \pi^+ \pi^-$
35 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_{90}/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_{91}/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_{92}/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_{93}/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_{94}/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_{95}/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_{96}/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_{97}/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_{98}/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_{99}/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_{100}/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_{101}/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_{102}/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_{103}/Γ (X = scalar with $m < 8.0$ GeV)

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
< 4.5	90	³⁶ DEL-AMO-SA..11J	BABR	$e^+ e^- \rightarrow \gamma + X$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<30	90	³⁷ BALEST	95 CLEO	$e^+ e^- \rightarrow \gamma + X$

NODE=M049R60
 NODE=M049R60
 NODE=M049R60

³⁶ For a noninteracting scalar X with mass $m < 8.0$ GeV.³⁷ For a noninteracting pseudoscalar X with mass < 7.2 GeV.

NODE=M049R60;LINKAGE=DA
 NODE=M049R60;LINKAGE=A

 $\Gamma(\gamma X \bar{X}(m_X < 3.1 \text{ GeV}))/\Gamma_{\text{total}}$ Γ_{104}/Γ (X $\bar{X}$ = vectors with $m < 3.1$ GeV)

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<1	90	³⁸ BALEST	95 CLEO	$e^+ e^- \rightarrow \gamma + X \bar{X}$

³⁸ For a noninteracting vector X with mass < 3.1 GeV.

NODE=M049R61
 NODE=M049R61
 NODE=M049R61

NODE=M049R61;LINKAGE=A

$\Gamma(\gamma X \bar{X} (m_X < 4.5 \text{ GeV}))/\Gamma_{\text{total}}$ Γ_{105}/Γ X and $\bar{X}$ = zero spin with $m < 4.5 \text{ GeV}$

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<24	90	³⁹ DEL-AMO-SA..11J	BABR	$e^+e^- \rightarrow \gamma + X \bar{X}$

³⁹ For a noninteracting scalar X with mass $m < 4.5 \text{ GeV}$.

NODE=M049R01

NODE=M049R01
NODE=M049R01

NODE=M049R01;LINKAGE=DA

 $\Gamma(\gamma X \rightarrow \gamma + \geq 4 \text{ prongs})/\Gamma_{\text{total}}$ Γ_{106}/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 $\Gamma(\gamma a_1^0 \rightarrow \gamma \mu^+ \mu^-)/\Gamma_{\text{total}}$ Γ_{107}/Γ $(201 < M(\mu^+ \mu^-) < 3565 \text{ MeV})$

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<9	90	⁴⁰ 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	⁴¹ LEES	13C BABR	$e^+e^- \rightarrow \gamma a_1^0 \rightarrow \gamma \mu^+ \mu^-$

⁴⁰ 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 $1-9 \times 10^{-6}$.⁴¹ For a narrow scalar or pseudoscalar a_1^0 with mass in the range $212-9200 \text{ MeV}$, excluding J/ψ and $\psi(2S)$. Measured 90% CL limits as a function of $m_{a_1^0}$ range from $0.28-9.7 \times 10^{-6}$.

NODE=M049R65

NODE=M049R65
NODE=M049R65

NODE=M049R65;LINKAGE=LO

NODE=M049R65;LINKAGE=LE

 $\Gamma(\gamma a_1^0 \rightarrow \gamma \tau^+ \tau^-)/\Gamma_{\text{total}}$ Γ_{108}/Γ $(2m_\tau < M(\tau^+ \tau^-) < 9.2 \text{ GeV})$

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<130	90	⁴² LEES	13R BABR	$\Upsilon(2S) \rightarrow \gamma \tau^+ \tau^- \pi^+ \pi^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 50	90	⁴³ LOVE	08 CLEO	$e^+e^- \rightarrow \gamma a_1^0 \rightarrow \gamma \tau^+ \tau^-$

⁴² For a narrow scalar a_1^0 with $2m_\tau < M(a_1^0) < 9.2 \text{ GeV}$, which result in a 90% CL upper limits of 0.9×10^{-5} at $M(a_1^0) = 2m_\tau$, $\approx 1.5 \times 10^{-5}$ at $M(a_1^0) = 7.5 \text{ GeV}$, and 13×10^{-5} at $M(a_1^0) = 9.2 \text{ GeV}$.⁴³ For a narrow scalar or pseudoscalar a_1^0 with $2m_\tau < M(a_1^0) < 7.5 \text{ GeV}$, which result in a 90% CL limits ranging from 1×10^{-5} at $M(a_1^0)=2m_\tau$ to 5×10^{-5} at $M(a_1^0)=7.5 \text{ GeV}$.

NODE=M049R66

NODE=M049R66
NODE=M049R66

NODE=M049R66;LINKAGE=A

NODE=M049R66;LINKAGE=LO

 $\Gamma(\gamma a_1^0 \rightarrow \gamma g g)/\Gamma_{\text{total}}$ Γ_{109}/Γ $(0.5 \text{ GeV} < m < 9.0 \text{ GeV})$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<1 $\times 10^{-2}$	90	⁴⁴ LEES	13L BABR	$\Upsilon(1S) \rightarrow \gamma X$

⁴⁴ For a narrow, CP -odd pseudoscalar a_1^0 searched for in 26 hadronic decay modes with invariant mass $0.5 \text{ GeV} < m_X < 9.0 \text{ GeV}$. Measured 90% CL limit as a function of m_X range from 10^{-6} to 10^{-2} .

NODE=M049R03

NODE=M049R03
NODE=M049R03

NODE=M049R03;LINKAGE=A

 $\Gamma(\gamma a_1^0 \rightarrow \gamma s \bar{s})/\Gamma_{\text{total}}$ Γ_{110}/Γ $(0.5 \text{ GeV} < m < 9.0 \text{ GeV})$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<1 $\times 10^{-3}$	90	⁴⁵ LEES	13L BABR	$\Upsilon(1S) \rightarrow \gamma X$

⁴⁵ For a narrow, CP -odd pseudoscalar a_1^0 searched for in 14 hadronic decay modes with invariant mass $1.5 \text{ GeV} < m_X < 9.0 \text{ GeV}$. Measured 90% CL limit as a function of m_X range from 10^{-5} to 10^{-3} .

NODE=M049R04

NODE=M049R04
NODE=M049R04

NODE=M049R04;LINKAGE=A

LEPTON FAMILY NUMBER (LF) VIOLATING MODES

NODE=M049230

 $\Gamma(\mu^\pm \tau^\mp)/\Gamma_{\text{total}}$ Γ_{111}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<6.0	95	LOVE	08A CLEO	$e^+e^- \rightarrow \mu^\pm \tau^\mp$

NODE=M049R67
NODE=M049R67

OTHER DECAYS

 $\Gamma(\text{invisible})/\Gamma_{\text{total}}$ Γ_{112}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 3.0	90	AUBERT	09AX BABR	$\Upsilon(3S) \rightarrow \pi^+ \pi^- \Upsilon(1S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<39	90	RUBIN	07 CLEO	$\Upsilon(2S) \rightarrow \pi^+ \pi^- \Upsilon(1S)$
<25	90	TAJIMA	07 BELL	$\Upsilon(3S) \rightarrow \pi^+ \pi^- \Upsilon(1S)$

NODE=M049235

NODE=M049R10
NODE=M049R10 $\Upsilon(1S)$ REFERENCES

NODE=M049

JIA	17	PR D95 012001	S. Jia <i>et al.</i>	(LHCb Collab.)	REFID=57635
SHEN	16	PR D93 112013	C.P. Shen <i>et al.</i>	(BELLE Collab.)	REFID=57515
LEES	14G	PR D89 111102	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=55939
YANG	14	PR D90 112008	S.D. Yang <i>et al.</i>	(BELLE Collab.)	REFID=56345
LEES	13C	PR D87 031102	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=54949
LEES	13L	PR D88 031701	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=55167
LEES	13R	PR D88 071102	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=55451
SHEN	13	PR D88 011102	C.P. Shen <i>et al.</i>	(BELLE Collab.)	REFID=55395
DOBBBS	12A	PR D86 052003	S. Dobbs <i>et al.</i>		REFID=54746
SHEN	12A	PR D86 031102	C.P. Shen <i>et al.</i>	(BELLE Collab.)	REFID=54314
BESSION	11	PR D83 037101	D. Besson <i>et al.</i>	(CLEO Collab.)	REFID=16737
DEL-AMO-SA...	11J	PRL 107 021804	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)	REFID=16495
AUBERT	10C	PR D81 011102	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=53211
DEL-AMO-SA...	10C	PRL 104 191801	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)	REFID=53354
SHEN	10A	PR D82 051504	C.P. Shen <i>et al.</i>	(BELLE Collab.)	REFID=53545
AUBERT	09AX	PRL 103 251801	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=53201
LOVE	08	PRL 101 151802	W. Love <i>et al.</i>	(CLEO Collab.)	REFID=52565
LOVE	08A	PRL 101 201601	W. Love <i>et al.</i>	(CLEO Collab.)	REFID=52592
PDG	08	PL B667 1	C. Amsler <i>et al.</i>	(PDG Collab.)	REFID=52166
ASNER	07	PR D75 012009	D.M. Asner <i>et al.</i>	(CLEO Collab.)	REFID=51617
ATHAR	07A	PR D76 072003	S.B. Athar <i>et al.</i>	(CLEO Collab.)	REFID=51945
BESSION	07	PRL 98 052002	D. Besson <i>et al.</i>	(CLEO Collab.)	REFID=51620
BESSION	07A	PR D75 072001	D. Besson <i>et al.</i>	(CLEO Collab.)	REFID=51638
ROSNER	07A	PR D76 117102	J.L. Rosner <i>et al.</i>	(CLEO Collab.)	REFID=52079
RUBIN	07	PR D75 031104	P. Rubin <i>et al.</i>	(CLEO Collab.)	REFID=51629
TAJIMA	07	PRL 98 132001	O. Tajima <i>et al.</i>	(BELLE Collab.)	REFID=51645
AQUINES	06A	PR D74 092006	O. Aquines <i>et al.</i>	(CLEO Collab.)	REFID=51510
ATHAR	06	PR D73 032001	S.B. Athar <i>et al.</i>	(CLEO Collab.)	REFID=50993
BESSION	06A	PR D74 012003	D. Besson <i>et al.</i>	(CLEO Collab.)	REFID=51147
ROSNER	06	PRL 96 092003	J.L. Rosner <i>et al.</i>	(CLEO Collab.)	REFID=51035
ADAMS	05	PRL 94 012001	G.S. Adams <i>et al.</i>	(CLEO Collab.)	REFID=50452
BRIERE	04	PR D70 072001	R.A. Briere <i>et al.</i>	(CLEO Collab.)	REFID=50183
ARTUSO	03	PR D67 052003	M. Artuso <i>et al.</i>	(CLEO Collab.)	REFID=49395
MASEK	02	PR D65 072002	G. Masek <i>et al.</i>	(CLEO Collab.)	REFID=48846
RICHICHI	01B	PRL 87 141801	S.J. Richichi <i>et al.</i>	(CLEO Collab.)	REFID=48345
ARTAMONOV	00	PL B474 427	A.S. Artamonov <i>et al.</i>		REFID=47424
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
BARU	92B	ZPHY C56 547	S.E. Baru <i>et al.</i>	(NOVO)	REFID=42168
KOBEL	92	ZPHY C53 193	M. Kobel <i>et al.</i>	(Crystal Ball Collab.)	REFID=41861
BLINOV	90	PL B245 311	A.E. Blinov <i>et al.</i>	(NOVO)	REFID=41361
FULTON	90B	PR D41 1401	R. Fulton <i>et al.</i>	(CLEO Collab.)	REFID=41012
MASCHMANN	90	ZPHY C46 555	W.S. Maschmann <i>et al.</i>	(Crystal Ball Collab.)	REFID=41224
ALBRECHT	89	ZPHY C42 349	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=40731
ALEXANDER	89	NP B320 45	J.P. Alexander <i>et al.</i>	(LBL, MICH, SLAC)	REFID=40345
BARU	89	ZPHY C42 505	S.E. Baru <i>et al.</i>	(NOVO)	REFID=40917
CHEN	89B	PR D39 3528	W.Y. Chen <i>et al.</i>	(CLEO Collab.)	REFID=40919
FULTON	89	PL B224 445	R. Fulton <i>et al.</i>	(CLEO Collab.)	REFID=40918
KAARSBERG	89	PRL 62 2077	T.M. Kaarsberg <i>et al.</i>	(CUSB Collab.)	REFID=40733
BUCHMUEL...	88	HE e^+e^- Physics 412	W. Buchmueller, S. Cooper	(HANN, DESY, MIT)	REFID=40034
Editors: A. Ali and P. Soeding, World Scientific, Singapore					
JAKUBOWSKI	88	ZPHY C40 49	Z. Jakubowski <i>et al.</i>	(Crystal Ball Collab.)	REFID=40742
SCHMITT	88	ZPHY C40 199	P. Schmitt <i>et al.</i>	(Crystal Ball Collab.)	REFID=40582
ALBRECHT	87	ZPHY C35 283	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=40016
COHEN	87	RMP 59 1121	E.R. Cohen, B.N. Taylor	(RISC, NBS)	REFID=11616
BARU	86	ZPHY C30 551	S.E. Baru <i>et al.</i>	(NOVO)	REFID=22284
ALBRECHT	85C	PL 154B 452	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=22282
KURAEV	85	SJNP 41 466	E.A. Kuraev, V.S. Fadin	(NOVO)	REFID=40033
Translated from YAF 41 733					
ARTAMONOV	84	PL 137B 272	A.S. Artamonov <i>et al.</i>	(NOVO)	REFID=22278
BESSION	84	PR D30 1433	D. Besson <i>et al.</i>	(CLEO Collab.)	REFID=22279
GILES	84B	PR D29 1285	R. Giles <i>et al.</i>	(CLEO Collab.)	REFID=22280
MACKAY	84	PR D29 2483	W.W. MacKay <i>et al.</i>	(CUSB Collab.)	REFID=22281
ANDREWS	83	PRL 50 807	D.E. Andrews <i>et al.</i>	(CLEO Collab.)	REFID=22273
GILES	83	PRL 50 877	R. Giles <i>et al.</i>	(HARV, OSU, ROCH, RUTG+)	REFID=22274
NICZYPORUK	83	ZPHY C17 197	B. Niczyporuk <i>et al.</i>	(LENA Collab.)	REFID=12488
ALBRECHT	82	PL 116B 383	H. Albrecht <i>et al.</i>	(DESY, DORT, HEIDH+)	REFID=22270
ARTAMONOV	82	PL 118B 225	A.S. Artamonov <i>et al.</i>	(NOVO)	REFID=22271
NICZYPORUK	82	ZPHY C15 299	B. Niczyporuk <i>et al.</i>	(LENA Collab.)	REFID=22272
BERGER	80C	PL 93B 497	C. Berger <i>et al.</i>	(PLUTO Collab.)	REFID=22263
BOCK	80	ZPHY C6 125	P. Bock <i>et al.</i>	(HEIDP, MPIM, DESY, HAMB)	REFID=22264
BERGER	79	ZPHY C1 343	C. Berger <i>et al.</i>	(PLUTO Collab.)	REFID=22259

$\chi_{b0}(1P)$

$$J^G(J^{PC}) = 0^+(0^{++})$$

J needs confirmation.

Observed in radiative decay of the $\Upsilon(2S)$, therefore $C = +$. Branching ratio requires E1 transition, M1 is strongly disfavored, therefore $P = +$.

NODE=M076

NODE=M076

 $\chi_{b0}(1P)$ MASS

VALUE (MeV)

DOCUMENT ID

9859.44 ± 0.42 ± 0.31 OUR EVALUATION From average γ energy below, using $\Upsilon(2S)$ mass = 10023.26 ± 0.31 MeV

NODE=M076M

NODE=M076M

→ UNCHECKED ←

 $m_{\chi_{b1}(1P)} - m_{\chi_{b0}(1P)}$

VALUE (MeV)

DOCUMENT ID

TECN

COMMENT

32.49 ± 0.93

LEES

14M

BABR

 $\Upsilon(2S) \rightarrow \gamma\gamma\mu^+\mu^-$

NODE=M076M2

NODE=M076M2

 γ ENERGY IN $\Upsilon(2S)$ DECAY

VALUE (MeV)

DOCUMENT ID

TECN

COMMENT

162.5 ± 0.4 OUR AVERAGE

162.56 ± 0.19 ± 0.42

162.0 ± 0.8 ± 1.2

162.1 ± 0.5 ± 1.4

163.8 ± 1.6 ± 2.7

158.0 ± 7 ± 1

• • • We do not use the following data for averages, fits, limits, etc. • • •

149.4 ± 0.7 ± 5.0

KLOPFEN...

83

CUSB

 $\Upsilon(2S) \rightarrow \gamma X$

NODE=M076DM

NODE=M076DM

 $\chi_{b0}(1P)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)	Confidence level
$\Gamma_1 \quad \gamma \Upsilon(1S)$	(1.95 ± 0.27) %	
$\Gamma_2 \quad D^0 X$	< 10.4 %	90%
$\Gamma_3 \quad \pi^+ \pi^- K^+ K^- \pi^0$	< 1.6 × 10 ⁻⁴	90%
$\Gamma_4 \quad 2\pi^+ \pi^- K^- K_S^0$	< 5 × 10 ⁻⁵	90%
$\Gamma_5 \quad 2\pi^+ \pi^- K^- K_S^0 2\pi^0$	< 5 × 10 ⁻⁴	90%
$\Gamma_6 \quad 2\pi^+ 2\pi^- 2\pi^0$	< 2.1 × 10 ⁻⁴	90%
$\Gamma_7 \quad 2\pi^+ 2\pi^- K^+ K^-$	(1.1 ± 0.6) × 10 ⁻⁴	
$\Gamma_8 \quad 2\pi^+ 2\pi^- K^+ K^- \pi^0$	< 2.7 × 10 ⁻⁴	90%
$\Gamma_9 \quad 2\pi^+ 2\pi^- K^+ K^- 2\pi^0$	< 5 × 10 ⁻⁴	90%
$\Gamma_{10} \quad 3\pi^+ 2\pi^- K^- K_S^0 \pi^0$	< 1.6 × 10 ⁻⁴	90%
$\Gamma_{11} \quad 3\pi^+ 3\pi^-$	< 8 × 10 ⁻⁵	90%
$\Gamma_{12} \quad 3\pi^+ 3\pi^- 2\pi^0$	< 6 × 10 ⁻⁴	90%
$\Gamma_{13} \quad 3\pi^+ 3\pi^- K^+ K^-$	(2.4 ± 1.2) × 10 ⁻⁴	
$\Gamma_{14} \quad 3\pi^+ 3\pi^- K^+ K^- \pi^0$	< 1.0 × 10 ⁻³	90%
$\Gamma_{15} \quad 4\pi^+ 4\pi^-$	< 8 × 10 ⁻⁵	90%
$\Gamma_{16} \quad 4\pi^+ 4\pi^- 2\pi^0$	< 2.1 × 10 ⁻³	90%
$\Gamma_{17} \quad J/\psi J/\psi$	< 7 × 10 ⁻⁵	90%
$\Gamma_{18} \quad J/\psi \psi(2S)$	< 1.2 × 10 ⁻⁴	90%
$\Gamma_{19} \quad \psi(2S) \psi(2S)$	< 3.1 × 10 ⁻⁵	90%

NODE=M076215;NODE=M076

DESIG=1

DESIG=2

DESIG=3

DESIG=4

DESIG=5

DESIG=6

DESIG=7

DESIG=8

DESIG=9

DESIG=10

DESIG=11

DESIG=12

DESIG=13

DESIG=14

DESIG=15

DESIG=16

DESIG=17

DESIG=18

DESIG=19

 $\chi_{b0}(1P)$ BRANCHING RATIOS $\Gamma(\gamma \Upsilon(1S))/\Gamma_{\text{total}}$ Γ_1/Γ

VALUE (%)

CL% EVTS

DOCUMENT ID

TECN

COMMENT

1.95 ± 0.27 OUR AVERAGE

[(1.76 ± 0.35)% OUR 2016 AVERAGE]

2.08 ± 0.24 ± 0.21

1,2 LEES

14M

BABR

 $\Upsilon(2S) \rightarrow$

1.76 ± 0.30 ± 0.18

87

2,3 KORNICER

11

CLEO

 $e^+ e^- \rightarrow \gamma\gamma\mu^+\mu^-$
 $\gamma\gamma\ell^+\ell^-$

NODE=M076220

NODE=M076R1

NODE=M076R1

NEW

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 4.6	90	⁴ LEES	11J	BABR	$\Upsilon(2S) \rightarrow X\gamma$
< 6	90	WALK	86	CBAL	$\Upsilon(2S) \rightarrow \gamma\gamma\ell^+\ell^-$
<11	90	PAUSS	83	CUSB	$\Upsilon(2S) \rightarrow \gamma\gamma\ell^+\ell^-$

¹ LEES 14M quotes $\Gamma(\chi_{b0}(1P) \rightarrow \gamma\Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(2S) \rightarrow \gamma\chi_{b0}(1P))/\Gamma_{\text{total}}$
 $= (7.8 \pm 0.9) \times 10^{-4}$ combining the results from samples of $\Upsilon(2S) \rightarrow \gamma\gamma\mu^+\mu^-$ with
 and without converted photons

² Assuming $B(\Upsilon(1S) \rightarrow \ell^+\ell^-) = (2.48 \pm 0.05)\%$.

³ 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.

⁴ LEES 11J quotes a central value of $\Gamma(\chi_{b0}(1P) \rightarrow \gamma\Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(2S) \rightarrow$
 $\gamma\chi_{b0}(1P))/\Gamma_{\text{total}} = (8.3 \pm 5.6^{+3.7}_{-2.6}) \times 10^{-4}$.

NODE=M076R1;LINKAGE=A

NODE=M076R1;LINKAGE=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 × 10⁻²	90	^{5,6} BRIERE	08	CLEO $\Upsilon(2S) \rightarrow \gamma D^0 X$

⁵ For $p_{D^0} > 2.5$ GeV/c.

⁶ 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	⁷ ASNER	08A	CLEO $\Upsilon(2S) \rightarrow \gamma\pi^+\pi^-K^+K^-\pi^0$

⁷ ASNER 08A reports $[\Gamma(\chi_{b0}(1P) \rightarrow \pi^+\pi^-K^+K^-\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow$
 $\gamma\chi_{b0}(1P))]$ < 6×10^{-6} which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma\chi_{b0}(1P))$
 $= 3.8 \times 10^{-2}$.

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	⁸ ASNER	08A	CLEO $\Upsilon(2S) \rightarrow \gamma 2\pi^+\pi^-K^-K_S^0$

⁸ ASNER 08A reports $[\Gamma(\chi_{b0}(1P) \rightarrow 2\pi^+\pi^-K^-K_S^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow$
 $\gamma\chi_{b0}(1P))]$ < 2×10^{-6} which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma\chi_{b0}(1P))$
 $= 3.8 \times 10^{-2}$.

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	⁹ ASNER	08A	CLEO $\Upsilon(2S) \rightarrow \gamma 2\pi^+\pi^-K^-2\pi^0$

⁹ ASNER 08A reports $[\Gamma(\chi_{b0}(1P) \rightarrow 2\pi^+\pi^-K^-K_S^0 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow$
 $\gamma\chi_{b0}(1P))]$ < 18×10^{-6} which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma\chi_{b0}(1P))$
 $= 3.8 \times 10^{-2}$.

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	¹⁰ ASNER	08A	CLEO $\Upsilon(2S) \rightarrow \gamma 2\pi^+2\pi^-2\pi^0$

¹⁰ ASNER 08A reports $[\Gamma(\chi_{b0}(1P) \rightarrow 2\pi^+2\pi^-2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma\chi_{b0}(1P))]$
 < 8×10^{-6} which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma\chi_{b0}(1P)) = 3.8 \times 10^{-2}$.

NODE=M076R05

NODE=M076R05

NODE=M076R05;LINKAGE=AS

$\Gamma(2\pi^+2\pi^-K^+K^-)/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE (units 10 ⁻⁴)	CL%	DOCUMENT ID	TECN	COMMENT
1.1 ± 0.6 ± 0.1	7	¹¹ ASNER	08A	CLEO $\Upsilon(2S) \rightarrow \gamma 2\pi^+2\pi^-K^+K^-$

¹¹ 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	¹² ASNER	08A	CLEO $\Upsilon(2S) \rightarrow \gamma 2\pi^+2\pi^-K^+K^-\pi^0$

¹² 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	13 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+ 2\pi^- K^+ K^- 2\pi^0$ 13 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	14 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+ 2\pi^- K^- K_S^0 \pi^0$ 14 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	15 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+ 3\pi^-$ 15 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	16 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+ 3\pi^- 2\pi^0$ 16 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	17 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+ 3\pi^- K^+ K^-$ 17 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	18 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+ 3\pi^- K^+ K^- \pi^0$ 18 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	19 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 4\pi^+ 4\pi^-$ 19 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	20 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 4\pi^+ 4\pi^- 2\pi^0$ 20 ASNER 08A reports $[\Gamma(\chi_{b0}(1P) \rightarrow 4\pi^+ 4\pi^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))]$ < 77×10^{-6} which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P)) = 3.8 \times 10^{-2}$.

NODE=M076R15
NODE=M076R15

NODE=M076R15;LINKAGE=AS

 $\Gamma(J/\psi J/\psi)/\Gamma_{\text{total}}$ **Γ_{17}/Γ**

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<7	90	21 SHEN	12 BELL	$\Upsilon(2S) \rightarrow J/\psi X$ 21 SHEN 12 reports < 7.1×10^{-5} from a measurement of $[\Gamma(\chi_{b0}(1P) \rightarrow J/\psi J/\psi)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))]$ assuming $B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P)) = (3.8 \pm 0.4) \times 10^{-2}$.

NODE=M076R16
NODE=M076R16

NODE=M076R16;LINKAGE=SH

$\Gamma(J/\psi\psi(2S))/\Gamma_{\text{total}}$ Γ_{18}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<12	90	²² SHEN	12 BELL	$\Upsilon(2S) \rightarrow \gamma\psi X$
²² SHEN 12 reports $< 12 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{b0}(1P) \rightarrow J/\psi\psi(2S))/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma\chi_{b0}(1P))]$ assuming $B(\Upsilon(2S) \rightarrow \gamma\chi_{b0}(1P)) = (3.8 \pm 0.4) \times 10^{-2}$.				

NODE=M076R17
 NODE=M076R17

NODE=M076R17;LINKAGE=SH

 $\Gamma(\psi(2S)\psi(2S))/\Gamma_{\text{total}}$ Γ_{19}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<3.1	90	²³ SHEN	12 BELL	$\Upsilon(2S) \rightarrow \gamma\psi X$
²³ SHEN 12 reports $< 3.1 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{b0}(1P) \rightarrow \psi(2S)\psi(2S))/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma\chi_{b0}(1P))]$ assuming $B(\Upsilon(2S) \rightarrow \gamma\chi_{b0}(1P)) = (3.8 \pm 0.4) \times 10^{-2}$.				

NODE=M076R18
 NODE=M076R18

NODE=M076R18;LINKAGE=SH

 $\chi_{b0}(1P)$ CROSS-PARTICLE BRANCHING RATIOS

NODE=M076230

$$\Gamma(\chi_{b0}(1P) \rightarrow \gamma\Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(2S) \rightarrow \gamma\chi_{b0}(1P))/\Gamma_{\text{total}}$$

$$\Gamma_1/\Gamma \times \Gamma_{49}^{\Upsilon(2S)}/\Gamma\Upsilon(2S)$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<1.7 $\times 10^{-3}$	90	²⁴ LEES	11J BABR	$\Upsilon(2S) \rightarrow X\gamma$
²⁴ LEES 11J quotes a central value of $\Gamma(\chi_{b0}(1P) \rightarrow \gamma\Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(2S) \rightarrow \gamma\chi_{b0}(1P))/\Gamma_{\text{total}} = (8.3 \pm 5.6^{+3.7}_{-2.6}) \times 10^{-4}$ and derives a 90% CL upper limit of $\Gamma(\gamma\Upsilon(1S))/\Gamma_{\text{total}} < 4.6\%$ using $B(\Upsilon(2S) \rightarrow \gamma\chi_{b0}(1P)) = (3.8 \pm 0.4)\%$.				

NODE=M076B02
 NODE=M076B02

NODE=M076B02;LINKAGE=LE

 $B(\chi_{b0}(1P) \rightarrow \gamma\Upsilon(1S)) \times B(\Upsilon(2S) \rightarrow \gamma\chi_{b0}(1P)) \times B(\Upsilon(1S) \rightarrow \ell^+\ell^-)$

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT
1.67$\pm$0.28 OUR AVERAGE				
[(1.63 $\pm$ 0.28) $\times 10^{-5}$ OUR 2016 AVERAGE]				

NODE=M076B01
 NODE=M076B01
 NEW

2.9 $^{+1.7}_{-1.4}$ $^{+0.1}_{-0.8}$	²⁵ LEES	14M BABR	$\Upsilon(2S) \rightarrow \gamma\gamma\mu^+\mu^-$

1.63 $\pm$ 0.24 $\pm$ 0.15	87 KORNICER	11 CLEO	$e^+e^- \rightarrow \gamma\gamma\ell^+\ell^-$

²⁵ From a sample of $\Upsilon(2S) \rightarrow \gamma\gamma\mu^+\mu^-$ with one converted photon

NODE=M076B01;LINKAGE=A

$$[B(\chi_{b0}(1P) \rightarrow \gamma\Upsilon(1S)) \times B(\Upsilon(2S) \rightarrow \gamma\chi_{b0}(1P))] / [B(\chi_{b1}(1P) \rightarrow \gamma\Upsilon(1S)) \times B(\Upsilon(2S) \rightarrow \gamma\chi_{b1}(1P))]$$

VALUE (%)	DOCUMENT ID	TECN	COMMENT
3.28$\pm$0.37	²⁶ LEES	14M BABR	$\Upsilon(2S) \rightarrow \gamma\gamma\mu^+\mu^-$
²⁶ From a sample of $\Upsilon(2S) \rightarrow \gamma\gamma\mu^+\mu^-$ without converted photons			

NODE=M076A01
 NODE=M076A01

NODE=M076A01;LINKAGE=A

 $\chi_{b0}(1P)$ REFERENCES

NODE=M076

LEES	14M	PR D90 112010	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=56343
SHEN	12	PR D85 071102	C.P. Shen <i>et al.</i>	(BELLE Collab.)	REFID=54313
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. Klopfenstein <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

$\chi_{b1}(1P)$

$$I^G(J^{PC}) = 0^+(1^{++})$$

J needs confirmation.

Observed in radiative decay of the $\Upsilon(2S)$, therefore $C = +$. Branching ratio requires E1 transition, M1 is strongly disfavored, therefore $P = +$. $J = 1$ from SKWARNICKI 87.

NODE=M077

NODE=M077

 $\chi_{b1}(1P)$ MASS

VALUE (MeV)

DOCUMENT ID

9892.78 ± 0.26 ± 0.31 OUR EVALUATION From average γ energy below, using $\Upsilon(2S)$ mass = 10023.26 ± 0.31 MeV

NODE=M077M

NODE=M077M

→ UNCHECKED ←

 γ ENERGY IN $\Upsilon(2S)$ DECAY

VALUE (MeV)

DOCUMENT ID

TECN

COMMENT

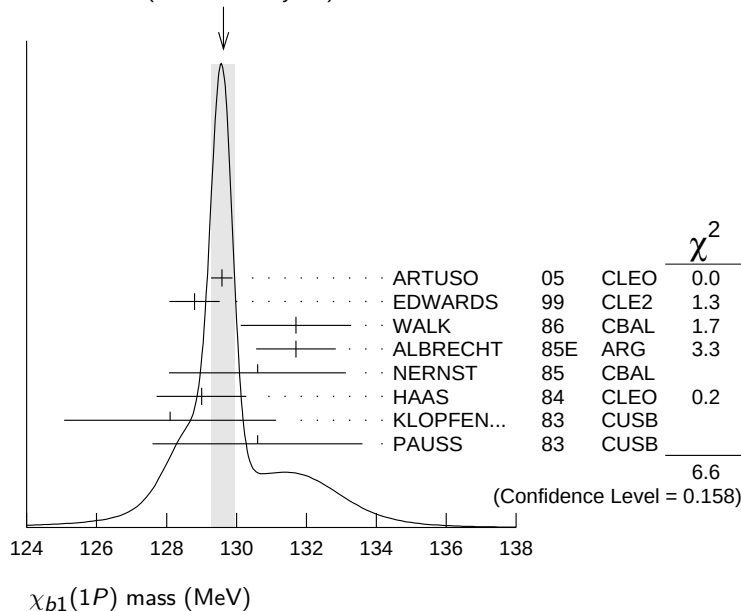
129.63 ± 0.33 OUR AVERAGE Error includes scale factor of 1.3. See the ideogram below.

129.58 ± 0.09 ± 0.29	ARTUSO	05	CLEO	$\Upsilon(2S) \rightarrow \gamma X$
128.8 ± 0.4 ± 0.6	EDWARDS	99	CLE2	$\Upsilon(2S) \rightarrow \gamma \chi(1P)$
131.7 ± 0.9 ± 1.3	WALK	86	CBAL	$\Upsilon(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$
131.7 ± 0.3 ± 1.1	ALBRECHT	85E	ARG	$\Upsilon(2S) \rightarrow \text{conv.} \gamma X$
130.6 ± 0.8 ± 2.4	NERNST	85	CBAL	$\Upsilon(2S) \rightarrow \gamma X$
129 ± 0.8 ± 1	HAAS	84	CLEO	$\Upsilon(2S) \rightarrow \text{conv.} \gamma X$
128.1 ± 0.4 ± 3.0	KLOPFEN...	83	CUSB	$\Upsilon(2S) \rightarrow \gamma X$
130.6 ± 3.0	PAUSS	83	CUSB	$\Upsilon(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$

NODE=M077DM

NODE=M077DM

WEIGHTED AVERAGE
129.63 ± 0.33 (Error scaled by 1.3)

 **$\chi_{b1}(1P)$ DECAY MODES**

NODE=M077215;NODE=M077

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 $\gamma \Upsilon(1S)$	(35.0 ± 2.1) %	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}	$3\pi^+ 2\pi^- K^- K_S^0 \pi^0$	$(9.3 \pm 3.3) \times 10^{-4}$		DESIG=10
Γ_{11}	$3\pi^+ 3\pi^-$	$(1.9 \pm 0.6) \times 10^{-4}$		DESIG=11
Γ_{12}	$3\pi^+ 3\pi^- 2\pi^0$	$(1.7 \pm 0.5) \times 10^{-3}$		DESIG=12
Γ_{13}	$3\pi^+ 3\pi^- K^+ K^-$	$(2.6 \pm 0.8) \times 10^{-4}$		DESIG=13
Γ_{14}	$3\pi^+ 3\pi^- K^+ K^- \pi^0$	$(7.5 \pm 2.6) \times 10^{-4}$		DESIG=14
Γ_{15}	$4\pi^+ 4\pi^-$	$(2.6 \pm 0.9) \times 10^{-4}$		DESIG=15
Γ_{16}	$4\pi^+ 4\pi^- 2\pi^0$	$(1.4 \pm 0.6) \times 10^{-3}$		DESIG=16
Γ_{17}	$J/\psi J/\psi$	$< 2.7 \times 10^{-5}$	90%	DESIG=17
Γ_{18}	$J/\psi \psi(2S)$	$< 1.7 \times 10^{-5}$	90%	DESIG=18
Γ_{19}	$\psi(2S) \psi(2S)$	$< 6 \times 10^{-5}$	90%	DESIG=19

$\chi_{b1}(1P)$ BRANCHING RATIOS

NODE=M077220

$\Gamma(\gamma \Upsilon(1S))/\Gamma_{\text{total}}$ Γ_1/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.350±0.021 OUR AVERAGE				
[0.339 ± 0.022 OUR 2016 AVERAGE]				
0.364±0.017±0.019		^{1,2} LEES	14M BABR	$\Upsilon(2S) \rightarrow \gamma \gamma \mu^+ \mu^-$
0.331±0.018±0.017	3222	^{2,3} KORNICER	11 CLEO	$e^+ e^- \rightarrow \gamma \gamma \ell^+ \ell^-$
0.350±0.023±0.018	13k	⁴ LEES	11J BABR	$\Upsilon(2S) \rightarrow X \gamma$
0.34 ± 0.07 ± 0.02	53	^{2,5,6} WALK	86 CBAL	$\Upsilon(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$
0.47 ± 0.18		KLOPFEN...	83 CUSB	$\Upsilon(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$

¹ LEES 14M quotes $\Gamma(\chi_{b1}(1P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))/\Gamma_{\text{total}} = (2.51 \pm 0.12) \%$ combining the results from samples of $\Upsilon(2S) \rightarrow \gamma \gamma \mu^+ \mu^-$ with and without converted photons

² Assuming $B(\Upsilon(1S) \rightarrow \ell^+ \ell^-) = (2.48 \pm 0.05)\%$.

³ 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.

⁴ 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.

⁵ WALK 86 quotes $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) \times B(\chi_{b1}(1P) \rightarrow \gamma \Upsilon(1S)) \times B(\Upsilon(1S) \rightarrow \ell^+ \ell^-) = (5.8 \pm 0.9 \pm 0.7) \%$.

⁶ WALK 86 reports $[\Gamma(\chi_{b1}(1P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))] = (23.4 \pm 3.63 \pm 2.82) \times 10^{-3}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M077R1;LINKAGE=B

NODE=M077R1;LINKAGE=KA
NODE=M077R1;LINKAGE=KR

NODE=M077R1;LINKAGE=LE

NODE=M077R1;LINKAGE=A

NODE=M077R1;LINKAGE=C

$\Gamma(D^0 X)/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
12.6±1.9±1.1	2310	⁷ BRIERE	08 CLEO	$\Upsilon(2S) \rightarrow \gamma D^0 X$

⁷ For $p_{D^0} > 2.5 \text{ GeV}/c$.

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	⁸ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^- \pi^0$

⁸ 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	⁹ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+ \pi^- K^- K_S^0$

⁹ 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

$\Gamma(2\pi^+\pi^-K^-K_S^02\pi^0)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<6	90	10 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+\pi^-K^-2\pi^0$
10 ASNER 08A reports $[\Gamma(\chi_{b1}(1P) \rightarrow 2\pi^+\pi^-K^-K_S^02\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma\chi_{b1}(1P))]$ $< 42 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma\chi_{b1}(1P)) = 6.9 \times 10^{-2}$.				

NODE=M077R04
 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
$8.0 \pm 2.4 \pm 0.4$	46	11 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+2\pi^-2\pi^0$
11 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
$1.5 \pm 0.5 \pm 0.1$	18	12 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+2\pi^-K^+K^-$
12 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
$3.5 \pm 1.2 \pm 0.2$	22	13 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+2\pi^-K^+K^-\pi^0$
13 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
$8.6 \pm 3.2 \pm 0.4$	26	14 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+2\pi^-K^+K^-2\pi^0$
14 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
$9.3 \pm 3.3 \pm 0.5$	21	15 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+2\pi^-K^-K_S^0\pi^0$
15 ASNER 08A reports $[\Gamma(\chi_{b1}(1P) \rightarrow 3\pi^+2\pi^-K^-K_S^0\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma\chi_{b1}(1P))]$ $= (64 \pm 16 \pm 16) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma\chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M077R09
 NODE=M077R09

NODE=M077R09;LINKAGE=AS

 $\Gamma(3\pi^+3\pi^-)/\Gamma_{\text{total}}$ Γ_{11}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.9 \pm 0.6 \pm 0.1$	25	16 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+3\pi^-$
16 ASNER 08A reports $[\Gamma(\chi_{b1}(1P) \rightarrow 3\pi^+3\pi^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma\chi_{b1}(1P))]$ $= (13 \pm 3 \pm 3) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma\chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M077R10
 NODE=M077R10

NODE=M077R10;LINKAGE=AS

 $\Gamma(3\pi^+3\pi^-2\pi^0)/\Gamma_{\text{total}}$ Γ_{12}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$17 \pm 5 \pm 1$	56	17 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+3\pi^-2\pi^0$
17 ASNER 08A reports $[\Gamma(\chi_{b1}(1P) \rightarrow 3\pi^+3\pi^-2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma\chi_{b1}(1P))]$ $= (119 \pm 18 \pm 32) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma\chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M077R11
 NODE=M077R11

NODE=M077R11;LINKAGE=AS

$\Gamma(3\pi^+ 3\pi^- K^+ K^-)/\Gamma_{\text{total}}$ Γ_{13}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$2.6 \pm 0.8 \pm 0.1$	21	18 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+ 3\pi^- K^+ K^-$
18 ASNER 08A reports $[\Gamma(\chi_{b1}(1P) \rightarrow 3\pi^+ 3\pi^- K^+ K^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))] = (18 \pm 4 \pm 4) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M077R12
 NODE=M077R12

NODE=M077R12;LINKAGE=AS

 $\Gamma(3\pi^+ 3\pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}$ Γ_{14}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$7.5 \pm 2.6 \pm 0.4$	28	19 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+ 3\pi^- K^+ K^- \pi^0$
19 ASNER 08A reports $[\Gamma(\chi_{b1}(1P) \rightarrow 3\pi^+ 3\pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))] = (52 \pm 11 \pm 14) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M077R13
 NODE=M077R13

NODE=M077R13;LINKAGE=AS

 $\Gamma(4\pi^+ 4\pi^-)/\Gamma_{\text{total}}$ Γ_{15}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$2.6 \pm 0.9 \pm 0.1$	24	20 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 4\pi^+ 4\pi^-$
20 ASNER 08A reports $[\Gamma(\chi_{b1}(1P) \rightarrow 4\pi^+ 4\pi^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))] = (18 \pm 4 \pm 5) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M077R14
 NODE=M077R14

NODE=M077R14;LINKAGE=AS

 $\Gamma(4\pi^+ 4\pi^- 2\pi^0)/\Gamma_{\text{total}}$ Γ_{16}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$14 \pm 5 \pm 1$	26	21 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 4\pi^+ 4\pi^- 2\pi^0$
21 ASNER 08A reports $[\Gamma(\chi_{b1}(1P) \rightarrow 4\pi^+ 4\pi^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))] = (96 \pm 24 \pm 29) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M077R15
 NODE=M077R15

NODE=M077R15;LINKAGE=AS

 $\Gamma(J/\psi J/\psi)/\Gamma_{\text{total}}$ Γ_{17}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<2.7	90	22 SHEN	12 BELL	$\Upsilon(2S) \rightarrow \gamma \psi X$
22 SHEN 12 reports $< 2.7 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{b1}(1P) \rightarrow J/\psi J/\psi)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))]$ assuming $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$.				

NODE=M077R16
 NODE=M077R16

NODE=M077R16;LINKAGE=SH

 $\Gamma(J/\psi \psi(2S))/\Gamma_{\text{total}}$ Γ_{18}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<1.7	90	23 SHEN	12 BELL	$\Upsilon(2S) \rightarrow \gamma \psi X$
23 SHEN 12 reports $< 1.7 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{b1}(1P) \rightarrow J/\psi \psi(2S))/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))]$ assuming $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$.				

NODE=M077R17
 NODE=M077R17

NODE=M077R17;LINKAGE=SH

 $\Gamma(\psi(2S) \psi(2S))/\Gamma_{\text{total}}$ Γ_{19}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<6	90	24 SHEN	12 BELL	$\Upsilon(2S) \rightarrow \gamma \psi X$
24 SHEN 12 reports $< 6.2 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{b1}(1P) \rightarrow \psi(2S) \psi(2S))/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))]$ assuming $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$.				

