

LIGHT UNFLAVORED MESONS

($S = C = B = 0$)

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

NODE=MXXX005

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NODE=M014

$f_0(500)$ or σ
was $f_0(600)$

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

A REVIEW GOES HERE – Check our WWW List of Reviews

NODE=M014

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

NODE=M014PP

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

NODE=M014PP

NODE=M014PP

→ UNCHECKED ←

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
(400–550)–i(200–350) OUR ESTIMATE			
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$(440 \pm 10) - i(238 \pm 10)$	¹ ALBALADEJO 12	RVUE	Compilation
$(445 \pm 25) - i(278^{+22}_{-18})$	^{2,3} GARCIA-MAR..11	RVUE	Compilation
$(457^{+14}_{-13}) - i(279^{+11}_{-7})$	^{2,4} GARCIA-MAR..11	RVUE	Compilation
$(442^{+5}_{-8}) - i(274^{+6}_{-5})$	⁵ MOUSSALLAM11	RVUE	Compilation
$(452 \pm 13) - i(259 \pm 16)$	⁶ MENNESSIER 10	RVUE	Compilation
$(448 \pm 43) - i(266 \pm 43)$	⁷ MENNESSIER 10	RVUE	Compilation
$(455 \pm 6^{+31}_{-13}) - i(278 \pm 6^{+34}_{-43})$	⁸ CAPRINI 08	RVUE	Compilation
$(463 \pm 6^{+31}_{-17}) - i(259 \pm 6^{+33}_{-34})$	⁹ CAPRINI 08	RVUE	Compilation
$(552^{+84}_{-106}) - i(232^{+81}_{-72})$	¹⁰ ABLIKIM 07A	BES2	$\psi(2S) \rightarrow \pi^+ \pi^- J/\psi$
$(466 \pm 18) - i(223 \pm 28)$	¹¹ BONVICINI 07	CLEO	$D^+ \rightarrow \pi^- \pi^+ \pi^+$
$(472 \pm 30) - i(271 \pm 30)$	¹² BUGG 07A	RVUE	Compilation
$(484 \pm 17) - i(255 \pm 10)$	GARCIA-MAR..07	RVUE	Compilation
$(430) - i(325)$	¹³ ANISOVICH 06	RVUE	Compilation
$(441^{+16}_{-8}) - i(272^{+9}_{-12.5})$	¹⁴ CAPRINI 06	RVUE	$\pi\pi \rightarrow \pi\pi$
$(470 \pm 50) - i(285 \pm 25)$	¹⁵ ZHOU 05	RVUE	
$(541 \pm 39) - i(252 \pm 42)$	¹⁶ ABLIKIM 04A	BES2	$J/\psi \rightarrow \omega \pi^+ \pi^-$
$(528 \pm 32) - i(207 \pm 23)$	¹⁷ GALLEGOS 04	RVUE	Compilation
$(440 \pm 8) - i(212 \pm 15)$	¹⁸ PELAEZ 04A	RVUE	$\pi\pi \rightarrow \pi\pi$
$(533 \pm 25) - i(249 \pm 25)$	¹⁹ BUGG 03	RVUE	
$517 - i240$	BLACK 01	RVUE	$\pi^0 \pi^0 \rightarrow \pi^0 \pi^0$
$(470 \pm 30) - i(295 \pm 20)$	¹⁴ COLANGELO 01	RVUE	$\pi\pi \rightarrow \pi\pi$
$(535^{+48}_{-36}) - i(155^{+76}_{-53})$	²⁰ ISHIDA 01		$\Upsilon(3S) \rightarrow \Upsilon \pi\pi$
$610 \pm 14 - i620 \pm 26$	²¹ SUROVTSEV 01	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$
$(540^{+36}_{-29}) - i(193^{+32}_{-40})$	ISHIDA 00B		$p\bar{p} \rightarrow \pi^0 \pi^0 \pi^0$
$445 - i235$	HANNAH 99	RVUE	π scalar form factor
$(523 \pm 12) - i(259 \pm 7)$	KAMINSKI 99	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}, \sigma\sigma$
$442 - i227$	OLLER 99	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$
$469 - i203$	OLLER 99B	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$
$445 - i221$	OLLER 99C	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}, \eta\eta$
$(1530^{+90}_{-250}) - i(560 \pm 40)$	ANISOVICH 98B	RVUE	Compilation
$420 - i212$	LOCHER 98	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$
$440 - i245$	²² DOBADO 97	RVUE	Compilation
$(602 \pm 26) - i(196 \pm 27)$	²³ ISHIDA 97		$\pi\pi \rightarrow \pi\pi$
$(537 \pm 20) - i(250 \pm 17)$	²⁴ KAMINSKI 97B	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}, 4\pi$
$470 - i250$	^{25,26} TORNQVIST 96	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}, K\pi, \eta\pi$
$387 - i305$	^{26,27} JANSSEN 95	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$
$420 - i370$	²⁸ ACHASOV 94	RVUE	$\pi\pi \rightarrow \pi\pi$
$(506 \pm 10) - i(247 \pm 3)$	KAMINSKI 94	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$
$370 - i356$	²⁹ ZOU 94B	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$
$408 - i342$	^{26,29} ZOU 93	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$

470 – $i208$

(750 ± 50)– $i(450 \pm 50)$
 (660 ± 100)– $i(320 \pm 70)$
 650 – $i370$

30 VANBEVEREN 86 RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}, \eta\eta,$

31 ESTABROOKS 79 RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}$
 PROTOPOPO... 73 HBC $\pi\pi \rightarrow \pi\pi, K\bar{K}$

32 BASDEVANT 72 RVUE $\pi\pi \rightarrow \pi\pi$ 1 Applying the chiral unitary approach at NLO to the K_{e4} data of BATLEY 10 and $\pi N \rightarrow \pi\pi N$ data of HYAMS 73, GRAYER 74, and PROTOPOPOESCU 73.2 Uses the K_{e4} data of BATLEY 10C and the $\pi N \rightarrow \pi\pi N$ data of HYAMS 73, GRAYER 74, and PROTOPOPOESCU 73.

3 Analytic continuation using Roy equations.

4 Analytic continuation using GKPY equations.

5 Using Roy equations.

6 Average of three variants of the analytic K-matrix model. Uses the K_{e4} data of BATLEY 08A and the $\pi