NODE=M077R18
 NODE=M077R18

NODE=M077R18;LINKAGE=SH

 $\chi_{b1}(1P)$ Cross-Particle Branching Ratios

NODE=M077230

$$\Gamma(\chi_{b1}(1P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))/\Gamma_{\text{total}}$$

$$\Gamma_1/\Gamma \times \Gamma_{47}^{\Upsilon(2S)}/\Gamma \Upsilon(2S)$$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$24.1 \pm 0.6 \pm 1.5$	13k	LEES	11J BABR	$\Upsilon(2S) \rightarrow X \gamma$

NODE=M077B03
 NODE=M077B03

$$B(\chi_{b1}(1P) \rightarrow \gamma \Upsilon(1S)) \times B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) \times B(\Upsilon(1S) \rightarrow \ell^+ \ell^-)$$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
5.90 ± 0.34 OUR AVERAGE				Error includes scale factor of 1.3. See the ideogram below. [[5.65 ± 0.29] $\times 10^{-4}$ OUR 2016 AVERAGE]

$6.86^{+0.47+0.44}_{-0.45-0.35}$	25	LEES	14M	BABR	$\Upsilon(2S) \rightarrow \gamma \gamma \mu^+ \mu^-$
$5.65 \pm 0.11 \pm 0.27$	3222	KORNICER	11	CLEO	$e^+ e^- \rightarrow \gamma \gamma \ell^+ \ell^-$
$5.8 \pm 0.9 \pm 0.7$	53	WALK	86	CBAL	$\Upsilon(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$

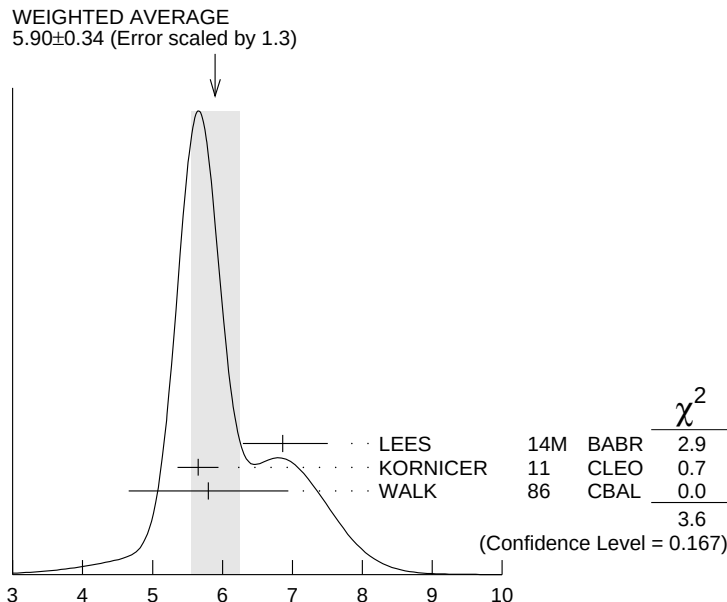
²⁵ From a sample of $\Upsilon(2S) \rightarrow \gamma \gamma \mu^+ \mu^-$ with one converted photon

NODE=M077B01

NODE=M077B01

NEW

NODE=M077B01;LINKAGE=A



$B(\chi_{b1}(1P) \rightarrow \gamma \Upsilon(1S)) \times B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) \times B(\Upsilon(1S) \rightarrow \ell^+ \ell^-)$
(units 10^{-4})

$$B(\chi_{b1}(1P) \rightarrow \gamma \Upsilon(1S)) \times B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(1P)) \times B(\Upsilon(1S) \rightarrow \ell^+ \ell^-)$$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
1.30 ± 0.34 OUR AVERAGE				
[[1.3 ± 0.4] $\times 10^{-5}$ OUR 2016 AVERAGE]				

$1.16^{+0.78+0.14}_{-0.67-0.16}$	26	LEES	14M	BABR	$\Upsilon(3S) \rightarrow \gamma \gamma \mu^+ \mu^-$
$1.33 \pm 0.30 \pm 0.23$	50	KORNICER	11	CLEO	$e^+ e^- \rightarrow \gamma \gamma \ell^+ \ell^-$

²⁶ From a sample of $\Upsilon(3S) \rightarrow \gamma \gamma \mu^+ \mu^-$ with converted photons

NODE=M077B02

NODE=M077B02

NEW

NODE=M077B02;LINKAGE=A

$$B(\chi_{b2}(1P) \rightarrow \rho X + \bar{\rho} X) / B(\chi_{b1}(1P) \rightarrow \rho X + \bar{\rho} X)$$

VALUE	DOCUMENT ID	TECN	COMMENT
$1.068 \pm 0.010 \pm 0.040$	BRIERE	07	CLEO $\Upsilon(2S) \rightarrow \gamma \chi_{bJ}(1P)$

NODE=M077R20

NODE=M077R20

$$B(\chi_{b0}(1P) \rightarrow \rho X + \bar{\rho} X) / B(\chi_{b1}(1P) \rightarrow \rho X + \bar{\rho} X)$$

VALUE	DOCUMENT ID	TECN	COMMENT
$1.11 \pm 0.15 \pm 0.20$	BRIERE	07	CLEO $\Upsilon(2S) \rightarrow \gamma \chi_{bJ}(1P)$

NODE=M077R21

NODE=M077R21

$\chi_{b1}(1P)$ REFERENCES

LEES	14M	PR D90 112010	J.P. Lees <i>et al.</i>	(BABAR Collab.)
SHEN	12	PR D85 071102	C.P. Shen <i>et al.</i>	(BELLE Collab.)
KORNICER	11	PR D83 054003	M. Kornicer <i>et al.</i>	(CLEO Collab.)
LEES	11J	PR D84 072002	J.P. Lees <i>et al.</i>	(BABAR Collab.)
ASNER	08A	PR D78 091103	D.M. Asner <i>et al.</i>	(CLEO Collab.)
BRIERE	08	PR D78 092007	R.A. Briere <i>et al.</i>	(CLEO Collab.)
BRIERE	07	PR D76 012005	R.A. Briere <i>et al.</i>	(CLEO Collab.)
ARTUSO	05	PRL 94 032001	M. Artuso <i>et al.</i>	(CLEO Collab.)
EDWARDS	99	PR D59 032003	K.W. Edwards <i>et al.</i>	(CLEO Collab.)
SKWARNICKI	87	PRL 58 972	T. Skwarnicki <i>et al.</i>	(Crystal Ball Collab.) 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=M077

REFID=56343

REFID=54313

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

NODE=M204

$$h_b(1P)$$

$$I^G(J^{PC}) = ?^?(1^{+-})$$

Quantum numbers are quark model predictions, $C = -$ established by $\eta_b \gamma$ decay.

NODE=M204

$h_b(1P)$ MASS

NODE=M204M

NODE=M204M

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
9899.3±0.8 OUR AVERAGE				
9899.3±0.4±1.0	112k	TAMPONI	15	BELL $e^+e^- \rightarrow \gamma\eta + \text{hadrons}$
9899.1±0.4±1.0	70k	MIZUK	12	BELL $e^+e^- \rightarrow \pi^+\pi^-\text{hadrons}$
9902 ±4 ±2	10.8k	LEES	11k	BABR $\Upsilon(3S) \rightarrow \eta_b \gamma \pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
9898.2 ^{+1.1+1.0} _{-1.0-1.1}	50.0k	¹ ADACHI	12	BELL 10.86 $e^+e^- \rightarrow \pi^+\pi^-$ MM
¹ Superseded by MIZUK 12.				

NODE=M204M;LINKAGE=AD

$h_b(1P)$ DECAY MODES

NODE=M204215;NODE=M204

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \eta_b(1S)\gamma$	(52 ⁺⁶ ₋₅) %

DESIG=1

$h_b(1P)$ BRANCHING RATIOS

NODE=M204225

NODE=M204R01
NODE=M204R01

$\Gamma(\eta_b(1S)\gamma)/\Gamma_{\text{total}}$				Γ_1/Γ	
VALUE (units 10 ⁻²)	EVTs	DOCUMENT ID	TECN	COMMENT	
52 ⁺⁶₋₅ OUR AVERAGE					
56 ±8 ±4	33.1k	¹ TAMPONI	15	BELL $e^+e^- \rightarrow \gamma\eta + \text{hadrons}$	
49.2±5.7 ^{+5.6} _{-3.3}	24k	MIZUK	12	BELL $e^+e^- \rightarrow (\gamma)\pi^+\pi^-\text{hadrons}$	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
seen	10.8k	LEES	11k	BABR $\Upsilon(3S) \rightarrow \eta_b \gamma \pi^0$	
¹ Using $B(\eta \rightarrow 2\gamma) = (39.41 \pm 0.20)\%$.					

NODE=M204R01;LINKAGE=A

$h_b(1P)$ REFERENCES

NODE=M204

REFID=56996
REFID=53962
REFID=54718
REFID=53937

TAMPONI	15	PRL 115 142001	U. Tamponi <i>et al.</i>	(BELLE Collab.)
ADACHI	12	PRL 108 032001	I. Adachi <i>et al.</i>	(BELLE Collab.)
MIZUK	12	PRL 109 232002	R. Mizuk <i>et al.</i>	(BELLE Collab.)
LEES	11K	PR D84 091101	J.P. Lees <i>et al.</i>	(BABAR Collab.)

$\chi_{b2}(1P)$

$$J^G(J^{PC}) = 0^+(2^{++})$$

J needs confirmation.

Observed in radiative decay of the $\Upsilon(2S)$, therefore $C = +$. Branching ratio requires E1 transition, M1 is strongly disfavored, therefore $P = +$. $J = 2$ from SKWARNICKI 87.

NODE=M078

NODE=M078

 $\chi_{b2}(1P)$ MASS

NODE=M078M

VALUE (MeV)

DOCUMENT ID

9912.21 ± 0.26 ± 0.31 OUR EVALUATION From average γ energy below, using $\Upsilon(2S)$ mass = 10023.26 ± 0.31 MeV

NODE=M078M

→ UNCHECKED ←

 $m_{\chi_{b2}(1P)} - m_{\chi_{b1}(1P)}$

NODE=M078DM2

VALUE (MeV)

DOCUMENT ID

TECN

COMMENT

19.10 ± 0.25 OUR AVERAGE Error includes scale factor of 1.1. [19.8 ± 0.7 MeV OUR 2016 AVERAGE]

NODE=M078DM2

NEW

19.81 ± 0.65 ± 0.20

¹ AAIJ

14BG LHCb

 $pp \rightarrow \gamma \mu^+ \mu^- X$

19.01 ± 0.24

LEES

14M BABR

 $\Upsilon(2S) \rightarrow \gamma \gamma \mu^+ \mu^-$

¹ From the $\chi_{bj}(1P) \rightarrow \Upsilon(1S) \gamma$ transition.

NODE=M078DM2;LINKAGE=A

 γ ENERGY IN $\Upsilon(2S)$ DECAY

NODE=M078DM

VALUE (MeV)

DOCUMENT ID

TECN

COMMENT

110.44 ± 0.29 OUR AVERAGE Error includes scale factor of 1.1.

NODE=M078DM

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

 $\Upsilon(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$ $\chi_{b2}(1P)$ DECAY MODES

NODE=M078215;NODE=M078

Mode	Fraction (Γ_i/Γ)	Confidence level
$\Gamma_1 \quad \gamma \Upsilon(1S)$	(18.8 ± 1.1) %	
$\Gamma_2 \quad D^0 X$	< 7.9 %	90%
$\Gamma_3 \quad \pi^+ \pi^- K^+ K^- \pi^0$	(8 ± 5) × 10 ⁻⁵	
$\Gamma_4 \quad 2\pi^+ \pi^- K^- K_S^0$	< 1.0 × 10 ⁻⁴	90%
$\Gamma_5 \quad 2\pi^+ \pi^- K^- K_S^0 2\pi^0$	(5.3 ± 2.4) × 10 ⁻⁴	
$\Gamma_6 \quad 2\pi^+ 2\pi^- 2\pi^0$	(3.5 ± 1.4) × 10 ⁻⁴	
$\Gamma_7 \quad 2\pi^+ 2\pi^- K^+ K^-$	(1.1 ± 0.4) × 10 ⁻⁴	
$\Gamma_8 \quad 2\pi^+ 2\pi^- K^+ K^- \pi^0$	(2.1 ± 0.9) × 10 ⁻⁴	
$\Gamma_9 \quad 2\pi^+ 2\pi^- K^+ K^- 2\pi^0$	(3.9 ± 1.8) × 10 ⁻⁴	
$\Gamma_{10} \quad 3\pi^+ 2\pi^- K^- K_S^0 \pi^0$	< 5 × 10 ⁻⁴	90%
$\Gamma_{11} \quad 3\pi^+ 3\pi^-$	(7.0 ± 3.1) × 10 ⁻⁵	
$\Gamma_{12} \quad 3\pi^+ 3\pi^- 2\pi^0$	(1.0 ± 0.4) × 10 ⁻³	
$\Gamma_{13} \quad 3\pi^+ 3\pi^- K^+ K^-$	< 8 × 10 ⁻⁵	90%
$\Gamma_{14} \quad 3\pi^+ 3\pi^- K^+ K^- \pi^0$	(3.6 ± 1.5) × 10 ⁻⁴	
$\Gamma_{15} \quad 4\pi^+ 4\pi^-$	(8 ± 4) × 10 ⁻⁵	
$\Gamma_{16} \quad 4\pi^+ 4\pi^- 2\pi^0$	(1.8 ± 0.7) × 10 ⁻³	
$\Gamma_{17} \quad J/\psi J/\psi$	< 4 × 10 ⁻⁵	90%
$\Gamma_{18} \quad J/\psi \psi(2S)$	< 5 × 10 ⁻⁵	90%
$\Gamma_{19} \quad \psi(2S) \psi(2S)$	< 1.6 × 10 ⁻⁵	90%

DESIG=1

DESIG=2

DESIG=3

DESIG=4

DESIG=5

DESIG=6

DESIG=7

DESIG=8

DESIG=9

DESIG=10

DESIG=11

DESIG=12

DESIG=13

DESIG=14

DESIG=15

DESIG=16

DESIG=17

DESIG=18

DESIG=19

$\chi_{b2}(1P)$ BRANCHING RATIOS

NODE=M078220

 $\Gamma(\gamma \Upsilon(1S))/\Gamma_{\text{total}}$ Γ_1/Γ

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT

0.188±0.011 OUR AVERAGE

[0.191 ± 0.012 OUR 2016 AVERAGE]

0.185±0.008±0.009		2,3 LEES	14M BABR	$\Upsilon(2S) \rightarrow \gamma\gamma\mu^+\mu^-$
0.186±0.011±0.009	1770	3,4 KORNICER	11 CLEO	$e^+e^- \rightarrow \gamma\gamma\ell^+\ell^-$
$0.194^{+0.014}_{-0.017} \pm 0.009$	8k	5 LEES	11J BABR	$\Upsilon(2S) \rightarrow X\gamma$
$0.25 \pm 0.06 \pm 0.01$	35	3,6,7 WALK	86 CBAL	$\Upsilon(2S) \rightarrow \gamma\gamma\ell^+\ell^-$
0.20 ± 0.05		KLOPFEN...	83 CUSB	$\Upsilon(2S) \rightarrow \gamma\gamma\ell^+\ell^-$

² LEES 14M quotes $\Gamma(\chi_{b2}(1P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(2S) \rightarrow \gamma\chi_{b2}(1P))/\Gamma_{\text{total}} = (1.32 \pm 0.06)\%$ combining the results from samples of $\Upsilon(2S) \rightarrow \gamma\gamma\mu^+\mu^-$ with and without converted photons

³ Assuming $B(\Upsilon(1S) \rightarrow \ell^+\ell^-) = (2.48 \pm 0.05)\%$.

⁴ 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.

⁵ 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.

⁶ WALK 86 quotes $B(\Upsilon(2S) \rightarrow \gamma\chi_{b2}(1P)) \times B(\chi_{b2}(1P) \rightarrow \gamma \Upsilon(1S)) \times B(\Upsilon(1S) \rightarrow \ell^+\ell^-) = (4.4 \pm 0.9 \pm 0.5) \%$.

⁷ WALK 86 reports $[\Gamma(\chi_{b2}(1P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma\chi_{b2}(1P))] = (17.7 \pm 3.6 \pm 2.0) \times 10^{-3}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma\chi_{b2}(1P)) = (7.15 \pm 0.35) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M078R1;LINKAGE=B

NODE=M078R1;LINKAGE=KA
 NODE=M078R1;LINKAGE=KR

NODE=M078R1;LINKAGE=LE

NODE=M078R1;LINKAGE=A

NODE=M078R1;LINKAGE=E

 $\Gamma(D^0 X)/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<7.9 × 10⁻² 90 8,9 BRIERE 08 CLEO $\Upsilon(2S) \rightarrow \gamma D^0 X$

⁸ For $p_{D^0} > 2.5 \text{ GeV}/c$.

⁹ The authors also present their result as $(5.4 \pm 1.9 \pm 0.5) \times 10^{-2}$.

NODE=M078R01
 NODE=M078R01

NODE=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±0.50±0.04 8 10 ASNER 08A CLEO $\Upsilon(2S) \rightarrow \gamma\pi^+\pi^-K^+K^-\pi^0$

¹⁰ 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 11 ASNER 08A CLEO $\Upsilon(2S) \rightarrow \gamma 2\pi^+\pi^-K^-K_S^0$

¹¹ 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±2.4±0.3 11 12 ASNER 08A CLEO $\Upsilon(2S) \rightarrow \gamma 2\pi^+\pi^-K^-2\pi^0$

¹² 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	13 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+ 2\pi^- 2\pi^0$
^{13} 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	14 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+ 2\pi^- K^+ K^-$
^{14} 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	15 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+ 2\pi^- K^+ K^- \pi^0$
^{15} 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	16 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+ 2\pi^- K^+ K^- 2\pi^0$
^{16} 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	17 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+ 2\pi^- K^- K_S^0 \pi^0$
^{17} 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 $B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P)) =$ 7.15×10^{-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
$0.70 \pm 0.31 \pm 0.03$	9	18 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+ 3\pi^-$
^{18} 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
$10.2 \pm 3.6 \pm 0.5$	34	19 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+ 3\pi^- 2\pi^0$
^{19} 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	20 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+ 3\pi^- K^+ K^-$
^{20} 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 $B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P)) =$ 7.15×10^{-2} .				

NODE=M078R12
 NODE=M078R12

NODE=M078R12;LINKAGE=AS

$\Gamma(3\pi^+ 3\pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}$ Γ_{14}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$3.6 \pm 1.5 \pm 0.2$	14	21 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+ 3\pi^- K^+ K^- \pi^0$
21 ASNER 08A reports $[\Gamma(\chi_{b2}(1P) \rightarrow 3\pi^+ 3\pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P))]$ = $(26 \pm 8 \pm 7) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P)) = (7.15 \pm 0.35) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M078R13
 NODE=M078R13

NODE=M078R13;LINKAGE=AS

 $\Gamma(4\pi^+ 4\pi^-)/\Gamma_{\text{total}}$ Γ_{15}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$0.84 \pm 0.40 \pm 0.04$	7	22 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 4\pi^+ 4\pi^-$
22 ASNER 08A reports $[\Gamma(\chi_{b2}(1P) \rightarrow 4\pi^+ 4\pi^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P))]$ = $(6 \pm 2 \pm 2) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P)) = (7.15 \pm 0.35) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M078R14
 NODE=M078R14

NODE=M078R14;LINKAGE=AS

 $\Gamma(4\pi^+ 4\pi^- 2\pi^0)/\Gamma_{\text{total}}$ Γ_{16}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$18 \pm 7 \pm 1$	29	23 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 4\pi^+ 4\pi^- 2\pi^0$
23 ASNER 08A reports $[\Gamma(\chi_{b2}(1P) \rightarrow 4\pi^+ 4\pi^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P))]$ = $(132 \pm 31 \pm 40) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P)) = (7.15 \pm 0.35) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M078R15
 NODE=M078R15

NODE=M078R15;LINKAGE=AS

 $\Gamma(J/\psi J/\psi)/\Gamma_{\text{total}}$ Γ_{17}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
< 5	90	24 SHEN	12 BELL	$\Upsilon(2S) \rightarrow \gamma \psi X$
24 SHEN 12 reports $< 4.5 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{b2}(1P) \rightarrow J/\psi J/\psi)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P))]$ assuming $B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P)) = (7.15 \pm 0.35) \times 10^{-2}$.				

NODE=M078R16
 NODE=M078R16

NODE=M078R16;LINKAGE=SH

 $\Gamma(J/\psi \psi(2S))/\Gamma_{\text{total}}$ Γ_{18}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
< 5	90	25 SHEN	12 BELL	$\Upsilon(2S) \rightarrow \gamma \psi X$
25 SHEN 12 reports $< 4.9 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{b2}(1P) \rightarrow J/\psi \psi(2S))/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P))]$ assuming $B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P)) = (7.15 \pm 0.35) \times 10^{-2}$.				

NODE=M078R17
 NODE=M078R17

NODE=M078R17;LINKAGE=SH

 $\Gamma(\psi(2S) \psi(2S))/\Gamma_{\text{total}}$ Γ_{19}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
< 1.6	90	26 SHEN	12 BELL	$\Upsilon(2S) \rightarrow \gamma \psi X$
26 SHEN 12 reports $< 1.6 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{b2}(1P) \rightarrow \psi(2S) \psi(2S))/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P))]$ assuming $B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P)) = (7.15 \pm 0.35) \times 10^{-2}$.				

NODE=M078R18
 NODE=M078R18

NODE=M078R18;LINKAGE=SH

 $\chi_{b2}(1P)$ Cross-Particle Branching Ratios

NODE=M078230

$$\Gamma(\chi_{b2}(1P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P))/\Gamma_{\text{total}}$$

$$\Gamma_1/\Gamma \times \Gamma_{48}^{\Upsilon(2S)}/\Gamma \Upsilon(2S)$$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$13.9 \pm 0.5^{+0.9}_{-1.1}$	8k	LEES	11J BABR	$\Upsilon(2S) \rightarrow X \gamma$

NODE=M078B03
 NODE=M078B03

 $B(\chi_{b2}(1P) \rightarrow \gamma \Upsilon(1S)) \times B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P)) \times B(\Upsilon(1S) \rightarrow \ell^+ \ell^-)$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
3.38 ± 0.16 OUR AVERAGE				
[(3.29 $\pm$ 0.18) $\times 10^{-4}$ OUR 2016 AVERAGE]				

NODE=M078B01
 NODE=M078B01

NEW

3.63 ^{+0.36+0.18} _{-0.34-0.19}	27	LEES	14M BABR	$\Upsilon(2S) \rightarrow \gamma \gamma \mu^+ \mu^-$
3.29 $\pm$ 0.09 $\pm$ 0.16	1770	KORNICER	11 CLEO	$e^+ e^- \rightarrow \gamma \gamma \ell^+ \ell^-$
4.4 $\pm$ 0.9 $\pm$ 0.5	35	WALK	86 CBAL	$\Upsilon(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$

27 From a sample of $\Upsilon(2S) \rightarrow \gamma \gamma \mu^+ \mu^-$ with converted photons

NODE=M078B01;LINKAGE=A

$$[B(\chi_{b2}(1P) \rightarrow \gamma \Upsilon(1S)) \times B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P))] / [B(\chi_{b1}(1P) \rightarrow \gamma \Upsilon(1S)) \times B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))]$$

VALUE (%)	DOCUMENT ID	TECN	COMMENT
55.6±1.6	²⁸ LEES	14M BABR	$\Upsilon(2S) \rightarrow \gamma \gamma \mu^+ \mu^-$

²⁸ From a sample of $\Upsilon(2S) \rightarrow \gamma \gamma \mu^+ \mu^-$ events without converted photons

$$B(\chi_{b2}(1P) \rightarrow \gamma \Upsilon(1S)) \times B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(1P)) \times B(\Upsilon(1S) \rightarrow \ell^+ \ell^-)$$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT

3.8 ±0.5 OUR AVERAGE

[(3.6 ± 0.6) × 10⁻⁵ OUR 2016 AVERAGE]

4.68 ^{+0.99} _{-0.92} ± 0.37	²⁹ LEES	14M BABR	$\Upsilon(3S) \rightarrow \gamma \gamma \mu^+ \mu^-$

3.56 ± 0.40 ± 0.41	126	KORNICER	11 CLEO	$e^+ e^- \rightarrow \gamma \gamma \ell^+ \ell^-$

²⁹ From a sample of $\Upsilon(3S) \rightarrow \gamma \gamma \mu^+ \mu^-$ with converted photons

$\chi_{b2}(1P)$ REFERENCES

AAJ	14BG	JHEP 1410 088	R. Aaij <i>et al.</i>	(LHCb Collab.)
LEES	14M	PR D90 112010	J.P. Lees <i>et al.</i>	(BABAR Collab.)
SHEN	12	PR D85 071102	C.P. Shen <i>et al.</i>	(BELLE Collab.)
KORNICER	11	PR D83 054003	M. Kornicer <i>et al.</i>	(CLEO Collab.)
LEES	11J	PR D84 072002	J.P. Lees <i>et al.</i>	(BABAR Collab.)
ASNER	08A	PR D78 091103	D.M. Asner <i>et al.</i>	(CLEO Collab.)
BRIERE	08	PR D78 092007	R.A. Briere <i>et al.</i>	(CLEO Collab.)
ARTUSO	05	PRL 94 032001	M. Artuso <i>et al.</i>	(CLEO Collab.)
EDWARDS	99	PR D59 032003	K.W. Edwards <i>et al.</i>	(CLEO Collab.)
SKWARNICKI	87	PRL 58 972	T. Skwarnicki <i>et al.</i>	(Crystal Ball Collab.) 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+)

$\eta_b(2S)$

$$I^G(J^{PC}) = 0^+(0^-+)$$

OMITTED FROM SUMMARY TABLE

Quantum numbers shown are quark-model predictions.

$\eta_b(2S)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
9999.0±3.5^{+2.8}_{-1.9}	26k	¹ MIZUK	12 BELL	$e^+ e^- \rightarrow \gamma \pi^+ \pi^- + \text{hadrons}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

9974.6 ± 2.3 ± 2.1	11 ± 4	^{2,3} DOBBS	12	$\Upsilon(2S) \rightarrow \gamma \text{ hadrons}$

¹ Assuming $\Gamma_{\eta_b(2S)} = 4.9$ MeV. Not independent of the corresponding mass difference measurement.

² 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.

$m \Upsilon(2S) - m_{\eta_b(2S)}$

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
24.3±3.5^{+2.8}_{-1.9}	26k	⁴ MIZUK	12 BELL	$e^+ e^- \rightarrow \gamma \pi^+ \pi^- + \text{hadrons}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

48.7 ± 2.3 ± 2.1	11 ± 4	^{5,6} DOBBS	12	$\Upsilon(2S) \rightarrow \gamma \text{ hadrons}$

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.

$\eta_b(2S)$ WIDTH

VALUE (MeV)	CL%	DOCUMENT ID	TECN	COMMENT
<24	90	MIZUK	12 BELL	$e^+ e^- \rightarrow \gamma \pi^+ \pi^- \text{ hadrons}$

NODE=M078A00
NODE=M078A00

NODE=M078A00;LINKAGE=A

NODE=M078B02
NODE=M078B02

NEW

NODE=M078B02;LINKAGE=A

NODE=M078

REFID=56199
REFID=56343
REFID=54313
REFID=16769
REFID=53936
REFID=52574
REFID=52577
REFID=50454
REFID=46612
REFID=40019
REFID=22290
REFID=22288
REFID=22289
REFID=22287
REFID=22285
REFID=22286

NODE=M200

NODE=M200

NODE=M200M

NODE=M200M

NODE=M200M;LINKAGE=MI

NODE=M200M;LINKAGE=DO

NODE=M200M;LINKAGE=NI

NODE=M200DM

NODE=M200DM

NODE=M200DM;LINKAGE=MI

NODE=M200DM;LINKAGE=DO

NODE=M200DM;LINKAGE=NI

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

NODE=M200225

$\Gamma(\text{hadrons})/\Gamma_{\text{total}}$					Γ_1/Γ
<i>VALUE</i>	<i>EVTS</i>	<i>DOCUMENT ID</i>	<i>TECN</i>	<i>COMMENT</i>	
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=M200R01
NODE=M200R01

NODE=M200R01;LINKAGE=DO

 $\eta_b(2S)$ REFERENCES

NODE=M200

DOBBS	12	PRL 109 082001	S. Dobbs <i>et al.</i>	
MIZUK	12	PRL 109 232002	R. Mizuk <i>et al.</i>	(BELLE Collab.)

REFID=54288
REFID=54718

NODE=M052

$\Upsilon(2S)$

$$J^G(J^{PC}) = 0^-(1^{--})$$

 $\Upsilon(2S)$ MASS

NODE=M052M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
10023.26$\pm$0.31 OUR AVERAGE			
10023.5 $\pm$ 0.5	¹ ARTAMONOV 00	MD1	$e^+e^- \rightarrow$ hadrons
10023.1 $\pm$ 0.4	BARBER 84	REDE	$e^+e^- \rightarrow$ hadrons
• • • We do not use the following data for averages, fits, limits, etc. • • •			
10023.6 $\pm$ 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;LINKAGE=AR
NODE=M052M;LINKAGE=C
NODE=M052M;LINKAGE=RZ $m\Upsilon(3S) - m\Upsilon(2S)$

NODE=M052DM3

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
331.50$\pm$0.02$\pm$0.13	LEES	11C BABR	$e^+e^- \rightarrow \pi^+\pi^-X$

NODE=M052DM3

 $\Upsilon(2S)$ WIDTH

NODE=M052W

VALUE (keV)	DOCUMENT ID
31.98$\pm$2.63 OUR EVALUATION	See the Note on "Width Determinations of the Υ States"

NODE=M052W
→ UNCHECKED ← $\Upsilon(2S)$ DECAY MODES

NODE=M052215;NODE=M052

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
Γ_1 $\Upsilon(1S)\pi^+\pi^-$	(17.85 $\pm$ 0.26) %	
Γ_2 $\Upsilon(1S)\pi^0\pi^0$	(8.6 $\pm$ 0.4) %	
Γ_3 $\tau^+\tau^-$	(2.00 $\pm$ 0.21) %	
Γ_4 $\mu^+\mu^-$	(1.93 $\pm$ 0.17) %	S=2.2
Γ_5 e^+e^-	(1.91 $\pm$ 0.16) %	
Γ_6 $\Upsilon(1S)\pi^0$	< 4 $\times 10^{-5}$	CL=90%
Γ_7 $\Upsilon(1S)\eta$	(2.9 $\pm$ 0.4) $\times 10^{-4}$	S=2.0
Γ_8 $J/\psi(1S)$ anything	< 6 $\times 10^{-3}$	CL=90%
Γ_9 $J/\psi(1S)\eta_c$	< 5.4 $\times 10^{-6}$	CL=90%
Γ_{10} $J/\psi(1S)\chi_{c0}$	< 3.4 $\times 10^{-6}$	CL=90%
Γ_{11} $J/\psi(1S)\chi_{c1}$	< 1.2 $\times 10^{-6}$	CL=90%
Γ_{12} $J/\psi(1S)\chi_{c2}$	< 2.0 $\times 10^{-6}$	CL=90%
Γ_{13} $J/\psi(1S)\eta_c(2S)$	< 2.5 $\times 10^{-6}$	CL=90%

DESIG=4

DESIG=5

DESIG=3

DESIG=1

DESIG=2

DESIG=10

DESIG=6

DESIG=20

DESIG=143

DESIG=144

DESIG=145

DESIG=146

DESIG=147

Γ ₁₄	$J/\psi(1S)X(3940)$	$< 2.0 \times 10^{-6}$	CL=90%	DESIG=148
Γ ₁₅	$J/\psi(1S)X(4160)$	$< 2.0 \times 10^{-6}$	CL=90%	DESIG=149
Γ ₁₆	χ_{c1} anything	$(2.2 \pm 0.5) \times 10^{-4}$		DESIG=157
Γ ₁₇	χ_{c2} anything	$(2.3 \pm 0.8) \times 10^{-4}$		DESIG=158
Γ ₁₈	$\psi(2S)\eta_c$	$< 5.1 \times 10^{-6}$	CL=90%	DESIG=150
Γ ₁₉	$\psi(2S)\chi_{c0}$	$< 4.7 \times 10^{-6}$	CL=90%	DESIG=151
Γ ₂₀	$\psi(2S)\chi_{c1}$	$< 2.5 \times 10^{-6}$	CL=90%	DESIG=152
Γ ₂₁	$\psi(2S)\chi_{c2}$	$< 1.9 \times 10^{-6}$	CL=90%	DESIG=153
Γ ₂₂	$\psi(2S)\eta_c(2S)$	$< 3.3 \times 10^{-6}$	CL=90%	DESIG=154
Γ ₂₃	$\psi(2S)X(3940)$	$< 3.9 \times 10^{-6}$	CL=90%	DESIG=155
Γ ₂₄	$\psi(2S)X(4160)$	$< 3.9 \times 10^{-6}$	CL=90%	DESIG=156
Γ ₂₅	$\overline{2H}$ anything	$(2.78^{+0.30}_{-0.26}) \times 10^{-5}$	S=1.2	DESIG=16
Γ ₂₆	hadrons	$(94 \pm 11) \%$		DESIG=101
Γ ₂₇	ggg	$(58.8 \pm 1.2) \%$		DESIG=105
Γ ₂₈	γgg	$(1.87 \pm 0.28) \%$		DESIG=106
Γ ₂₉	$\phi K^+ K^-$	$(1.6 \pm 0.4) \times 10^{-6}$		DESIG=133
Γ ₃₀	$\omega \pi^+ \pi^-$	$< 2.58 \times 10^{-6}$	CL=90%	DESIG=134
Γ ₃₁	$K^*(892)^0 K^- \pi^+ + \text{c.c.}$	$(2.3 \pm 0.7) \times 10^{-6}$		DESIG=135
Γ ₃₂	$\phi f'_2(1525)$	$< 1.33 \times 10^{-6}$	CL=90%	DESIG=136
Γ ₃₃	$\omega f_2(1270)$	$< 5.7 \times 10^{-7}$	CL=90%	DESIG=137
Γ ₃₄	$\rho(770) a_2(1320)$	$< 8.8 \times 10^{-7}$	CL=90%	DESIG=138
Γ ₃₅	$K^*(892)^0 \overline{K}_2^*(1430)^0 + \text{c.c.}$	$(1.5 \pm 0.6) \times 10^{-6}$		DESIG=139
Γ ₃₆	$K_1(1270)^\pm K^\mp$	$< 3.22 \times 10^{-6}$	CL=90%	DESIG=140
Γ ₃₇	$K_1(1400)^\pm K^\mp$	$< 8.3 \times 10^{-7}$	CL=90%	DESIG=141
Γ ₃₈	$b_1(1235)^\pm \pi^\mp$	$< 4.0 \times 10^{-7}$	CL=90%	DESIG=142
Γ ₃₉	$\rho \pi$	$< 1.16 \times 10^{-6}$	CL=90%	DESIG=126
Γ ₄₀	$\pi^+ \pi^- \pi^0$	$< 8.0 \times 10^{-7}$	CL=90%	DESIG=127
Γ ₄₁	$\omega \pi^0$	$< 1.63 \times 10^{-6}$	CL=90%	DESIG=128
Γ ₄₂	$\pi^+ \pi^- \pi^0 \pi^0$	$(1.30 \pm 0.28) \times 10^{-5}$		DESIG=129
Γ ₄₃	$K_S^0 K^+ \pi^- + \text{c.c.}$	$(1.14 \pm 0.33) \times 10^{-6}$		DESIG=130
Γ ₄₄	$K^*(892)^0 \overline{K}^0 + \text{c.c.}$	$< 4.22 \times 10^{-6}$	CL=90%	DESIG=131
Γ ₄₅	$K^*(892)^- K^+ + \text{c.c.}$	$< 1.45 \times 10^{-6}$	CL=90%	DESIG=132
Γ ₄₆	Sum of 100 exclusive modes	$(2.90 \pm 0.30) \times 10^{-3}$		DESIG=121

Radiative decays

NODE=M052;CLUMP=A

Γ ₄₇	$\gamma \chi_{b1}(1P)$	$(6.9 \pm 0.4) \%$		DESIG=8
Γ ₄₈	$\gamma \chi_{b2}(1P)$	$(7.15 \pm 0.35) \%$		DESIG=7
Γ ₄₉	$\gamma \chi_{b0}(1P)$	$(3.8 \pm 0.4) \%$		DESIG=9
Γ ₅₀	$\gamma f_0(1710)$	$< 5.9 \times 10^{-4}$	CL=90%	DESIG=13
Γ ₅₁	$\gamma f'_2(1525)$	$< 5.3 \times 10^{-4}$	CL=90%	DESIG=12
Γ ₅₂	$\gamma f_2(1270)$	$< 2.41 \times 10^{-4}$	CL=90%	DESIG=11
Γ ₅₃	$\gamma f_J(2220)$			DESIG=14
Γ ₅₄	$\gamma \eta_c(1S)$	$< 2.7 \times 10^{-5}$	CL=90%	DESIG=111
Γ ₅₅	$\gamma \chi_{c0}$	$< 1.0 \times 10^{-4}$	CL=90%	DESIG=112
Γ ₅₆	$\gamma \chi_{c1}$	$< 3.6 \times 10^{-6}$	CL=90%	DESIG=113
Γ ₅₇	$\gamma \chi_{c2}$	$< 1.5 \times 10^{-5}$	CL=90%	DESIG=114
Γ ₅₈	$\gamma X(3872) \rightarrow \pi^+ \pi^- J/\psi$	$< 8 \times 10^{-7}$	CL=90%	DESIG=115
Γ ₅₉	$\gamma X(3872) \rightarrow \pi^+ \pi^- \pi^0 J/\psi$	$< 2.4 \times 10^{-6}$	CL=90%	DESIG=116
Γ ₆₀	$\gamma X(3915) \rightarrow \omega J/\psi$	$< 2.8 \times 10^{-6}$	CL=90%	DESIG=117
Γ ₆₁	$\gamma X(4140) \rightarrow \phi J/\psi$	$< 1.2 \times 10^{-6}$	CL=90%	DESIG=118
Γ ₆₂	$\gamma X(4350) \rightarrow \phi J/\psi$	$< 1.3 \times 10^{-6}$	CL=90%	DESIG=119
Γ ₆₃	$\gamma \eta_b(1S)$	$(3.9 \pm 1.5) \times 10^{-4}$		DESIG=102
Γ ₆₄	$\gamma \eta_b(1S) \rightarrow \gamma$ Sum of 26 exclusive modes	$< 3.7 \times 10^{-6}$	CL=90%	DESIG=124
Γ ₆₅	$\gamma X_{b\overline{b}} \rightarrow \gamma$ Sum of 26 exclusive modes	$< 4.9 \times 10^{-6}$	CL=90%	DESIG=125
Γ ₆₆	$\gamma X \rightarrow \gamma + \geq 4$ prongs	[a] $< 1.95 \times 10^{-4}$	CL=95%	DESIG=103
Γ ₆₇	$\gamma A^0 \rightarrow \gamma$ hadrons	$< 8 \times 10^{-5}$	CL=90%	DESIG=108
Γ ₆₈	$\gamma a_1^0 \rightarrow \gamma \mu^+ \mu^-$	$< 8.3 \times 10^{-6}$	CL=90%	DESIG=123

Lepton Family number (LF) violating modes

Γ_{69}	$e^\pm \tau^\mp$	LF	< 3.2	$\times 10^{-6}$	CL=90%
Γ_{70}	$\mu^\pm \tau^\mp$	LF	< 3.3	$\times 10^{-6}$	CL=90%

[a] 1.5 GeV < m_X < 5.0 GeV

NODE=M052;CLUMP=B

DESIG=107

DESIG=104

LINKAGE=C52

CONSTRAINED FIT INFORMATION

An overall fit to 3 branching ratios uses 13 measurements and one constraint to determine 3 parameters. The overall fit has a $\chi^2 = 11.8$ for 11 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta x_i \delta x_j \rangle / (\delta x_i \cdot \delta x_j)$, in percent, from the fit to the branching fractions, $x_i \equiv \Gamma_i / \Gamma_{\text{total}}$. The fit constrains the x_i whose labels appear in this array to sum to one.

$$x_7 \quad \left| \quad \frac{2}{x_1} \right.$$

 $\mathcal{T}(2S) \Gamma(i) \Gamma(e^+ e^-) / \Gamma(\text{total})$

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 ± 1.5 ± 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 ± 1.0 ± 4.2	11.8K	¹ AUBERT	08BP	BABR 10.58 $e^+ e^- \rightarrow \gamma \pi^+ \pi^- \ell^+ \ell^-$

NODE=M052G03
NODE=M052G03

¹ Using $B(\mathcal{T}(1S) \rightarrow e^+ e^-) = (2.38 \pm 0.11)\%$ and $B(\mathcal{T}(1S) \rightarrow \mu^+ \mu^-) = (2.48 \pm 0.05)\%$.

NODE=M052G03;LINKAGE=AU

 $\Gamma(\text{hadrons}) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$ **$\Gamma_{26} \Gamma_5 / \Gamma$**

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
0.577 ± 0.009 OUR AVERAGE			
0.581 ± 0.004 ± 0.009	¹ ROSNER	06	CLEO 10.0 $e^+ e^- \rightarrow \text{hadrons}$
0.552 ± 0.031 ± 0.017	¹ BARU	96	MD1 $e^+ e^- \rightarrow \text{hadrons}$
0.54 ± 0.04 ± 0.02	¹ JAKUBOWSKI	88	CBAL $e^+ e^- \rightarrow \text{hadrons}$
0.58 ± 0.03 ± 0.04	² GILES	84B	CLEO $e^+ e^- \rightarrow \text{hadrons}$
0.60 ± 0.12 ± 0.07	² ALBRECHT	82	DASP $e^+ e^- \rightarrow \text{hadrons}$
0.54 ± 0.07 ^{+0.09} / _{-0.05}	² NICZYPORUK	81C	LENA $e^+ e^- \rightarrow \text{hadrons}$
0.41 ± 0.18	² BOCK	80	CNTR $e^+ e^- \rightarrow \text{hadrons}$

NODE=M052G2
NODE=M052G2

¹ Radiative corrections evaluated following KURAEV 85.

² Radiative corrections reevaluated by BUCHMUELLER 88 following KURAEV 85.

NODE=M052G2;LINKAGE=P
NODE=M052G2;LINKAGE=R **$\mathcal{T}(2S)$ PARTIAL WIDTHS**

NODE=M052220

 $\Gamma(e^+ e^-)$ **Γ_5**

VALUE (keV)	DOCUMENT ID
0.612 ± 0.011 OUR EVALUATION	

NODE=M052W2
NODE=M052W2
→ UNCHECKED ← **$\mathcal{T}(2S)$ BRANCHING RATIOS**

NODE=M052225

 $\Gamma(\mathcal{T}(1S) \pi^+ \pi^-) / \Gamma_{\text{total}}$ **Γ_1 / Γ**

Abbreviation MM in the COMMENT field below stands for missing mass.

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
17.85 ± 0.26 OUR FIT				
17.92 ± 0.26 OUR AVERAGE				
16.8 ± 1.1 ± 1.3	906k	¹ LEES	11C	BABR $e^+ e^- \rightarrow \pi^+ \pi^- X$
17.80 ± 0.05 ± 0.37	170k	² LEES	11L	BABR $\mathcal{T}(2S) \rightarrow \pi^+ \pi^- \mu^+ \mu^-$
18.02 ± 0.02 ± 0.61	851k	³ BHARI	09	CLEO $e^+ e^- \rightarrow \pi^+ \pi^- \text{MM}$
17.22 ± 0.17 ± 0.75	11.8K	⁴ AUBERT	08BP	BABR $e^+ e^- \rightarrow \gamma \pi^+ \pi^- \ell^+ \ell^-$
19.2 ± 0.2 ± 1.0	52.6k	⁵ ALEXANDER	98	CLE2 $\pi^+ \pi^- \ell^+ \ell^-, \pi^+ \pi^- \text{MM}$

NODE=M052R4
NODE=M052R4
NODE=M052R4

18.1 ±0.5 ±1.0	11.6k	ALBRECHT	87	ARG	$e^+e^- \rightarrow \pi^+\pi^-$ MM
16.9 ±4.0		GELPHMAN	85	CBAL	$e^+e^- \rightarrow e^+e^-\pi^+\pi^-$
19.1 ±1.2 ±0.6		BESSON	84	CLEO	$\pi^+\pi^-$ MM
18.9 ±2.6		FONSECA	84	CUSB	$e^+e^- \rightarrow \ell^+\ell^-\pi^+\pi^-$
21 ±7	7	NICZYPORUK	81B	LENA	$e^+e^- \rightarrow \ell^+\ell^-\pi^+\pi^-$

¹ LEES 11C reports $[\Gamma(\Upsilon(2S) \rightarrow \Upsilon(1S)\pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \Upsilon(2S)\text{anything})] = (1.78 \pm 0.02 \pm 0.11) \times 10^{-2}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \Upsilon(2S)\text{anything}) = (10.6 \pm 0.8) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² Using $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.05)\%$.

³ A weighted average of the inclusive and exclusive results.

⁴ Using $B(\Upsilon(2S) \rightarrow e^+e^-) = (1.91 \pm 0.16)\%$, $B(\Upsilon(2S) \rightarrow \mu^+\mu^-) = (1.93 \pm 0.17)\%$ and, $\Gamma_{ee}(\Upsilon(2S)) = 0.612 \pm 0.011$ keV.

⁵ Using $B(\Upsilon(1S) \rightarrow e^+e^-) = (2.52 \pm 0.17)\%$ and $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.07)\%$.

NODE=M052R4;LINKAGE=ES

NODE=M052R4;LINKAGE=LE

NODE=M052R4;LINKAGE=BH

NODE=M052R4;LINKAGE=AU

NODE=M052R4;LINKAGE=T

$\Gamma(\Upsilon(1S)\pi^0\pi^0)/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
8.6 ±0.4 OUR AVERAGE				
8.43 ±0.16 ±0.42	38k	¹ BHARI	09	CLEO $e^+e^- \rightarrow \pi^0\pi^0\ell^+\ell^-$
9.2 ±0.6 ±0.8	275	² ALEXANDER	98	CLE2 $e^+e^- \rightarrow \pi^0\pi^0\ell^+\ell^-$
9.5 ±1.9 ±1.9	25	ALBRECHT	87	ARG $e^+e^- \rightarrow \pi^0\pi^0\ell^+\ell^-$
8.0 ±1.5		GELPHMAN	85	CBAL $e^+e^- \rightarrow \pi^0\pi^0\ell^+\ell^-$
10.3 ±2.3		FONSECA	84	CUSB $e^+e^- \rightarrow \pi^0\pi^0\ell^+\ell^-$

¹ Authors assume $B(\Upsilon(1S) \rightarrow e^+e^-) + B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = 4.96\%$.

² Using $B(\Upsilon(1S) \rightarrow e^+e^-) = (2.52 \pm 0.17)\%$ and $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.07)\%$.

NODE=M052R5

NODE=M052R5

NODE=M052R5;LINKAGE=BH

NODE=M052R5;LINKAGE=T

$\Gamma(\Upsilon(1S)\pi^0\pi^0)/\Gamma(\Upsilon(1S)\pi^+\pi^-)$ Γ_2/Γ_1

VALUE	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.462 ±0.037 ¹ BHARI 09 CLEO $e^+e^- \rightarrow \Upsilon(2S)$

¹ Not independent of other values reported by BHARI 09.

NODE=M052R21

NODE=M052R21

NODE=M052R21;LINKAGE=BH

$\Gamma(\tau^+\tau^-)/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
2.00 ±0.21 OUR AVERAGE				
2.00 ±0.12 ±0.18	22k	¹ BESSON	07	CLEO $e^+e^- \rightarrow \Upsilon(2S) \rightarrow \tau^+\tau^-$
1.7 ±1.5 ±0.6		HAAS	84B	CLEO $e^+e^- \rightarrow \tau^+\tau^-$

¹ BESSON 07 reports $[\Gamma(\Upsilon(2S) \rightarrow \tau^+\tau^-)/\Gamma_{\text{total}}] / [B(\Upsilon(2S) \rightarrow \mu^+\mu^-)] = 1.04 \pm 0.04 \pm 0.05$ which we multiply by our best value $B(\Upsilon(2S) \rightarrow \mu^+\mu^-) = (1.93 \pm 0.17) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M052R3

NODE=M052R3

NODE=M052R3;LINKAGE=BE

$\Gamma(\mu^+\mu^-)/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
0.0193 ±0.0017 OUR AVERAGE					Error includes scale factor of 2.2. See the ideogram below.
0.0203 ±0.0003 ±0.0008	120k	ADAMS	05	CLEO	$e^+e^- \rightarrow \mu^+\mu^-$
0.0122 ±0.0028 ±0.0019		¹ KOBEL	92	CBAL	$e^+e^- \rightarrow \mu^+\mu^-$
0.0138 ±0.0025 ±0.0015		KAARSBERG	89	CSB2	$e^+e^- \rightarrow \mu^+\mu^-$
0.009 ±0.006 ±0.006		² ALBRECHT	85	ARG	$e^+e^- \rightarrow \mu^+\mu^-$
0.018 ±0.008 ±0.005		HAAS	84B	CLEO	$e^+e^- \rightarrow \mu^+\mu^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.038 90 NICZYPORUK 81C LENA $e^+e^- \rightarrow \mu^+\mu^-$

¹ Taking into account interference between the resonance and continuum.

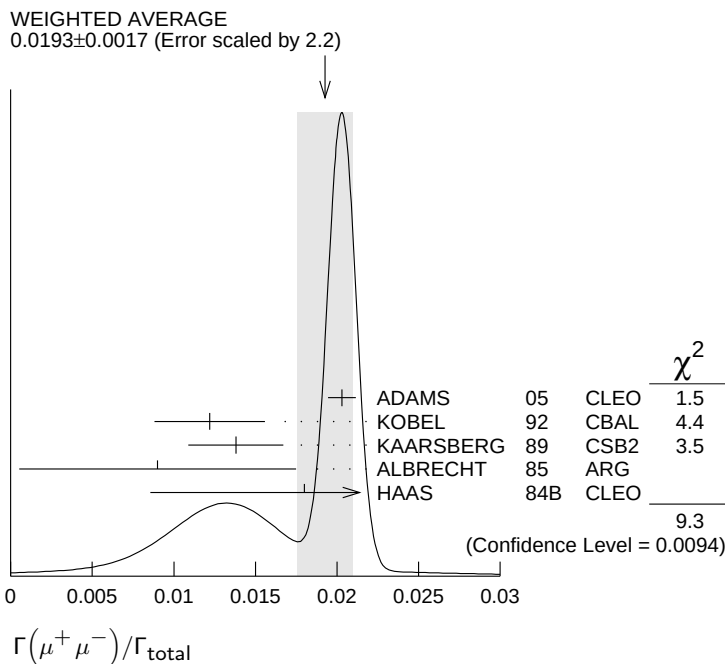
² Re-evaluated using $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = 0.026$.

NODE=M052R1

NODE=M052R1

NODE=M052R1;LINKAGE=A

NODE=M052R1;LINKAGE=R



$\Gamma(\tau^+\tau^-)/\Gamma(\mu^+\mu^-)$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_3/Γ_4
1.04±0.04±0.05	22k	BESSION	07	CLEO $e^+e^- \rightarrow \Upsilon(2S)$	

NODE=M052R17
NODE=M052R17

$\Gamma(\Upsilon(1S)\pi^0)/\Gamma_{\text{total}}$

VALUE (units 10 ⁻⁵)	CL%	DOCUMENT ID	TECN	COMMENT	Γ_6/Γ

NODE=M052R10
NODE=M052R10

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 4	90	¹ TAMPONI	13	BELL	$e^+e^- \rightarrow \Upsilon(1S)\pi^0$
< 18	90	² HE	08A	CLEO	$e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$
<110	90	ALEXANDER	98	CLE2	$e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$
<800	90	LURZ	87	CBAL	$e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$

¹ TAMPONI 13 reports $[\Gamma(\Upsilon(2S) \rightarrow \Upsilon(1S)\pi^0)/\Gamma_{\text{total}}] / [B(\Upsilon(2S) \rightarrow \Upsilon(1S)\pi^+\pi^-)] < 2.3 \times 10^{-4}$ which we multiply by our best value $B(\Upsilon(2S) \rightarrow \Upsilon(1S)\pi^+\pi^-) = 17.85 \times 10^{-2}$.

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

$\Gamma(\Upsilon(1S)\pi^0)/\Gamma(\Upsilon(1S)\pi^+\pi^-)$

VALUE (units 10 ⁻⁴)	CL%	DOCUMENT ID	TECN	COMMENT	Γ_6/Γ_1
<2.3	90	TAMPONI	13	BELL $e^+e^- \rightarrow \Upsilon(1S)\pi^0$	

NODE=M052R09
NODE=M052R09

$\Gamma(\Upsilon(1S)\eta)/\Gamma_{\text{total}}$

VALUE (units 10 ⁻⁴)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_7/Γ

NODE=M052R6
NODE=M052R6

2.9 ±0.4 OUR FIT Error includes scale factor of 2.0.

2.9 ±0.4 OUR AVERAGE Error includes scale factor of 1.9. See the ideogram below.

2.39±0.31±0.14	112	¹ LEES	11L	BABR	$\Upsilon(2S) \rightarrow \ell^+\ell^-\eta$
2.1 ^{+0.7} / _{-0.6} ±0.3	14	² HE	08A	CLEO	$e^+e^- \rightarrow \ell^+\ell^-\eta$

• • • We use the following data for averages but not for fits. • • •

3.55±0.32±0.05	241	³ TAMPONI	13	BELL	$e^+e^- \rightarrow \Upsilon(1S)\eta$

NOTFITTED

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 9	90	^{1,4} AUBERT	08BP	BABR	$e^+e^- \rightarrow \gamma\pi^+\pi^-\pi^0\ell^+\ell^-$
< 28	90	ALEXANDER	98	CLE2	$e^+e^- \rightarrow \ell^+\ell^-\eta$
< 50	90	ALBRECHT	87	ARG	$e^+e^- \rightarrow \pi^+\pi^-\ell^+\ell^-MM$
< 70	90	LURZ	87	CBAL	$e^+e^- \rightarrow \ell^+\ell^-(\gamma\gamma, 3\pi^0)$
< 100	90	BESSION	84	CLEO	$e^+e^- \rightarrow \pi^+\pi^-\ell^+\ell^-MM$
< 20	90	FONSECA	84	CUSB	$e^+e^- \rightarrow \ell^+\ell^-(\gamma\gamma, \pi^+\pi^-\pi^0)$

¹ Using $B(\Upsilon(1S) \rightarrow e^+e^-) = (2.38 \pm 0.11)\%$ and $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.05)\%$.

² Authors assume $B(\Upsilon(1S) \rightarrow e^+e^-) + B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = 4.96\%$.

³ TAMPONI 13 reports $[\Gamma(\Upsilon(2S) \rightarrow \Upsilon(1S)\eta)/\Gamma_{\text{total}}] / [B(\Upsilon(2S) \rightarrow \Upsilon(1S)\pi^+\pi^-)] = (1.99 \pm 0.14 \pm 0.11) \times 10^{-3}$ which we multiply by our best value $B(\Upsilon(2S) \rightarrow \Upsilon(1S)\pi^+\pi^-) = (17.85 \pm 0.26) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

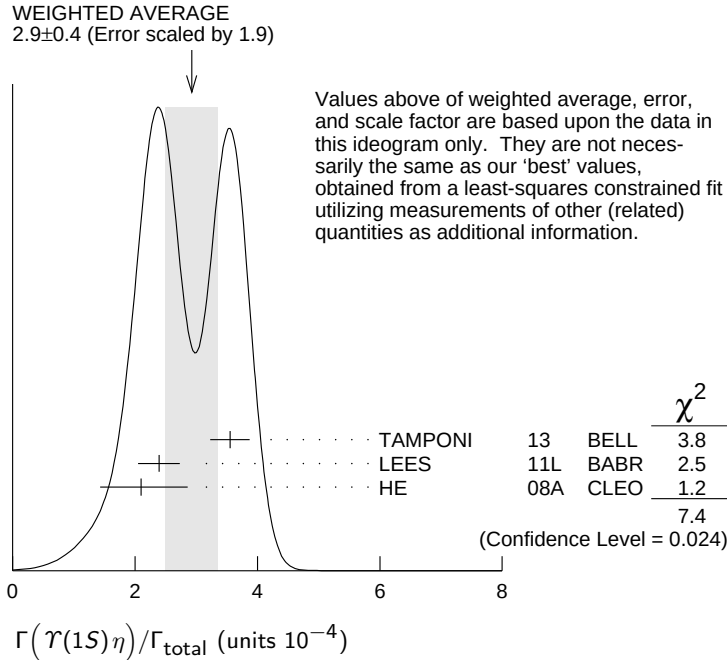
⁴ Using $\Gamma_{ee}(\Upsilon(2S)) = 0.612 \pm 0.011$ keV.

NODE=M052R6;LINKAGE=AU

NODE=M052R6;LINKAGE=HE

NODE=M052R6;LINKAGE=TA

NODE=M052R6;LINKAGE=UB



$\Gamma(\Upsilon(1S)\eta)/\Gamma(\Upsilon(1S)\pi^+\pi^-)$

Γ_7/Γ_1

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
1.64±0.25 OUR FIT					Error includes scale factor of 2.0.

1.99±0.14±0.11 241 TAMPONI 13 BELL $e^+e^- \rightarrow \Upsilon(1S)\eta$

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.35±0.17±0.08 ¹ LEES 11L BABR $\Upsilon(2S) \rightarrow (\pi^+\pi^-)(\gamma\gamma)\mu^+\mu^-$
 < 5.2 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 $e^+e^- \rightarrow \Upsilon(1S)\pi^0$

NODE=M052R23
NODE=M052R23

$\Gamma(J/\psi(1S) \text{ anything})/\Gamma_{\text{total}}$

Γ_8/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

< 0.006 90 MASCHMANN 90 CBAL $e^+e^- \rightarrow \text{hadrons}$

NODE=M052R16
NODE=M052R16

$\Gamma(J/\psi(1S)\eta_c)/\Gamma_{\text{total}}$

Γ_9/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

< 5.4 × 10⁻⁶ 90 YANG 14 BELL $e^+e^- \rightarrow J/\psi X$

NODE=M052R53
NODE=M052R53

$\Gamma(J/\psi(1S)\chi_{c0})/\Gamma_{\text{total}}$

Γ_{10}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

< 3.4 × 10⁻⁶ 90 YANG 14 BELL $e^+e^- \rightarrow J/\psi X$

NODE=M052R54
NODE=M052R54

$\Gamma(J/\psi(1S)\chi_{c1})/\Gamma_{\text{total}}$

Γ_{11}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

< 1.2 × 10⁻⁶ 90 YANG 14 BELL $e^+e^- \rightarrow J/\psi X$

NODE=M052R55
NODE=M052R55

$\Gamma(J/\psi(1S)\chi_{c2})/\Gamma_{\text{total}}$					Γ_{12}/Γ	NODE=M052R56 NODE=M052R56
VALUE	CL%	DOCUMENT ID	TECN	COMMENT		
$<2.0 \times 10^{-6}$	90	YANG	14	BELL	$e^+e^- \rightarrow J/\psi X$	
$\Gamma(J/\psi(1S)\eta_c(2S))/\Gamma_{\text{total}}$					Γ_{13}/Γ	NODE=M052R57 NODE=M052R57
VALUE	CL%	DOCUMENT ID	TECN	COMMENT		
$<2.5 \times 10^{-6}$	90	YANG	14	BELL	$e^+e^- \rightarrow J/\psi X$	
$\Gamma(J/\psi(1S)X(3940))/\Gamma_{\text{total}}$					Γ_{14}/Γ	NODE=M052R58 NODE=M052R58
VALUE	CL%	DOCUMENT ID	TECN	COMMENT		
$<2.0 \times 10^{-6}$	90	YANG	14	BELL	$e^+e^- \rightarrow J/\psi X$	
$\Gamma(J/\psi(1S)X(4160))/\Gamma_{\text{total}}$					Γ_{15}/Γ	NODE=M052R59 NODE=M052R59
VALUE	CL%	DOCUMENT ID	TECN	COMMENT		
$<2.0 \times 10^{-6}$	90	YANG	14	BELL	$e^+e^- \rightarrow J/\psi X$	
$\Gamma(\chi_{c1} \text{ anything})/\Gamma_{\text{total}}$					Γ_{16}/Γ	NODE=M052R00 NODE=M052R00
VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT		
$2.24 \pm 0.44 \pm 0.20$	376	JIA	17	LHCB	$\Upsilon(2S) \rightarrow \gamma J/\psi(1S)$	
$\Gamma(\chi_{c2} \text{ anything})/\Gamma_{\text{total}}$					Γ_{17}/Γ	NODE=M052R67 NODE=M052R67
VALUE (units 10^{-4})		DOCUMENT ID	TECN	COMMENT		
$2.28 \pm 0.73 \pm 0.34$		JIA	17	LHCB	$\Upsilon(2S) \rightarrow \gamma J/\psi(1S)$	
$\Gamma(\psi(2S)\eta_c)/\Gamma_{\text{total}}$					Γ_{18}/Γ	NODE=M052R60 NODE=M052R60
VALUE	CL%	DOCUMENT ID	TECN	COMMENT		
$<5.1 \times 10^{-6}$	90	YANG	14	BELL	$e^+e^- \rightarrow \psi(2S)X$	
$\Gamma(\psi(2S)\chi_{c0})/\Gamma_{\text{total}}$					Γ_{19}/Γ	NODE=M052R61 NODE=M052R61
VALUE	CL%	DOCUMENT ID	TECN	COMMENT		
$<4.7 \times 10^{-6}$	90	YANG	14	BELL	$e^+e^- \rightarrow \psi(2S)X$	
$\Gamma(\psi(2S)\chi_{c1})/\Gamma_{\text{total}}$					Γ_{20}/Γ	NODE=M052R62 NODE=M052R62
VALUE	CL%	DOCUMENT ID	TECN	COMMENT		
$<2.5 \times 10^{-6}$	90	YANG	14	BELL	$e^+e^- \rightarrow \psi(2S)X$	
$\Gamma(\psi(2S)\chi_{c2})/\Gamma_{\text{total}}$					Γ_{21}/Γ	NODE=M052R63 NODE=M052R63
VALUE	CL%	DOCUMENT ID	TECN	COMMENT		
$<1.9 \times 10^{-6}$	90	YANG	14	BELL	$e^+e^- \rightarrow \psi(2S)X$	
$\Gamma(\psi(2S)\eta_c(2S))/\Gamma_{\text{total}}$					Γ_{22}/Γ	NODE=M052R64 NODE=M052R64
VALUE	CL%	DOCUMENT ID	TECN	COMMENT		
$<3.3 \times 10^{-6}$	90	YANG	14	BELL	$e^+e^- \rightarrow \psi(2S)X$	
$\Gamma(\psi(2S)X(3940))/\Gamma_{\text{total}}$					Γ_{23}/Γ	NODE=M052R65 NODE=M052R65
VALUE	CL%	DOCUMENT ID	TECN	COMMENT		
$<3.9 \times 10^{-6}$	90	YANG	14	BELL	$e^+e^- \rightarrow \psi(2S)X$	
$\Gamma(\psi(2S)X(4160))/\Gamma_{\text{total}}$					Γ_{24}/Γ	NODE=M052R66 NODE=M052R66
VALUE	CL%	DOCUMENT ID	TECN	COMMENT		
$<3.9 \times 10^{-6}$	90	YANG	14	BELL	$e^+e^- \rightarrow \psi(2S)X$	
$\Gamma(\overline{2H} \text{ anything})/\Gamma_{\text{total}}$					Γ_{25}/Γ	NODE=M052R18 NODE=M052R18
VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT		
$2.78^{+0.30}_{-0.26}$		OUR AVERAGE Error includes scale factor of 1.2.				
$2.64 \pm 0.11^{+0.26}_{-0.21}$		LEES	14G	BABR	$e^+e^- \rightarrow \overline{2H} X$	
$3.37 \pm 0.50 \pm 0.25$	58	ASNER	07	CLEO	$e^+e^- \rightarrow \overline{2H} X$	

$\Gamma(ggg)/\Gamma_{\text{total}}$ Γ_{27}/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 $\Gamma(\gamma gg)/\Gamma(ggg) = (3.18 \pm 0.04 \pm 0.22 \pm 0.41)\%$ from BESSON 06A and PDG 08 values of $B(\pi^+\pi^-\Upsilon(1S)) = (18.1 \pm 0.4)\%$, $B(\pi^0\pi^0\Upsilon(1S)) = (8.6 \pm 0.4)\%$, $B(\mu^+\mu^-) = (1.93 \pm 0.17)\%$, and $R_{\text{hadrons}} = 3.51$. The statistical error is negligible and the systematic error is partially correlated with that of $\Gamma(\gamma gg)/\Gamma_{\text{total}}$ measurement of BESSON 06A.

NODE=M052R01;LINKAGE=BE

$\Gamma(\gamma gg)/\Gamma(ggg)$ Γ_{28}/Γ_{27}

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

$\Gamma(\phi K^+ K^-)/\Gamma_{\text{total}}$ Γ_{29}/Γ

VALUE (units 10^{-6})	EVTs	DOCUMENT ID	TECN	COMMENT
1.58±0.33±0.18	58	SHEN	12A BELL	$\Upsilon(1S) \rightarrow 2(K^+ K^-)$

NODE=M052R43
NODE=M052R43

$\Gamma(\omega \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{30}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<2.58	90	SHEN	12A BELL	$\Upsilon(1S) \rightarrow 2(\pi^+ \pi^-) \pi^0$

NODE=M052R44
NODE=M052R44

$\Gamma(K^*(892)^0 K^- \pi^+ + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{31}/Γ

VALUE (units 10^{-6})	EVTs	DOCUMENT ID	TECN	COMMENT
2.32±0.40±0.54	135	SHEN	12A BELL	$\Upsilon(1S) \rightarrow K^+ K^- \pi^+ \pi^-$

NODE=M052R45
NODE=M052R45

$\Gamma(\phi f'_2(1525))/\Gamma_{\text{total}}$ Γ_{32}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<1.33	90	SHEN	12A BELL	$\Upsilon(1S) \rightarrow 2(K^+ K^-)$

NODE=M052R46
NODE=M052R46

$\Gamma(\omega f_2(1270))/\Gamma_{\text{total}}$ Γ_{33}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<0.57	90	SHEN	12A BELL	$\Upsilon(1S) \rightarrow 2(\pi^+ \pi^-) \pi^0$

NODE=M052R47
NODE=M052R47

$\Gamma(\rho(770) a_2(1320))/\Gamma_{\text{total}}$ Γ_{34}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<0.88	90	SHEN	12A BELL	$\Upsilon(1S) \rightarrow 2(\pi^+ \pi^-) \pi^0$

NODE=M052R48
NODE=M052R48

$\Gamma(K^*(892)^0 \bar{K}_2^*(1430)^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{35}/Γ

VALUE (units 10^{-6})	EVTs	DOCUMENT ID	TECN	COMMENT
1.53±0.52±0.19	32	SHEN	12A BELL	$\Upsilon(1S) \rightarrow K^+ K^- \pi^+ \pi^-$

NODE=M052R49
NODE=M052R49

$\Gamma(K_1(1270)^\pm K^\mp)/\Gamma_{\text{total}}$ Γ_{36}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<3.22	90	SHEN	12A BELL	$\Upsilon(1S) \rightarrow K^+ K^- \pi^+ \pi^-$

NODE=M052R50
NODE=M052R50

$\Gamma(K_1(1400)^\pm K^\mp)/\Gamma_{\text{total}}$ Γ_{37}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<0.83	90	SHEN	12A BELL	$\Upsilon(1S) \rightarrow K^+ K^- \pi^+ \pi^-$

NODE=M052R51
NODE=M052R51

$\Gamma(b_1(1235)^\pm \pi^\mp)/\Gamma_{\text{total}}$ Γ_{38}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<0.40	90	SHEN	12A BELL	$\Upsilon(1S) \rightarrow 2(\pi^+ \pi^-) \pi^0$

NODE=M052R52
NODE=M052R52

$\Gamma(\rho\pi)/\Gamma_{\text{total}}$ Γ_{39}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<1.16	90	SHEN	13 BELL	$\Upsilon(2S) \rightarrow \pi^+ \pi^- \pi^0$

NODE=M052R27
NODE=M052R27

$\Gamma(\pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}$ Γ_{40}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<0.80	90	SHEN	13 BELL	$\Upsilon(2S) \rightarrow \pi^+ \pi^- \pi^0$

NODE=M052R28
NODE=M052R28

$\Gamma(\omega\pi^0)/\Gamma_{\text{total}}$ Γ_{41}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<1.63	90	SHEN	13	BELL $\Upsilon(2S) \rightarrow \pi^+\pi^-\pi^0\pi^0$

NODE=M052R29
NODE=M052R29

 $\Gamma(\pi^+\pi^-\pi^0\pi^0)/\Gamma_{\text{total}}$ Γ_{42}/Γ

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
$13.0 \pm 1.9 \pm 2.1$	261 ± 37	SHEN	13	BELL $\Upsilon(2S) \rightarrow \pi^+\pi^-\pi^0\pi^0$

NODE=M052R30
NODE=M052R30

 $\Gamma(K_S^0 K^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{43}/Γ

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$1.14 \pm 0.30 \pm 0.13$	40 ± 10	SHEN	13	BELL	$\Upsilon(2S) \rightarrow K_S^0 K^- \pi^+$

NODE=M052R40
NODE=M052R40

• • • We do not use the following data for averages, fits, limits, etc. • • •

<3.2	90	¹ DOBBS	12A	$\Upsilon(2S) \rightarrow K_S^0 K^- \pi^+$

¹ Obtained by analyzing CLEO III data but not authored by the CLEO Collaboration.

NODE=M052R40;LINKAGE=DO

 $\Gamma(K^*(892)^0 \bar{K}^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{44}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<4.22	90	SHEN	13	BELL $\Upsilon(2S) \rightarrow K_S^0 K^- \pi^+$

NODE=M052R41
NODE=M052R41

 $\Gamma(K^*(892)^- K^+ + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{45}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<1.45	90	SHEN	13	BELL $\Upsilon(2S) \rightarrow K_S^0 K^- \pi^+$

NODE=M052R42
NODE=M052R42

 $\Gamma(\text{Sum of 100 exclusive modes})/\Gamma_{\text{total}}$ Γ_{46}/Γ

VALUE (units 10^{-2})	DOCUMENT ID	COMMENT
0.29 ± 0.03	^{1,2} DOBBS	12A $\Upsilon(2S) \rightarrow \text{hadrons}$

NODE=M052R08
NODE=M052R08

¹ DOBBS 12A presents individual exclusive branching fractions or upper limits for 100 modes of four to ten pions, kaons, or protons.

NODE=M052R08;LINKAGE=DO

² Obtained by analyzing CLEO III data but not authored by the CLEO Collaboration.

NODE=M052R08;LINKAGE=NC

 $\Gamma(\gamma\chi_{b1}(1P))/\Gamma_{\text{total}}$ Γ_{47}/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.069 ± 0.004 OUR AVERAGE				
$0.0693 \pm 0.0012 \pm 0.0041$	407k	ARTUSO	05	CLEO $e^+e^- \rightarrow \gamma X$
$0.069 \pm 0.005 \pm 0.009$		EDWARDS	99	CLE2 $\Upsilon(2S) \rightarrow \gamma\chi(1P)$
$0.091 \pm 0.018 \pm 0.022$		ALBRECHT	85E	ARG $e^+e^- \rightarrow \gamma \text{conv. } X$
$0.065 \pm 0.007 \pm 0.012$		NERNST	85	CBAL $e^+e^- \rightarrow \gamma X$
$0.080 \pm 0.017 \pm 0.016$		HAAS	84	CLEO $e^+e^- \rightarrow \gamma \text{conv. } X$
0.059 ± 0.014		KLOPFEN...	83	CUSB $e^+e^- \rightarrow \gamma X$

NODE=M052R8
NODE=M052R8

 $\Gamma(\gamma\chi_{b2}(1P))/\Gamma_{\text{total}}$ Γ_{48}/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.0715 ± 0.0035 OUR AVERAGE				
$0.0724 \pm 0.0011 \pm 0.0040$	410k	ARTUSO	05	CLEO $e^+e^- \rightarrow \gamma X$
$0.074 \pm 0.005 \pm 0.008$		EDWARDS	99	CLE2 $\Upsilon(2S) \rightarrow \gamma\chi(1P)$
$0.098 \pm 0.021 \pm 0.024$		ALBRECHT	85E	ARG $e^+e^- \rightarrow \gamma \text{conv. } X$
$0.058 \pm 0.007 \pm 0.010$		NERNST	85	CBAL $e^+e^- \rightarrow \gamma X$
$0.102 \pm 0.018 \pm 0.021$		HAAS	84	CLEO $e^+e^- \rightarrow \gamma \text{conv. } X$
0.061 ± 0.014		KLOPFEN...	83	CUSB $e^+e^- \rightarrow \gamma X$

NODE=M052R7
NODE=M052R7

 $\Gamma(\gamma\chi_{b0}(1P))/\Gamma_{\text{total}}$ Γ_{49}/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.038 ± 0.004 OUR AVERAGE				
$0.0375 \pm 0.0012 \pm 0.0047$	198k	ARTUSO	05	CLEO $e^+e^- \rightarrow \gamma X$
$0.034 \pm 0.005 \pm 0.006$		EDWARDS	99	CLE2 $\Upsilon(2S) \rightarrow \gamma\chi(1P)$
$0.064 \pm 0.014 \pm 0.016$		ALBRECHT	85E	ARG $e^+e^- \rightarrow \gamma \text{conv. } X$
$0.036 \pm 0.008 \pm 0.009$		NERNST	85	CBAL $e^+e^- \rightarrow \gamma X$
$0.044 \pm 0.023 \pm 0.009$		HAAS	84	CLEO $e^+e^- \rightarrow \gamma \text{conv. } X$

NODE=M052R9
NODE=M052R9

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.035 ± 0.014	KLOPFEN...	83	CUSB	$e^+e^- \rightarrow \gamma X$

$\Gamma(\gamma f_0(1710))/\Gamma_{\text{total}}$

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	$\Upsilon(2S) \rightarrow \gamma \pi^+ \pi^-$
¹ Re-evaluated assuming $B(f_0(1710) \rightarrow K^+ K^-) = 0.19$.				
² Includes unknown branching ratio of $f_0(1710) \rightarrow \pi^+ \pi^-$.				

 Γ_{50}/Γ

NODE=M052R13
 NODE=M052R13

OCCUR=2

NODE=M052R13;LINKAGE=M
 NODE=M052R13;LINKAGE=N

 $\Gamma(\gamma f'_2(1525))/\Gamma_{\text{total}}$

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 $B(f'_2(1525) \rightarrow K \bar{K}) = 0.71$.				

 Γ_{51}/Γ

NODE=M052R12
 NODE=M052R12

NODE=M052R12;LINKAGE=L

 $\Gamma(\gamma f_2(1270))/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<24.1	90	¹ ALBRECHT 89	ARG	$\Upsilon(2S) \rightarrow \gamma \pi^+ \pi^-$
¹ Using $B(f_2(1270) \rightarrow \pi \pi) = 0.84$.				

 Γ_{52}/Γ

NODE=M052R11
 NODE=M052R11

NODE=M052R11;LINKAGE=K

 $\Gamma(\gamma f_J(2220))/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<6.8	90	¹ ALBRECHT 89	ARG	$\Upsilon(2S) \rightarrow \gamma K^+ K^-$
¹ Includes unknown branching ratio of $f_J(2220) \rightarrow K^+ K^-$.				

 Γ_{53}/Γ

NODE=M052R14
 NODE=M052R14

NODE=M052R14;LINKAGE=S

 $\Gamma(\gamma \eta_c(1S))/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<2.7 $\times 10^{-5}$	90	WANG	11B BELL	$\Upsilon(2S) \rightarrow \gamma X$

 Γ_{54}/Γ

NODE=M052R31
 NODE=M052R31

 $\Gamma(\gamma \chi_{c0})/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<1.0 $\times 10^{-4}$	90	WANG	11B BELL	$\Upsilon(2S) \rightarrow \gamma X$

 Γ_{55}/Γ

NODE=M052R32
 NODE=M052R32

 $\Gamma(\gamma \chi_{c1})/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<3.6 $\times 10^{-6}$	90	WANG	11B BELL	$\Upsilon(2S) \rightarrow \gamma X$

 Γ_{56}/Γ

NODE=M052R33
 NODE=M052R33

 $\Gamma(\gamma \chi_{c2})/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<1.5 $\times 10^{-5}$	90	WANG	11B BELL	$\Upsilon(2S) \rightarrow \gamma X$

 Γ_{57}/Γ

NODE=M052R34
 NODE=M052R34

 $\Gamma(\gamma X(3872) \rightarrow \pi^+ \pi^- J/\psi)/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.8 $\times 10^{-6}$	90	WANG	11B BELL	$\Upsilon(2S) \rightarrow \gamma X$

 Γ_{58}/Γ

NODE=M052R35
 NODE=M052R35

 $\Gamma(\gamma X(3872) \rightarrow \pi^+ \pi^- \pi^0 J/\psi)/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<2.4 $\times 10^{-6}$	90	WANG	11B BELL	$\Upsilon(2S) \rightarrow \gamma X$

 Γ_{59}/Γ

NODE=M052R36
 NODE=M052R36

 $\Gamma(\gamma X(3915) \rightarrow \omega J/\psi)/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<2.8 $\times 10^{-6}$	90	WANG	11B BELL	$\Upsilon(2S) \rightarrow \gamma X$

 Γ_{60}/Γ

NODE=M052R37
 NODE=M052R37

 $\Gamma(\gamma X(4140) \rightarrow \phi J/\psi)/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<1.2 $\times 10^{-6}$	90	WANG	11B BELL	$\Upsilon(2S) \rightarrow \gamma X$

 Γ_{61}/Γ

NODE=M052R38
 NODE=M052R38

 $\Gamma(\gamma X(4350) \rightarrow \phi J/\psi)/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<1.3 $\times 10^{-6}$	90	WANG	11B BELL	$\Upsilon(2S) \rightarrow \gamma X$

 Γ_{62}/Γ

NODE=M052R39
 NODE=M052R39

$\Gamma(\gamma\eta_b(1S))/\Gamma_{\text{total}}$
 Γ_{63}/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=M052R15

NODE=M052R15;LINKAGE=BO
NODE=M052R15;LINKAGE=SU

 $\Gamma(\gamma\eta_b(1S) \rightarrow \gamma \text{Sum of 26 exclusive modes})/\Gamma_{\text{total}}$
 Γ_{64}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 3.7 \times 10^{-6}$	90	SANDILYA	13 BELL	$\Upsilon(2S) \rightarrow \gamma$ hadrons

NODE=M052R25
NODE=M052R25

 $\Gamma(\gamma X_{b\bar{b}} \rightarrow \gamma \text{Sum of 26 exclusive modes})/\Gamma_{\text{total}}$
 Γ_{65}/Γ

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
< 4.9	90		SANDILYA	13 BELL	$\Upsilon(2S) \rightarrow \gamma$ hadrons
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$46.2^{+29.7}_{-14.2} \pm 10.6$		10	¹ DOBBS	12	$\Upsilon(2S) \rightarrow \gamma$ hadrons

¹ Obtained by analyzing CLEO III data but not authored by the CLEO Collaboration.

NODE=M052R26
NODE=M052R26

NODE=M052R26;LINKAGE=DO

 $\Gamma(\gamma X \rightarrow \gamma + \geq 4 \text{ prongs})/\Gamma_{\text{total}}$
 Γ_{66}/Γ

(1.5 GeV < m_X < 5.0 GeV)

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.95	95	ROSNER	07A CLEO	$e^+e^- \rightarrow \gamma X$

NODE=M052R19
NODE=M052R19
NODE=M052R19

 $\Gamma(\gamma A^0 \rightarrow \gamma \text{hadrons})/\Gamma_{\text{total}}$
 Γ_{67}/Γ

(0.3 GeV < m_{A^0} < 7 GeV)

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
< 8×10^{-5}	90	¹ LEES	11H BABR	$\Upsilon(2S) \rightarrow \gamma$ hadrons

¹ For a narrow scalar or pseudoscalar A^0 , excluding known resonances, with mass in the range 0.3–7 GeV. Measured 90% CL limits as a function of m_{A^0} range from 1×10^{-6} to 8×10^{-5} .

NODE=M052R06
NODE=M052R06
NODE=M052R06

NODE=M052R06;LINKAGE=LE

 $\Gamma(\gamma a_1^0 \rightarrow \gamma \mu^+ \mu^-)/\Gamma_{\text{total}}$
 Γ_{68}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<8.3	90	¹ AUBERT	09Z BABR	$e^+e^- \rightarrow \gamma a_1^0 \rightarrow \gamma \mu^+ \mu^-$

¹ For a narrow scalar or pseudoscalar a_1^0 with mass in the range 212–9300 MeV, excluding J/ψ and $\psi(2S)$. Measured 90% CL limits as a function of $m_{a_1^0}$ range from $0.26\text{--}8.3 \times 10^{-6}$.

NODE=M052R24
NODE=M052R24

NODE=M052R24;LINKAGE=AU

LEPTON FAMILY NUMBER (LF) VIOLATING MODES

 $\Gamma(e^\pm \tau^\mp)/\Gamma_{\text{total}}$
 Γ_{69}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<3.2	90	LEES	10B BABR	$e^+e^- \rightarrow e^\pm \tau^\mp$

NODE=M052230

NODE=M052R04
NODE=M052R04

 $\Gamma(\mu^\pm \tau^\mp)/\Gamma_{\text{total}}$
 Γ_{70}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
< 3.3	90	LEES	10B BABR	$e^+e^- \rightarrow \mu^\pm \tau^\mp$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<14.4	95	LOVE	08A CLEO	$e^+e^- \rightarrow \mu^\pm \tau^\mp$

NODE=M052R20
NODE=M052R20

$\Upsilon(2S)$ Cross-Particle Branching Ratios

NODE=M052240

 $B(\Upsilon(2S) \rightarrow \pi^+ \pi^-) \times B(\Upsilon(3S) \rightarrow \Upsilon(2S) X)$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.78 \pm 0.02 \pm 0.11$	906k	LEES	11C BABR	$e^+e^- \rightarrow \pi^+ \pi^- X$

NODE=M052R05
NODE=M052R05

$T(2S)$ REFERENCES

NODE=M052

JIA	17	PR D95 012001	S. Jia <i>et al.</i>	(LHCb Collab.)	REFID=57635
LEES	14G	PR D89 111102	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=55939
YANG	14	PR D90 112008	S.D. Yang <i>et al.</i>	(BELLE Collab.)	REFID=56345
SANDILYA	13	PRL 111 112001	S. Sandilya <i>et al.</i>	(BELLE Collab.)	REFID=55590
SHEN	13	PR D88 011102	C.P. Shen <i>et al.</i>	(BELLE Collab.)	REFID=55395
TAMPONI	13	PR D87 011104	U. Tamponi <i>et al.</i>	(BELLE Collab.)	REFID=54919
DOBBS	12	PRL 109 082001	S. Dobbs <i>et al.</i>		REFID=54288
DOBBS	12A	PR D86 052003	S. Dobbs <i>et al.</i>		REFID=54746
SHEN	12A	PR D86 031102	C.P. Shen <i>et al.</i>	(BELLE Collab.)	REFID=54314
LEES	11C	PR D84 011104	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=16775
LEES	11H	PRL 107 221803	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=53877
LEES	11J	PR D84 072002	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=53936
LEES	11L	PR D84 092003	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=53938
WANG	11B	PR D84 071107	X.L. Wang <i>et al.</i>	(BELLE Collab.)	REFID=53939
BONVICINI	10	PR D81 031104	G. Bonvicini <i>et al.</i>	(CLEO Collab.)	REFID=53231
LEES	10B	PRL 104 151802	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=53355
AUBERT	09AQ	PRL 103 161801	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=53106
AUBERT	09Z	PRL 103 081803	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52930
BHARI	09	PR D79 011103	S.R. Bhari <i>et al.</i>	(CLEO Collab.)	REFID=52662
AUBERT	08BP	PR D78 112002	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52660
HE	08A	PRL 101 192001	Q. He <i>et al.</i>	(CLEO Collab.)	REFID=52587
LOVE	08A	PRL 101 201601	W. Love <i>et al.</i>	(CLEO Collab.)	REFID=52592
PDG	08	PL B667 1	C. Amsler <i>et al.</i>	(PDG Collab.)	REFID=52166
ASNER	07	PR D75 012009	D.M. Asner <i>et al.</i>	(CLEO Collab.)	REFID=51617
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
EDWARDS	99	PR D59 032003	K.W. Edwards <i>et al.</i>	(CLEO Collab.)	REFID=46612
ALEXANDER	98	PR D58 052004	J.P. Alexander <i>et al.</i>	(CLEO Collab.)	REFID=46329
BARU	96	PRPL 267 71	S.E. Baru <i>et al.</i>	(NOVO)	REFID=44651
KOBEL	92	ZPHY C53 193	M. Kobel <i>et al.</i>	(Crystal Ball Collab.)	REFID=41861
MASCHMANN	90	ZPHY C46 555	W.S. Maschmann <i>et al.</i>	(Crystal Ball Collab.)	REFID=41224
ALBRECHT	89	ZPHY C42 349	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=40731
KAARSBERG	89	PRL 62 2077	T.M. Kaarsberg <i>et al.</i>	(CUSB Collab.)	REFID=40733
BUCHMUEL...	88	HE e^+e^- Physics 412	W. Buchmüller, S. Cooper	(HANN, DESY, MIT)	REFID=40034
Editors: A. Ali and P. Soeding, World Scientific, Singapore					
JAKUBOWSKI	88	ZPHY C40 49	Z. Jakubowski <i>et al.</i>	(Crystal Ball Collab.)	REFID=40742
ALBRECHT	87	ZPHY C35 283	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=40016
COHEN	87	RMP 59 1121	E.R. Cohen, B.N. Taylor	(RISC, NBS)	REFID=11616
LURZ	87	ZPHY C36 383	B. Lurz <i>et al.</i>	(Crystal Ball Collab.)	REFID=40021
BARU	86B	ZPHY C32 622 (erratum)	S.E. Baru <i>et al.</i>	(NOVO)	REFID=22338
ALBRECHT	85	ZPHY C28 45	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=22334
ALBRECHT	85E	PL 160B 331	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=22288
GELPHMAN	85	PR D32 2893	D. Gelphman <i>et al.</i>	(Crystal Ball Collab.)	REFID=22336
KURAEV	85	SJNP 41 466	E.A. Kuraev, V.S. Fadin	(NOVO)	REFID=40033
Translated from YAF 41 733.					
NERNST	85	PRL 54 2195	R. Nernst <i>et al.</i>	(Crystal Ball Collab.)	REFID=22289
ARTAMONOV	84	PL 137B 272	A.S. Artamonov <i>et al.</i>	(NOVO)	REFID=22278
BARBER	84	PL 135B 498	D.P. Barber <i>et al.</i>	(DESY, ARGUS Collab.+)	REFID=22327
BESSION	84	PR D30 1433	D. Besson <i>et al.</i>	(CLEO Collab.)	REFID=22279
FONSECA	84	NP B242 31	V. Fonseca <i>et al.</i>	(CUSB Collab.)	REFID=22329
GILES	84B	PR D29 1285	R. Giles <i>et al.</i>	(CLEO Collab.)	REFID=22280
HAAS	84	PRL 52 799	J. Haas <i>et al.</i>	(CLEO Collab.)	REFID=22287
HAAS	84B	PR D30 1996	J. Haas <i>et al.</i>	(CLEO Collab.)	REFID=22332
KLOPFEN...	83	PRL 51 160	C. Klopfenstein <i>et al.</i>	(CUSB Collab.)	REFID=22285
ALBRECHT	82	PL 116B 383	H. Albrecht <i>et al.</i>	(DESY, DORT, HEIDH+)	REFID=22270
NICZYPORUK	81B	PL 100B 95	B. Niczyporuk <i>et al.</i>	(LENA Collab.)	REFID=22319
NICZYPORUK	81C	PL 99B 169	B. Niczyporuk <i>et al.</i>	(LENA Collab.)	REFID=22318
BOCK	80	ZPHY C6 125	P. Bock <i>et al.</i>	(HEIDP, MPIM, DESY, HAMB)	REFID=22264

$\Upsilon(1D)$

$I^G(J^{PC}) = 0^-(2^{--})$

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

NODE=M177

$\Upsilon(1D)$ MASS

NODE=M177M

NODE=M177M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
10163.7±1.4 OUR AVERAGE				
Error includes scale factor of 1.7.				
10164.5±0.8±0.5		DEL-AMO-SA..10R	BABR	$\Upsilon(3S) \rightarrow \gamma\gamma\pi^+\pi^-\ell^+\ell^-$
10161.1±0.6±1.6	38	BONVICINI 04	CLE3	$\Upsilon(3S) \rightarrow 4\gamma\ell^+\ell^-$

$\Upsilon(1D)$ 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
$\Gamma_4 \quad \pi^+\pi^- \Upsilon(1S)$	$(6.6\pm1.6) \times 10^{-3}$

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})		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.)
BONVICINI 04	PR D70 032001	G. Bonvicini <i>et al.</i>	(CLEO Collab.)

REFID=53634
REFID=49759

$\chi_{b0}(2P)$

$$J^G(J^{PC}) = 0^+(0^{++})$$

J needs confirmation.

Observed in radiative decay of the $\Upsilon(3S)$, therefore $C = +$. Branching ratio requires E1 transition, M1 is strongly disfavored, therefore $P = +$.

NODE=M079

NODE=M079

$\chi_{b0}(2P)$ MASS

VALUE (MeV)	DOCUMENT ID
10232.5 ± 0.4 ± 0.5 OUR EVALUATION	From γ energy below, using $\Upsilon(3S)$ mass = 10355.2 ± 0.5 MeV

$$m_{\chi_{b1}(2P)} - m_{\chi_{b0}(2P)}$$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
23.8 ± 1.7	LEES	14M BABR	$\Upsilon(3S) \rightarrow \gamma\gamma\mu^+\mu^-$

NODE=M079M

NODE=M079M
→ UNCHECKED ←

NODE=M079M2

NODE=M079M2

NODE=M079M2

γ ENERGY IN $\Upsilon(3S)$ DECAY

VALUE (MeV)	EVS	DOCUMENT ID	TECN	COMMENT
121.9 ± 0.4 OUR EVALUATION		Treating systematic errors as correlated		
122.2 ± 0.5 OUR AVERAGE		Error includes scale factor of 1.4. See the ideogram below.		
121.55 ± 0.16 ± 0.46		ARTUSO	05	CLEO $\Upsilon(3S) \rightarrow \gamma X$
123.0 ± 0.8	4959	¹ HEINTZ	92	CSB2 $e^+e^- \rightarrow \gamma X$
124.6 ± 1.4	17	² HEINTZ	92	CSB2 $e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$
122.3 ± 0.3 ± 0.6	9903	MORRISON	91	CLE2 $e^+e^- \rightarrow \gamma X$

¹ A systematic uncertainty on the energy scale of 0.9% not included. Supersedes NARAIN 91.

² A systematic uncertainty on the energy scale of 0.9% not included. Supersedes HEINTZ 91.

NODE=M079DM

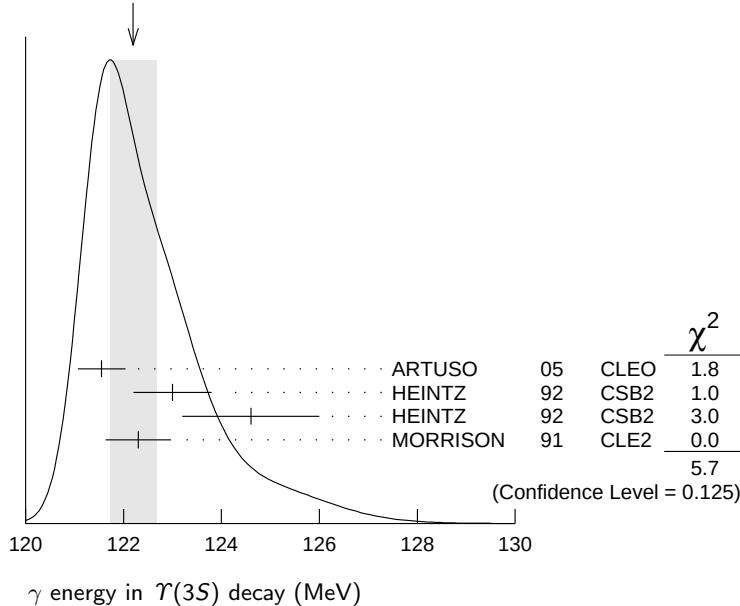
NODE=M079DM
→ UNCHECKED ←

OCCUR=2

NODE=M079DM;LINKAGE=A

NODE=M079DM;LINKAGE=B

WEIGHTED AVERAGE
122.2 ± 0.5 (Error scaled by 1.4)



$\chi_{b0}(2P)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)	Confidence level
$\Gamma_1 \quad \gamma \Upsilon(2S)$	(1.38 ± 0.30) %	
$\Gamma_2 \quad \gamma \Upsilon(1S)$	(3.8 ± 1.7) × 10 ⁻³	
$\Gamma_3 \quad D^0 X$	< 8.2 %	90%
$\Gamma_4 \quad \pi^+\pi^- K^+ K^- \pi^0$	< 3.4 × 10 ⁻⁵	90%
$\Gamma_5 \quad 2\pi^+\pi^- K^- K_S^0$	< 5 × 10 ⁻⁵	90%
$\Gamma_6 \quad 2\pi^+\pi^- K^- K_S^0 2\pi^0$	< 2.2 × 10 ⁻⁴	90%
$\Gamma_7 \quad 2\pi^+ 2\pi^- 2\pi^0$	< 2.4 × 10 ⁻⁴	90%

NODE=M079215;NODE=M079

DESIG=2

DESIG=1

DESIG=3

DESIG=4

DESIG=5

DESIG=6

DESIG=7

Γ_8	$2\pi^+ 2\pi^- K^+ K^-$	< 1.5	$\times 10^{-4}$	90%	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

 1.38 ± 0.30 OUR AVERAGE[0.046 $\pm$ 0.021 OUR 2016 AVERAGE]1.31 $\pm$ 0.27 $^{+0.13}_{-0.12}$ 3,4 LEES 14M BABR $\Upsilon(3S) \rightarrow \gamma \gamma \mu^+ \mu^-$ 3.6 $\pm$ 1.6 $\pm$ 0.3 3,5 HEINTZ 92 CSB2 $e^+ e^- \rightarrow \ell^+ \ell^- \gamma \gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<2.8 90 6 LEES 11J BABR $\Upsilon(3S) \rightarrow X \gamma$ <8.9 90 7 CRAWFORD 92B CLE2 $e^+ e^- \rightarrow \ell^+ \ell^- \gamma \gamma$ ³ Assuming $B(\Upsilon(2S) \rightarrow \mu^+ \mu^-) = (1.93 \pm 0.17)\%$ ⁴ LEES 14M reports $[\Gamma(\chi_{b0}(2P) \rightarrow \gamma \Upsilon(2S))/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P))] = (7.7 \pm 1.6) \times 10^{-4}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P)) = (5.9 \pm 0.6) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.⁵ Recalculated by us. HEINTZ 92 quotes $B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P)) \times B(\chi_{b0}(2P) \rightarrow \gamma \Upsilon(2S)) = (0.28 \pm 0.12 \pm 0.03)\%$ using $B(\Upsilon(2S) \rightarrow \mu^+ \mu^-) = (1.44 \pm 0.10)\%$. Supersedes HEINTZ 91.⁶ LEES 11J quotes a central value of $\Gamma(\chi_{b0}(2P) \rightarrow \gamma \Upsilon(2S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P))/\Gamma_{\text{total}} = (-0.3 \pm 0.2^{+0.5}_{-0.4})\%$.⁷ Using $B(\Upsilon(2S) \rightarrow \mu^+ \mu^-) = (1.37 \pm 0.26)\%$, $B(\Upsilon(3S) \rightarrow \gamma \gamma \Upsilon(2S)) \times 2 B(\Upsilon(2S) \rightarrow \mu^+ \mu^-) < 1.19 \times 10^{-4}$, and $B(\Upsilon(3S) \rightarrow \chi_{b0}(2P) \gamma) = 0.049$.

NODE=M079R2

NODE=M079R2

NEW

NODE=M079R2;LINKAGE=D

NODE=M079R2;LINKAGE=E

NODE=M079R2;LINKAGE=C

NODE=M079R2;LINKAGE=LE

NODE=M079R2;LINKAGE=B

 $\Gamma(\gamma \Upsilon(1S))/\Gamma_{\text{total}}$ **Γ_2/Γ**

VALUE (%)	CL%	DOCUMENT ID	TECN	COMMENT

 0.38 ± 0.17 OUR AVERAGE[0.009 $\pm$ 0.006 OUR 2016 AVERAGE]0.36 $\pm$ 0.17 $\pm$ 0.03 8,9 LEES 14M BABR $\Upsilon(3S) \rightarrow \gamma \gamma \mu^+ \mu^-$ 0.9 $\pm$ 0.7 $\pm$ 0.1 9,10 HEINTZ 92 CSB2 $e^+ e^- \rightarrow \ell^+ \ell^- \gamma \gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<1.2 90 11 LEES 11J BABR $\Upsilon(3S) \rightarrow X \gamma$ <2.5 90 12 CRAWFORD 92B CLE2 $e^+ e^- \rightarrow \ell^+ \ell^- \gamma \gamma$ ⁸ LEES 14M quotes $\Gamma(\chi_{b0}(2P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P))/\Gamma_{\text{total}} = (2.1 \pm 1.0) \times 10^{-4}$ combining the results from $\Upsilon(3S) \rightarrow \gamma \gamma \mu^+ \mu^-$ samples with and without photon conversions⁹ Assuming $B(\Upsilon(1S) \rightarrow \mu^+ \mu^-) = (2.48 \pm 0.05)\%$ ¹⁰ Recalculated by us. HEINTZ 92 quotes $B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P)) \times B(\chi_{b0}(2P) \rightarrow \gamma \Upsilon(1S)) = (0.05 \pm 0.04 \pm 0.01)\%$ using $B(\Upsilon(1S) \rightarrow \mu^+ \mu^-) = (2.57 \pm 0.05)\%$. Supersedes HEINTZ 91.¹¹ LEES 11J quotes a central value of $\Gamma(\chi_{b0}(2P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P))/\Gamma_{\text{total}} = (3.9 \pm 2.2^{+1.2}_{-0.6}) \times 10^{-4}$.¹² 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

NEW

NODE=M079R1;LINKAGE=D

NODE=M079R1;LINKAGE=E

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 13,14 BRIERE 08 CLEO $\Upsilon(3S) \rightarrow \gamma D^0 X$ ¹³ For $p_{D^0} > 2.5$ GeV/c.¹⁴ 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	15 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma\pi^+\pi^-K^+K^-\pi^0$ 15 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	16 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+\pi^-K^-K_S^0$ 16 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	17 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+\pi^-K^-2\pi^0$ 17 ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \rightarrow 2\pi^+\pi^-K^-K_S^02\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P))] < 13 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P)) = 5.9 \times 10^{-2}$.

NODE=M079R04
NODE=M079R04

NODE=M079R04;LINKAGE=AS

$$\Gamma(2\pi^+2\pi^-2\pi^0)/\Gamma_{\text{total}}$$

 Γ_7/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<2.4	90	18 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+2\pi^-2\pi^0$ 18 ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \rightarrow 2\pi^+2\pi^-2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P))] < 14 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P)) = 5.9 \times 10^{-2}$.

NODE=M079R05
NODE=M079R05

NODE=M079R05;LINKAGE=AS

$$\Gamma(2\pi^+2\pi^-K^+K^-)/\Gamma_{\text{total}}$$

 Γ_8/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.5	90	19 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+2\pi^-K^+K^-$ 19 ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \rightarrow 2\pi^+2\pi^-K^+K^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P))] < 9 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P)) = 5.9 \times 10^{-2}$.

NODE=M079R06
NODE=M079R06

NODE=M079R06;LINKAGE=AS

$$\Gamma(2\pi^+2\pi^-K^+K^-\pi^0)/\Gamma_{\text{total}}$$

 Γ_9/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<2.2	90	20 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+2\pi^-K^+K^-\pi^0$ 20 ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \rightarrow 2\pi^+2\pi^-K^+K^-\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P))] < 13 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P)) = 5.9 \times 10^{-2}$.

NODE=M079R07
NODE=M079R07

NODE=M079R07;LINKAGE=AS

$$\Gamma(2\pi^+2\pi^-K^+K^-2\pi^0)/\Gamma_{\text{total}}$$

 Γ_{10}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<11	90	21 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+2\pi^-K^+K^-2\pi^0$ 21 ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \rightarrow 2\pi^+2\pi^-K^+K^-2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P))] < 63 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P)) = 5.9 \times 10^{-2}$.

NODE=M079R08
NODE=M079R08

NODE=M079R08;LINKAGE=AS

$$\Gamma(3\pi^+2\pi^-K^-K_S^0\pi^0)/\Gamma_{\text{total}}$$

 Γ_{11}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<7	90	22 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+2\pi^-K^-K_S^0\pi^0$ 22 ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \rightarrow 3\pi^+2\pi^-K^-K_S^0\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P))] < 39 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P)) = 5.9 \times 10^{-2}$.

NODE=M079R09
NODE=M079R09

NODE=M079R09;LINKAGE=AS

$$\Gamma(3\pi^+3\pi^-)/\Gamma_{\text{total}}$$

 Γ_{12}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<0.7	90	23 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+3\pi^-$ 23 ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \rightarrow 3\pi^+3\pi^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P))] < 4 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P)) = 5.9 \times 10^{-2}$.

NODE=M079R10
NODE=M079R10

NODE=M079R10;LINKAGE=AS

$\Gamma(3\pi^+ 3\pi^- 2\pi^0)/\Gamma_{\text{total}}$ Γ_{13}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<12	90	24 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+ 3\pi^- 2\pi^0$ 24 ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \rightarrow 3\pi^+ 3\pi^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P))]$ $< 72 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P)) = 5.9 \times 10^{-2}$.

NODE=M079R11
NODE=M079R11

NODE=M079R11;LINKAGE=AS

 $\Gamma(3\pi^+ 3\pi^- K^+ K^-)/\Gamma_{\text{total}}$ Γ_{14}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.5	90	25 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+ 3\pi^- K^+ K^-$ 25 ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \rightarrow 3\pi^+ 3\pi^- K^+ K^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P))]$ $< 9 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P)) = 5.9 \times 10^{-2}$.

NODE=M079R12
NODE=M079R12

NODE=M079R12;LINKAGE=AS

 $\Gamma(3\pi^+ 3\pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}$ Γ_{15}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<7	90	26 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+ 3\pi^- K^+ K^- \pi^0$ 26 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	27 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 4\pi^+ 4\pi^-$ 27 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	28 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 4\pi^+ 4\pi^- 2\pi^0$ 28 ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \rightarrow 4\pi^+ 4\pi^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P))]$ $< 38 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P)) = 5.9 \times 10^{-2}$.

NODE=M079R15
NODE=M079R15

NODE=M079R15;LINKAGE=AS

 $\Gamma(\chi_{b0}(2P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P))/\Gamma_{\text{total}}$
 $\Gamma_2/\Gamma \times \Gamma_{22}^{\Upsilon(3S)}/\Gamma \Upsilon(3S)$

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<8.2	90	29 LEES	11J BABR	$\Upsilon(3S) \rightarrow X\gamma$ 29 LEES 11J quotes a central value of $\Gamma(\chi_{b0}(2P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P))/\Gamma_{\text{total}} = (3.9 \pm 2.2^{+1.2}_{-0.6}) \times 10^{-4}$ and derives a 90% CL upper limit of $B(\chi_{b0}(2P) \rightarrow \gamma \Upsilon(1S)) < 1.2\%$ using $B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P)) = (5.9 \pm 0.6)\%$.

NODE=M079B01
NODE=M079B01

NODE=M079B01;LINKAGE=LE

 $B(\chi_{b0}(2P) \rightarrow \gamma \Upsilon(1S)) \times B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P)) \times B(\Upsilon(1S) \rightarrow \ell^+ \ell^-)$

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
1.4$\pm$0.9 OUR AVERAGE			

1.7 $^{+1.5+0.1}_{-1.4-1.2}$	30 LEES	14M BABR	$\Upsilon(3S) \rightarrow \gamma \gamma \mu^+ \mu^-$
1.3 $\pm$ 1.0 $\pm$ 0.3	31 HEINTZ	92 CSB2	$\Upsilon(3S) \rightarrow \gamma \gamma \ell^+ \ell^-$
30 From a sample of $\Upsilon(3S) \rightarrow \gamma \gamma \mu^+ \mu^-$ with one converted photon			
31 Calculated by us. HEINTZ 92 quotes $B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P)) \times B(\chi_{b0}(2P) \rightarrow \gamma \Upsilon(1S)) = (0.05 \pm 0.04 \pm 0.01)\%$ using $B(\Upsilon(1S) \rightarrow \mu^+ \mu^-) = (2.57 \pm 0.05)\%$.			

NODE=M079A02
NODE=M079A02NODE=M079A02;LINKAGE=A
NODE=M079A02;LINKAGE=K $[B(\chi_{b0}(2P) \rightarrow \gamma \Upsilon(1S)) \times B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P))] / [B(\chi_{b1}(2P) \rightarrow \gamma \Upsilon(1S)) \times B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P))]$

VALUE (%)	DOCUMENT ID	TECN	COMMENT
1.71$\pm$0.80	32 LEES	14M BABR	$\Upsilon(3S) \rightarrow \gamma \gamma \mu^+ \mu^-$
32 From a sample of $\Upsilon(3S) \rightarrow \gamma \gamma \mu^+ \mu^-$ without converted photons			

NODE=M079A00
NODE=M079A00

NODE=M079A00;LINKAGE=A

 $\Gamma(\chi_{b0}(2P) \rightarrow \gamma \Upsilon(2S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P))/\Gamma_{\text{total}}$
 $\Gamma_1/\Gamma \times \Gamma_{22}^{\Upsilon(3S)}/\Gamma \Upsilon(3S)$

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<1.6	90	33 LEES	11J BABR	$\Upsilon(3S) \rightarrow X\gamma$ 33 LEES 11J quotes a central value of $\Gamma(\chi_{b0}(2P) \rightarrow \gamma \Upsilon(2S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P))/\Gamma_{\text{total}} = (-0.3 \pm 0.2^{+0.5}_{-0.4})\%$ and derives a 90% CL upper limit of $B(\chi_{b0}(2P) \rightarrow \gamma \Upsilon(2S)) < 2.8\%$ using $B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P)) = (5.9 \pm 0.6)\%$.

NODE=M079B02
NODE=M079B02

NODE=M079B02;LINKAGE=LE

$$B(\chi_{b0}(2P) \rightarrow \gamma \Upsilon(2S)) \times B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P)) \times B(\Upsilon(2S) \rightarrow \ell^+ \ell^-)$$
VALUE (units 10^{-5})

DOCUMENT ID

TECN

COMMENT

4.4 ± 1.6 OUR AVERAGE6.6^{+4.9+2.0}_{-4.0-0.3}³⁴ LEES

14M BABR

 $\Upsilon(3S) \rightarrow \gamma \gamma \mu^+ \mu^-$

4.0 ± 1.7 ± 0.3

³⁵ HEINTZ

92 CSB2

 $\Upsilon(3S) \rightarrow \gamma \gamma \ell^+ \ell^-$ ³⁴ From a sample of $\Upsilon(3S) \rightarrow \gamma \gamma \mu^+ \mu^-$ with one converted photon³⁵ Calculated by us. HEINTZ 92 quotes $B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P)) \times B(\chi_{b0}(2P) \rightarrow \gamma \Upsilon(2S)) = (0.28 \pm 0.12 \pm 0.03)\%$ using $B(\Upsilon(2S) \rightarrow \mu^+ \mu^-) = (1.44 \pm 0.10)\%$.NODE=M079A03
NODE=M079A03NODE=M079A03;LINKAGE=A
NODE=M079A03;LINKAGE=B
$$[B(\chi_{b0}(2P) \rightarrow \gamma \Upsilon(2S)) \times B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P))] / [B(\chi_{b1}(2P) \rightarrow \gamma \Upsilon(2S)) \times B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P))]$$

VALUE (%)

DOCUMENT ID

TECN

COMMENT

3.31 ± 0.56³⁶ LEES

14M BABR

 $\Upsilon(3S) \rightarrow \gamma \gamma \mu^+ \mu^-$ ³⁶ From a sample of $\Upsilon(3S) \rightarrow \gamma \gamma \mu^+ \mu^-$ without converted photonsNODE=M079A01
NODE=M079A01

NODE=M079A01;LINKAGE=A

 $\chi_{b0}(2P)$ REFERENCES

LEES	14M	PR D90 112010	J.P. Lees <i>et al.</i>	(BABAR Collab.)
LEES	11J	PR D84 072002	J.P. Lees <i>et al.</i>	(BABAR Collab.)
ASNER	08A	PR D78 091103	D.M. Asner <i>et al.</i>	(CLEO Collab.)
BRIERE	08	PR D78 092007	R.A. Briere <i>et al.</i>	(CLEO Collab.)
ARTUSO	05	PRL 94 032001	M. Artuso <i>et al.</i>	(CLEO Collab.)
CRAWFORD	92B	PL B294 139	G. Crawford <i>et al.</i>	(CLEO Collab.)
HEINTZ	92	PR D46 1928	U. Heintz <i>et al.</i>	(CUSB II Collab.)
HEINTZ	91	PRL 66 1563	U. Heintz <i>et al.</i>	(CUSB Collab.)
MORRISON	91	PRL 67 1696	R.J. Morrison <i>et al.</i>	(CLEO Collab.)
NARAIN	91	PRL 66 3113	M. Narain <i>et al.</i>	(CUSB Collab.)

NODE=M079

REFID=56343
REFID=53936
REFID=52574
REFID=52577
REFID=50454
REFID=43177
REFID=43604
REFID=41580
REFID=41634
REFID=41586

NODE=M080

 $\chi_{b1}(2P)$

$$J^G(J^{PC}) = 0^+(1^{++})$$

J needs confirmation.

Observed in radiative decay of the $\Upsilon(3S)$, therefore $C = +$. Branching ratio requires E1 transition, M1 is strongly disfavored, therefore $P = +$.

NODE=M080

 $\chi_{b1}(2P)$ MASS

VALUE (MeV)

DOCUMENT ID

10255.46 ± 0.22 ± 0.50 OUR EVALUATION From γ energy below, using $\Upsilon(3S)$ mass = 10355.2 ± 0.5 MeV

NODE=M080M

NODE=M080M
→ UNCHECKED ← **$m_{\chi_{b1}(2P)} - m_{\chi_{b0}(2P)}$**

VALUE (MeV)

DOCUMENT ID

TECN

COMMENT

23.5 ± 0.7 ± 0.7¹ HEINTZ

92 CSB2

 $e^+ e^- \rightarrow \gamma X, \ell^+ \ell^- \gamma \gamma$ ¹ From the average photon energy for inclusive and exclusive events. Supersedes NARAIN 91.

NODE=M080M2

NODE=M080M2

NODE=M080M2;LINKAGE=A

 γ ENERGY IN $\Upsilon(3S)$ DECAY

VALUE (MeV)

EVTS

DOCUMENT ID

TECN

COMMENT

99.26 ± 0.22 OUR EVALUATION

Treating systematic errors as correlated

99.53 ± 0.23 OUR AVERAGE

Error includes scale factor of 1.3. See the ideogram below.

99.15 ± 0.07 ± 0.25

ARTUSO

05 CLEO

 $\Upsilon(3S) \rightarrow \gamma X$

99 ± 1

169

CRAWFORD

92B CLE2

 $e^+ e^- \rightarrow \ell^+ \ell^- \gamma \gamma$

100.1 ± 0.4

11147

² HEINTZ

92 CSB2

 $e^+ e^- \rightarrow \gamma X$

100.2 ± 0.5

223

³ HEINTZ

92 CSB2

 $e^+ e^- \rightarrow \ell^+ \ell^- \gamma \gamma$

99.5 ± 0.1 ± 0.5

25759

MORRISON

91 CLE2

 $e^+ e^- \rightarrow \gamma X$

NODE=M080DM

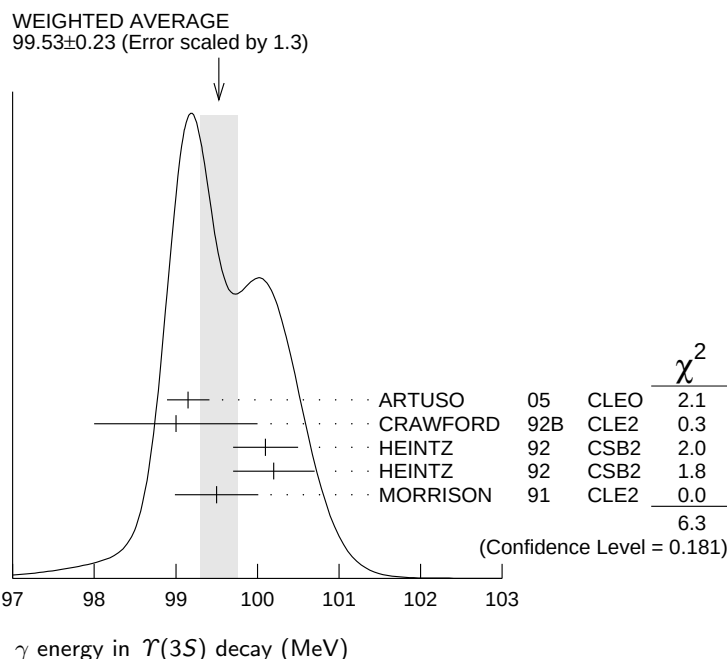
NODE=M080DM
→ UNCHECKED ←

OCCUR=2

- ²A systematic uncertainty on the energy scale of 0.9% not included. Supersedes NARAIN 91.
- ³A systematic uncertainty on the energy scale of 0.9% not included. Supersedes HEINTZ 91.

NODE=M080DM;LINKAGE=A

NODE=M080DM;LINKAGE=B

 **$\chi_{b1}(2P)$ DECAY MODES**

NODE=M080215;NODE=M080

Mode	Fraction (Γ_i/Γ)	
Γ_1 $\omega \Upsilon(1S)$	$(1.63^{+0.40}_{-0.34})\%$	DESIG=3
Γ_2 $\gamma \Upsilon(2S)$	$(18.1 \pm 1.9)\%$	DESIG=2
Γ_3 $\gamma \Upsilon(1S)$	$(9.9 \pm 1.0)\%$	DESIG=1
Γ_4 $\pi\pi\chi_{b1}(1P)$	$(9.1 \pm 1.3) \times 10^{-3}$	DESIG=4
Γ_5 $D^0 X$	$(8.8 \pm 1.7)\%$	DESIG=5
Γ_6 $\pi^+\pi^-K^+K^-\pi^0$	$(3.1 \pm 1.0) \times 10^{-4}$	DESIG=6
Γ_7 $2\pi^+\pi^-K^-K_S^0$	$(1.1 \pm 0.5) \times 10^{-4}$	DESIG=7
Γ_8 $2\pi^+\pi^-K^-K_S^0 2\pi^0$	$(7.7 \pm 3.2) \times 10^{-4}$	DESIG=8
Γ_9 $2\pi^+ 2\pi^- 2\pi^0$	$(5.9 \pm 2.0) \times 10^{-4}$	DESIG=9
Γ_{10} $2\pi^+ 2\pi^- K^+ K^-$	$(10 \pm 4) \times 10^{-5}$	DESIG=10
Γ_{11} $2\pi^+ 2\pi^- K^+ K^- \pi^0$	$(5.5 \pm 1.8) \times 10^{-4}$	DESIG=11
Γ_{12} $2\pi^+ 2\pi^- K^+ K^- 2\pi^0$	$(10 \pm 4) \times 10^{-4}$	DESIG=12
Γ_{13} $3\pi^+ 2\pi^- K^- K_S^0 \pi^0$	$(6.7 \pm 2.6) \times 10^{-4}$	DESIG=13
Γ_{14} $3\pi^+ 3\pi^-$	$(1.2 \pm 0.4) \times 10^{-4}$	DESIG=14
Γ_{15} $3\pi^+ 3\pi^- 2\pi^0$	$(1.2 \pm 0.4) \times 10^{-3}$	DESIG=15
Γ_{16} $3\pi^+ 3\pi^- K^+ K^-$	$(2.0 \pm 0.8) \times 10^{-4}$	DESIG=16
Γ_{17} $3\pi^+ 3\pi^- K^+ K^- \pi^0$	$(6.1 \pm 2.2) \times 10^{-4}$	DESIG=17
Γ_{18} $4\pi^+ 4\pi^-$	$(1.7 \pm 0.6) \times 10^{-4}$	DESIG=18
Γ_{19} $4\pi^+ 4\pi^- 2\pi^0$	$(1.9 \pm 0.7) \times 10^{-3}$	DESIG=19

 $\chi_{b1}(2P)$ BRANCHING RATIOS

NODE=M080220

$\Gamma(\omega \Upsilon(1S))/\Gamma_{\text{total}}$					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	$\Upsilon(3S) \rightarrow \gamma \omega \Upsilon(1S)$	

NODE=M080R3
NODE=M080R3

⁴Using $B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P)) = (11.3 \pm 0.6)\%$ and $B(\Upsilon(1S) \rightarrow \ell^+ \ell^-) = 2$
 $B(\Upsilon(1S) \rightarrow \mu^+ \mu^-) = 2 (2.48 \pm 0.06)\%$.

NODE=M080R3;LINKAGE=CR

$\Gamma(\gamma \Upsilon(2S))/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.181±0.019 OUR AVERAGE				
[0.199 ± 0.019 OUR 2016 AVERAGE]				
0.211±0.017±0.019		^{5,6} LEES	14M BABR	$\Upsilon(3S) \rightarrow \gamma\gamma\mu^+\mu^-$
0.190±0.018±0.017	4.3k	⁷ LEES	11J BABR	$\Upsilon(3S) \rightarrow X\gamma$
0.206±0.035±0.019		^{5,8} CRAWFORD	92B CLE2	$e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$
0.132±0.018±0.012		^{5,9} HEINTZ	92 CSB2	$e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$

⁵ Assuming $B(\Upsilon(2S) \rightarrow \mu^+\mu^-) = (1.97 \pm 0.17)\%$

⁶ LEES 14M quotes $\Gamma(\chi_{b1}(2P) \rightarrow \gamma \Upsilon(2S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P))/\Gamma_{\text{total}} = (2.66 \pm 0.22)\%$ combining the results from $\Upsilon(3S) \rightarrow \gamma\gamma\mu^+\mu^-$ samples with and without photon conversions

⁷ LEES 11J reports $[\Gamma(\chi_{b1}(2P) \rightarrow \gamma \Upsilon(2S))/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P))] = (2.4 \pm 0.1 \pm 0.2) \times 10^{-2}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P)) = (12.6 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

⁸ CRAWFORD 92B quotes $B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P)) \times B(\chi_{b1}(2P) \rightarrow \gamma \Upsilon(2S)) \times 2 B(\Upsilon(2S) \rightarrow \ell^+\ell^-) = (10.23 \pm 1.20 \pm 1.26) 10^{-4}$.

⁹ Recalculated by us. HEINTZ 92 quotes $B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P)) \times B(\chi_{b1}(2P) \rightarrow \gamma \Upsilon(2S)) = (2.29 \pm 0.23 \pm 0.21) \%$ using $B(\Upsilon(2S) \rightarrow \mu^+\mu^-) = (1.44 \pm 0.10)\%$. Supersedes HEINTZ 91.

NODE=M080R2
NODE=M080R2
NEW

NODE=M080R2;LINKAGE=D
NODE=M080R2;LINKAGE=E

NODE=M080R2;LINKAGE=LE

NODE=M080R2;LINKAGE=B

NODE=M080R2;LINKAGE=C

 $\Gamma(\gamma \Upsilon(1S))/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.099±0.010 OUR AVERAGE				
[0.092 ± 0.008 OUR 2016 AVERAGE Scale factor = 1.1]				
0.107±0.006±0.010		^{10,11} LEES	14M BABR	$\Upsilon(3S) \rightarrow \gamma\gamma\mu^+\mu^-$
0.098±0.005±0.009	15k	¹² LEES	11J BABR	$\Upsilon(3S) \rightarrow X\gamma$
0.103±0.023±0.009		^{10,13} CRAWFORD	92B CLE2	$e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$
0.075±0.010±0.007		^{10,14} HEINTZ	92 CSB2	$e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$

¹⁰ Assuming $B(\Upsilon(1S) \rightarrow \ell^+\ell^-) = (2.48 \pm 0.05)\%$

¹¹ LEES 14M quotes $\Gamma(\chi_{b1}(2P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P))/\Gamma_{\text{total}} = (13.48 \pm 0.72) \times 10^{-3}$ combining the results from samples of $\Upsilon(3S) \rightarrow \gamma\gamma\mu^+\mu^-$ with and without converted photons

¹² LEES 11J reports $[\Gamma(\chi_{b1}(2P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P))] = (12.4 \pm 0.3 \pm 0.6) \times 10^{-3}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P)) = (12.6 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

¹³ CRAWFORD 92B quotes $B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P)) \times B(\chi_{b1}(2P) \rightarrow \gamma \Upsilon(1S)) \times 2 B(\Upsilon(1S) \rightarrow \ell^+\ell^-) = (6.47 \pm 1.12 \pm 0.82) 10^{-4}$.

¹⁴ Recalculated by us. HEINTZ 92 quotes $B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P)) \times B(\chi_{b1}(2P) \rightarrow \gamma \Upsilon(1S)) = (0.91 \pm 0.11 \pm 0.06)\%$ using $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.57 \pm 0.05)\%$. Supersedes HEINTZ 91.

NODE=M080R1
NODE=M080R1
NEW

NODE=M080R1;LINKAGE=D
NODE=M080R1;LINKAGE=E

NODE=M080R1;LINKAGE=LE

NODE=M080R1;LINKAGE=B

NODE=M080R1;LINKAGE=F

 $\Gamma(\pi\pi\chi_{b1}(1P))/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
9.1±1.3 OUR AVERAGE				
9.2±1.1±0.8	31k	¹⁵ LEES	11C BABR	$e^+e^- \rightarrow \pi^+\pi^-X$
8.6±2.3±2.1		¹⁶ CAWLFIELD	06 CLE3	$\Upsilon(3S) \rightarrow 2(\gamma\pi\ell)$

¹⁵ LEES 11C measures $B(\Upsilon(3S) \rightarrow \chi_{b1}(2P)X) \times B(\chi_{b1}(2P) \rightarrow \chi_{b1}(1P)\pi^+\pi^-) = (1.16 \pm 0.07 \pm 0.12) \times 10^{-3}$. We derive the value assuming $B(\Upsilon(3S) \rightarrow \chi_{b1}(2P)X) = B(\Upsilon(3S) \rightarrow \chi_{b1}(2P)\gamma) = (12.6 \pm 1.2) \times 10^{-2}$.

¹⁶ CAWLFIELD 06 quote $\Gamma(\chi_b(2P) \rightarrow \pi\pi\chi_b(1P)) = 0.83 \pm 0.22 \pm 0.08 \pm 0.19$ keV assuming l-spin conservation, no D-wave contribution, $\Gamma(\chi_{b1}(2P)) = 96 \pm 16$ keV, and $\Gamma(\chi_{b2}(2P)) = 138 \pm 19$ keV.

NODE=M080R4
NODE=M080R4

NODE=M080R4;LINKAGE=LE

NODE=M080R4;LINKAGE=CA

 $\Gamma(D^0X)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
8.8±1.5±0.8				
	2243	¹⁷ BRIERE	08 CLEO	$\Upsilon(3S) \rightarrow \gamma D^0 X$

¹⁷ For $p_{D^0} > 2.5$ GeV/c.

NODE=M080R01
NODE=M080R01

NODE=M080R01;LINKAGE=BR

$$\Gamma(\pi^+\pi^-K^+K^-\pi^0)/\Gamma_{\text{total}} \quad \Gamma_6/\Gamma$$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
3.1±1.0±0.3	30	18 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma\pi^+\pi^-K^+K^-\pi^0$
18 ASNER 08A reports $[\Gamma(\chi_{b1}(2P) \rightarrow \pi^+\pi^-K^+K^-\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P))]$ = $(39 \pm 8 \pm 9) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P)) = (12.6 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M080R02
NODE=M080R02

NODE=M080R02;LINKAGE=AS

$$\Gamma(2\pi^+\pi^-K^-K_S^0)/\Gamma_{\text{total}} \quad \Gamma_7/\Gamma$$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.1±0.5±0.1	10	19 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+\pi^-K^-K_S^0$
19 ASNER 08A reports $[\Gamma(\chi_{b1}(2P) \rightarrow 2\pi^+\pi^-K^-K_S^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P))]$ = $(14 \pm 5 \pm 3) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P)) = (12.6 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M080R03
NODE=M080R03

NODE=M080R03;LINKAGE=AS

$$\Gamma(2\pi^+\pi^-K^-K_S^0 2\pi^0)/\Gamma_{\text{total}} \quad \Gamma_8/\Gamma$$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
7.7±3.1±0.7	15	20 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+\pi^-K^-2\pi^0$
20 ASNER 08A reports $[\Gamma(\chi_{b1}(2P) \rightarrow 2\pi^+\pi^-K^-K_S^0 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P))]$ = $(97 \pm 30 \pm 26) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P)) = (12.6 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M080R04
NODE=M080R04

NODE=M080R04;LINKAGE=AS

$$\Gamma(2\pi^+2\pi^-2\pi^0)/\Gamma_{\text{total}} \quad \Gamma_9/\Gamma$$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
5.9±2.0±0.5	36	21 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+2\pi^-2\pi^0$
21 ASNER 08A reports $[\Gamma(\chi_{b1}(2P) \rightarrow 2\pi^+2\pi^-2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P))]$ = $(74 \pm 16 \pm 19) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P)) = (12.6 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M080R05
NODE=M080R05

NODE=M080R05;LINKAGE=AS

$$\Gamma(2\pi^+2\pi^-K^+K^-)/\Gamma_{\text{total}} \quad \Gamma_{10}/\Gamma$$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.0±0.4±0.1	12	22 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+2\pi^-K^+K^-$
22 ASNER 08A reports $[\Gamma(\chi_{b1}(2P) \rightarrow 2\pi^+2\pi^-K^+K^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P))]$ = $(12 \pm 4 \pm 3) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P)) = (12.6 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M080R06
NODE=M080R06

NODE=M080R06;LINKAGE=AS

$$\Gamma(2\pi^+2\pi^-K^+K^-\pi^0)/\Gamma_{\text{total}} \quad \Gamma_{11}/\Gamma$$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
5.5±1.7±0.5	38	23 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+2\pi^-K^+K^-\pi^0$
23 ASNER 08A reports $[\Gamma(\chi_{b1}(2P) \rightarrow 2\pi^+2\pi^-K^+K^-\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P))]$ = $(69 \pm 13 \pm 17) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P)) = (12.6 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M080R07
NODE=M080R07

NODE=M080R07;LINKAGE=AS

$$\Gamma(2\pi^+2\pi^-K^+K^-2\pi^0)/\Gamma_{\text{total}} \quad \Gamma_{12}/\Gamma$$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
9.6±3.5±0.9	27	24 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+2\pi^-K^+K^-2\pi^0$
24 ASNER 08A reports $[\Gamma(\chi_{b1}(2P) \rightarrow 2\pi^+2\pi^-K^+K^-2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P))]$ = $(121 \pm 29 \pm 33) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P)) = (12.6 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M080R08
NODE=M080R08

NODE=M080R08;LINKAGE=AS

$$\Gamma(3\pi^+2\pi^-K^-K_S^0\pi^0)/\Gamma_{\text{total}} \quad \Gamma_{13}/\Gamma$$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
6.7±2.5±0.6	17	25 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+2\pi^-K^-K_S^0\pi^0$
25 ASNER 08A reports $[\Gamma(\chi_{b1}(2P) \rightarrow 3\pi^+2\pi^-K^-K_S^0\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P))]$ = $(85 \pm 23 \pm 22) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P)) = (12.6 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M080R09
NODE=M080R09

NODE=M080R09;LINKAGE=AS

$\Gamma(3\pi^+3\pi^-)/\Gamma_{\text{total}}$ Γ_{14}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.2±0.4±0.1	18	²⁶ ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+ 3\pi^-$
²⁶ ASNER 08A reports $[\Gamma(\chi_{b1}(2P) \rightarrow 3\pi^+ 3\pi^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P))]$ $= (15 \pm 4 \pm 3) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P)) =$ $(12.6 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M080R10
 NODE=M080R10

NODE=M080R10;LINKAGE=AS

 $\Gamma(3\pi^+3\pi^-2\pi^0)/\Gamma_{\text{total}}$ Γ_{15}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
12±4±1	44	²⁷ ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+ 3\pi^- 2\pi^0$
²⁷ ASNER 08A reports $[\Gamma(\chi_{b1}(2P) \rightarrow 3\pi^+ 3\pi^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P))]$ $= (150 \pm 30 \pm 40) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P)) =$ $(12.6 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M080R11
 NODE=M080R11

NODE=M080R11;LINKAGE=AS

 $\Gamma(3\pi^+3\pi^-K^+K^-)/\Gamma_{\text{total}}$ Γ_{16}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.0±0.7±0.2	16	²⁸ ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+ 3\pi^- K^+ K^-$
²⁸ ASNER 08A reports $[\Gamma(\chi_{b1}(2P) \rightarrow 3\pi^+ 3\pi^- K^+ K^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P))]$ $= (25 \pm 7 \pm 6) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P)) =$ $(12.6 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M080R12
 NODE=M080R12

NODE=M080R12;LINKAGE=AS

 $\Gamma(3\pi^+3\pi^-K^+K^-\pi^0)/\Gamma_{\text{total}}$ Γ_{17}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
6.1±2.1±0.6	25	²⁹ ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+ 3\pi^- K^+ K^-\pi^0$
²⁹ ASNER 08A reports $[\Gamma(\chi_{b1}(2P) \rightarrow 3\pi^+ 3\pi^- K^+ K^-\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P))]$ $= (77 \pm 17 \pm 21) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P)) =$ $(12.6 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M080R13
 NODE=M080R13

NODE=M080R13;LINKAGE=AS

 $\Gamma(4\pi^+4\pi^-)/\Gamma_{\text{total}}$ Γ_{18}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.7±0.6±0.2	16	³⁰ ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 4\pi^+ 4\pi^-$
³⁰ ASNER 08A reports $[\Gamma(\chi_{b1}(2P) \rightarrow 4\pi^+ 4\pi^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P))]$ $= (22 \pm 6 \pm 5) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P)) =$ $(12.6 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M080R14
 NODE=M080R14

NODE=M080R14;LINKAGE=AS

 $\Gamma(4\pi^+4\pi^-2\pi^0)/\Gamma_{\text{total}}$ Γ_{19}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
19±7±2	41	³¹ ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 4\pi^+ 4\pi^- 2\pi^0$
³¹ ASNER 08A reports $[\Gamma(\chi_{b1}(2P) \rightarrow 4\pi^+ 4\pi^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P))]$ $= (241 \pm 47 \pm 72) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P)) =$ $(12.6 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M080R15
 NODE=M080R15

NODE=M080R15;LINKAGE=AS

 $\chi_{b1}(2P)$ Cross-Particle Branching Ratios

NODE=M080230

$$\Gamma(\chi_{b1}(2P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P))/\Gamma_{\text{total}}$$

$$\Gamma_3/\Gamma \times \Gamma_{21}^{\Upsilon(3S)}/\Gamma \Upsilon(3S)$$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
12.4±0.3±0.6	15k	LEES	11J BABR	$\Upsilon(3S) \rightarrow X\gamma$

NODE=M080B01
 NODE=M080B01

 $B(\chi_{b1}(2P) \rightarrow \gamma \Upsilon(1S)) \times B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P)) \times B(\Upsilon(1S) \rightarrow \ell^+ \ell^-)$

NODE=M080A00
 NODE=M080A00

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.9 ±0.4 OUR AVERAGE	Error includes scale factor of 1.9. See the ideogram below.			
3.52 ^{+0.28+0.17} _{-0.27-0.18}		³² LEES	14M BABR	$\Upsilon(3S) \rightarrow \gamma \gamma \mu^+ \mu^-$
3.24±0.56±0.41	58	³³ CRAWFORD	92B CLE2	$\Upsilon(3S) \rightarrow \gamma \gamma \ell^+ \ell^-$
2.34±0.28±0.15		³⁴ HEINTZ	92 CSB2	$\Upsilon(3S) \rightarrow \gamma \gamma \ell^+ \ell^-$

32 From a sample of $\Upsilon(3S) \rightarrow \gamma\gamma\mu^+\mu^-$ with one converted photon

33 CRAWFORD 92B quotes $2 \times B(\Upsilon(3S) \rightarrow \gamma\chi_{bJ}(2P))B(\chi_{bJ}(2P) \rightarrow \gamma\Upsilon(nS))B(\Upsilon(nS) \rightarrow \ell^+\ell^-)$

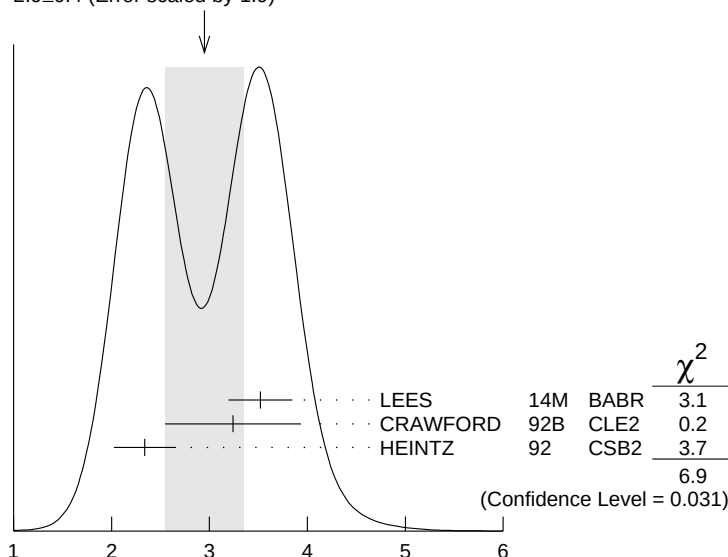
34 Calculated by us. HEINTZ 92 quotes $B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P)) \times B(\chi_{b1}(2P) \rightarrow \gamma\Upsilon(1S)) = (0.91 \pm 0.11 \pm 0.06)\%$ using $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.57 \pm 0.05)\%$.

NODE=M080A00;LINKAGE=A

NODE=M080A00;LINKAGE=C

NODE=M080A00;LINKAGE=B

WEIGHTED AVERAGE
2.9±0.4 (Error scaled by 1.9)



$B(\chi_{b1}(2P) \rightarrow \gamma\Upsilon(1S)) \times B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P)) \times B(\Upsilon(1S) \rightarrow \ell^+\ell^-)$
(units 10^{-4})

$\Gamma(\chi_{b1}(2P) \rightarrow \gamma\Upsilon(2S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P))/\Gamma_{\text{total}}$
 $\Gamma_2/\Gamma \times \Gamma_{21}^{\Upsilon(3S)}/\Gamma^{\Upsilon(3S)}$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
2.4±0.1±0.2	4.3k	LEES	11J BABR	$\Upsilon(3S) \rightarrow X\gamma$

NODE=M080B02
NODE=M080B02

$B(\chi_{b1}(2P) \rightarrow \gamma\Upsilon(2S)) \times B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P)) \times B(\Upsilon(2S) \rightarrow \ell^+\ell^-)$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
3.8 ±0.6 OUR AVERAGE		Error includes scale factor of 1.8. See the ideogram below.		

NODE=M080A01
NODE=M080A01

4.95 ^{+0.75+1.01} _{-0.70-0.24}		35 LEES	14M BABR	$\Upsilon(3S) \rightarrow \gamma\gamma\mu^+\mu^-$
5.12±0.60±0.63	111	36 CRAWFORD	92B CLE2	$\Upsilon(3S) \rightarrow \gamma\gamma\ell^+\ell^-$
3.30±0.33±0.20		37 HEINTZ	92 CSB2	$\Upsilon(3S) \rightarrow \gamma\gamma\ell^+\ell^-$

35 From a sample of $\Upsilon(3S) \rightarrow \gamma\gamma\mu^+\mu^-$ with one converted photon

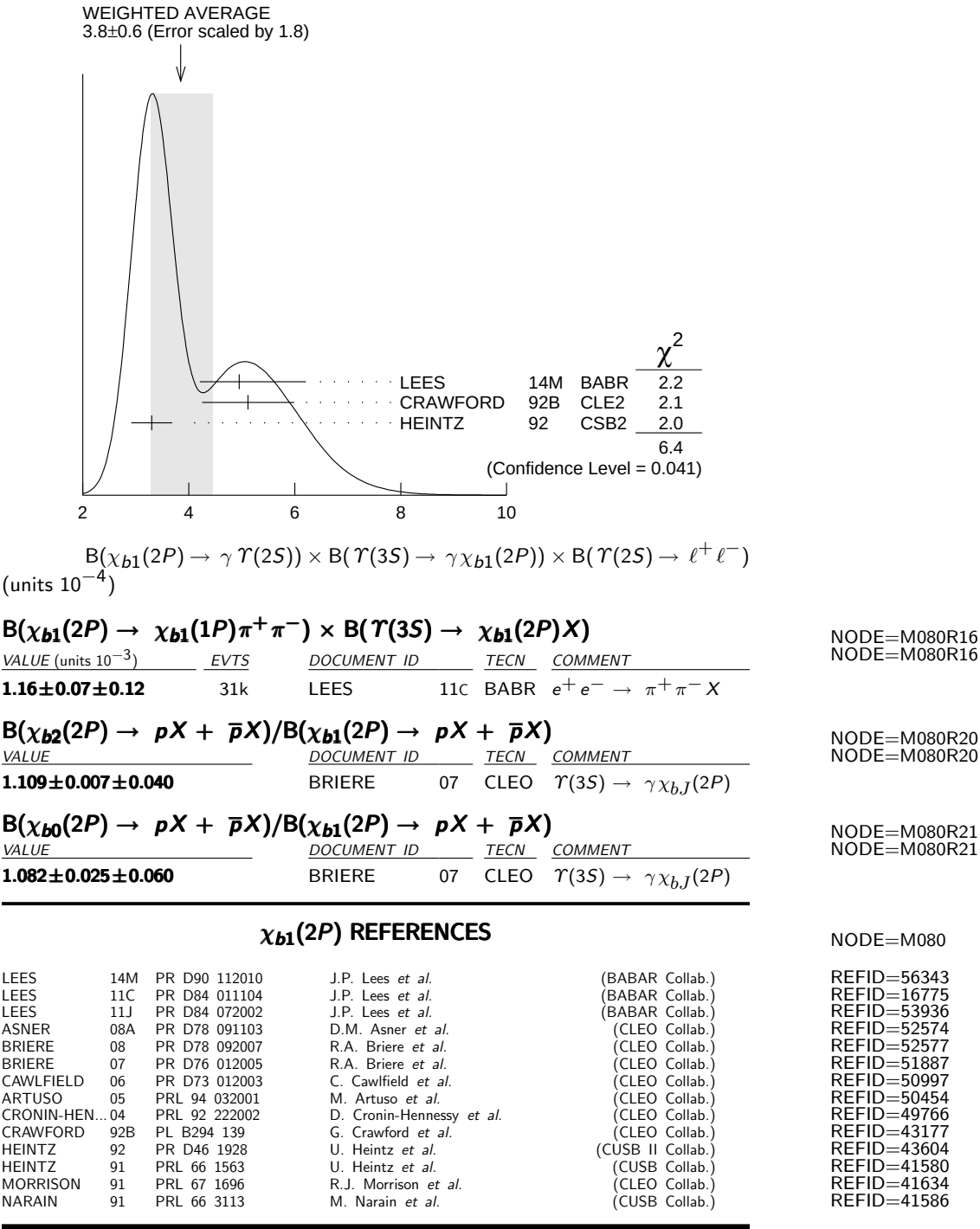
36 CRAWFORD 92B quotes $2 \times B(\Upsilon(3S) \rightarrow \gamma\chi_{bJ}(2P))B(\chi_{bJ}(2P) \rightarrow \gamma\Upsilon(nS))B(\Upsilon(nS) \rightarrow \ell^+\ell^-)$

37 Calculated by us. HEINTZ 92 quotes $B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P)) \times B(\chi_{b1}(2P) \rightarrow \gamma\Upsilon(2S)) = (2.29 \pm 0.23 \pm 0.21)\%$ using $B(\Upsilon(2S) \rightarrow \mu^+\mu^-) = (1.44 \pm 0.10)\%$.

NODE=M080A01;LINKAGE=A

NODE=M080A01;LINKAGE=C

NODE=M080A01;LINKAGE=B



$$h_b(2P)$$

$$J^{PC} = ?^?(1^{+-})$$

OMITTED FROM SUMMARY TABLE
Quantum numbers are quark model predictions.

$h_b(2P)$ MASS

<i>VALUE</i> (MeV)	<i>EVTS</i>	<i>DOCUMENT ID</i>	<i>TECN</i>	<i>COMMENT</i>
10259.8±0.5±1.1	90k	MIZUK	12	BELL $e^+e^- \rightarrow \pi^+\pi^-$ hadrons
• • • We do not use the following data for averages, fits, limits, etc. • • •				
10259.8±0.6 ^{+1.4} _{-1.0}	83.9k	¹ ADACHI	12	BELL 10.86 $e^+e^- \rightarrow \pi^+\pi^-$ MM
¹ Superseded by MIZUK 12.				

$h_b(2P)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 hadrons	not seen
Γ_2 $\eta_b(1S)\gamma$	(22± 5) %
Γ_3 $\eta_b(2S)\gamma$	(48±13) %

$h_b(2P)$ BRANCHING RATIOS

$\Gamma(\text{hadrons})/\Gamma_{\text{total}}$				Γ_1/Γ
<i>VALUE</i>	<i>EVTS</i>	<i>DOCUMENT ID</i>	<i>TECN</i>	<i>COMMENT</i>
not seen	83.9k	ADACHI	12	BELL 10.86 $e^+e^- \rightarrow \pi^+\pi^-$ MM
$\Gamma(\eta_b(1S)\gamma)/\Gamma_{\text{total}}$				Γ_2/Γ
<i>VALUE</i> (units 10 ⁻²)	<i>EVTS</i>	<i>DOCUMENT ID</i>	<i>TECN</i>	<i>COMMENT</i>
22.3±3.8^{+3.1}_{-3.3}	10k	MIZUK	12	BELL $e^+e^- \rightarrow (\gamma)\pi^+\pi^-$ hadrons
$\Gamma(\eta_b(2S)\gamma)/\Gamma_{\text{total}}$				Γ_3/Γ
<i>VALUE</i> (units 10 ⁻²)	<i>EVTS</i>	<i>DOCUMENT ID</i>	<i>TECN</i>	<i>COMMENT</i>
47.5±10.5^{+6.8}_{-7.7}	26k	MIZUK	12	BELL $e^+e^- \rightarrow (\gamma)\pi^+\pi^-$ hadrons

$h_b(2P)$ REFERENCES

ADACHI	12	PRL 108 032001	I. Adachi <i>et al.</i>	(BELLE Collab.)
MIZUK	12	PRL 109 232002	R. Mizuk <i>et al.</i>	(BELLE Collab.)

NODE=M205

NODE=M205

NODE=M205M

NODE=M205M

NODE=M205M;LINKAGE=AD

NODE=M205215;NODE=M205

DESIG=1

DESIG=2

DESIG=3

NODE=M205225

NODE=M205R01
NODE=M205R01

NODE=M205R02
NODE=M205R02

NODE=M205R03
NODE=M205R03

NODE=M205

REFID=53962
REFID=54718

$\chi_{b2}(2P)$

$$I^G(J^{PC}) = 0^+(2^{++})$$

J needs confirmation.

Observed in radiative decay of the $\Upsilon(3S)$, therefore $C = +$. Branching ratio requires E1 transition, M1 is strongly disfavored, therefore $P = +$.

NODE=M081

NODE=M081

$\chi_{b2}(2P)$ MASS

VALUE (MeV)

DOCUMENT ID

10268.65 ± 0.22 ± 0.50 OUR EVALUATION From γ energy below, using $\Upsilon(3S)$ mass = 10355.2 ± 0.5 MeV

NODE=M081M

NODE=M081M

→ UNCHECKED ←

$m_{\chi_{b2}(2P)} - m_{\chi_{b1}(2P)}$

VALUE (MeV)

DOCUMENT ID

TECN

COMMENT

13.10 ± 0.24 OUR AVERAGE

[13.4 ± 0.6 MeV OUR 2016 AVERAGE]

12.3 ± 2.6 ± 0.6

¹ AAIJ

14BG LHCb

 $pp \rightarrow \gamma \mu^+ \mu^- X$

13.04 ± 0.26

LEES

14M BABR $\Upsilon(3S) \rightarrow \gamma \gamma \mu^+ \mu^-$

13.5 ± 0.4 ± 0.5

² HEINTZ

92 CSB2

 $e^+ e^- \rightarrow \gamma X, \ell^+ \ell^- \gamma \gamma$

¹ From the $\chi_{bj}(2P) \rightarrow \Upsilon(1S) \gamma$ transition.

² From the average photon energy for inclusive and exclusive events. Supersedes NARAIN 91.

NODE=M081M2

NODE=M081M2

NEW

NODE=M081M2;LINKAGE=B

NODE=M081M2;LINKAGE=A

γ ENERGY IN $\Upsilon(3S)$ DECAY

VALUE (MeV)

EVTS

DOCUMENT ID

TECN

COMMENT

86.19 ± 0.22 OUR EVALUATION

Treating systematic errors as correlated

86.40 ± 0.18 OUR AVERAGE

86.04 ± 0.06 ± 0.27

ARTUSO

05

CLEO

 $\Upsilon(3S) \rightarrow \gamma X$

86 ± 1

101

CRAWFORD

92B

CLE2

 $e^+ e^- \rightarrow \ell^+ \ell^- \gamma \gamma$

86.7 ± 0.4

10319

³ HEINTZ

92

CSB2

 $e^+ e^- \rightarrow \gamma X$

86.9 ± 0.4

157

⁴ HEINTZ

92

CSB2

 $e^+ e^- \rightarrow \ell^+ \ell^- \gamma \gamma$

86.4 ± 0.1 ± 0.4

30741

MORRISON

91

CLE2

 $e^+ e^- \rightarrow \gamma X$

³ A systematic uncertainty on the energy scale of 0.9% not included. Supersedes NARAIN 91.

⁴ A systematic uncertainty on the energy scale of 0.9% not included. Supersedes HEINTZ 91.

NODE=M081DM

NODE=M081DM

→ UNCHECKED ←

OCCUR=2

NODE=M081DM;LINKAGE=A

NODE=M081DM;LINKAGE=B

$\chi_{b2}(2P)$ DECAY MODES

NODE=M081215;NODE=M081

Mode	Fraction (Γ_i/Γ)	Confidence level
$\Gamma_1 \quad \omega \Upsilon(1S)$	$(1.10^{+0.34}_{-0.30}) \%$	
$\Gamma_2 \quad \gamma \Upsilon(2S)$	$(8.9 \pm 1.2) \%$	
$\Gamma_3 \quad \gamma \Upsilon(1S)$	$(6.6 \pm 0.8) \%$	
$\Gamma_4 \quad \pi \pi \chi_{b2}(1P)$	$(5.1 \pm 0.9) \times 10^{-3}$	
$\Gamma_5 \quad D^0 X$	$< 2.4 \%$	90%
$\Gamma_6 \quad \pi^+ \pi^- K^+ K^- \pi^0$	$< 1.1 \times 10^{-4}$	90%
$\Gamma_7 \quad 2\pi^+ \pi^- K^- K_S^0$	$< 9 \times 10^{-5}$	90%
$\Gamma_8 \quad 2\pi^+ \pi^- K^- K_S^0 2\pi^0$	$< 7 \times 10^{-4}$	90%
$\Gamma_9 \quad 2\pi^+ 2\pi^- 2\pi^0$	$(3.9 \pm 1.6) \times 10^{-4}$	
$\Gamma_{10} \quad 2\pi^+ 2\pi^- K^+ K^-$	$(9 \pm 4) \times 10^{-5}$	
$\Gamma_{11} \quad 2\pi^+ 2\pi^- K^+ K^- \pi^0$	$(2.4 \pm 1.1) \times 10^{-4}$	
$\Gamma_{12} \quad 2\pi^+ 2\pi^- K^- K^- 2\pi^0$	$(4.7 \pm 2.3) \times 10^{-4}$	
$\Gamma_{13} \quad 3\pi^+ 2\pi^- K^- K_S^0 \pi^0$	$< 4 \times 10^{-4}$	90%
$\Gamma_{14} \quad 3\pi^+ 3\pi^-$	$(9 \pm 4) \times 10^{-5}$	
$\Gamma_{15} \quad 3\pi^+ 3\pi^- 2\pi^0$	$(1.2 \pm 0.4) \times 10^{-3}$	
$\Gamma_{16} \quad 3\pi^+ 3\pi^- K^+ K^-$	$(1.4 \pm 0.7) \times 10^{-4}$	
$\Gamma_{17} \quad 3\pi^+ 3\pi^- K^+ K^- \pi^0$	$(4.2 \pm 1.7) \times 10^{-4}$	
$\Gamma_{18} \quad 4\pi^+ 4\pi^-$	$(9 \pm 5) \times 10^{-5}$	
$\Gamma_{19} \quad 4\pi^+ 4\pi^- 2\pi^0$	$(1.3 \pm 0.5) \times 10^{-3}$	

DESIG=3

DESIG=2

DESIG=1

DESIG=4

DESIG=5

DESIG=6

DESIG=7

DESIG=8

DESIG=9

DESIG=10

DESIG=11

DESIG=12

DESIG=13

DESIG=14

DESIG=15

DESIG=16

DESIG=17

DESIG=18

DESIG=19

$\chi_{b2}(2P)$ BRANCHING RATIOS

NODE=M081220

 $\Gamma(\omega \Upsilon(1S))/\Gamma_{\text{total}}$ Γ_1/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT

$1.10^{+0.32+0.11}_{-0.28-0.10}$	$20.1^{+5.8}_{-5.1}$	⁵ CRONIN-HEN..04	CLE3	$\Upsilon(3S) \rightarrow \gamma \omega \Upsilon(1S)$

⁵ Using $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) = (11.4 \pm 0.8)\%$ and $B(\Upsilon(1S) \rightarrow \ell^+ \ell^-) = 2$
 $B(\Upsilon(1S) \rightarrow \mu^+ \mu^-) = 2 (2.48 \pm 0.06)\%$.

NODE=M081R3
NODE=M081R3

NODE=M081R3;LINKAGE=CR

 $\Gamma(\gamma \Upsilon(2S))/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

0.089±0.012 OUR AVERAGE

[0.106 ± 0.026 OUR 2016 AVERAGE Scale factor = 2.0]

$0.085 \pm 0.010 \pm 0.010$	^{6,7} LEES	14M	BABR	$\Upsilon(3S) \rightarrow \gamma \gamma \mu^+ \mu^-$
$0.084 \pm 0.011 \pm 0.010$	⁸ LEES	11J	BABR	$\Upsilon(3S) \rightarrow X \gamma$
$0.096 \pm 0.022 \pm 0.012$	^{7,9} CRAWFORD	92B	CLE2	$e^+ e^- \rightarrow \ell^+ \ell^- \gamma \gamma$
$0.106 \pm 0.016 \pm 0.013$	^{7,10} HEINTZ	92	CSB2	$e^+ e^- \rightarrow \ell^+ \ell^- \gamma \gamma$

⁶ LEES 14M quotes $\Gamma(\chi_{b2}(2P) \rightarrow \gamma \Upsilon(2S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))/\Gamma_{\text{total}}$
 $= (1.12 \pm 0.13)\%$ combining the results from samples of $\Upsilon(3S) \rightarrow \gamma \gamma \mu^+ \mu^-$ with and without converted photons

⁷ Assuming $B(\Upsilon(2S) \rightarrow \ell^+ \ell^-) = (1.97 \pm 0.17)\%$.

⁸ 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.

⁹ CRAWFORD 92B quotes $B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P)) \times B(\chi_{b2}(2P) \rightarrow \gamma \Upsilon(2S)) \times 2$
 $B(\Upsilon(2S) \rightarrow \ell^+ \ell^-) = (4.98 \pm 0.94 \pm 0.62) 10^{-4}$.

¹⁰ Recalculated by us. HEINTZ 92 quotes $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) \times B(\chi_{b2}(2P) \rightarrow \gamma \Upsilon(2S)) =$
 $(1.90 \pm 0.23 \pm 0.18) \%$ using $B(\Upsilon(2S) \rightarrow \mu^+ \mu^-) = (1.44 \pm 0.10)\%$.
 Supersedes HEINTZ 91.

NODE=M081R2
NODE=M081R2
NEW

NODE=M081R2;LINKAGE=D

NODE=M081R2;LINKAGE=E
NODE=M081R2;LINKAGE=LE

NODE=M081R2;LINKAGE=B

NODE=M081R2;LINKAGE=C

 $\Gamma(\gamma \Upsilon(1S))/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

0.066±0.008 OUR AVERAGE

[0.070 ± 0.007 OUR 2016 AVERAGE]

$0.061 \pm 0.004 \pm 0.007$	^{11,12} LEES	14M	BABR	$\Upsilon(3S) \rightarrow \gamma \gamma \mu^+ \mu^-$
$0.070 \pm 0.004 \pm 0.008$	¹³ LEES	11J	BABR	$\Upsilon(3S) \rightarrow X \gamma$
$0.077 \pm 0.018 \pm 0.009$	^{12,14} CRAWFORD	92B	CLE2	$e^+ e^- \rightarrow \ell^+ \ell^- \gamma \gamma$
$0.061 \pm 0.009 \pm 0.007$	^{12,15} HEINTZ	92	CSB2	$e^+ e^- \rightarrow \ell^+ \ell^- \gamma \gamma$

¹¹ LEES 14M quotes $\Gamma(\chi_{b2}(2P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))/\Gamma_{\text{total}}$
 $= (8.03 \pm 0.50) \times 10^{-3}$ combining the results from samples of $\Upsilon(3S) \rightarrow \gamma \gamma \mu^+ \mu^-$ with and without converted photons

¹² Assuming $B(\Upsilon(1S) \rightarrow \ell^+ \ell^-) = (2.48 \pm 0.05)\%$.

¹³ 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.

¹⁴ CRAWFORD 92B quotes $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) \times B(\chi_{b2}(2P) \rightarrow \gamma \Upsilon(1S)) \times 2$
 $B(\Upsilon(1S) \rightarrow \ell^+ \ell^-) = (5.03 \pm 0.94 \pm 0.63) 10^{-4}$.

¹⁵ Recalculated by us. HEINTZ 92 quotes $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) \times B(\chi_{b2}(2P) \rightarrow \gamma \Upsilon(1S)) =$
 $(0.77 \pm 0.11 \pm 0.05)\%$ using $B(\Upsilon(1S) \rightarrow \mu^+ \mu^-) = (2.57 \pm 0.05)\%$.
 Supersedes HEINTZ 91.

NODE=M081R1
NODE=M081R1
NEW

NODE=M081R1;LINKAGE=D

NODE=M081R1;LINKAGE=E
NODE=M081R1;LINKAGE=LE

NODE=M081R1;LINKAGE=B

NODE=M081R1;LINKAGE=C

 $\Gamma(\pi \pi \chi_{b2}(1P))/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT

5.1±0.9 OUR AVERAGE

$4.9 \pm 0.7 \pm 0.6$	¹⁶ LEES	11C	BABR	$e^+ e^- \rightarrow \pi^+ \pi^- X$
$6.0 \pm 1.6 \pm 1.4$	¹⁷ CAWLFIELD	06	CLE3	$\Upsilon(3S) \rightarrow 2(\gamma \pi \ell)$

¹⁶ $(0.64 \pm 0.05 \pm 0.08) \times 10^{-3}$. We derive the value assuming $B(\Upsilon(3S) \rightarrow \chi_{b2}(2P) X)$
 $= B(\Upsilon(3S) \rightarrow \chi_{b2}(2P) \gamma) = (13.1 \pm 1.6) \times 10^{-2}$.

¹⁷ CAWLFIELD 06 quote $\Gamma(\chi_b(2P) \rightarrow \pi \pi \chi_b(1P)) = 0.83 \pm 0.22 \pm 0.08 \pm 0.19$ keV
 assuming l-spin conservation, no D-wave contribution, $\Gamma(\chi_{b1}(2P)) = 96 \pm 16$ keV, and
 $\Gamma(\chi_{b2}(2P)) = 138 \pm 19$ keV.

NODE=M081R4
NODE=M081R4

NODE=M081R4;LINKAGE=LE

NODE=M081R4;LINKAGE=CA

$\Gamma(D^0 X)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<2.4 \times 10^{-2}$	90	18,19 BRIERE	08 CLEO	$\Upsilon(3S) \rightarrow \gamma D^0 X$

¹⁸ For $p_{D^0} > 2.5 \text{ GeV}/c$.

¹⁹ The authors also present their result as $(0.2 \pm 1.4 \pm 0.1) \times 10^{-2}$.

NODE=M081R01
NODE=M081R01

NODE=M081R01;LINKAGE=BR
NODE=M081R01;LINKAGE=RI

 $\Gamma(\pi^+ \pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.1	90	²⁰ ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma \pi^+ \pi^- K^+ K^- \pi^0$

²⁰ ASNER 08A reports $[\Gamma(\chi_{b2}(2P) \rightarrow \pi^+ \pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))] < 14 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) = 13.1 \times 10^{-2}$.

NODE=M081R02
NODE=M081R02

NODE=M081R02;LINKAGE=AS

 $\Gamma(2\pi^+ \pi^- K^- K_S^0)/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<0.9	90	²¹ ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+ \pi^- K^- K_S^0$

²¹ ASNER 08A reports $[\Gamma(\chi_{b2}(2P) \rightarrow 2\pi^+ \pi^- K^- K_S^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))] < 12 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) = 13.1 \times 10^{-2}$.

NODE=M081R03
NODE=M081R03

NODE=M081R03;LINKAGE=AS

 $\Gamma(2\pi^+ \pi^- K^- K_S^0 2\pi^0)/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<7	90	²² ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+ \pi^- K^- 2\pi^0$

²² ASNER 08A reports $[\Gamma(\chi_{b2}(2P) \rightarrow 2\pi^+ \pi^- K^- K_S^0 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))] < 87 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) = 13.1 \times 10^{-2}$.

NODE=M081R04
NODE=M081R04

NODE=M081R04;LINKAGE=AS

 $\Gamma(2\pi^+ 2\pi^- 2\pi^0)/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$3.9 \pm 1.6 \pm 0.5$	23	²³ ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+ 2\pi^- 2\pi^0$

²³ ASNER 08A reports $[\Gamma(\chi_{b2}(2P) \rightarrow 2\pi^+ 2\pi^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))] = (51 \pm 16 \pm 13) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) = (13.1 \pm 1.6) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M081R05
NODE=M081R05

NODE=M081R05;LINKAGE=AS

 $\Gamma(2\pi^+ 2\pi^- K^+ K^-)/\Gamma_{\text{total}}$ Γ_{10}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$0.9 \pm 0.4 \pm 0.1$	11	²⁴ ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+ 2\pi^- K^+ K^-$

²⁴ ASNER 08A reports $[\Gamma(\chi_{b2}(2P) \rightarrow 2\pi^+ 2\pi^- K^+ K^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))] = (12 \pm 4 \pm 3) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) = (13.1 \pm 1.6) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M081R06
NODE=M081R06

NODE=M081R06;LINKAGE=AS

 $\Gamma(2\pi^+ 2\pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}$ Γ_{11}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$2.4 \pm 1.0 \pm 0.3$	16	²⁵ ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+ 2\pi^- K^+ K^- \pi^0$

²⁵ ASNER 08A reports $[\Gamma(\chi_{b2}(2P) \rightarrow 2\pi^+ 2\pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))] = (32 \pm 11 \pm 8) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) = (13.1 \pm 1.6) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M081R07
NODE=M081R07

NODE=M081R07;LINKAGE=AS

 $\Gamma(2\pi^+ 2\pi^- K^+ K^- 2\pi^0)/\Gamma_{\text{total}}$ Γ_{12}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$4.7 \pm 2.2 \pm 0.6$	14	²⁶ ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+ 2\pi^- K^+ K^- 2\pi^0$

²⁶ ASNER 08A reports $[\Gamma(\chi_{b2}(2P) \rightarrow 2\pi^+ 2\pi^- K^+ K^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))] = (62 \pm 23 \pm 17) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) = (13.1 \pm 1.6) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M081R08
NODE=M081R08

NODE=M081R08;LINKAGE=AS

$\Gamma(3\pi^+ 2\pi^- K^- K_S^0 \pi^0)/\Gamma_{\text{total}}$ Γ_{13}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<4	90	27 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+ 2\pi^- K^- K_S^0 \pi^0$
27 ASNER 08A reports $[\Gamma(\chi_{b2}(2P) \rightarrow 3\pi^+ 2\pi^- K^- K_S^0 \pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))] < 58 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) = 13.1 \times 10^{-2}$.				

NODE=M081R09
 NODE=M081R09

NODE=M081R09;LINKAGE=AS

 $\Gamma(3\pi^+ 3\pi^-)/\Gamma_{\text{total}}$ Γ_{14}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
0.9±0.4±0.1	14	28 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+ 3\pi^-$
28 ASNER 08A reports $[\Gamma(\chi_{b2}(2P) \rightarrow 3\pi^+ 3\pi^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))] = (12 \pm 4 \pm 3) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) = (13.1 \pm 1.6) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M081R10
 NODE=M081R10

NODE=M081R10;LINKAGE=AS

 $\Gamma(3\pi^+ 3\pi^- 2\pi^0)/\Gamma_{\text{total}}$ Γ_{15}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
12±4±1	45	29 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+ 3\pi^- 2\pi^0$
29 ASNER 08A reports $[\Gamma(\chi_{b2}(2P) \rightarrow 3\pi^+ 3\pi^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))] = (159 \pm 33 \pm 43) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) = (13.1 \pm 1.6) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M081R11
 NODE=M081R11

NODE=M081R11;LINKAGE=AS

 $\Gamma(3\pi^+ 3\pi^- K^+ K^-)/\Gamma_{\text{total}}$ Γ_{16}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.4±0.7±0.2	12	30 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+ 3\pi^- K^+ K^-$
30 ASNER 08A reports $[\Gamma(\chi_{b2}(2P) \rightarrow 3\pi^+ 3\pi^- K^+ K^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))] = (19 \pm 7 \pm 5) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) = (13.1 \pm 1.6) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M081R12
 NODE=M081R12

NODE=M081R12;LINKAGE=AS

 $\Gamma(3\pi^+ 3\pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}$ Γ_{17}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
4.2±1.7±0.5	16	31 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+ 3\pi^- K^+ K^- \pi^0$
31 ASNER 08A reports $[\Gamma(\chi_{b2}(2P) \rightarrow 3\pi^+ 3\pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))] = (55 \pm 16 \pm 15) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) = (13.1 \pm 1.6) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M081R13
 NODE=M081R13

NODE=M081R13;LINKAGE=AS

 $\Gamma(4\pi^+ 4\pi^-)/\Gamma_{\text{total}}$ Γ_{18}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
0.9±0.4±0.1	9	32 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 4\pi^+ 4\pi^-$
32 ASNER 08A reports $[\Gamma(\chi_{b2}(2P) \rightarrow 4\pi^+ 4\pi^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))] = (12 \pm 5 \pm 3) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) = (13.1 \pm 1.6) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M081R14
 NODE=M081R14

NODE=M081R14;LINKAGE=AS

 $\Gamma(4\pi^+ 4\pi^- 2\pi^0)/\Gamma_{\text{total}}$ Γ_{19}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
13±5±2	27	33 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 4\pi^+ 4\pi^- 2\pi^0$
33 ASNER 08A reports $[\Gamma(\chi_{b2}(2P) \rightarrow 4\pi^+ 4\pi^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))] = (165 \pm 46 \pm 50) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) = (13.1 \pm 1.6) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M081R15
 NODE=M081R15

NODE=M081R15;LINKAGE=AS

 $\chi_{b2}(2P)$ Cross-Particle Branching Ratios

NODE=M081230

$$\Gamma(\chi_{b2}(2P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))/\Gamma_{\text{total}}$$

$$\Gamma_3/\Gamma \times \Gamma_{20}^{\Upsilon(3S)}/\Gamma \Upsilon(3S)$$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
9.2±0.3±0.4	11k	LEES	11J BABR	$\Upsilon(3S) \rightarrow X\gamma$

NODE=M081B01
 NODE=M081B01

$$\Gamma(\chi_{b2}(2P) \rightarrow \gamma \Upsilon(2S)) / \Gamma_{\text{total}} \times \Gamma(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) / \Gamma_{\text{total}}$$

$$\Gamma_2 / \Gamma \times \Gamma_{20}^{\Upsilon(3S)} / \Gamma \Upsilon(3S)$$

VALUE (units 10^{-2})	EVTs	DOCUMENT ID	TECN	COMMENT
1.1±0.1±0.1	2.5k	LEES	11J BABR	$\Upsilon(3S) \rightarrow X \gamma$

NODE=M081B02
NODE=M081B02

$$B(\chi_{b2}(2P) \rightarrow \chi_{b2}(1P) \pi^+ \pi^-) \times B(\Upsilon(3S) \rightarrow \chi_{b2}(2P) X)$$

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
0.64±0.05±0.08	17k	LEES	11C BABR	$e^+ e^- \rightarrow \pi^+ \pi^- X$

NODE=M081R16
NODE=M081R16

$$B(\chi_{b2}(2P) \rightarrow \gamma \Upsilon(1S)) \times B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) \times B(\Upsilon(1S) \rightarrow \ell^+ \ell^-)$$

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
2.02±0.18 OUR AVERAGE				

1.95 ^{+0.22+0.10} _{-0.21-0.16}		34 LEES	14M BABR	$\Upsilon(3S) \rightarrow \gamma \gamma \mu^+ \mu^-$
2.52±0.47±0.32	48	35 CRAWFORD	92B CLE2	$\Upsilon(3S) \rightarrow \gamma \gamma \ell^+ \ell^-$
1.98±0.28±0.12		36 HEINTZ	92 CSB2	$\Upsilon(3S) \rightarrow \gamma \gamma \ell^+ \ell^-$

34 From a sample of $\Upsilon(3S) \rightarrow \gamma \gamma \mu^+ \mu^-$ with converted photons
 35 CRAWFORD 92B quotes $2 \times B(\Upsilon(3S) \rightarrow \gamma \chi_{bJ}(2P)) B(\chi_{bJ}(2P) \rightarrow \gamma \Upsilon(nS)) B(\Upsilon(nS) \rightarrow \ell^+ \ell^-)$
 36 Calculated by us. HEINTZ 92 quotes $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) \times B(\chi_{b2}(2P) \rightarrow \gamma \Upsilon(1S)) = (0.77 \pm 0.11 \pm 0.05)\%$ using $B(\Upsilon(1S) \rightarrow \mu^+ \mu^-) = (2.57 \pm 0.05)\%$.

NODE=M081A01
NODE=M081A01

NODE=M081A01;LINKAGE=A
NODE=M081A01;LINKAGE=C

NODE=M081A01;LINKAGE=B

$$[B(\chi_{b2}(2P) \rightarrow \gamma \Upsilon(1S)) \times B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))] / [B(\chi_{b1}(2P) \rightarrow \gamma \Upsilon(1S)) \times B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P))]$$

VALUE (%)	DOCUMENT ID	TECN	COMMENT
66.6±3.0	37 LEES	14M BABR	$\Upsilon(3S) \rightarrow \gamma \gamma \mu^+ \mu^-$

37 From a sample of $\Upsilon(3S) \rightarrow \gamma \gamma \mu^+ \mu^-$ events without converted photons

NODE=M081A00
NODE=M081A00
NODE=M081A00

NODE=M081A00;LINKAGE=A

$$B(\chi_{b2}(2P) \rightarrow \gamma \Upsilon(2S)) \times B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) \times B(\Upsilon(2S) \rightarrow \ell^+ \ell^-)$$

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
2.74±0.29 OUR AVERAGE				

3.22 ^{+0.58+0.16} _{-0.53-0.71}		38 LEES	14M BABR	$\Upsilon(3S) \rightarrow \gamma \gamma \mu^+ \mu^-$
2.49±0.47±0.31	53	39 CRAWFORD	92B CLE2	$\Upsilon(3S) \rightarrow \gamma \gamma \ell^+ \ell^-$
2.74±0.33±0.18		40 HEINTZ	92 CSB2	$\Upsilon(3S) \rightarrow \gamma \gamma \ell^+ \ell^-$

38 From a sample of $\Upsilon(3S) \rightarrow \gamma \gamma \mu^+ \mu^-$ with converted photons
 39 CRAWFORD 92B quotes $2 \times B(\Upsilon(3S) \rightarrow \gamma \chi_{bJ}(2P)) B(\chi_{bJ}(2P) \rightarrow \gamma \Upsilon(nS)) B(\Upsilon(nS) \rightarrow \ell^+ \ell^-)$
 40 Calculated by us. HEINTZ 92 quotes $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) \times B(\chi_{b2}(2P) \rightarrow \gamma \Upsilon(2S)) = (1.90 \pm 0.23 \pm 0.18)\%$ using $B(\Upsilon(2S) \rightarrow \mu^+ \mu^-) = (1.44 \pm 0.10)\%$.

NODE=M081A02
NODE=M081A02

NODE=M081A02;LINKAGE=A
NODE=M081A02;LINKAGE=C

NODE=M081A02;LINKAGE=B

$$[B(\chi_{b2}(2P) \rightarrow \gamma \Upsilon(2S)) \times B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))] / [B(\chi_{b1}(2P) \rightarrow \gamma \Upsilon(2S)) \times B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P))]$$

VALUE (%)	DOCUMENT ID	TECN	COMMENT
46.9±2.0	41 LEES	14M BABR	$\Upsilon(3S) \rightarrow \gamma \gamma \mu^+ \mu^-$

41 From a sample of $\Upsilon(3S) \rightarrow \gamma \gamma \mu^+ \mu^-$ without converted photons

NODE=M081A03
NODE=M081A03

NODE=M081A03;LINKAGE=A

$\chi_{b2}(2P)$ REFERENCES

AAIJ	14BG	JHEP 1410 088	R. Aaij <i>et al.</i>	(LHCb Collab.)
LEES	14M	PR D90 112010	J.P. Lees <i>et al.</i>	(BABAR Collab.)
LEES	11C	PR D84 011104	J.P. Lees <i>et al.</i>	(BABAR Collab.)
LEES	11J	PR D84 072002	J.P. Lees <i>et al.</i>	(BABAR Collab.)
ASNER	08A	PR D78 091103	D.M. Asner <i>et al.</i>	(CLEO Collab.)
BRIERE	08	PR D78 092007	R.A. Briere <i>et al.</i>	(CLEO Collab.)
CAWLFIELD	06	PR D73 012003	C. Cawfield <i>et al.</i>	(CLEO Collab.)
ARTUSO	05	PRL 94 032001	M. Artuso <i>et al.</i>	(CLEO Collab.)
CRONIN-HEN...	04	PRL 92 222002	D. Cronin-Hennessy <i>et al.</i>	(CLEO Collab.)
CRAWFORD	92B	PL B294 139	G. Crawford <i>et al.</i>	(CLEO Collab.)
HEINTZ	92	PR D46 1928	U. Heintz <i>et al.</i>	(CUSB II Collab.)
HEINTZ	91	PRL 66 1563	U. Heintz <i>et al.</i>	(CUSB Collab.)
MORRISON	91	PRL 67 1696	R.J. Morrison <i>et al.</i>	(CLEO Collab.)
NARAIN	91	PRL 66 3113	M. Narain <i>et al.</i>	(CUSB Collab.)

NODE=M081

REFID=56199
REFID=56343
REFID=16775
REFID=53936
REFID=52574
REFID=52577
REFID=50997
REFID=50454
REFID=49766
REFID=43177
REFID=43604
REFID=41580
REFID=41634
REFID=41586

$\Upsilon(3S)$

$$J^{PC} = 0^{-}(1^{-}-)$$

NODE=M048

 $\Upsilon(3S)$ MASS

NODE=M048M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
10355.2±0.5	¹ ARTAMONOV 00	MD1	$e^+e^- \rightarrow \text{hadrons}$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
10355.3±0.5	^{2,3} BARU	86B REDE	$e^+e^- \rightarrow \text{hadrons}$
¹ Reanalysis of BARU 86B using new electron mass (COHEN 87).			
² Reanalysis of ARTAMONOV 84.			
³ Superseded by ARTAMONOV 00.			

NODE=M048M

NODE=M048M;LINKAGE=AR
 NODE=M048M;LINKAGE=C
 NODE=M048M;LINKAGE=RZ

 $m\Upsilon(3S) - m\Upsilon(2S)$

NODE=M048DM2

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
331.50±0.02±0.13	LEES	11C BABR	$e^+e^- \rightarrow \pi^+\pi^-X$

NODE=M048DM2

 $\Upsilon(3S)$ WIDTH

NODE=M048W

VALUE (keV)	DOCUMENT ID	COMMENT
20.32±1.85 OUR EVALUATION	See the Note on "Width Determinations of the Υ States"	

NODE=M048W
 → UNCHECKED ←

 $\Upsilon(3S)$ DECAY MODES

NODE=M048215;NODE=M048

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
Γ_1 $\Upsilon(2S)\text{anything}$	(10.6 ± 0.8) %	
Γ_2 $\Upsilon(2S)\pi^+\pi^-$	(2.82±0.18) %	S=1.6
Γ_3 $\Upsilon(2S)\pi^0\pi^0$	(1.85±0.14) %	
Γ_4 $\Upsilon(2S)\gamma\gamma$	(5.0 ± 0.7) %	
Γ_5 $\Upsilon(2S)\pi^0$	< 5.1 × 10 ⁻⁴	CL=90%
Γ_6 $\Upsilon(1S)\pi^+\pi^-$	(4.37±0.08) %	
Γ_7 $\Upsilon(1S)\pi^0\pi^0$	(2.20±0.13) %	
Γ_8 $\Upsilon(1S)\eta$	< 1 × 10 ⁻⁴	CL=90%
Γ_9 $\Upsilon(1S)\pi^0$	< 7 × 10 ⁻⁵	CL=90%
Γ_{10} $h_b(1P)\pi^0$	< 1.2 × 10 ⁻³	CL=90%
Γ_{11} $h_b(1P)\pi^0 \rightarrow \gamma\eta_b(1S)\pi^0$	(4.3 ± 1.4) × 10 ⁻⁴	
Γ_{12} $h_b(1P)\pi^+\pi^-$	< 1.2 × 10 ⁻⁴	CL=90%
Γ_{13} $\tau^+\tau^-$	(2.29±0.30) %	
Γ_{14} $\mu^+\mu^-$	(2.18±0.21) %	S=2.1
Γ_{15} e^+e^-	seen	
Γ_{16} hadrons		
Γ_{17} ggg	(35.7 ± 2.6) %	
Γ_{18} $\gamma g g$	(9.7 ± 1.8) × 10 ⁻³	
Γ_{19} ^2H anything	(2.33±0.33) × 10 ⁻⁵	

DESIG=8
 DESIG=4
 DESIG=10
 DESIG=12
 DESIG=107
 DESIG=3
 DESIG=11
 DESIG=9
 DESIG=106
 DESIG=112
 DESIG=113
 DESIG=114
 DESIG=16
 DESIG=1
 DESIG=2;OUR EVAL;→ UNCHECKED ←
 DESIG=101
 DESIG=109
 DESIG=110
 DESIG=117

Radiative decays

NODE=M048;CLUMP=B

Γ_{20} $\gamma\chi_{b2}(2P)$	(13.1 ± 1.6) %	S=3.4
Γ_{21} $\gamma\chi_{b1}(2P)$	(12.6 ± 1.2) %	S=2.4
Γ_{22} $\gamma\chi_{b0}(2P)$	(5.9 ± 0.6) %	S=1.4
Γ_{23} $\gamma\chi_{b2}(1P)$	(9.9 ± 1.2) × 10 ⁻³	S=1.9
Γ_{24} $\gamma A^0 \rightarrow \gamma \text{hadrons}$	< 8 × 10 ⁻⁵	CL=90%
Γ_{25} $\gamma\chi_{b1}(1P)$	(9 ± 5) × 10 ⁻⁴	S=1.8
Γ_{26} $\gamma\chi_{b0}(1P)$	(2.7 ± 0.4) × 10 ⁻³	
Γ_{27} $\gamma\eta_b(2S)$	< 6.2 × 10 ⁻⁴	CL=90%
Γ_{28} $\gamma\eta_b(1S)$	(5.1 ± 0.7) × 10 ⁻⁴	
Γ_{29} $\gamma X \rightarrow \gamma + \geq 4 \text{ prongs}$	[a] < 2.2 × 10 ⁻⁴	CL=95%
Γ_{30} $\gamma a_1^0 \rightarrow \gamma \mu^+\mu^-$	< 5.5 × 10 ⁻⁶	CL=90%
Γ_{31} $\gamma a_1^0 \rightarrow \gamma \tau^+\tau^-$	[b] < 1.6 × 10 ⁻⁴	CL=90%

DESIG=108

Lepton Family number (LF) violating modes

Γ_{32}	$e^{\pm}\tau^{\mp}$	LF	< 4.2	$\times 10^{-6}$	CL=90%
Γ_{33}	$\mu^{\pm}\tau^{\mp}$	LF	< 3.1	$\times 10^{-6}$	CL=90%

NODE=M048;CLUMP=C

DESIG=111

DESIG=105

[a] $1.5 \text{ GeV} < m_X < 5.0 \text{ GeV}$

LINKAGE=C48

[b] For $m_{\tau^+\tau^-}$ in the ranges 4.03–9.52 and 9.61–10.10 GeV.

LINKAGE=MRG

 $\Upsilon(3S) \Gamma(i) \Gamma(e^+ e^-) / \Gamma(\text{total})$

NODE=M048218

 $\Gamma(\text{hadrons}) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$ **$\Gamma_{16} \Gamma_{15} / \Gamma$**

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
0.414 ± 0.007 OUR AVERAGE			
0.413 ± 0.004 ± 0.006	ROSNER	06	CLEO $10.4 e^+ e^- \rightarrow \text{hadrons}$
0.45 ± 0.03 ± 0.03	⁴ GILES	84B	CLEO $e^+ e^- \rightarrow \text{hadrons}$

NODE=M048G2
NODE=M048G2⁴ 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	$e^+ e^- \rightarrow \gamma \pi^+ \pi^- \ell^+ \ell^-$

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
NODE=M048G01

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=M048R8⁶ Using $B(\Upsilon(2S) \rightarrow \Upsilon(1S)\gamma\gamma) = (0.038 \pm 0.007)\%$, and $B(\Upsilon(2S) \rightarrow \Upsilon(1S)\pi^0\pi^0) = (1/2)B(\Upsilon(2S) \rightarrow \Upsilon(1S)\pi^+\pi^-)$.

NODE=M048R;LINKAGE=A

⁷ Using $B(\Upsilon(1S) \rightarrow \mu^+ \mu^-) = (2.48 \pm 0.06)\%$. With the assumption of $e\mu$ universality.

NODE=M048R;LINKAGE=B

⁸ Using $B(\Upsilon(2S) \rightarrow \Upsilon(1S)\pi^+\pi^-) = (18.5 \pm 0.8)\%$.

NODE=M048R;LINKAGE=D

⁹ Using $B(\Upsilon(2S) \rightarrow \mu^+ \mu^-) = (1.31 \pm 0.21)\%$, $B(\Upsilon(2S) \rightarrow \Upsilon(1S)\gamma\gamma) \times 2B(\Upsilon(1S) \rightarrow \mu^+ \mu^-) = (0.188 \pm 0.035)\%$, and $B(\Upsilon(2S) \rightarrow \Upsilon(1S)\pi^0\pi^0) \times 2B(\Upsilon(1S) \rightarrow \mu^+ \mu^-) = (0.436 \pm 0.056)\%$. With the assumption of $e\mu$ universality.

NODE=M048R;LINKAGE=C

 $\Gamma(\Upsilon(2S)\pi^+\pi^-) / \Gamma_{\text{total}}$ **Γ_2 / Γ**

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
2.82 ± 0.18 OUR AVERAGE				Error includes scale factor of 1.6. See the ideogram below.
3.00 ± 0.02 ± 0.14	543k	LEES	11C BABR	$e^+ e^- \rightarrow \pi^+ \pi^- X$
2.40 ± 0.10 ± 0.26	800	¹⁰ AUBERT	08BP BABR	$e^+ e^- \rightarrow \gamma \pi^+ \pi^- e^+ e^-$
3.12 ± 0.49	980	^{11,12} BUTLER	94B CLE2	$e^+ e^- \rightarrow \pi^+ \pi^- \ell^+ \ell^-$
2.13 ± 0.38	974	¹³ BROCK	91 CLEO	$e^+ e^- \rightarrow \pi^+ \pi^- X,$ $\pi^+ \pi^- \ell^+ \ell^-$

NODE=M048R4
NODE=M048R4

• • • We do not use the following data for averages, fits, limits, etc. • • •

4.82 ± 0.65 ± 0.53	138	¹³ WU	93 CUSB	$\Upsilon(3S) \rightarrow \pi^+ \pi^- \ell^+ \ell^-$
3.1 ± 2.0	5	MAGERAS	82 CUSB	$\Upsilon(3S) \rightarrow \pi^+ \pi^- \ell^+ \ell^-$

¹⁰ Using $B(\Upsilon(1S) \rightarrow e^+ e^-) = (2.38 \pm 0.11)\%$, $B(\Upsilon(1S) \rightarrow \mu^+ \mu^-) = (2.48 \pm 0.05)\%$, and $\Gamma_{ee}(\Upsilon(3S)) = 0.443 \pm 0.008 \text{ keV}$.

NODE=M048R4;LINKAGE=AU

¹¹ From the exclusive mode.

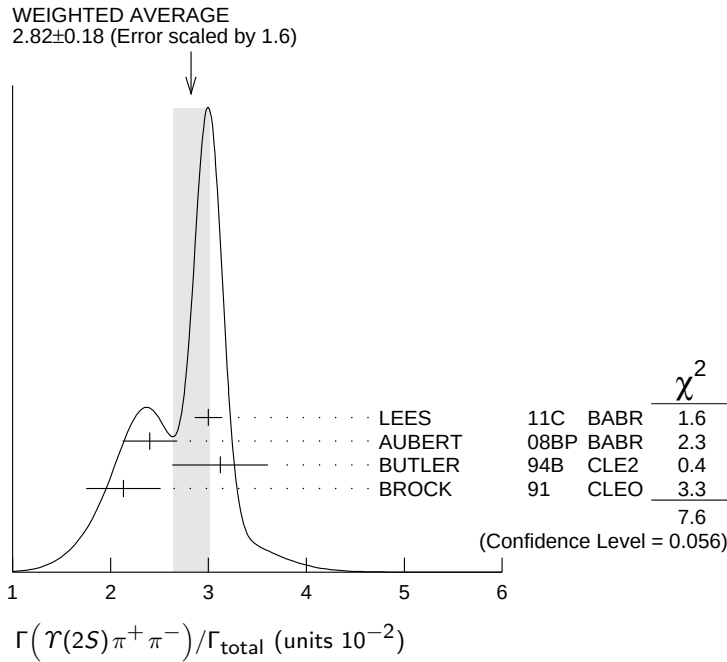
NODE=M048R;LINKAGE=M

¹² Using $B(\Upsilon(2S) \rightarrow \Upsilon(1S)\gamma\gamma) = (0.038 \pm 0.007)\%$, and $B(\Upsilon(2S) \rightarrow \Upsilon(1S)\pi^0\pi^0) = (1/2)B(\Upsilon(2S) \rightarrow \Upsilon(1S)\pi^+\pi^-)$.

NODE=M048R4;LINKAGE=A

¹³ Using $B(\Upsilon(2S) \rightarrow \mu^+ \mu^-) = (1.31 \pm 0.21)\%$, $B(\Upsilon(2S) \rightarrow \Upsilon(1S)\gamma\gamma) \times 2B(\Upsilon(1S) \rightarrow \mu^+ \mu^-) = (0.188 \pm 0.035)\%$, and $B(\Upsilon(2S) \rightarrow \Upsilon(1S)\pi^0\pi^0) \times 2B(\Upsilon(1S) \rightarrow \mu^+ \mu^-) = (0.436 \pm 0.056)\%$. With the assumption of $e\mu$ universality.

NODE=M048R4;LINKAGE=C



$\Gamma(\Upsilon(2S)\pi^0\pi^0)/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
1.85±0.14 OUR AVERAGE				
1.82±0.09±0.12	4391	¹⁴ BHARI	09 CLEO	$e^+e^- \rightarrow \pi^0\pi^0\ell^+\ell^-$
2.16±0.39		^{15,16} BUTLER	94B CLE2	$e^+e^- \rightarrow \pi^0\pi^0\ell^+\ell^-$
1.7 ±0.5 ±0.2	10	¹⁷ HEINTZ	92 CSB2	$e^+e^- \rightarrow \pi^0\pi^0\ell^+\ell^-$
¹⁴ Authors assume $B(\Upsilon(1S) \rightarrow e^+e^-) + B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = 4.06\%$.				
¹⁵ $B(\Upsilon(2S) \rightarrow \mu^+\mu^-) = (1.31 \pm 0.21)\%$ and assuming $e\mu$ universality.				
¹⁶ From the exclusive mode.				
¹⁷ $B(\Upsilon(2S) \rightarrow \mu^+\mu^-) = (1.44 \pm 0.10)\%$ and assuming $e\mu$ universality. Supersedes HEINTZ 91.				

NODE=M048R10
NODE=M048R10

NODE=M048R10;LINKAGE=BH
NODE=M048R;LINKAGE=K
NODE=M048R10;LINKAGE=M
NODE=M048R;LINKAGE=G

$\Gamma(\Upsilon(2S)\gamma\gamma)/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
0.0502±0.0069	¹⁸ BUTLER	94B CLE2	$e^+e^- \rightarrow \ell^+\ell^-2\gamma$

¹⁸ From the exclusive mode.

NODE=M048R12
NODE=M048R12

NODE=M048R12;LINKAGE=M

$\Gamma(\Upsilon(2S)\pi^0)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<0.51	90	¹⁹ HE	08A CLEO	$e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$

¹⁹ Authors assume $B(\Upsilon(2S) \rightarrow e^+e^-) + B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = 4.06\%$.

NODE=M048R25
NODE=M048R25

NODE=M048R25;LINKAGE=HE

$\Gamma(\Upsilon(1S)\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_6/Γ

Abbreviation MM in the COMMENT field below stands for missing mass.

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
4.37±0.08 OUR AVERAGE				
4.32±0.07±0.13	90k	²⁰ LEES	11L BABR	$\Upsilon(3S) \rightarrow \pi^+\pi^-\ell^+\ell^-$
4.46±0.01±0.13	190k	²¹ BHARI	09 CLEO	$e^+e^- \rightarrow \pi^+\pi^- \text{MM}$
4.17±0.06±0.19	6.4K	²² AUBERT	08BP BABR	$10.58 e^+e^- \rightarrow \gamma\pi^+\pi^-\ell^+\ell^-$
4.52±0.35	11830	²³ BUTLER	94B CLE2	$e^+e^- \rightarrow \pi^+\pi^-X,$ $\pi^+\pi^-\ell^+\ell^-$
4.46±0.34±0.50	451	²³ WU	93 CUSB	$\Upsilon(3S) \rightarrow \pi^+\pi^-\ell^+\ell^-$
4.46±0.30	11221	²³ BROCK	91 CLEO	$e^+e^- \rightarrow \pi^+\pi^-X,$ $\pi^+\pi^-\ell^+\ell^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

4.9 ±1.0	22	GREEN	82 CLEO	$\Upsilon(3S) \rightarrow \pi^+\pi^-\ell^+\ell^-$
3.9 ±1.3	26	MAGERAS	82 CUSB	$\Upsilon(3S) \rightarrow \pi^+\pi^-\ell^+\ell^-$

²⁰ Using $B(\Upsilon(1S) \rightarrow e^+e^-) = (2.38 \pm 0.11)\%$ and $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.05)\%$.

²¹ A weighted average of the inclusive and exclusive results.

²² Using $B(\Upsilon(2S) \rightarrow e^+e^-) = (1.91 \pm 0.16)\%$, $B(\Upsilon(2S) \rightarrow \mu^+\mu^-) = (1.93 \pm 0.17)\%$, and $\Gamma_{ee}(\Upsilon(3S)) = 0.443 \pm 0.008$ keV.

²³ Using $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.06)\%$. With the assumption of $e\mu$ universality.

NODE=M048R3
NODE=M048R3
NODE=M048R3

NODE=M048R3;LINKAGE=LE

NODE=M048R3;LINKAGE=BH
NODE=M048R3;LINKAGE=AU

NODE=M048R3;LINKAGE=B

$\Gamma(\Upsilon(2S)\pi^+\pi^-)/\Gamma(\Upsilon(1S)\pi^+\pi^-)$ Γ_2/Γ_6

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.577 ± 0.026 ± 0.060	800	²⁴ AUBERT	08BP BABR	$e^+e^- \rightarrow \gamma\pi^+\pi^-\ell^+\ell^-$

²⁴ Using $B(\Upsilon(1S) \rightarrow e^+e^-) = (2.38 \pm 0.11)\%$, $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.05)\%$, $B(\Upsilon(2S) \rightarrow e^+e^-) = (1.91 \pm 0.16)\%$, and $B(\Upsilon(2S) \rightarrow \mu^+\mu^-) = (1.93 \pm 0.17)\%$. Not independent of other values reported by AUBERT 08BP.

NODE=M048R28
NODE=M048R28

NODE=M048R28;LINKAGE=AU

 $\Gamma(\Upsilon(1S)\pi^0\pi^0)/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT

2.20 ± 0.13 OUR AVERAGE

2.24 ± 0.09 ± 0.11	6584	²⁵ BHARI	09 CLEO	$e^+e^- \rightarrow \pi^0\pi^0\ell^+\ell^-$

1.99 ± 0.34	56	²⁶ BUTLER	94B CLE2	$e^+e^- \rightarrow \pi^0\pi^0\ell^+\ell^-$

2.2 ± 0.4 ± 0.3	33	²⁷ HEINTZ	92 CSB2	$e^+e^- \rightarrow \pi^0\pi^0\ell^+\ell^-$

²⁵ Authors assume $B(\Upsilon(1S) \rightarrow e^+e^-) + B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = 4.96\%$.

²⁶ Using $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.06)\%$ and assuming $e\mu$ universality.

²⁷ Using $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.57 \pm 0.07)\%$ and assuming $e\mu$ universality. Supersedes HEINTZ 91.

NODE=M048R11
NODE=M048R11

NODE=M048R11;LINKAGE=BH
NODE=M048R11;LINKAGE=B
NODE=M048R;LINKAGE=I

 $\Gamma(\Upsilon(1S)\pi^0\pi^0)/\Gamma(\Upsilon(1S)\pi^+\pi^-)$ Γ_7/Γ_6

VALUE	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.501 ± 0.043	²⁸ BHARI	09 CLEO	$e^+e^- \rightarrow \Upsilon(3S)$

²⁸ Not independent of other values reported by BHARI 09.

NODE=M048R26
NODE=M048R26

NODE=M048R26;LINKAGE=BH

 $\Gamma(\Upsilon(1S)\eta)/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT

<0.1	90	²⁹ LEES	11L BABR	$\Upsilon(3S) \rightarrow (\pi^+\pi^-)(\gamma\gamma)\ell^+\ell^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.8	90	^{29,30} AUBERT	08BP BABR	$e^+e^- \rightarrow \gamma\pi^+\pi^-\pi^0\ell^+\ell^-$

<0.18	90	³¹ HE	08A CLEO	$e^+e^- \rightarrow \ell^+\ell^-\eta$

<2.2	90	BROCK	91 CLEO	$e^+e^- \rightarrow \ell^+\ell^-\eta$

²⁹ Using $B(\Upsilon(1S) \rightarrow e^+e^-) = (2.38 \pm 0.11)\%$, $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.05)\%$.

³⁰ Using $\Gamma_{ee}(\Upsilon(3S)) = 0.443 \pm 0.008$ keV.

³¹ Authors assume $B(\Upsilon(1S) \rightarrow e^+e^-) + B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = 4.96\%$.

NODE=M048R9
NODE=M048R9

NODE=M048R9;LINKAGE=LE
NODE=M048R9;LINKAGE=AU
NODE=M048R9;LINKAGE=HE

 $\Gamma(\Upsilon(1S)\eta)/\Gamma(\Upsilon(1S)\pi^+\pi^-)$ Γ_8/Γ_6

VALUE (units 10^{-2})	CL%	DOCUMENT ID	TECN	COMMENT

<0.23	90	³² LEES	11L BABR	$\Upsilon(3S) \rightarrow (\pi^+\pi^-)(\gamma\gamma)\ell^+\ell^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<1.9	90	³³ AUBERT	08BP BABR	$e^+e^- \rightarrow \gamma\pi^+\pi^-(\pi^0)\ell^+\ell^-$

³² Not independent of other values reported by LEES 11L.

³³ Not independent of other values reported by AUBERT 08BP.

NODE=M048R27
NODE=M048R27

NODE=M048R27;LINKAGE=LE
NODE=M048R27;LINKAGE=AU

 $\Gamma(\Upsilon(1S)\pi^0)/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT

<0.07	90	³⁴ HE	08A CLEO	$e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$

³⁴ Authors assume $B(\Upsilon(1S) \rightarrow e^+e^-) + B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = 4.96\%$.

NODE=M048R24
NODE=M048R24

NODE=M048R24;LINKAGE=HE

 $\Gamma(h_b(1P)\pi^0)/\Gamma_{\text{total}}$ Γ_{10}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<1.2 × 10 ⁻³	90	³⁵ GE	11 CLEO	$\Upsilon(3S) \rightarrow \pi^0$ anything

³⁵ Assuming $M(h_b(1P)) = 9900$ MeV and $\Gamma(h_b(1P)) = 0$ MeV, and allowing $B(h_b(1P) \rightarrow \gamma\eta_b(1S))$ to vary from 0–100%.

NODE=M048R03
NODE=M048R03

NODE=M048R03;LINKAGE=GE

 $\Gamma(h_b(1P)\pi^0 \rightarrow \gamma\eta_b(1S)\pi^0)/\Gamma_{\text{total}}$ Γ_{11}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT

4.3 ± 1.1 ± 0.9	LEES	11K BABR	$\Upsilon(3S) \rightarrow \eta_b\gamma\pi^0$

NODE=M048R33
NODE=M048R33

$\Gamma(h_b(1P)\pi^+\pi^-)/\Gamma_{\text{total}}$

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
$2.29 \pm 0.21 \pm 0.22$	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

 $\Gamma(\tau^+\tau^-)/\Gamma(\mu^+\mu^-)$

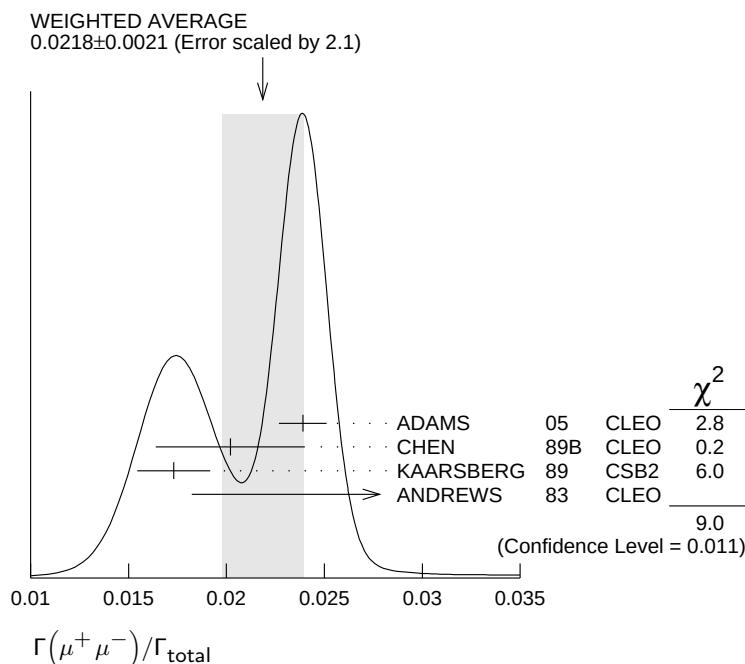
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
$1.05 \pm 0.08 \pm 0.05$	15k	BESSON	07 CLEO	$e^+e^- \rightarrow \Upsilon(3S)$

NODE=M048R19
 NODE=M048R19

 $\Gamma(\mu^+\mu^-)/\Gamma_{\text{total}}$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.0218 ± 0.0021 OUR AVERAGE		Error includes scale factor of 2.1. See the ideogram below.		
$0.0239 \pm 0.0007 \pm 0.0010$	81k	ADAMS	05 CLEO	$e^+e^- \rightarrow \mu^+\mu^-$
$0.0202 \pm 0.0019 \pm 0.0033$		CHEN	89B CLEO	$e^+e^- \rightarrow \mu^+\mu^-$
$0.0173 \pm 0.0015 \pm 0.0011$		KAARSBERG	89 CSB2	$e^+e^- \rightarrow \mu^+\mu^-$
$0.033 \pm 0.013 \pm 0.007$	1096	ANDREWS	83 CLEO	$e^+e^- \rightarrow \mu^+\mu^-$

NODE=M048R1
 NODE=M048R1

 $\Gamma(ggg)/\Gamma_{\text{total}}$

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

 $\Gamma(\overline{2H} \text{ anything})/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
2.33±0.15^{+0.31}_{-0.28}	LEES	14G BABR	$e^+e^- \rightarrow \overline{2H} X$

 Γ_{19}/Γ

NODE=M048R00
NODE=M048R00

 $\Gamma(\gamma \chi_{b2}(2P))/\Gamma_{\text{total}}$

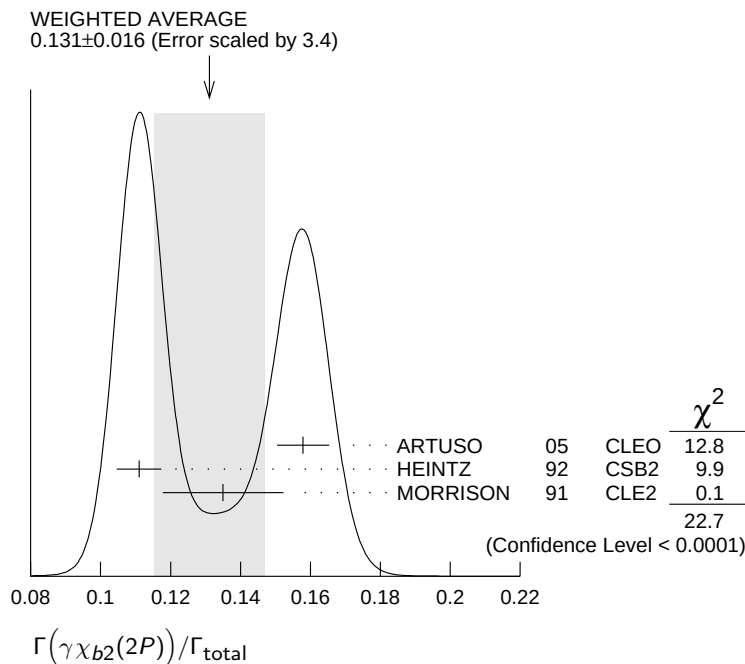
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.131 ± 0.016 OUR AVERAGE		Error includes scale factor of 3.4. See the ideogram below.		
0.1579 ± 0.0017 ± 0.0073	568k	ARTUSO	05 CLEO	$e^+e^- \rightarrow \gamma X$
0.111 ± 0.005 ± 0.004	10319	⁴⁰ HEINTZ	92 CSB2	$e^+e^- \rightarrow \gamma X$
0.135 ± 0.003 ± 0.017	30741	MORRISON	91 CLE2	$e^+e^- \rightarrow \gamma X$

⁴⁰ Supersedes NARAIN 91.

 Γ_{20}/Γ

NODE=M048R5
NODE=M048R5

NODE=M048R;LINKAGE=H

 $\Gamma(\gamma \chi_{b1}(2P))/\Gamma_{\text{total}}$

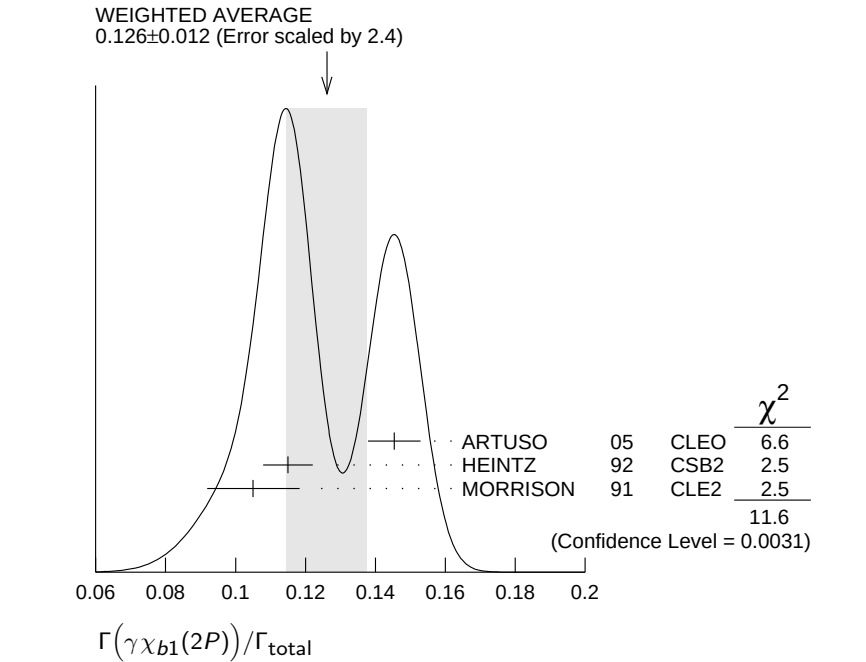
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.126 ± 0.012 OUR AVERAGE		Error includes scale factor of 2.4. See the ideogram below.		
0.1454 ± 0.0018 ± 0.0073	537k	ARTUSO	05 CLEO	$e^+e^- \rightarrow \gamma X$
0.115 ± 0.005 ± 0.005	11147	⁴¹ HEINTZ	92 CSB2	$e^+e^- \rightarrow \gamma X$
0.105 ^{+0.003} _{-0.002} ± 0.013	25759	MORRISON	91 CLE2	$e^+e^- \rightarrow \gamma X$

⁴¹ Supersedes NARAIN 91.

 Γ_{21}/Γ

NODE=M048R6
NODE=M048R6

NODE=M048R6;LINKAGE=H

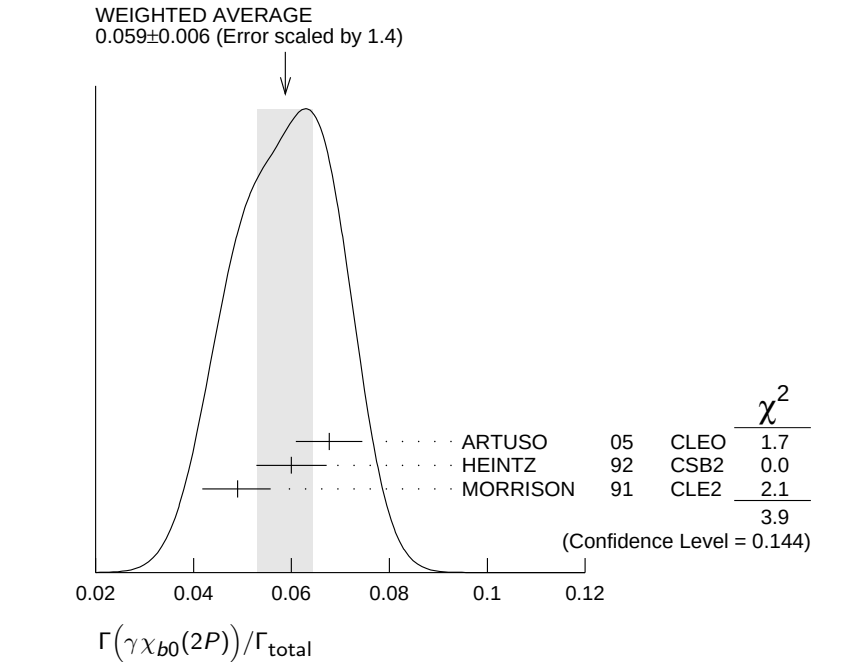


$\Gamma(\gamma\chi_{b0}(2P))/\Gamma_{\text{total}}$				Γ_{22}/Γ	
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
0.059 ±0.006 OUR AVERAGE Error includes scale factor of 1.4. See the ideogram below.					
0.0677 ±0.0020 ±0.0065	225k	ARTUSO	05	CLEO	$e^+e^- \rightarrow \gamma X$
0.060 ±0.004 ±0.006	4959	HEINTZ	92	CSB2	$e^+e^- \rightarrow \gamma X$
0.049 $^{+0.003}_{-0.004}$ ±0.006	9903	MORRISON	91	CLE2	$e^+e^- \rightarrow \gamma X$

⁴²Supersedes NARAIN 91.

NODE=M048R7
NODE=M048R7

NODE=M048R7;LINKAGE=H



$\Gamma(\gamma\chi_{b2}(1P))/\Gamma_{\text{total}}$				Γ_{23}/Γ	
VALUE (units 10 ⁻³)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
9.9±1.2 OUR AVERAGE Error includes scale factor of 1.9. [(9.9 ± 1.3) × 10 ⁻³]					
OUR 2016 AVERAGE Scale factor = 2.0]					
7.6±1.2±0.4	126	^{43,44} KORNICER	11	CLEO	$e^+e^- \rightarrow \gamma\gamma\ell^+\ell^-$
10.5±0.3 $^{+0.7}_{-0.6}$	9.7k	LEES	11J	BABR	$\Upsilon(3S) \rightarrow X\gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<19 seen	90	⁴⁵ ASNER	08A	CLEO	$\Upsilon(3S) \rightarrow \gamma + \text{hadrons}$
		⁴⁶ HEINTZ	92	CSB2	$e^+e^- \rightarrow \gamma\gamma\ell^+\ell^-$

NODE=M048R21
NODE=M048R21

NEW

⁴³ Assuming $B(\Upsilon(1S) \rightarrow \ell^+ \ell^-) = (2.48 \pm 0.05)\%$.

⁴⁴ KORNICER 11 reports $[\Gamma(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(1P))/\Gamma_{\text{total}}] \times [B(\chi_{b2}(1P) \rightarrow \gamma \Upsilon(1S))] = (1.435 \pm 0.162 \pm 0.169) \times 10^{-3}$ which we divide by our best value $B(\chi_{b2}(1P) \rightarrow \gamma \Upsilon(1S)) = (18.8 \pm 1.1) \times 10^{-2}$. 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_{25}/Γ

VALUE (units 10^{-3}) CL% EVTS DOCUMENT ID TECN COMMENT
0.9±0.5 OUR AVERAGE Error includes scale factor of 1.8. $[(0.9 \pm 0.5) \times 10^{-3}$ OUR 2016 AVERAGE Scale factor = 1.9]

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
1.5±0.4±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 $\Upsilon(3S) \rightarrow X \gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<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 $B(\chi_{b1}(1P) \rightarrow \gamma \Upsilon(1S)) = (35.0 \pm 2.1) \times 10^{-2}$. 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
 NODE=M048R22

NEW

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_{26}/Γ

VALUE (units 10^{-2}) CL% EVTS DOCUMENT ID TECN COMMENT
0.27±0.04 OUR AVERAGE

VALUE (units 10^{-2})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
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 $e^+ e^- \rightarrow \gamma X$

• • • We do not use the following data for averages, fits, limits, etc. • • •

VALUE (units 10^{-2})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<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
 NODE=M048R15

NODE=M048R15;LINKAGE=AS

$\Gamma(\gamma \eta_b(2S))/\Gamma_{\text{total}}$ Γ_{27}/Γ

VALUE (units 10^{-4}) CL% EVTS DOCUMENT ID TECN COMMENT
< 6.2

• • • We do not use the following data for averages, fits, limits, etc. • • •

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<19	90		LEES	11J	BABR $\Upsilon(3S) \rightarrow X \gamma$

NODE=M048R16
 NODE=M048R16

$\Gamma(\gamma \eta_b(1S))/\Gamma_{\text{total}}$ Γ_{28}/Γ

VALUE (units 10^{-4}) CL% EVTS DOCUMENT ID TECN COMMENT
5.1±0.7 OUR AVERAGE

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
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. • • •

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<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 $e^+ e^- \rightarrow \gamma X$

⁵² Assuming $\Gamma_{\eta_b(1S)} = 10$ 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_{29}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<2.2	95	ROSNER	07A CLEO	$e^+e^- \rightarrow \gamma X$

NODE=M048R20

NODE=M048R20

NODE=M048R20

 $\Gamma(\gamma a_1^0 \rightarrow \gamma \mu^+ \mu^-)/\Gamma_{\text{total}}$ Γ_{30}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<5.5	90	⁵⁵ AUBERT	09Z BABR	$e^+e^- \rightarrow \gamma a_1^0 \rightarrow \gamma \mu^+ \mu^-$

NODE=M048R04

NODE=M048R04

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_{31}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
< 1.6×10^{-4}	90	⁵⁶ AUBERT	09P BABR	$e^+e^- \rightarrow \gamma a_1^0 \rightarrow \gamma \tau^+ \tau^-$

NODE=M048R29

NODE=M048R29

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_{24}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
< 8×10^{-5}	90	⁵⁷ LEES	11H BABR	$\Upsilon(3S) \rightarrow \gamma \text{hadrons}$

NODE=M048R02

NODE=M048R02

NODE=M048R02

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 $\Gamma(e^\pm \tau^\mp)/\Gamma_{\text{total}}$ Γ_{32}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<4.2	90	LEES	10B BABR	$e^+e^- \rightarrow e^\pm \tau^\mp$

NODE=M048R01

NODE=M048R01

 $\Gamma(\mu^\pm \tau^\mp)/\Gamma_{\text{total}}$ Γ_{33}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
< 3.1	90	LEES	10B BABR	$e^+e^- \rightarrow \mu^\pm \tau^\mp$

NODE=M048R23

NODE=M048R23

• • • 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

LEES	14G	PR D89 111102	J.P. Lees <i>et al.</i>	(BABAR Collab.)
GE	11	PR D84 032008	J.Y. Ge <i>et al.</i>	(CLEO Collab.)
KORNICER	11	PR D83 054003	M. Kornicer <i>et al.</i>	(CLEO Collab.)
LEES	11C	PR D84 011104	J.P. Lees <i>et al.</i>	(BABAR Collab.)
LEES	11H	PRL 107 221803	J.P. Lees <i>et al.</i>	(BABAR Collab.)
LEES	11J	PR D84 072002	J.P. Lees <i>et al.</i>	(BABAR Collab.)
LEES	11K	PR D84 091101	J.P. Lees <i>et al.</i>	(BABAR Collab.)
LEES	11L	PR D84 092003	J.P. Lees <i>et al.</i>	(BABAR Collab.)
BONVICINI	10	PR D81 031104	G. Bonvicini <i>et al.</i>	(CLEO Collab.)
LEES	10B	PRL 104 151802	J.P. Lees <i>et al.</i>	(BABAR Collab.)
AUBERT	09AQ	PRL 103 161801	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT	09P	PRL 103 181801	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT	09Z	PRL 103 081803	B. Aubert <i>et al.</i>	(BABAR Collab.)
BHARI	09	PR D79 011103	S.R. Bhari <i>et al.</i>	(CLEO Collab.)
ASNER	08A	PR D78 091103	D.M. Asner <i>et al.</i>	(CLEO Collab.)
AUBERT	08BP	PR D78 112002	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT	08V	PRL 101 071801	B. Aubert <i>et al.</i>	(BABAR Collab.)
HE	08A	PRL 101 192001	Q. He <i>et al.</i>	(CLEO Collab.)
LOVE	08A	PRL 101 201601	W. Love <i>et al.</i>	(CLEO Collab.)
PDG	08	PL B667 1	C. Amsler <i>et al.</i>	(PDG Collab.)
BESSON	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.)
BESSON	06A	PR D74 012003	D. Besson <i>et al.</i>	(CLEO Collab.)
ROSNER	06	PRL 96 092003	J.L. Rosner <i>et al.</i>	(CLEO Collab.)
ADAMS	05	PRL 94 012001	G.S. Adams <i>et al.</i>	(CLEO Collab.)
ARTUSO	05	PRL 94 032001	M. Artuso <i>et al.</i>	(CLEO Collab.)
ARTAMONOV	00	PL B474 427	A.S. Artamonov <i>et al.</i>	

REFID=55939

REFID=53960

REFID=16769

REFID=16775

REFID=53877

REFID=53936

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REFID=52592

REFID=52166

REFID=51620

REFID=52079

REFID=51147

REFID=51035

REFID=50452

REFID=50454

REFID=47424

BUTLER	94B	PR D49 40	F. Butler <i>et al.</i>	(CLEO Collab.)
WU	93	PL B301 307	Q.W. Wu <i>et al.</i>	(CUSB Collab.)
HEINTZ	92	PR D46 1928	U. Heintz <i>et al.</i>	(CUSB II Collab.)
BROCK	91	PR D43 1448	I.C. Brock <i>et al.</i>	(CLEO Collab.)
HEINTZ	91	PRL 66 1563	U. Heintz <i>et al.</i>	(CUSB Collab.)
MORRISON	91	PRL 67 1696	R.J. Morrison <i>et al.</i>	(CLEO Collab.)
NARAIN	91	PRL 66 3113	M. Narain <i>et al.</i>	(CUSB Collab.)
CHEN	89B	PR D39 3528	W.Y. Chen <i>et al.</i>	(CLEO Collab.)
KAARSBERG	89	PRL 62 2077	T.M. Kaarsberg <i>et al.</i>	(CUSB Collab.)
BUCHMUEL...	88	HE e^+e^- Physics 412	W. Buchmueller, S. Cooper	(HANN, DESY, MIT)
Editors: A. Ali and P. Soeding, World Scientific, Singapore				
COHEN	87	RMP 59 1121	E.R. Cohen, B.N. Taylor	(RISC, NBS)
BARU	86B	ZPHY C32 622 (erratum)	S.E. Baru <i>et al.</i>	(NOVO)
KURAEV	85	SJNP 41 466	E.A. Kuraev, V.S. Fadin	(NOVO)
Translated from YAF 41 733.				
ARTAMONOV	84	PL 137B 272	A.S. Artamonov <i>et al.</i>	(NOVO)
GILES	84B	PR D29 1285	R. Giles <i>et al.</i>	(CLEO Collab.)
ANDREWS	83	PRL 50 807	D.E. Andrews <i>et al.</i>	(CLEO Collab.)
GREEN	82	PRL 49 617	J. Green <i>et al.</i>	(CLEO Collab.)
MAGERAS	82	PL 118B 453	G. Mageras <i>et al.</i>	(COLU, CORN, LSU+)

REFID=43799
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REFID=22273
REFID=22321
REFID=22359

NODE=M206

$\chi_{b1}(3P)$

$$J^G(J^{PC}) = 0^+(1^{++})$$

Observed in the radiative decay to $\Upsilon(1S, 2S, 3S)$, therefore $C = +$.
 J needs confirmation.

NODE=M206

$\chi_{b1}(3P)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
10512.1 ± 2.1 ± 0.9	351	¹ AAIJ	14BG LHCB	$pp \rightarrow \gamma \mu^+ \mu^- X$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
10515.7 ⁺ _{-2.2} ^{2.2} _{-3.9} ^{1.5} _{-2.1}	169	² AAIJ	14BG LHCB	$pp \rightarrow \gamma \mu^+ \mu^- X$
10511.3 ± 1.7 ± 2.5	182	³ AAIJ	14BI LHCB	$pp \rightarrow \gamma \mu^+ \mu^- X$
10530 ± 5 ± 9		⁴ AAD	12A ATLS	$pp \rightarrow \gamma \mu^+ \mu^- X$
10551 ± 14 ± 17		⁴ ABAZOV	12Q D0	$p\bar{p} \rightarrow \gamma \mu^+ \mu^- X$

¹ The mass of the $\chi_{b1}(3P)$ state obtained by combining the results of AAIJ 14BG with that of AAIJ 14BI. The first uncertainty is experimental and the second attributable to the unknown mass splitting, assumed to be $m_{\chi_{b2}(3P)} - m_{\chi_{b1}(3P)} = 10.5 \pm 1.5$ MeV.

² From $\chi_{b1}(3P) \rightarrow \Upsilon(1S, 2S)\gamma$ transitions assuming $m_{\chi_{b2}(3P)} - m_{\chi_{b1}(3P)} = 10.5 \pm 1.5$ MeV and allowing for $\pm 30\%$ variation in the $\chi_{b2}(3P)$ production rate relative to that of $\chi_{b1}(3P)$.

³ From $\chi_{b1}(3P) \rightarrow \Upsilon(3S)\gamma$ transition assuming $m_{\chi_{b2}(3P)} - m_{\chi_{b1}(3P)} = 10.5 \pm 1.5$ MeV.

⁴ The mass barycenter of the merged lineshapes from the $J = 1$ and 2 states.

NODE=M206M

NODE=M206M

OCCUR=2

NODE=M206M;LINKAGE=B

NODE=M206M;LINKAGE=A

NODE=M206M;LINKAGE=C

NODE=M206M;LINKAGE=AA

$\chi_{b1}(3P)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \Upsilon(1S)\gamma$	seen
$\Gamma_2 \quad \Upsilon(2S)\gamma$	seen
$\Gamma_3 \quad \Upsilon(3S)\gamma$	seen

NODE=M206215;NODE=M206

DESIG=1

DESIG=2

DESIG=3

$\chi_{b1}(3P)$ BRANCHING RATIOS

$\Gamma(\Upsilon(1S)\gamma)/\Gamma_{\text{total}}$	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_1/Γ
seen	169	⁵ AAIJ	14BG LHCB	$pp \rightarrow \gamma \mu^+ \mu^- X$	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
seen		AAD	12A ATLS	$pp \rightarrow \gamma \mu^+ \mu^- X$	
seen		ABAZOV	12Q D0	$p\bar{p} \rightarrow \gamma \mu^+ \mu^- X$	

⁵ From $\chi_{b1}(3P) \rightarrow \Upsilon(1S, 2S)\gamma$ transitions assuming $m_{\chi_{b2}(3P)} - m_{\chi_{b1}(3P)} = 10.5 \pm 1.5$ MeV and allowing for $\pm 30\%$ variation in the $\chi_{b2}(3P)$ production rate relative to that of $\chi_{b1}(3P)$.

NODE=M206225

NODE=M206R01
NODE=M206R01

NODE=M206R01;LINKAGE=A

$\Gamma(\Upsilon(2S)\gamma)/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
seen	169	⁶ AAIJ	14BG LHCB	$pp \rightarrow \gamma \mu^+ \mu^- X$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
seen		AAD	12A ATLS	$pp \rightarrow \gamma \mu^+ \mu^- X$

⁶ From $\chi_{b1}(3P) \rightarrow \Upsilon(1S, 2S)\gamma$ transitions assuming $m_{\chi_{b2}(3P)} - m_{\chi_{b1}(3P)} = 10.5 \pm 1.5$ MeV and allowing for $\pm 30\%$ variation in the $\chi_{b2}(3P)$ production rate relative to that of $\chi_{b1}(3P)$.

NODE=M206R02
NODE=M206R02

NODE=M206R02;LINKAGE=A

 $\Gamma(\Upsilon(3S)\gamma)/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
seen	182	AAIJ	14BI LHCB	$pp \rightarrow \gamma \mu^+ \mu^- X$

NODE=M206R03
NODE=M206R03

 $\chi_{b1}(3P)$ REFERENCES

AAIJ	14BG JHEP 1410 088	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	14BI EPJ C74 3092	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAD	12A PRL 108 152001	G. Aad <i>et al.</i>	(ATLAS Collab.)
ABAZOV	12Q PR D86 031103	V.M. Abazov <i>et al.</i>	(D0 Collab.)

NODE=M206

REFID=56199
REFID=56235
REFID=54037
REFID=54264

NODE=M047

$\Upsilon(4S)$
or $\Upsilon(10580)$

$$J^G(J^{PC}) = 0^-(1^{--})$$

 $\Upsilon(4S)$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
10579.4 $\pm$ 1.2 OUR AVERAGE			
10579.3 $\pm$ 0.4 $\pm$ 1.2	AUBERT	05Q BABR	$e^+ e^- \rightarrow \text{hadrons}$
10580.0 $\pm$ 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 $\pm$ 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

NODE=M047M;LINKAGE=C
NODE=M047M;LINKAGE=B

 $\Upsilon(4S)$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
20.5 $\pm$ 2.5 OUR AVERAGE			
20.7 $\pm$ 1.6 $\pm$ 2.5	AUBERT	05Q BABR	$e^+ e^- \rightarrow \text{hadrons}$
20 $\pm$ 2 $\pm$ 4	BESSON	85 CLEO	$e^+ e^- \rightarrow \text{hadrons}$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
25 $\pm$ 2.5	LOVELOCK	85 CUSB	$e^+ e^- \rightarrow \text{hadrons}$

NODE=M047W

NODE=M047W

 $\Upsilon(4S)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 $B\bar{B}$	> 96 %	95%
Γ_2 $B^+ B^-$	(51.4 $\pm$ 0.6) %	
Γ_3 D_s^+ anything + c.c.	(17.8 $\pm$ 2.6) %	
Γ_4 $B^0 \bar{B}^0$	(48.6 $\pm$ 0.6) %	
Γ_5 $J/\psi K_S^0 + (J/\psi, \eta_c) K_S^0$	< 4 $\times 10^{-7}$	90%
Γ_6 non- $B\bar{B}$	< 4 %	95%
Γ_7 $e^+ e^-$	(1.57 $\pm$ 0.08) $\times 10^{-5}$	
Γ_8 $\rho^+ \rho^-$	< 5.7 $\times 10^{-6}$	90%
Γ_9 $K^*(892)^0 \bar{K}^0$	< 2.0 $\times 10^{-6}$	90%
Γ_{10} $J/\psi(1S)$ anything	< 1.9 $\times 10^{-4}$	95%
Γ_{11} D^{*+} anything + c.c.	< 7.4 %	90%

NODE=M047215;NODE=M047

DESIG=8;OUR EST;→ UNCHECKED ←
DESIG=10
DESIG=12
DESIG=11
DESIG=15
DESIG=6
DESIG=1
DESIG=16
DESIG=22
DESIG=2
DESIG=3

Γ_{12}	ϕ anything	$(7.1 \pm 0.6) \%$		
Γ_{13}	$\phi \eta$	< 1.8	$\times 10^{-6}$	90%
Γ_{14}	$\phi \eta'$	< 4.3	$\times 10^{-6}$	90%
Γ_{15}	$\rho \eta$	< 1.3	$\times 10^{-6}$	90%
Γ_{16}	$\rho \eta'$	< 2.5	$\times 10^{-6}$	90%
Γ_{17}	$\Upsilon(1S)$ anything	< 4	$\times 10^{-3}$	90%
Γ_{18}	$\Upsilon(1S) \pi^+ \pi^-$	$(8.1 \pm 0.6) \times 10^{-5}$		
Γ_{19}	$\Upsilon(1S) \eta$	$(1.96 \pm 0.28) \times 10^{-4}$		
Γ_{20}	$\Upsilon(2S) \pi^+ \pi^-$	$(8.6 \pm 1.3) \times 10^{-5}$		
Γ_{21}	$h_b(1P) \pi^+ \pi^-$	not seen		
Γ_{22}	$h_b(1P) \eta$	$(2.18 \pm 0.21) \times 10^{-3}$		
Γ_{23}	^2H anything	< 1.3	$\times 10^{-5}$	90%

DESIG=4
DESIG=13
DESIG=18
DESIG=19
DESIG=20
DESIG=5
DESIG=7
DESIG=17
DESIG=9
DESIG=21
DESIG=23
DESIG=14

$\Upsilon(4S)$ PARTIAL WIDTHS

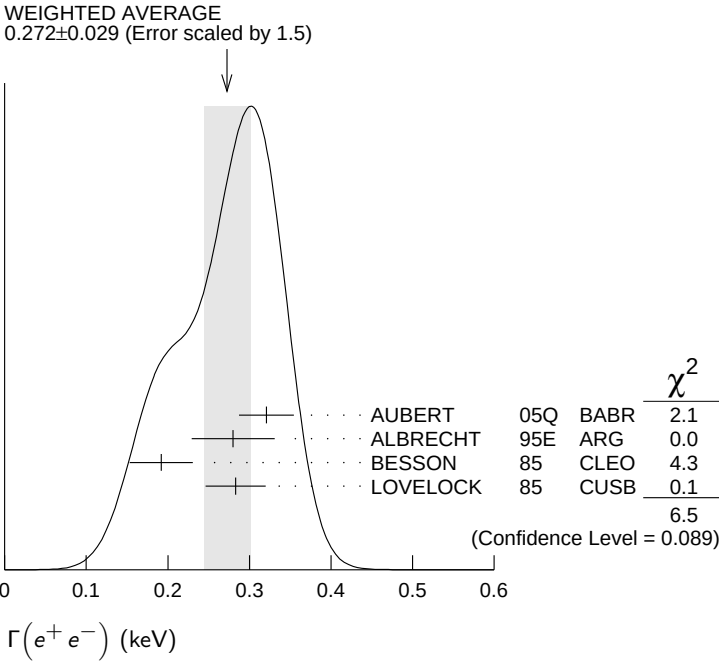
NODE=M047220

$\Gamma(e^+e^-)$						Γ_7
VALUE (keV)	DOCUMENT ID	TECN	COMMENT			
0.272$\pm$0.029 OUR AVERAGE	Error includes scale factor of 1.5. See the ideogram below.					
0.321 $\pm$ 0.017 $\pm$ 0.029	AUBERT	05Q	BABR	$e^+e^- \rightarrow$ hadrons		
0.28 $\pm$ 0.05 $\pm$ 0.01	³ ALBRECHT	95E	ARG	$e^+e^- \rightarrow$ hadrons		
0.192 $\pm$ 0.007 $\pm$ 0.038	BESSON	85	CLEO	$e^+e^- \rightarrow$ hadrons		
0.283 $\pm$ 0.037	LOVELOCK	85	CUSB	$e^+e^- \rightarrow$ hadrons		

NODE=M047W1
NODE=M047W1

³Using LEYAOUANC 77 parametrization of $\Gamma(s)$.

NODE=M047W1;LINKAGE=A



$\Upsilon(4S)$ BRANCHING RATIOS

NODE=M047230

$B\bar{B}$ DECAYS

NODE=M047BBD

NODE=M047BBD

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.

$\Gamma(B^+B^-)/\Gamma_{\text{total}}$					Γ_2/Γ
VALUE	DOCUMENT ID				
0.514$\pm$0.006 OUR EVALUATION	Assuming $B(\Upsilon(4S) \rightarrow B\bar{B}) = 1$				

NODE=M047R11
NODE=M047R11
→ UNCHECKED ←

$\Gamma(D_s^+ \text{ anything} + \text{c.c.})/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
0.178±0.021±0.016	⁴ ARTUSO	05B CLE3	$e^+e^- \rightarrow D_s^+ X$

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

 $\Gamma(B^0\bar{B}^0)/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
0.486±0.006 OUR EVALUATION	Assuming $B(\Upsilon(4S) \rightarrow B\bar{B}) = 1$		

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

 $\Gamma(B^+B^-)/\Gamma(B^0\bar{B}^0)$ Γ_2/Γ_4

VALUE	DOCUMENT ID	TECN	COMMENT
1.058±0.024 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	$\Upsilon(4S) \rightarrow B\bar{B} \rightarrow J/\psi K^*$

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 $\tau(B^+) / \tau(B^0) = 1.066 \pm 0.024$.

NODE=M047R10;LINKAGE=F
 NODE=M047R10;LINKAGE=D
 NODE=M047R10;LINKAGE=E
 NODE=M047R10;LINKAGE=C

 $[\Gamma(J/\psi K_S^0) + \Gamma((J/\psi, \eta_c)K_S^0)]/\Gamma_{\text{total}}$ Γ_5/Γ

Forbidden by CP invariance.

VALUE (units 10^{-7})	CL%	DOCUMENT ID	TECN	COMMENT
<4	90	¹⁰ TAJIMA	07A BELL	$\Upsilon(4S) \rightarrow B^0\bar{B}^0$

¹⁰ $\Upsilon(4S)$ with $CP = +1$ decays to the final state with $CP = -1$.

NODE=M047R16
 NODE=M047R16
 NODE=M047R16

NODE=M047R16;LINKAGE=TA

non- $B\bar{B}$ DECAYS $\Gamma(\text{non-}B\bar{B})/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.04	95	BARISH	96B CLEO	e^+e^-

NODE=M047R6
 NODE=M047R6

NODE=M047NBB

 $\Gamma(e^+e^-)/\Gamma_{\text{total}}$ 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 $\Gamma(s)$.

NODE=M047R5
 NODE=M047R5

NODE=M047R5;LINKAGE=A

 $\Gamma(\rho^+\rho^-)/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<5.7 × 10⁻⁶	90	AUBERT	08BO BABR	$e^+e^- \rightarrow \pi^+\pi^-2\pi^0$

NODE=M047R17
 NODE=M047R17

 $\Gamma(K^*(892)^0\bar{K}^0)/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<2.0 × 10⁻⁶	90	SHEN	13A BELL	$e^+e^- \rightarrow K^*(892)^0\bar{K}^0$

NODE=M047R02
 NODE=M047R02

 $\Gamma(J/\psi(1S) \text{ anything})/\Gamma_{\text{total}}$ Γ_{10}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.9	95	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 $B(J/\psi \rightarrow \mu^+\mu^-) = 0.0588 \pm 0.0010$.

NODE=M047R1
 NODE=M047R1

NODE=M047R;LINKAGE=AC

$\Gamma(D^{*+} \text{ anything} + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{11}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.074	90	¹³ ALEXANDER	90C CLEO	$e^+ e^-$

¹³ For $x > 0.473$.NODE=M047R2
NODE=M047R2

NODE=M047R2;LINKAGE=A

 $\Gamma(\phi \text{ anything})/\Gamma_{\text{total}}$ Γ_{12}/Γ

VALUE (units 10^{-2})	CL%	DOCUMENT ID	TECN	COMMENT
7.1 $\pm 0.1 \pm 0.6$		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 $x > 0.52$.NODE=M047R3
NODE=M047R3

NODE=M047R3;LINKAGE=A

 $\Gamma(\phi\eta)/\Gamma_{\text{total}}$ Γ_{13}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<1.8	90	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.NODE=M047R14
NODE=M047R14

NODE=M047R14;LINKAGE=BE

 $\Gamma(\phi\eta')/\Gamma_{\text{total}}$ Γ_{14}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<4.3	90	¹⁶ BELOUS	09 BELL	$e^+ e^- \rightarrow \phi\eta'$

¹⁶ Using all intermedite branching fraction values from PDG 08.NODE=M047R21
NODE=M047R21

NODE=M047R21;LINKAGE=BE

 $\Gamma(\rho\eta)/\Gamma_{\text{total}}$ Γ_{15}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<1.3	90	¹⁷ BELOUS	09 BELL	$e^+ e^- \rightarrow \rho\eta$

¹⁷ Using all intermedite branching fraction values from PDG 08.NODE=M047R22
NODE=M047R22

NODE=M047R22;LINKAGE=BE

 $\Gamma(\rho\eta')/\Gamma_{\text{total}}$ Γ_{16}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<2.5	90	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_{17}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.004	90	ALEXANDER	90C CLEO	$e^+ e^-$

NODE=M047R4
NODE=M047R4 $\Gamma(\Upsilon(1S)\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{18}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
8.1 ± 0.6 OUR AVERAGE					

8.5 $\pm 1.3 \pm 0.2$	113 ± 16	¹⁹ SOKOLOV	09 BELL	$e^+ e^- \rightarrow \pi^+\pi^-\mu^+\mu^-$

8.00 $\pm 0.64 \pm 0.27$	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 $\pm 4.0 \pm 0.3$		^{21,22} SOKOLOV	07 BELL	$e^+ e^- \rightarrow \pi^+\pi^-\mu^+\mu^-$

9.0 $\pm 1.5 \pm 0.2$	167 ± 19	²³ AUBERT	06R BABR	$e^+ e^- \rightarrow \pi^+\pi^-\mu^+\mu^-$

<12	90	GLENN	99 CLE2	$e^+ e^-$

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.

²⁰ Using $B(\Upsilon(1S) \rightarrow e^+e^-) = (2.38 \pm 0.11)\%$ and $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.05)\%$.

²¹ 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.

²² According to the authors, systematic errors were underestimated.

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
NODE=M047R7

NODE=M047R7;LINKAGE=SK

NODE=M047R7;LINKAGE=UB

NODE=M047R7;LINKAGE=SO

NODE=M047R7;LINKAGE=US

NODE=M047R7;LINKAGE=AU

$\Gamma(\Upsilon(1S)\eta)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$1.96 \pm 0.26 \pm 0.09$		56	24 AUBERT	08BP BABR	$\Upsilon(4S) \rightarrow \pi^+ \pi^- \pi^0 \ell^+ \ell^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<2.7	90	25 TAMPONI	15 BELL	$e^+ e^- \rightarrow \gamma \eta + \text{hadrons}$

²⁴ Using $B(\Upsilon(1S) \rightarrow e^+ e^-) = (2.38 \pm 0.11)\%$ and $B(\Upsilon(1S) \rightarrow \mu^+ \mu^-) = (2.48 \pm 0.05)\%$.

²⁵ Using $B(\eta \rightarrow 2\gamma) = (39.41 \pm 0.20)\%$.

 $\Gamma(\Upsilon(1S)\eta)/\Gamma(\Upsilon(1S)\pi^+\pi^-)$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

$2.41 \pm 0.40 \pm 0.12$	56	26 AUBERT	08BP BABR	$\Upsilon(4S) \rightarrow \pi^+ \pi^- (\pi^0) \ell^+ \ell^-$

²⁶ Not independent of other values reported by AUBERT 08BP.

 $\Gamma(\Upsilon(2S)\pi^+\pi^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT

$0.86 \pm 0.11 \pm 0.07$		220	27 AUBERT	08BP BABR	$\Upsilon(4S) \rightarrow \pi^+ \pi^- \ell^+ \ell^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

$0.88 \pm 0.17 \pm 0.08$	97 ± 15	28 AUBERT	06R BABR	$e^+ e^- \rightarrow \pi^+ \pi^- \mu^+ \mu^-$
<3.9	90	GLENN	99 CLE2	$e^+ e^-$

²⁷ Using $B(\Upsilon(2S) \rightarrow e^+ e^-) = (1.91 \pm 0.16)\%$ and $B(\Upsilon(2S) \rightarrow \mu^+ \mu^-) = (1.93 \pm 0.17)\%$.

²⁸ 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.

 $\Gamma(\Upsilon(2S)\pi^+\pi^-)/\Gamma(\Upsilon(1S)\pi^+\pi^-)$

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	29 AUBERT	08BP BABR	$\Upsilon(4S) \rightarrow \pi^+ \pi^- \ell^+ \ell^-$

²⁹ 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.

 $\Gamma(h_b(1P)\pi^+\pi^-)/\Gamma_{\text{total}}$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

not seen	$(35^{+32}_{-26})k$	30 ADACHI	12 BELL	$10.58 e^+ e^- \rightarrow h_b(1P)\pi^+\pi^-$

³⁰ 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.

 $\Gamma(h_b(1P)\eta)/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT

$2.18 \pm 0.11 \pm 0.18$	112k	31 TAMPONI	15 BELL	$e^+ e^- \rightarrow h_b(1P)\eta$

³¹ Using $B(\eta \rightarrow 2\gamma) = (39.41 \pm 0.20)\%$.

 $\Gamma(\overline{2H} \text{ anything})/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT

<1.3	90	ASNER	07 CLEO	$e^+ e^- \rightarrow \overline{d} X$

$\Upsilon(4S)$ REFERENCES

TAMPONI	15	PRL 115 142001	U. Tamponi <i>et al.</i>	(BELLE Collab.)
SHEN	13A	PR D88 052019	C.P. Shen <i>et al.</i>	(BELLE Collab.)
ADACHI	12	PRL 108 032001	I. Adachi <i>et al.</i>	(BELLE Collab.)
BELOUS	09	PL B681 400	K. Belous <i>et al.</i>	(BELLE Collab.)
SOKOLOV	09	PR D79 051103	A. Sokolov <i>et al.</i>	(BELLE Collab.)
AUBERT	08BO	PR D78 071103	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT	08BP	PR D78 112002	B. Aubert <i>et al.</i>	(BABAR 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.)
HUANG	07	PR D75 012002	G.S. Huang <i>et al.</i>	(CLEO Collab.)
SOKOLOV	07	PR D75 071103	A. Sokolov <i>et al.</i>	(BELLE Collab.)
TAJIMA	07A	PRL 99 211601	O. Tajima <i>et al.</i>	(BELLE Collab.)
AUBERT	06R	PRL 96 232001	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT,BE	06F	PR D74 111103	B. Aubert <i>et al.</i>	(BABAR Collab.)
ARTUSO	05B	PRL 95 261801	M. Artuso <i>et al.</i>	(CLEO Collab.)

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NODE=M047

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REFID=52166
REFID=51617
REFID=51624
REFID=51715
REFID=52066
REFID=51143
REFID=51563
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
BESSION	85	PRL 54 381	D. Besson <i>et al.</i>	(CLEO Collab.)	REFID=22368
LOVELOCK	85	PRL 54 377	D.M.J. Lovelock <i>et al.</i>	(CUSB Collab.)	REFID=22369
LEYAOUANC	77	PL B71 397	A. Le Yaouanc <i>et al.</i>	(ORSAY)	REFID=44695

 $X(10610)^\pm$

$$J^G(J^P) = 1^+(1^+)$$

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. Isospin = 1 is favored due to observation by KROKOVNY 13 of a corresponding neutral state produced in $\Upsilon(10860) \rightarrow \Upsilon(2S)/\Upsilon(3S)\pi^0\pi^0$ decays at a consistent mass.

NODE=M207

NODE=M207

$X(10610)^\pm$ MASS

NODE=M207M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
10607.2$\pm$2.0	¹ BONDAR 12	BELL	$e^+e^- \rightarrow \text{hadrons}$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
10608.5 $\pm$ 3.4 $^{+3.7}_{-1.4}$	² GARMASH 15	BELL	$e^+e^- \rightarrow \Upsilon(1S)\pi^+\pi^-$
10608.1 $\pm$ 1.2 $^{+1.5}_{-0.2}$	² GARMASH 15	BELL	$e^+e^- \rightarrow \Upsilon(2S)\pi^+\pi^-$
10607.4 $\pm$ 1.5 $^{+0.8}_{-0.2}$	² GARMASH 15	BELL	$e^+e^- \rightarrow \Upsilon(3S)\pi^+\pi^-$
10611 $\pm 4 \pm 3$	³ BONDAR 12	BELL	$e^+e^- \rightarrow \Upsilon(1S)\pi^+\pi^-$
10609 $\pm 2 \pm 3$	³ BONDAR 12	BELL	$e^+e^- \rightarrow \Upsilon(2S)\pi^+\pi^-$
10608 $\pm 2 \pm 3$	³ BONDAR 12	BELL	$e^+e^- \rightarrow \Upsilon(3S)\pi^+\pi^-$
10605 $\pm 2 \pm 1$	³ BONDAR 12	BELL	$e^+e^- \rightarrow h_b(1P)\pi^+\pi^-$
10599 $^{+6}_{-3} \pm 5$	³ BONDAR 12	BELL	$e^+e^- \rightarrow h_b(2P)\pi^+\pi^-$

¹ Average of the BONDAR 12 measurements in separate channels.

² Correlated with the corresponding result from BONDAR 12.

³ Superseded by the average measurement of BONDAR 12.

NODE=M207M

OCCUR=2

OCCUR=3

OCCUR=2

OCCUR=3

OCCUR=4

OCCUR=5

OCCUR=6

NODE=M207M;LINKAGE=BO

NODE=M207M;LINKAGE=A

NODE=M207M;LINKAGE=BN

$X(10610)^\pm$ WIDTH

NODE=M207W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
18.4$\pm$ 2.4	⁴ BONDAR 12	BELL	$e^+e^- \rightarrow \text{hadrons}$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
18.5 $\pm$ 5.3 $^{+6.1}_{-2.3}$	⁵ GARMASH 15	BELL	$e^+e^- \rightarrow \Upsilon(1S)\pi^+\pi^-$
20.8 $\pm$ 2.5 $^{+0.3}_{-2.1}$	⁵ GARMASH 15	BELL	$e^+e^- \rightarrow \Upsilon(2S)\pi^+\pi^-$
18.7 $\pm$ 3.4 $^{+2.5}_{-1.3}$	⁵ GARMASH 15	BELL	$e^+e^- \rightarrow \Upsilon(3S)\pi^+\pi^-$
22.3 $\pm$ 7.7 $^{+3.0}_{-4.0}$	⁶ BONDAR 12	BELL	$e^+e^- \rightarrow \Upsilon(1S)\pi^+\pi^-$
24.2 $\pm$ 3.1 $^{+2.0}_{-3.0}$	⁶ BONDAR 12	BELL	$e^+e^- \rightarrow \Upsilon(2S)\pi^+\pi^-$
17.6 $\pm$ 3.0 $\pm$ 3.0	⁶ BONDAR 12	BELL	$e^+e^- \rightarrow \Upsilon(3S)\pi^+\pi^-$
11.4 $^{+4.5}_{-3.9} \pm 2.1$	⁶ BONDAR 12	BELL	$e^+e^- \rightarrow h_b(1P)\pi^+\pi^-$
13 $^{+10}_{-8} \pm 9$	⁶ BONDAR 12	BELL	$e^+e^- \rightarrow h_b(2P)\pi^+\pi^-$

⁴ Average of the BONDAR 12 measurements in separate channels.

⁵ Correlated with the corresponding result from BONDAR 12.

⁶ Superseded by the average measurement of BONDAR 12.

NODE=M207W

OCCUR=2

OCCUR=3

OCCUR=2

OCCUR=3

OCCUR=4

OCCUR=5

OCCUR=6

NODE=M207W;LINKAGE=BO

NODE=M207W;LINKAGE=A

NODE=M207W;LINKAGE=BN

X(10610)⁺ DECAY MODESX(10610)[−] decay modes are charge conjugates of the modes below.

NODE=M207215;NODE=M207

NODE=M207

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \Upsilon(1S)\pi^+$	$(5.4^{+1.9}_{-1.5}) \times 10^{-3}$
$\Gamma_2 \quad \Upsilon(2S)\pi^+$	$(3.6^{+1.1}_{-0.8})\%$
$\Gamma_3 \quad \Upsilon(3S)\pi^+$	$(2.1^{+0.8}_{-0.6})\%$
$\Gamma_4 \quad h_b(1P)\pi^+$	$(3.5^{+1.2}_{-0.9})\%$
$\Gamma_5 \quad h_b(2P)\pi^+$	$(4.7^{+1.7}_{-1.3})\%$
$\Gamma_6 \quad B^+\bar{B}^0$	not seen
$\Gamma_7 \quad B^+\bar{B}^{*0} + \bar{B}^0 B^{*+}$	$(85.6^{+2.1}_{-2.9})\%$
$\Gamma_8 \quad B^{*+}\bar{B}^{*0}$	not seen

DESIG=1

DESIG=2

DESIG=3

DESIG=4

DESIG=5

DESIG=8

DESIG=6

DESIG=7

X(10610)[±] BRANCHING RATIOS

NODE=M207225

$\Gamma(\Upsilon(1S)\pi^+)/\Gamma_{\text{total}}$	Γ_1/Γ
VALUE	DOCUMENT ID TECN COMMENT
$(0.54^{+0.16+0.11}_{-0.13-0.08}) \times 10^{-2}$	⁷ GARMASH 16 BELL $e^+e^- \rightarrow \pi^- B^+ \bar{B}^{*0}, \pi^- \bar{B}^0 B^{*+}$
• • • We do not use the following data for averages, fits, limits, etc. • • •	
seen	GARMASH 15 BELL $e^+e^- \rightarrow \Upsilon(1S)\pi^+\pi^-$
seen	BONDAR 12 BELL $e^+e^- \rightarrow \Upsilon(1S)\pi^+\pi^-$
⁷ Assuming the X(10610) [±] decay width is saturated by the channels $\pi^+\Upsilon(1S, 2S, 3S)$, $\pi^+h_b(1P, 2P)$, and $B^+\bar{B}^{*0} + \bar{B}^0 B^{*+}$, and using the results from BONDAR 12 and MIZUK 16.	

NODE=M207R01
NODE=M207R01

NODE=M207R01;LINKAGE=A

$\Gamma(\Upsilon(2S)\pi^+)/\Gamma_{\text{total}}$	Γ_2/Γ
VALUE	DOCUMENT ID TECN COMMENT
$(3.62^{+0.76+0.79}_{-0.59-0.53}) \times 10^{-2}$	⁸ GARMASH 16 BELL $e^+e^- \rightarrow \pi^- B^+ \bar{B}^{*0}, \pi^- \bar{B}^0 B^{*+}$
• • • We do not use the following data for averages, fits, limits, etc. • • •	
seen	GARMASH 15 BELL $e^+e^- \rightarrow \Upsilon(2S)\pi^+\pi^-$
seen	BONDAR 12 BELL $e^+e^- \rightarrow \Upsilon(2S)\pi^+\pi^-$
⁸ Assuming the X(10610) [±] decay width is saturated by the channels $\pi^+\Upsilon(1S, 2S, 3S)$, $\pi^+h_b(1P, 2P)$, and $B^+\bar{B}^{*0} + \bar{B}^0 B^{*+}$, and using the results from BONDAR 12 and MIZUK 16.	

NODE=M207R02
NODE=M207R02

NODE=M207R02;LINKAGE=A

$\Gamma(\Upsilon(3S)\pi^+)/\Gamma_{\text{total}}$	Γ_3/Γ
VALUE	DOCUMENT ID TECN COMMENT
$(2.15^{+0.55+0.60}_{-0.42-0.43}) \times 10^{-2}$	⁹ GARMASH 16 BELL $e^+e^- \rightarrow \pi^- B^+ \bar{B}^{*0}, \pi^- \bar{B}^0 B^{*+}$
• • • We do not use the following data for averages, fits, limits, etc. • • •	
seen	GARMASH 15 BELL $e^+e^- \rightarrow \Upsilon(3S)\pi^+\pi^-$
seen	BONDAR 12 BELL $e^+e^- \rightarrow \Upsilon(3S)\pi^+\pi^-$
⁹ Assuming the X(10610) [±] decay width is saturated by the channels $\pi^+\Upsilon(1S, 2S, 3S)$, $\pi^+h_b(1P, 2P)$, and $B^+\bar{B}^{*0} + \bar{B}^0 B^{*+}$, and using the results from BONDAR 12 and MIZUK 16.	

NODE=M207R03
NODE=M207R03

NODE=M207R03;LINKAGE=A

$\Gamma(h_b(1P)\pi^+)/\Gamma_{\text{total}}$	Γ_4/Γ
VALUE	DOCUMENT ID TECN COMMENT
$(3.45^{+0.87+0.86}_{-0.71-0.63}) \times 10^{-2}$	¹⁰ GARMASH 16 BELL $e^+e^- \rightarrow \pi^- B^+ \bar{B}^{*0}, \pi^- \bar{B}^0 B^{*+}$
• • • We do not use the following data for averages, fits, limits, etc. • • •	
possibly seen	¹¹ MIZUK 16 BELL $e^+e^- \rightarrow h_b(1P)\pi^+\pi^-$
seen	¹² BONDAR 12 BELL $e^+e^- \rightarrow h_b(1P)\pi^+\pi^-$
¹⁰ Assuming the X(10610) [±] decay width is saturated by the channels $\pi^+\Upsilon(1S, 2S, 3S)$, $\pi^+h_b(1P, 2P)$, and $B^+\bar{B}^{*0} + \bar{B}^0 B^{*+}$, and using the results from BONDAR 12 and MIZUK 16.	
¹¹ Using e^+e^- energies near the $\Upsilon(11020)$.	
¹² Using e^+e^- energies near the $\Upsilon(10860)$.	

NODE=M207R04
NODE=M207R04

NODE=M207R04;LINKAGE=C

NODE=M207R04;LINKAGE=A
NODE=M207R04;LINKAGE=B

$\Gamma(h_b(2P)\pi^+)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE	DOCUMENT ID	TECN	COMMENT

$(4.67^{+1.24+1.18}_{-1.00-0.89}) \times 10^{-2}$	13 GARMASH	16	BELL $e^+e^- \rightarrow \pi^- B^+ \bar{B}^{*0}, \pi^- \bar{B}^0 B^{*+}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

possibly seen	14 MIZUK	16	BELL $e^+e^- \rightarrow h_b(2P)\pi^+\pi^-$

seen	15 BONDAR	12	BELL $e^+e^- \rightarrow h_b(2P)\pi^+\pi^-$

¹³ Assuming the $X(10610)^\pm$ decay width is saturated by the channels $\pi^+ \Upsilon(1S, 2S, 3S)$, $\pi^+ h_b(1P, 2P)$, and $B^+ \bar{B}^{*0} + \bar{B}^0 B^{*+}$, and using the results from BONDAR 12 and MIZUK 16.

¹⁴ Using e^+e^- energies near the $\Upsilon(11020)$.

¹⁵ Using e^+e^- energies near the $\Upsilon(10860)$.

NODE=M207R05
NODE=M207R05

NODE=M207R05;LINKAGE=C

NODE=M207R05;LINKAGE=A
NODE=M207R05;LINKAGE=B

 $\Gamma(B^+ \bar{B}^0)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE	DOCUMENT ID	TECN	COMMENT

not seen	GARMASH	16	BELL $e^+e^- \rightarrow \pi^- B^+ \bar{B}^0$

NODE=M207R08
NODE=M207R08

 $[\Gamma(B^+ \bar{B}^{*0}) + \Gamma(\bar{B}^0 B^{*+})]/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

$(85.6^{+1.5+1.5}_{-2.0-2.1}) \times 10^{-2}$	357	16 GARMASH	16	BELL $e^+e^- \rightarrow \pi^- B^+ \bar{B}^{*0}, \pi^- \bar{B}^0 B^{*+}$

¹⁶ Assuming the $X(10610)^\pm$ decay width is saturated by the channels $\pi^+ \Upsilon(1S, 2S, 3S)$, $\pi^+ h_b(1P, 2P)$, and $B^+ \bar{B}^{*0} + \bar{B}^0 B^{*+}$, and using the results from BONDAR 12 and MIZUK 16. Using the mass and width of the $X(10610)^\pm$ from BONDAR 12.

NODE=M207R00
NODE=M207R00

NODE=M207R00;LINKAGE=A

 $\Gamma(B^{*+} \bar{B}^{*0})/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE	DOCUMENT ID	TECN	COMMENT

not seen	GARMASH	16	BELL $e^+e^- \rightarrow \pi^- B^{*+} \bar{B}^{*0}$

NODE=M207R06
NODE=M207R06

$[\Gamma(B^+ \bar{B}^{*0}) + \Gamma(\bar{B}^0 B^{*+})]/[\Gamma(\Upsilon(1S)\pi^+) + \Gamma(\Upsilon(2S)\pi^+) + \Gamma(\Upsilon(3S)\pi^+) + \Gamma(h_b(1P)\pi^+) + \Gamma(h_b(2P)\pi^+)]$ $\Gamma_7/(\Gamma_1+\Gamma_2+\Gamma_3+\Gamma_4+\Gamma_5)$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

$(5.93^{+0.99+1.01}_{-0.69-0.73}) \times 10^{-2}$	357	17 GARMASH	16	BELL $e^+e^- \rightarrow \pi^- B^+ \bar{B}^{*0}, \pi^- \bar{B}^0 B^{*+}$

¹⁷ Combined with the results of BONDAR 12 and MIZUK 16. Not independent from $X(10610)^\pm$ branching fractions to $\pi^+ \Upsilon(1S, 2S, 3S)$, $\pi^+ h_b(1P, 2P)$, and $B^+ \bar{B}^{*0} + \bar{B}^0 B^{*+}$.

NODE=M207R07
NODE=M207R07

NODE=M207R07;LINKAGE=A

$X(10610)^\pm$ REFERENCES

NODE=M207

GARMASH	16	PRL 116 212001	A. Garmash <i>et al.</i>	(BELLE Collab.)
MIZUK	16	PRL 117 142001	R. Mizuk <i>et al.</i>	(BELLE Collab.)
GARMASH	15	PR D91 072003	A. Garmash <i>et al.</i>	(BELLE Collab.)
KROKOVNY	13	PR D88 052016	P. Krokovny <i>et al.</i>	(BELLE Collab.)
BONDAR	12	PRL 108 122001	A. Bondar <i>et al.</i>	(BELLE Collab.)

REFID=57446
REFID=57465
REFID=56811
REFID=55588
REFID=53963

NODE=M214

X(10610)⁰

$I^G(J^P) = 1^+(1^+)$

Observed by KROKOVNY 13 in $\Upsilon(10860) \rightarrow \Upsilon(nS)\pi^0\pi^0$ (n=2,3). Isospin 1 is favored from the proximity in mass to $X(10610)^\pm$ and their similarity of observed decay modes and cross sections. $J^P = 1^+$ is favored from angular analysis of $X(10610)^\pm$ decays by BONDAR 12.

NODE=M214

X(10610)⁰ MASS

NODE=M214M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
10609±4±4	¹ KROKOVNY 13	BELL	$e^+e^- \rightarrow \Upsilon(2S)/\Upsilon(3S)\pi^0\pi^0$
¹ From a simultaneous fit to the KROKOVNY 13 Dalitz analysis of $e^+e^- \rightarrow \Upsilon(2S)/\Upsilon(3S)\pi^0\pi^0$ decays with fixed width $\Gamma(X(10610)^0) = 18.4$ MeV.			

NODE=M214M

NODE=M214M;LINKAGE=A

X(10610)⁰ DECAY MODES

NODE=M214215;NODE=M214

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \Upsilon(1S)\pi^0$	not seen
$\Gamma_2 \quad \Upsilon(2S)\pi^0$	seen
$\Gamma_3 \quad \Upsilon(3S)\pi^0$	seen

DESIG=1
DESIG=2
DESIG=3

X(10610)⁰ BRANCHING RATIOS

NODE=M214225

$\Gamma(\Upsilon(1S)\pi^0)/\Gamma_{\text{total}}$				Γ_1/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
not seen	KROKOVNY	13	BELL	$e^+e^- \rightarrow \Upsilon(1S)\pi^0\pi^0$
$\Gamma(\Upsilon(2S)\pi^0)/\Gamma_{\text{total}}$				Γ_2/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
seen	² KROKOVNY	13	BELL	$e^+e^- \rightarrow \Upsilon(2S)\pi^0\pi^0$
² Combined significance in $e^+e^- \rightarrow \Upsilon(2S)/\Upsilon(3S)\pi^0\pi^0$, including systematics, of 6.5 σ .				
$\Gamma(\Upsilon(3S)\pi^0)/\Gamma_{\text{total}}$				Γ_3/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
seen	³ KROKOVNY	13	BELL	$e^+e^- \rightarrow \Upsilon(3S)\pi^0\pi^0$
³ Combined significance in $e^+e^- \rightarrow \Upsilon(2S)/\Upsilon(3S)\pi^0\pi^0$, including systematics, of 6.5 σ .				

NODE=M214R01
NODE=M214R01

NODE=M214R02
NODE=M214R02

NODE=M214R02;LINKAGE=A

NODE=M214R03
NODE=M214R03

NODE=M214R03;LINKAGE=A

X(10610)⁰ REFERENCES

NODE=M214

KROKOVNY 13	PR D88 052016	P. Krokovny <i>et al.</i>	(BELLE Collab.)
BONDAR 12	PRL 108 122001	A. Bondar <i>et al.</i>	(BELLE Collab.)

REFID=55588
REFID=53963

$X(10650)^\pm$

$$I^G(J^P) = ?^+(1^+)$$

NODE=M208

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$1.5	¹ BONDAR 12	BELL	$e^+e^- \rightarrow \text{hadrons}$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
10656.7 $\pm$ 5.0 $^{+1.1}_{-3.1}$	² GARMASH 15	BELL	$e^+e^- \rightarrow \Upsilon(1S)\pi^+\pi^-$
10650.7 $\pm$ 1.5 $^{+0.5}_{-0.2}$	² GARMASH 15	BELL	$e^+e^- \rightarrow \Upsilon(2S)\pi^+\pi^-$
10651.2 $\pm$ 1.0 $^{+0.4}_{-0.3}$	² GARMASH 15	BELL	$e^+e^- \rightarrow \Upsilon(3S)\pi^+\pi^-$
10657 $\pm$ 6 $\pm$ 3	³ BONDAR 12	BELL	$e^+e^- \rightarrow \Upsilon(1S)\pi^+\pi^-$
10651 $\pm$ 2 $\pm$ 3	³ BONDAR 12	BELL	$e^+e^- \rightarrow \Upsilon(2S)\pi^+\pi^-$
10652 $\pm$ 1 $\pm$ 2	³ BONDAR 12	BELL	$e^+e^- \rightarrow \Upsilon(3S)\pi^+\pi^-$
10654 $\pm$ 3 $^{+1}_{-2}$	³ BONDAR 12	BELL	$e^+e^- \rightarrow h_b(1P)\pi^+\pi^-$
10651 $^{+2}_{-3}$ $^{+3}_{-2}$	³ BONDAR 12	BELL	$e^+e^- \rightarrow h_b(2P)\pi^+\pi^-$

NODE=M208M

¹ Average of the BONDAR 12 measurements in separate channels.² Correlated with the corresponding result from BONDAR 12.³ Superseded by the average measurement of BONDAR 12.

OCCUR=2

OCCUR=3

OCCUR=2

OCCUR=3

OCCUR=4

OCCUR=5

OCCUR=6

NODE=M208M;LINKAGE=BO

NODE=M208M;LINKAGE=A

NODE=M208M;LINKAGE=BN

 $X(10650)^\pm$ WIDTH

NODE=M208W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
11.5$\pm$ 2.2	⁴ BONDAR 12	BELL	$e^+e^- \rightarrow \text{hadrons}$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
12.1 $^{+11.3+2.7}_{-4.8-0.6}$	⁵ GARMASH 15	BELL	$e^+e^- \rightarrow \Upsilon(1S)\pi^+\pi^-$
14.2 $\pm$ 3.7 $^{+0.9}_{-0.4}$	⁵ GARMASH 15	BELL	$e^+e^- \rightarrow \Upsilon(2S)\pi^+\pi^-$
9.3 $\pm$ 2.2 $^{+0.3}_{-0.5}$	⁵ GARMASH 15	BELL	$e^+e^- \rightarrow \Upsilon(3S)\pi^+\pi^-$
16.3 $\pm$ 9.8 $^{+6.0}_{-2.0}$	⁶ BONDAR 12	BELL	$e^+e^- \rightarrow \Upsilon(1S)\pi^+\pi^-$
13.3 $\pm$ 3.3 $^{+4.0}_{-3.0}$	⁶ BONDAR 12	BELL	$e^+e^- \rightarrow \Upsilon(2S)\pi^+\pi^-$
8.4 $\pm$ 2.0 $\pm$ 2.0	⁶ BONDAR 12	BELL	$e^+e^- \rightarrow \Upsilon(3S)\pi^+\pi^-$
20.9 $^{+5.4+2.1}_{-4.7-5.7}$	⁶ BONDAR 12	BELL	$e^+e^- \rightarrow h_b(1P)\pi^+\pi^-$
19 $\pm$ 7 $^{+11}_{-7}$	⁶ BONDAR 12	BELL	$e^+e^- \rightarrow h_b(2P)\pi^+\pi^-$

NODE=M208W

⁴ Average of the BONDAR 12 measurements in separate channels.⁵ Correlated with the corresponding result from BONDAR 12.⁶ Superseded by the average measurement of BONDAR 12.

OCCUR=2

OCCUR=3

OCCUR=2

OCCUR=3

OCCUR=4

OCCUR=5

OCCUR=6

NODE=M208W;LINKAGE=BO

NODE=M208W;LINKAGE=A

NODE=M208W;LINKAGE=BN

 $X(10650)^+$ 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 $\Upsilon(1S)\pi^+$	(1.7 $^{+0.8}_{-0.6}$) $\times 10^{-3}$
Γ_2 $\Upsilon(2S)\pi^+$	(1.4 $^{+0.6}_{-0.4}$) %
Γ_3 $\Upsilon(3S)\pi^+$	(1.6 $^{+0.7}_{-0.5}$) %
Γ_4 $h_b(1P)\pi^+$	(8.4 $^{+2.9}_{-2.4}$) %
Γ_5 $h_b(2P)\pi^+$	(15 $\pm$ 4) %
Γ_6 $B^+\bar{B}^0$	
Γ_7 $B^+\bar{B}^{*0} + \bar{B}^0 B^{*+}$	not seen
Γ_8 $B^{*+}\bar{B}^{*0}$	(74 $^{+4}_{-6}$) %

DESIG=1

DESIG=2

DESIG=3

DESIG=4

DESIG=5

DESIG=8

DESIG=6

DESIG=7

X(10650)[±] BRANCHING RATIOS

NODE=M208225

 $\Gamma(\Upsilon(1S)\pi^+)/\Gamma_{\text{total}}$ **Γ_1/Γ**

VALUE	DOCUMENT ID	TECN	COMMENT
$(0.17^{+0.07+0.03}_{-0.06-0.02}) \times 10^{-2}$	⁷ GARMASH	16	BELL $e^+e^- \rightarrow \pi^- B^{*+} \bar{B}^0$

NODE=M208R01
NODE=M208R01

• • • We do not use the following data for averages, fits, limits, etc. • • •

seen	GARMASH	15	BELL $e^+e^- \rightarrow \Upsilon(1S)\pi^+\pi^-$
seen	BONDAR	12	BELL $e^+e^- \rightarrow \Upsilon(1S)\pi^+\pi^-$

⁷ Assuming the X(10650)[±] decay width is saturated by the channels $\pi^+ \Upsilon(1S, 2S, 3S)$, $\pi^+ h_b(1P, 2P)$, and $B^{*+} \bar{B}^0$, and using the results from BONDAR 12 and MIZUK 16.

NODE=M208R01;LINKAGE=A

 $\Gamma(\Upsilon(2S)\pi^+)/\Gamma_{\text{total}}$ **Γ_2/Γ**

VALUE	DOCUMENT ID	TECN	COMMENT
$(1.39^{+0.48+0.34}_{-0.38-0.23}) \times 10^{-2}$	⁸ GARMASH	16	$e^+e^- \rightarrow \pi^- B^{*+} \bar{B}^0$

NODE=M208R02
NODE=M208R02

• • • We do not use the following data for averages, fits, limits, etc. • • •

seen	GARMASH	15	BELL $e^+e^- \rightarrow \Upsilon(2S)\pi^+\pi^-$
seen	BONDAR	12	BELL $e^+e^- \rightarrow \Upsilon(2S)\pi^+\pi^-$

⁸ Assuming the X(10650)[±] decay width is saturated by the channels $\pi^+ \Upsilon(1S, 2S, 3S)$, $\pi^+ h_b(1P, 2P)$, and $B^{*+} \bar{B}^0$, and using the results from BONDAR 12 and MIZUK 16.

NODE=M208R02;LINKAGE=A

 $\Gamma(\Upsilon(3S)\pi^+)/\Gamma_{\text{total}}$ **Γ_3/Γ**

VALUE	DOCUMENT ID	TECN	COMMENT
$(1.63^{+0.53+0.39}_{-0.42-0.28}) \times 10^{-2}$	⁹ GARMASH	16	BELL $e^+e^- \rightarrow \pi^- B^{*+} \bar{B}^0$

NODE=M208R03
NODE=M208R03

• • • We do not use the following data for averages, fits, limits, etc. • • •

seen	GARMASH	15	BELL $e^+e^- \rightarrow \Upsilon(3S)\pi^+\pi^-$
seen	BONDAR	12	BELL $e^+e^- \rightarrow \Upsilon(3S)\pi^+\pi^-$

⁹ Assuming the X(10650)[±] decay width is saturated by the channels $\pi^+ \Upsilon(1S, 2S, 3S)$, $\pi^+ h_b(1P, 2P)$, and $B^{*+} \bar{B}^0$, and using the results from BONDAR 12 and MIZUK 16.

NODE=M208R03;LINKAGE=A

 $\Gamma(h_b(1P)\pi^+)/\Gamma_{\text{total}}$ **Γ_4/Γ**

VALUE	DOCUMENT ID	TECN	COMMENT
$(8.41^{+2.43+1.49}_{-2.12-1.06}) \times 10^{-2}$	¹⁰ GARMASH	16	BELL $e^+e^- \rightarrow \pi^- B^{*+} \bar{B}^0$

NODE=M208R04
NODE=M208R04

• • • We do not use the following data for averages, fits, limits, etc. • • •

seen	¹¹ MIZUK	16	BELL $e^+e^- \rightarrow h_b(1P)\pi^+\pi^-$
seen	¹² BONDAR	12	BELL $e^+e^- \rightarrow h_b(1P)\pi^+\pi^-$

¹⁰ Assuming the X(10650)[±] decay width is saturated by the channels $\pi^+ \Upsilon(1S, 2S, 3S)$, $\pi^+ h_b(1P, 2P)$, and $B^{*+} \bar{B}^0$, and using the results from BONDAR 12 and MIZUK 16.

NODE=M208R04;LINKAGE=C

¹¹ Using e^+e^- energies near the $\Upsilon(11020)$.

NODE=M208R04;LINKAGE=A

¹² Using e^+e^- energies near the $\Upsilon(10860)$.

NODE=M208R04;LINKAGE=B

 $\Gamma(h_b(2P)\pi^+)/\Gamma_{\text{total}}$ **Γ_5/Γ**

VALUE	DOCUMENT ID	TECN	COMMENT
$(14.7^{+3.2+2.8}_{-2.8-2.3}) \times 10^{-2}$	¹³ GARMASH	16	BELL $e^+e^- \rightarrow \pi^- B^{*+} \bar{B}^0$

NODE=M208R05
NODE=M208R05

• • • We do not use the following data for averages, fits, limits, etc. • • •

possibly seen	¹⁴ MIZUK	16	BELL $e^+e^- \rightarrow h_b(2P)\pi^+\pi^-$
seen	¹⁵ BONDAR	12	BELL $e^+e^- \rightarrow h_b(2P)\pi^+\pi^-$

¹³ Assuming the X(10650)[±] decay width is saturated by the channels $\pi^+ \Upsilon(1S, 2S, 3S)$, $\pi^+ h_b(1P, 2P)$, and $B^{*+} \bar{B}^0$, and using the results from BONDAR 12 and MIZUK 16.

NODE=M208R05;LINKAGE=C

¹⁴ Using e^+e^- energies near the $\Upsilon(11020)$.

NODE=M208R05;LINKAGE=A

¹⁵ Using e^+e^- energies near the $\Upsilon(10860)$.

NODE=M208R05;LINKAGE=B

 $\Gamma(B^+ \bar{B}^0)/\Gamma_{\text{total}}$ **Γ_6/Γ**

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	GARMASH	16	BELL $e^+e^- \rightarrow \pi^- B^+ \bar{B}^0$

NODE=M208R08
NODE=M208R08 **$[\Gamma(B^+ \bar{B}^0) + \Gamma(\bar{B}^0 B^{*+})]/\Gamma_{\text{total}}$** **$\Gamma_7/\Gamma$**

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	GARMASH	16	BELL $e^+e^- \rightarrow \pi^- B^+ \bar{B}^0$, $\pi^- \bar{B}^0 B^{*+}$

NODE=M208R00
NODE=M208R00

$$\Gamma(B^{*+}\bar{B}^{*0})/\Gamma_{\text{total}} \quad \Gamma_8/\Gamma$$

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
$(73.7^{+3.4+2.7}_{-4.4-3.5}) \times 10^{-2}$	161	16 GARMASH	16 BELL	$e^+e^- \rightarrow \pi^- B^{*+} \bar{B}^{*0}$

NODE=M208R06
NODE=M208R06

¹⁶ Assuming the $X(10650)^\pm$ decay width is saturated by the channels $\pi^+ \Upsilon(1S, 2S, 3S)$, $\pi^+ h_b(1P, 2P)$, and $B^{*+} \bar{B}^{*0}$, and using the results from BONDAR 12 and MIZUK 16. Using the mass and width of the $X(10650)^\pm$ from BONDAR 12.

NODE=M208R06;LINKAGE=A

$$\Gamma(B^{*+}\bar{B}^{*0})/[\Gamma(\Upsilon(1S)\pi^+) + \Gamma(\Upsilon(2S)\pi^+) + \Gamma(\Upsilon(3S)\pi^+) + \Gamma(h_b(1P)\pi^+) + \Gamma(h_b(2P)\pi^+)] \quad \Gamma_8/(\Gamma_1+\Gamma_2+\Gamma_3+\Gamma_4+\Gamma_5)$$

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT

NODE=M208R07
NODE=M208R07

• • • We do not use the following data for averages, fits, limits, etc. • • •

$(2.80^{+0.69+0.54}_{-0.40-0.36}) \times 10^{-2}$	161	17 GARMASH	16 BELL	$e^+e^- \rightarrow \pi^- B^{*+} \bar{B}^{*0}$

¹⁷ Combined with the results of BONDAR 12 and MIZUK 16. Not independent from $X(10650)^\pm$ branching fractions to $\pi^+ \Upsilon(1S, 2S, 3S)$, $\pi^+ h_b(1P, 2P)$, and $B^{*+} \bar{B}^{*0}$.

NODE=M208R07;LINKAGE=A

$X(10650)^\pm$ REFERENCES

GARMASH	16	PRL 116 212001	A. Garmash <i>et al.</i>	(BELLE Collab.)
MIZUK	16	PRL 117 142001	R. Mizuk <i>et al.</i>	(BELLE Collab.)
GARMASH	15	PR D91 072003	A. Garmash <i>et al.</i>	(BELLE Collab.)
BONDAR	12	PRL 108 122001	A. Bondar <i>et al.</i>	(BELLE Collab.)

NODE=M208

REFID=57446
REFID=57465
REFID=56811
REFID=53963

$\Upsilon(10860)$

$$I^G(J^{PC}) = 0^-(1^{--})$$

NODE=M092

$\Upsilon(10860)$ MASS

NODE=M092M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

NODE=M092M

$10889.9^{+3.2}_{-2.6}$ OUR AVERAGE

[10891 $\pm$ 4 MeV OUR 2016 AVERAGE]

NEW

$10884.7^{+3.6+8.9}_{-3.4-1.0}$	¹ MIZUK	16 BELL	$e^+e^- \rightarrow h_b(1P, 2P)\pi^+\pi^-$
$10891.1 \pm 3.2^{+1.2}_{-2.0}$	² SANTEL	16 BELL	$e^+e^- \rightarrow \Upsilon(1S, 2S, 3S)\pi^+\pi^-$

OCCUR=2

• • • We do not use the following data for averages, fits, limits, etc. • • •

$10881.8^{+1.0}_{-1.1} \pm 1.2$	^{3,4} SANTEL	16 BELL	$e^+e^- \rightarrow \text{hadrons}$
10879 ± 3	^{5,6} CHEN	10 BELL	$e^+e^- \rightarrow \text{hadrons}$
$10888.4^{+2.7}_{-2.6} \pm 1.2$	⁷ CHEN	10 BELL	$e^+e^- \rightarrow \Upsilon(1S, 2S, 3S)\pi^+\pi^-$
10876 ± 2	⁵ AUBERT	09E BABR	$e^+e^- \rightarrow \text{hadrons}$
10869 ± 2	⁸ AUBERT	09E BABR	$e^+e^- \rightarrow \text{hadrons}$
$10868 \pm 6 \pm 5$	⁹ BESSON	85 CLEO	$e^+e^- \rightarrow \text{hadrons}$
10845 ± 20	¹⁰ LOVELOCK	85 CUSB	$e^+e^- \rightarrow \text{hadrons}$

OCCUR=2

OCCUR=2

¹ From a simultaneous fit to the $h_b(nP)\pi^+\pi^-$, $n = 1, 2$ cross sections at 22 energy points within $\sqrt{s} = 10.77\text{--}11.02$ GeV to a pair of interfering Breit-Wigner amplitudes modified by phase space factors, with eight resonance parameters (a mass and width for each of $\Upsilon(10860)$ and $\Upsilon(11020)$, a single relative phase, a single relative amplitude, and two overall normalization factors, one for each n). The systematic error estimate is dominated by possible interference with a small nonresonant continuum amplitude.

NODE=M092M;LINKAGE=D

² From a simultaneous fit to the $\Upsilon(nS)\pi^+\pi^-$, $n = 1, 2, 3$ cross sections at 25 energy points within $\sqrt{s} = 10.6\text{--}11.05$ GeV to a pair of interfering Breit-Wigner amplitudes modified by phase space factors, with fourteen resonance parameters (a mass, width, and three amplitudes for each of $\Upsilon(10860)$ and $\Upsilon(11020)$, a single universal relative phase, and three decoherence coefficients, one for each n). Continuum contributions were measured (and therefore fixed) to be zero.

NODE=M092M;LINKAGE=C

³ From a fit to the total hadronic cross sections measured at 60 energy points within $\sqrt{s} = 10.82\text{--}11.05$ GeV to a pair of interfering Breit-Wigner amplitudes and two floating continuum amplitudes with $1/\sqrt{s}$ dependence, one coherent with the resonances and one incoherent, with six resonance parameters (a mass, width, and an amplitude for each of $\Upsilon(10860)$ and $\Upsilon(11020)$, one relative phase, and one decoherence coefficient).

NODE=M092M;LINKAGE=A

⁴ Not including uncertain and potentially large systematic errors due to assumed continuum amplitude $1/\sqrt{s}$ dependence and related interference contributions.

NODE=M092M;LINKAGE=B

- ⁵ 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.
- ⁶ The parameters of the $\Upsilon(11020)$ are fixed to those in AUBERT 09E.
- ⁷ In a model where a flat nonresonant $\Upsilon(1S, 2S, 3S)\pi^+\pi^-$ continuum interferes with a single Breit-Wigner resonance.
- ⁸ 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.
- ⁹ Assuming four Gaussians with radiative tails and a single step in R .
- ¹⁰ 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

NODE=M092W

51 $\pm \frac{6}{7}$ OUR AVERAGE

NEW

[54 $\pm$ 7 MeV OUR 2016 AVERAGE]

40.6 $^{+12.7+1.1}_{-8.0-19.1}$	11 MIZUK	16 BELL	$e^+e^- \rightarrow h_b(1P, 2P)\pi^+\pi^-$
53.7 $^{+7.1+1.3}_{-5.6-5.4}$	12 SANTEL	16 BELL	$e^+e^- \rightarrow \Upsilon(1S, 2S, 3S)\pi^+\pi^-$

OCCUR=2

• • • We do not use the following data for averages, fits, limits, etc. • • •

48.5 $^{+1.9+2.0}_{-1.8-2.8}$	13,14 SANTEL	16 BELL	$e^+e^- \rightarrow$ hadrons
46 $\pm \frac{9}{7}$	15,16 CHEN	10 BELL	$e^+e^- \rightarrow$ hadrons
30.7 $^{+8.3}_{-7.0} \pm 3.1$	17 CHEN	10 BELL	$e^+e^- \rightarrow \Upsilon(1S, 2S, 3S)\pi^+\pi^-$
43 ± 4	15 AUBERT	09E BABR	$e^+e^- \rightarrow$ hadrons
74 ± 4	18 AUBERT	09E BABR	$e^+e^- \rightarrow$ hadrons
112 $\pm 17 \pm 23$	19 BESSON	85 CLEO	$e^+e^- \rightarrow$ hadrons
110 ± 15	20 LOVELOCK	85 CUSB	$e^+e^- \rightarrow$ hadrons

OCCUR=2

OCCUR=2

¹¹ From a simultaneous fit to the $h_b(nP)\pi^+\pi^-$, $n = 1, 2$ cross sections at 22 energy points within $\sqrt{s} = 10.77\text{--}11.02$ GeV to a pair of interfering Breit-Wigner amplitudes modified by phase space factors, with eight resonance parameters (a mass and width for each of $\Upsilon(10860)$ and $\Upsilon(11020)$, a single relative phase, a single relative amplitude, and two overall normalization factors, one for each n). The systematic error estimate is dominated by possible interference with a small nonresonant continuum amplitude.

NODE=M092W;LINKAGE=D

¹² From a simultaneous fit to the $\Upsilon(nS)\pi^+\pi^-$, $n = 1, 2, 3$ cross sections at 25 energy points within $\sqrt{s} = 10.6\text{--}11.05$ GeV to a pair of interfering Breit-Wigner amplitudes modified by phase space factors, with fourteen resonance parameters (a mass, width, and three amplitudes for each of $\Upsilon(10860)$ and $\Upsilon(11020)$, a single universal relative phase, and three decoherence coefficients, one for each n). Continuum contributions were measured (and therefore fixed) to be zero.

NODE=M092W;LINKAGE=C

¹³ From a fit to the total hadronic cross sections measured at 60 energy points within $\sqrt{s} = 10.82\text{--}11.05$ GeV to a pair of interfering Breit-Wigner amplitudes and two floating continuum amplitudes with $1/\sqrt{s}$ dependence, one coherent with the resonances and one incoherent, with six resonance parameters (a mass, width, and an amplitude for each of $\Upsilon(10860)$ and $\Upsilon(11020)$, one relative phase, and one decoherence coefficient).

NODE=M092W;LINKAGE=A

¹⁴ Not including uncertain and potentially large systematic errors due to assumed continuum amplitude $1/\sqrt{s}$ dependence and related interference contributions.

NODE=M092W;LINKAGE=B

¹⁵ 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

¹⁶ The parameters of the $\Upsilon(11020)$ are fixed to those in AUBERT 09E.

NODE=M092W;LINKAGE=CH

¹⁷ 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

¹⁸ 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

¹⁹ Assuming four Gaussians with radiative tails and a single step in R .

NODE=M092W;LINKAGE=BE

²⁰ In a coupled-channel model with three resonances and a smooth step in R .

NODE=M092W;LINKAGE=LO

$\Upsilon(10860)$ DECAY MODES

NODE=M092215;NODE=M092

Mode	Fraction (Γ_i/Γ)	Confidence level	
Γ_1 $B\bar{B}X$	(76.2 $^{+2.7}_{-4.0}$) %		DESIG=9
Γ_2 $B\bar{B}$	(5.5 ± 1.0) %		DESIG=2
Γ_3 $B\bar{B}^* + \text{c.c.}$	(13.7 ± 1.6) %		DESIG=3
Γ_4 $B^*\bar{B}^*$	(38.1 ± 3.4) %		DESIG=4
Γ_5 $B\bar{B}^{(*)}\pi$	< 19.7 %	90%	DESIG=10
Γ_6 $B\bar{B}\pi$	(0.0 ± 1.2) %		DESIG=23
Γ_7 $B^*\bar{B}\pi + B\bar{B}^*\pi$	(7.3 ± 2.3) %		DESIG=24
Γ_8 $B^*\bar{B}^*\pi$	(1.0 ± 1.4) %		DESIG=25
Γ_9 $B\bar{B}\pi\pi$	< 8.9 %	90%	DESIG=11
Γ_{10} $B_s^{(*)}\bar{B}_s^{(*)}$	(20.1 ± 3.1) %		DESIG=16
Γ_{11} $B_s\bar{B}_s$	(5 ± 5) $\times 10^{-3}$		DESIG=5
Γ_{12} $B_s\bar{B}_s^* + \text{c.c.}$	(1.35 ± 0.32) %		DESIG=7
Γ_{13} $B_s^*\bar{B}_s^*$	(17.6 ± 2.7) %		DESIG=8
Γ_{14} no open-bottom	(3.8 $^{+5.0}_{-0.5}$) %		DESIG=28
Γ_{15} e^+e^-	(6.1 ± 1.6) $\times 10^{-6}$		DESIG=1
Γ_{16} $K^*(892)^0\bar{K}^0$	< 1.0 $\times 10^{-5}$	90%	DESIG=29
Γ_{17} $\Upsilon(1S)\pi^+\pi^-$	(5.3 ± 0.6) $\times 10^{-3}$		DESIG=17
Γ_{18} $\Upsilon(2S)\pi^+\pi^-$	(7.8 ± 1.3) $\times 10^{-3}$		DESIG=18
Γ_{19} $\Upsilon(3S)\pi^+\pi^-$	(4.8 $^{+1.9}_{-1.7}$) $\times 10^{-3}$		DESIG=19
Γ_{20} $\Upsilon(1S)K^+K^-$	(6.1 ± 1.8) $\times 10^{-4}$		DESIG=20
Γ_{21} $h_b(1P)\pi^+\pi^-$	(3.5 $^{+1.0}_{-1.3}$) $\times 10^{-3}$		DESIG=26
Γ_{22} $h_b(2P)\pi^+\pi^-$	(5.7 $^{+1.7}_{-2.1}$) $\times 10^{-3}$		DESIG=27
Γ_{23} $\chi_{b0}(1P)\pi^+\pi^-\pi^0$	< 6.3 $\times 10^{-3}$	90%	DESIG=30
Γ_{24} $\chi_{b0}(1P)\omega$	< 3.9 $\times 10^{-3}$	90%	DESIG=31
Γ_{25} $\chi_{b0}(1P)(\pi^+\pi^-\pi^0)_{\text{non-}\omega}$	< 4.8 $\times 10^{-3}$	90%	DESIG=32
Γ_{26} $\chi_{b1}(1P)\pi^+\pi^-\pi^0$	(1.85 ± 0.33) $\times 10^{-3}$		DESIG=33
Γ_{27} $\chi_{b1}(1P)\omega$	(1.57 ± 0.30) $\times 10^{-3}$		DESIG=34
Γ_{28} $\chi_{b1}(1P)(\pi^+\pi^-\pi^0)_{\text{non-}\omega}$	(5.2 ± 1.9) $\times 10^{-4}$		DESIG=35
Γ_{29} $\chi_{b2}(1P)\pi^+\pi^-\pi^0$	(1.17 ± 0.30) $\times 10^{-3}$		DESIG=36
Γ_{30} $\chi_{b2}(1P)\omega$	(6.0 ± 2.7) $\times 10^{-4}$		DESIG=37
Γ_{31} $\chi_{b2}(1P)(\pi^+\pi^-\pi^0)_{\text{non-}\omega}$	(6 ± 4) $\times 10^{-4}$		DESIG=38
Γ_{32} $\gamma X_b \rightarrow \gamma \Upsilon(1S)\omega$	< 3.8 $\times 10^{-5}$	90%	DESIG=39

Inclusive Decays.

NODE=M092;CLUMP=I

These decay modes are submodes of one or more of the decay modes above.

NODE=M092

Γ_{33} ϕ anything	(13.8 $^{+2.4}_{-1.7}$) %	DESIG=12
Γ_{34} D^0 anything + c.c.	(108 ± 8) %	DESIG=13
Γ_{35} D_s anything + c.c.	(46 ± 6) %	DESIG=6
Γ_{36} J/ψ anything	(2.06 ± 0.21) %	DESIG=14
Γ_{37} B^0 anything + c.c.	(77 ± 8) %	DESIG=21
Γ_{38} B^+ anything + c.c.	(72 ± 6) %	DESIG=22

 $\Upsilon(10860)$ PARTIAL WIDTHS

NODE=M092220

 $\Gamma(e^+e^-)$ **Γ_{15}**

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
0.31 ± 0.07 OUR AVERAGE	Error includes scale factor of 1.3.		
0.22 ± 0.05 ± 0.07	BESSON	85	CLEO $e^+e^- \rightarrow \text{hadrons}$
0.365 ± 0.070	LOVELOCK	85	CUSB $e^+e^- \rightarrow \text{hadrons}$

 NODE=M092W1
 NODE=M092W1

$\Upsilon(10860)$ BRANCHING RATIOS

"OUR EVALUATION" is obtained based on averages of rescaled data listed below. The averages and rescaling were performed by the Heavy Flavor Averaging Group (HFAG) and are described at <http://www.slac.stanford.edu/xorg/hfag/>.

NODE=M092230

NODE=M092230

 $\Gamma(B\bar{B}X)/\Gamma_{\text{total}}$ **Γ_1/Γ**

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

0.762^{+0.027}_{-0.043} OUR EVALUATION**0.71 ± 0.06 OUR AVERAGE**

0.737 ± 0.032 ± 0.051	1063	21 DRUTSKOY	10 BELL	$\Upsilon(5S) \rightarrow B^+ X, B^0 X$
0.589 ± 0.100 ± 0.092		22 HUANG	07 CLEO	$\Upsilon(5S) \rightarrow \text{hadrons}$

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^{+1.0}_{-0.9} ± 0.423 DRUTSKOY 10 BELL $\Upsilon(5S) \rightarrow B^+ X, B^0 X$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<13.8	90	22 HUANG	07 CLEO	$\Upsilon(5S) \rightarrow \text{hadrons}$

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	$\Upsilon(5S) \rightarrow \text{hadrons}$

NODE=M092R05
NODE=M092R05 **$\Gamma(B\bar{B}^* + \text{c.c.})/\Gamma_{\text{total}}$** **$\Gamma_3/\Gamma$**

VALUE	DOCUMENT ID	TECN	COMMENT

0.137 ± 0.016 OUR AVERAGE

0.137 ± 0.013 ± 0.011	23 DRUTSKOY	10 BELL	$\Upsilon(5S) \rightarrow B^+ X, B^0 X$
0.143 ± 0.053 ± 0.027	22 HUANG	07 CLEO	$\Upsilon(5S) \rightarrow \text{hadrons}$

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 ± 0.09 ± 0.03	10	AQUINES	06 CLE3	$\Upsilon(5S) \rightarrow \text{hadrons}$

NODE=M092R06
NODE=M092R06 **$\Gamma(B^*\bar{B}^*)/\Gamma_{\text{total}}$** **$\Gamma_4/\Gamma$**

VALUE	DOCUMENT ID	TECN	COMMENT

0.381 ± 0.034 OUR AVERAGE

0.375 ^{+0.021} _{-0.019} ± 0.030	23 DRUTSKOY	10 BELL	$\Upsilon(5S) \rightarrow B^+ X, B^0 X$
0.436 ± 0.083 ± 0.072	22 HUANG	07 CLEO	$\Upsilon(5S) \rightarrow \text{hadrons}$

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 ± 0.15 ± 0.08	31	AQUINES	06 CLE3	$\Upsilon(5S) \rightarrow \text{hadrons}$

NODE=M092R07
NODE=M092R07 **$\Gamma(B\bar{B}^{(*)}\pi)/\Gamma_{\text{total}}$** **$\Gamma_5/\Gamma$**

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<0.197	90	22 HUANG	07 CLEO	$\Upsilon(5S) \rightarrow \text{hadrons}$

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	$\Upsilon(5S) \rightarrow \text{hadrons}$

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 ± 1.2 ± 0.3	0	23 DRUTSKOY	10 BELL	$\Upsilon(5S) \rightarrow B^{+,0}\pi^- X$

NODE=M092R28
NODE=M092R28 **$[\Gamma(B^*\bar{B}\pi) + \Gamma(B\bar{B}^*\pi)]/\Gamma_{\text{total}}$** **$\Gamma_7/\Gamma$**

VALUE (units 10 ⁻²)	EVTS	DOCUMENT ID	TECN	COMMENT

7.3 ^{+2.3} _{-2.1} ± 0.8	38	23 DRUTSKOY	10 BELL	$\Upsilon(5S) \rightarrow B^{+,0}\pi^- X$

NODE=M092R29
NODE=M092R29 **$\Gamma(B^*\bar{B}^*\pi)/\Gamma_{\text{total}}$** **$\Gamma_8/\Gamma$**

VALUE (units 10 ⁻²)	EVTS	DOCUMENT ID	TECN	COMMENT

1.0 ^{+1.4} _{-1.3} ± 0.4	5	23 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	22 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

NODE=M092R01
NODE=M092R01

0.201^{+0.030}_{-0.031} OUR EVALUATION

→ UNCHECKED ←

0.189^{+0.027}_{-0.021} OUR AVERAGE

0.172±0.030	24 ESEN	13 BELL	$\Upsilon(5S) \rightarrow D^0 X, D_s X$
0.21 ^{+0.06} _{-0.03}	25 HUANG	07 CLEO	$\Upsilon(5S) \rightarrow D_s X$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.180±0.013±0.032	26 DRUTSKOY	07 BELL	$\Upsilon(5S) \rightarrow D^0 X, D_s X$
0.160±0.026±0.058	27 ARTUSO	05B CLEO	$e^+e^- \rightarrow D_X X$

 $\Gamma(B_s^{(*)}\bar{B}_s^{(*)})/\Gamma(B\bar{B}X) \quad \Gamma_{10}/\Gamma_1$

VALUE	DOCUMENT ID

NODE=M092R34
NODE=M092R34

0.264^{+0.052}_{-0.045} 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±1.5 OUR AVERAGE

87.0±1.7	28,29 ESEN	13 BELL	$B_s^0 \rightarrow D_s^- \pi^+$
90.5±3.2±0.1	227 29,30 LI	12 BELL	$B_s^0 \rightarrow J/\psi \eta^{(\prime)}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

90.1 ^{+3.8} _{-4.0} ±0.2	31 LOUVOT	09 BELL	10.86 $e^+e^- \rightarrow B_s^{(*)}\bar{B}_s^{(*)}$
93 ⁺⁷ ₋₉ ±1	31 DRUTSKOY	07A BELL	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} LOUVOT 09 BELL 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±1.2 OUR AVERAGE

7.3±1.4	28,29 ESEN	13 BELL	$B_s^0 \rightarrow D_s^- \pi^+$
4.9±2.5±0.0	227 29,30 LI	12 BELL	$B_s^0 \rightarrow J/\psi \eta^{(\prime)}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

7.3 ^{+3.3} _{-3.0} ±0.1	LOUVOT	09 BELL	10.86 $e^+e^- \rightarrow B_s^{(*)}\bar{B}_s^{(*)}$

 $\Gamma(B_s\bar{B}_s^* + \text{c.c.})/\Gamma(B_s^*\bar{B}_s^*) \quad \Gamma_{12}/\Gamma_{13}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.16	90	BONVICINI	06 CLE3	e^+e^-

NODE=M092R04
NODE=M092R04

 $\Gamma(\text{no open-bottom})/\Gamma_{\text{total}} \quad \Gamma_{14}/\Gamma$

VALUE	DOCUMENT ID

NODE=M092R33
NODE=M092R33

0.038^{+0.051}_{-0.005} OUR EVALUATION

→ UNCHECKED ←

$$\Gamma(K^*(892)^0 \bar{K}^0)/\Gamma_{\text{total}} \quad \Gamma_{16}/\Gamma$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<1.0 \times 10^{-5}$	90	SHEN	13A	BELL $e^+ e^- \rightarrow K^*(892)^0 \bar{K}^0$

NODE=M092R35
NODE=M092R35

$$\Gamma(\Upsilon(1S)\pi^+\pi^-)/\Gamma_{\text{total}} \quad \Gamma_{17}/\Gamma$$

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
$5.3 \pm 0.3 \pm 0.5$	325	32 CHEN	08	BELL $10.87 e^+ e^- \rightarrow \Upsilon(1S)\pi^+\pi^-$

NODE=M092R20
NODE=M092R20

$$\Gamma(\Upsilon(2S)\pi^+\pi^-)/\Gamma_{\text{total}} \quad \Gamma_{18}/\Gamma$$

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
$7.8 \pm 0.6 \pm 1.1$	186	32 CHEN	08	BELL $10.87 e^+ e^- \rightarrow \Upsilon(2S)\pi^+\pi^-$

NODE=M092R21
NODE=M092R21

$$\Gamma(\Upsilon(3S)\pi^+\pi^-)/\Gamma_{\text{total}} \quad \Gamma_{19}/\Gamma$$

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
$4.8^{+1.8}_{-1.5} \pm 0.7$	10	32 CHEN	08	BELL $10.87 e^+ e^- \rightarrow \Upsilon(3S)\pi^+\pi^-$

NODE=M092R22
NODE=M092R22

$$\Gamma(\Upsilon(1S)K^+K^-)/\Gamma_{\text{total}} \quad \Gamma_{20}/\Gamma$$

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
$6.1^{+1.6}_{-1.4} \pm 1.0$	20	32 CHEN	08	BELL $10.87 e^+ e^- \rightarrow \Upsilon(1S)K^+K^-$

NODE=M092R23
NODE=M092R23

$$\Gamma(h_b(1P)\pi^+\pi^-)/\Gamma(\Upsilon(2S)\pi^+\pi^-) \quad \Gamma_{21}/\Gamma_{18}$$

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

$$\Gamma(h_b(2P)\pi^+\pi^-)/\Gamma(\Upsilon(2S)\pi^+\pi^-) \quad \Gamma_{22}/\Gamma_{18}$$

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

$$\Gamma(h_b(1P)\pi^+\pi^-)/\Gamma(h_b(2P)\pi^+\pi^-) \quad \Gamma_{21}/\Gamma_{22}$$

VALUE	DOCUMENT ID	TECN	COMMENT
$0.616 \pm 0.052 \pm 0.017$	MIZUK	16	BELL $e^+ e^- \rightarrow h_b(1P, 2P)\pi^+\pi^-$

NODE=M092R00
NODE=M092R00

$$\Gamma(\chi_{b0}(1P)\pi^+\pi^-\pi^0)/\Gamma_{\text{total}} \quad \Gamma_{23}/\Gamma$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<6.3 \times 10^{-3}$	90	33 HE	14	BELL $\Upsilon(5S) \rightarrow \pi^+\pi^-\pi^0 \gamma \Upsilon(1S)$

NODE=M092R36
NODE=M092R36

$$\Gamma(\chi_{b0}(1P)\omega)/\Gamma_{\text{total}} \quad \Gamma_{24}/\Gamma$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<3.9 \times 10^{-3}$	90	33 HE	14	BELL $\Upsilon(5S) \rightarrow \pi^+\pi^-\pi^0 \gamma \Upsilon(1S)$

NODE=M092R37
NODE=M092R37

$$\Gamma(\chi_{b0}(1P)(\pi^+\pi^-\pi^0)_{\text{non-}\omega})/\Gamma_{\text{total}} \quad \Gamma_{25}/\Gamma$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<4.8 \times 10^{-3}$	90	33 HE	14	BELL $\Upsilon(5S) \rightarrow \pi^+\pi^-\pi^0 \gamma \Upsilon(1S)$

NODE=M092R38
NODE=M092R38

$$\Gamma(\chi_{b1}(1P)\pi^+\pi^-\pi^0)/\Gamma_{\text{total}} \quad \Gamma_{26}/\Gamma$$

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
$1.85 \pm 0.23 \pm 0.23$	80	33 HE	14	BELL $\Upsilon(5S) \rightarrow \pi^+\pi^-\pi^0 \gamma \Upsilon(1S)$

NODE=M092R39
NODE=M092R39

$$\Gamma(\chi_{b1}(1P)\omega)/\Gamma_{\text{total}} \quad \Gamma_{27}/\Gamma$$

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
$1.57 \pm 0.22 \pm 0.21$	60	33 HE	14	BELL $\Upsilon(5S) \rightarrow \pi^+\pi^-\pi^0 \gamma \Upsilon(1S)$

NODE=M092R40
NODE=M092R40

$$\Gamma(\chi_{b1}(1P)(\pi^+\pi^-\pi^0)_{\text{non-}\omega})/\Gamma_{\text{total}} \quad \Gamma_{28}/\Gamma$$

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
$0.52 \pm 0.15 \pm 0.11$	24	33 HE	14	BELL $\Upsilon(5S) \rightarrow \pi^+\pi^-\pi^0 \gamma \Upsilon(1S)$

NODE=M092R41
NODE=M092R41

$$\Gamma(\chi_{b2}(1P)\pi^+\pi^-\pi^0)/\Gamma_{\text{total}} \quad \Gamma_{29}/\Gamma$$

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
$1.17 \pm 0.27 \pm 0.14$	29	33 HE	14	BELL $\Upsilon(5S) \rightarrow \pi^+\pi^-\pi^0 \gamma \Upsilon(1S)$

NODE=M092R42
NODE=M092R42

$\Gamma(\chi_{b2}(1P)\omega)/\Gamma_{\text{total}}$ Γ_{30}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
0.60±0.23±0.15	13	33 HE	14 BELL	$\Upsilon(5S) \rightarrow \pi^+ \pi^- \pi^0 \gamma \Upsilon(1S)$

NODE=M092R43
NODE=M092R43

 $\Gamma(\chi_{b2}(1P)\omega)/\Gamma(\chi_{b1}(1P)\omega)$ Γ_{30}/Γ_{27}

VALUE	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.38±0.16±0.09	34 HE	14 BELL	$\Upsilon(5S) \rightarrow \pi^+ \pi^- \pi^0 \gamma \Upsilon(1S)$

NODE=M092R44
NODE=M092R44

 $\Gamma(\chi_{b2}(1P)(\pi^+ \pi^- \pi^0)_{\text{non-}\omega})/\Gamma_{\text{total}}$ Γ_{31}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
0.61±0.22±0.28	16	33 HE	14 BELL	$\Upsilon(5S) \rightarrow \pi^+ \pi^- \pi^0 \gamma \Upsilon(1S)$

NODE=M092R45
NODE=M092R45

 $\Gamma(\chi_{b2}(1P)(\pi^+ \pi^- \pi^0)_{\text{non-}\omega})/\Gamma(\chi_{b1}(1P)(\pi^+ \pi^- \pi^0)_{\text{non-}\omega})$ Γ_{31}/Γ_{28}

VALUE	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.20±0.55±0.65	34 HE	14 BELL	$\Upsilon(5S) \rightarrow \pi^+ \pi^- \pi^0 \gamma \Upsilon(1S)$

NODE=M092R46
NODE=M092R46

 $\Gamma(\gamma X_b \rightarrow \gamma \Upsilon(1S)\omega)/\Gamma_{\text{total}}$ Γ_{32}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<3.8 × 10⁻⁵	90	35 HE	14 BELL	$\Upsilon(5S) \rightarrow \pi^+ \pi^- \pi^0 \gamma \Upsilon(1S)$

NODE=M092R47
NODE=M092R47

 $\Gamma(\phi \text{ anything})/\Gamma_{\text{total}}$ Γ_{33}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT

0.138±0.007^{+0.023}_{-0.015}	HUANG	07 CLEO	$\Upsilon(5S) \rightarrow \phi X$

NODE=M092R12
NODE=M092R12

 $\Gamma(D^0 \text{ anything} + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{34}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT

1.076±0.040±0.068	DRUTSKOY	07 BELL	$\Upsilon(5S) \rightarrow D^0 X$

NODE=M092R10
NODE=M092R10

 $\Gamma(D_s \text{ anything} + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{35}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT

0.46 ±0.06 OUR AVERAGE			
0.472±0.024±0.072	26 DRUTSKOY	07 BELL	$\Upsilon(5S) \rightarrow D_s X$
0.44 ±0.09 ±0.04	36 ARTUSO	05B CLE3	$e^+ e^- \rightarrow D_s X$

NODE=M092R02
NODE=M092R02

 $\Gamma(J/\psi \text{ anything})/\Gamma_{\text{total}}$ Γ_{36}/Γ

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT

2.060±0.160±0.134	DRUTSKOY	07 BELL	$\Upsilon(5S) \rightarrow J/\psi X$

NODE=M092R11
NODE=M092R11

 $\Gamma(B^0 \text{ anything} + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{37}/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

0.770^{+0.058}_{-0.056} ±0.061	352	DRUTSKOY	10 BELL	$\Upsilon(5S) \rightarrow B^0 X$

NODE=M092R26
NODE=M092R26

 $\Gamma(B^+ \text{ anything} + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{38}/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

0.721^{+0.039}_{-0.038} ±0.050	711	DRUTSKOY	10 BELL	$\Upsilon(5S) \rightarrow B^+ X$

NODE=M092R27
NODE=M092R27

²¹ Not independent of DRUTSKOY 10 values for $\Upsilon(5S) \rightarrow B^{\pm,0} \text{ anything}$.

²² Using measurements or limits from AQUINES 06.

²³ Assuming isospin conservation.

²⁴ Supersedes DRUTSKOY 07.

²⁵ 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.

²⁶ Using $B(D_s^+ \rightarrow \phi \pi^+) = (4.4 \pm 0.6)\%$ from PDG 06.

²⁷ Uses a model-dependent estimate $B(B_s \rightarrow D_s X) = (92 \pm 11)\%$.

²⁸ Supersedes LOUVOT 09.

²⁹ With $N(B_s^{(*)} \bar{B}_s^{(*)}) = (7.11 \pm 1.30) \times 10^6$.

³⁰ The ratios $N(B_s^{(*)} \bar{B}_s^{(*)}) / N(B_s^{(*)} \bar{B}_s^{(*)})$ and $N(B_s^{(*)} \bar{B}_s^{(*)}) / N(B_s^{(*)} \bar{B}_s^{(*)})$ are measured with a correlation coefficient of -0.72 .

³¹ 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.

³² Assuming that the observed events are solely due to the $\Upsilon(5S)$ resonance.

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

- ³³ Assuming that all the $b\bar{b}$ events are from $\Upsilon(5S)$ resonance decays and using $\sigma(e^+e^- \rightarrow b\bar{b}) = 0.340 \pm 0.016$ nb from ESEN 13. Correlated with other results from HE 14.
- ³⁴ Accounting for correlated systematics.
- ³⁵ Assuming that all the $b\bar{b}$ events are from $\Upsilon(5S)$ resonance decays and using $\sigma(e^+e^- \rightarrow b\bar{b}) = 0.340 \pm 0.016$ nb from ESEN 13. Correlated with other results from HE 14. For a state X_b with mass between 10.55 GeV/c² and 10.65 GeV/c², the obtained 90% upper limit as a function of m_{X_b} varies from 2.6×10^{-5} to 3.8×10^{-5} .
- ³⁶ 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=M092R36;LINKAGE=A

NODE=M092R44;LINKAGE=A

NODE=M092R47;LINKAGE=A

NODE=M092R02;LINKAGE=AR

$\Upsilon(10860)$ REFERENCES

MIZUK	16	PRL 117 142001	R. Mizuk <i>et al.</i>	(BELLE Collab.)
SANTEL	16	PR D93 011101	D. Santel <i>et al.</i>	(BELLE Collab.)
HE	14	PRL 113 142001	X.H. He <i>et al.</i>	(BELLE Collab.)
ESEN	13	PR D87 031101	S. Esen <i>et al.</i>	(BELLE Collab.)
SHEN	13A	PR D88 052019	C.P. Shen <i>et al.</i>	(BELLE Collab.)
ADACHI	12	PRL 108 032001	I. Adachi <i>et al.</i>	(BELLE Collab.)
LI	12	PRL 108 181808	J. Li <i>et al.</i>	(BELLE Collab.)
CHEN	10	PR D82 091106	K.-F. Chen <i>et al.</i>	(BELLE Collab.)
DRUTSKOY	10	PR D81 112003	A. Drutskoy <i>et al.</i>	(BELLE Collab.)
AUBERT	09E	PRL 102 012001	B. Aubert <i>et al.</i>	(BABAR Collab.)
LOUVOT	09	PRL 102 021801	R. Louvot <i>et al.</i>	(BELLE Collab.)
CHEN	08	PRL 100 112001	K.-F. Chen <i>et al.</i>	(BELLE Collab.)
DRUTSKOY	07	PRL 98 052001	A. Drutskoy <i>et al.</i>	(BELLE Collab.)
DRUTSKOY	07A	PR D76 012002	A. Drutskoy <i>et al.</i>	(BELLE Collab.)
HUANG	07	PR D75 012002	G.S. Huang <i>et al.</i>	(CLEO Collab.)
AQUINES	06	PRL 96 152001	O. Aquines <i>et al.</i>	(CLEO Collab.)
BONVICINI	06	PRL 96 022002	G. Bonvicini <i>et al.</i>	(CLEO Collab.)
PDG	06	JP G33 1	W.-M. Yao <i>et al.</i>	(PDG Collab.)
ARTUSO	05B	PRL 95 261801	M. Artuso <i>et al.</i>	(CLEO Collab.)
BESSION	85	PRL 54 381	D. Besson <i>et al.</i>	(CLEO Collab.)
LOVELOCK	85	PRL 54 377	D.M.J. Lovelock <i>et al.</i>	(CUSB Collab.)

NODE=M092

REFID=57465
REFID=57121
REFID=55927
REFID=54894
REFID=55591
REFID=53962
REFID=54116
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REFID=53358
REFID=52661
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REFID=51852
REFID=51624
REFID=51106
REFID=50995
REFID=51004
REFID=50992
REFID=22368
REFID=22369

NODE=M093

$\Upsilon(11020)$

$$I^G(J^{PC}) = 0^-(1^{--})$$

$\Upsilon(11020)$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$10992.9^{+10.0}_{-3.1}$ OUR AVERAGE			
[$10987.5^{+11.0}_{-3.4}$ MeV OUR 2016 AVERAGE]			
$10999.0^{+7.3+16.9}_{-7.8-1.0}$	¹ MIZUK	16	BELL $e^+e^- \rightarrow h_b(1P,2P)\pi^+\pi^-$
$10987.5^{+6.4+9.1}_{-2.5-2.3}$	² SANTEL	16	BELL $e^+e^- \rightarrow \Upsilon(1S,2S,3S)\pi^+\pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$11003.0 \pm 1.1^{+0.9}_{-1.0}$	^{3,4} SANTEL	16	BELL $e^+e^- \rightarrow \text{hadrons}$
10996 ± 2	⁵ AUBERT	09E	BABR $e^+e^- \rightarrow \text{hadrons}$
$11019 \pm 5 \pm 7$	BESSION	85	CLEO $e^+e^- \rightarrow \text{hadrons}$
11020 ± 30	LOVELOCK	85	CUSB $e^+e^- \rightarrow \text{hadrons}$

NODE=M093M

NODE=M093M

NEW

OCCUR=2

¹ From a simultaneous fit to the $h_b(nP)\pi^+\pi^-$, $n = 1, 2$ cross sections at 22 energy points within $\sqrt{s} = 10.77\text{--}11.02$ GeV to a pair of interfering Breit-Wigner amplitudes modified by phase space factors, with eight resonance parameters (a mass and width for each of $\Upsilon(10860)$ and $\Upsilon(11020)$, a single relative phase, a single relative amplitude, and two overall normalization factors, one for each n). The systematic error estimate is dominated by possible interference with a small nonresonant continuum amplitude.

NODE=M093M;LINKAGE=D

² From a simultaneous fit to the $\Upsilon(nS)\pi^+\pi^-$, $n = 1, 2, 3$ cross sections at 25 energy points within $\sqrt{s} = 10.6\text{--}11.05$ GeV to a pair of interfering Breit-Wigner amplitudes modified by phase space factors, with fourteen resonance parameters (a mass, width, and three amplitudes for each of $\Upsilon(10860)$ and $\Upsilon(11020)$, a single universal relative phase, and three decoherence coefficients, one for each n). Continuum contributions were measured (and therefore fixed) to be zero.

NODE=M093M;LINKAGE=C

³ From a fit to the total hadronic cross sections measured at 60 energy points within $\sqrt{s} = 10.82\text{--}11.05$ GeV to a pair of interfering Breit-Wigner amplitudes and two floating continuum amplitudes with $1/\sqrt{s}$ dependence, one coherent with the resonances and one incoherent, with six resonance parameters (a mass, width, and an amplitude for each of $\Upsilon(10860)$ and $\Upsilon(11020)$, one relative phase, and one decoherence coefficient).

NODE=M093M;LINKAGE=A

⁴ Not including uncertain and potentially large systematic errors due to assumed continuum amplitude $1/\sqrt{s}$ dependence and related interference contributions.

⁵ In a model where a flat non-resonant $b\bar{b}$ -continuum is incoherently added to a second flat component interfering with two Breit-Wigner resonances. Systematic uncertainties not estimated.

NODE=M093M;LINKAGE=B

NODE=M093M;LINKAGE=AU

$\Upsilon(11020)$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
49^{+9}_{-15} OUR AVERAGE			
[61^{+9}_{-28} MeV OUR 2016 AVERAGE]			
$27^{+27}_{-11} \pm 5$	⁶ MIZUK	16 BELL	$e^+e^- \rightarrow h_b(1P, 2P)\pi^+\pi^-$
$61^{+9}_{-19} \pm 2$	⁷ SANTEL	16 BELL	$e^+e^- \rightarrow \Upsilon(1S, 2S, 3S)\pi^+\pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$39.3^{+1.7+1.3}_{-1.6-2.4}$	^{8,9} SANTEL	16 BELL	$e^+e^- \rightarrow$ hadrons
37 ± 3	¹⁰ AUBERT	09E BABR	$e^+e^- \rightarrow$ hadrons
$61 \pm 13 \pm 22$	BESSION	85 CLEO	$e^+e^- \rightarrow$ hadrons
90 ± 20	LOVELOCK	85 CUSB	$e^+e^- \rightarrow$ hadrons

NODE=M093W

NODE=M093W

NEW

OCCUR=2

⁶ From a simultaneous fit to the $h_b(nP)\pi^+\pi^-$, $n=1, 2$ cross sections at 22 energy points within $\sqrt{s} = 10.77\text{--}11.02$ GeV to a pair of interfering Breit-Wigner amplitudes modified by phase space factors, with eight resonance parameters (a mass and width for each of $\Upsilon(10860)$ and $\Upsilon(11020)$, a single relative phase, a single relative amplitude, and two overall normalization factors, one for each n). The systematic error estimate is dominated by possible interference with a small nonresonant continuum amplitude.

⁷ From a simultaneous fit to the $\Upsilon(nS)\pi^+\pi^-$, $n=1, 2, 3$ cross sections at 25 energy points within $\sqrt{s} = 10.6\text{--}11.05$ GeV to a pair of interfering Breit-Wigner amplitudes modified by phase space factors, with fourteen resonance parameters (a mass, width, and three amplitudes for each of $\Upsilon(10860)$ and $\Upsilon(11020)$, a single universal relative phase, and three decoherence coefficients, one for each n). Continuum contributions were measured (and therefore fixed) to be zero.

⁸ From a fit to the total hadronic cross sections measured at 60 energy points within $\sqrt{s} = 10.82\text{--}11.05$ GeV to a pair of interfering Breit-Wigner amplitudes and two floating continuum amplitudes with $1/\sqrt{s}$ dependence, one coherent with the resonances and one incoherent, with six resonance parameters (a mass, width, and an amplitude for each of $\Upsilon(10860)$ and $\Upsilon(11020)$, one relative phase, and one decoherence coefficient).

⁹ Not including uncertain and potentially large systematic errors due to assumed continuum amplitude $1/\sqrt{s}$ dependence and related interference contributions.

¹⁰ In a model where a flat non-resonant $b\bar{b}$ -continuum is incoherently added to a second flat component interfering with two Breit-Wigner resonances. Systematic uncertainties not estimated.

NODE=M093W;LINKAGE=D

NODE=M093W;LINKAGE=C

NODE=M093W;LINKAGE=A

NODE=M093W;LINKAGE=B

NODE=M093W;LINKAGE=AU

$\Upsilon(11020)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad e^+e^-$	$(2.7^{+1.0}_{-0.8}) \times 10^{-6}$

NODE=M093215;NODE=M093

DESIG=1

$\Upsilon(11020)$ PARTIAL WIDTHS

$\Gamma(e^+e^-)$	DOCUMENT ID	TECN	COMMENT	Γ_1
0.130 ± 0.030 OUR AVERAGE				
$0.095 \pm 0.03 \pm 0.035$	BESSION	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

MIZUK	16	PRL 117 142001	R. Mizuk <i>et al.</i>	(BELLE Collab.)
SANTEL	16	PR D93 011101	D. Santel <i>et al.</i>	(BELLE Collab.)
AUBERT	09E	PRL 102 012001	B. Aubert <i>et al.</i>	(BABAR Collab.)
BESSION	85	PRL 54 381	D. Besson <i>et al.</i>	(CLEO Collab.)
LOVELOCK	85	PRL 54 377	D.M.J. Lovelock <i>et al.</i>	(CUSB Collab.)

NODE=M093

REFID=57465
REFID=57121
REFID=52661
REFID=22368
REFID=22369

NON- $q\bar{q}$ CANDIDATES

NODE=MXXX050

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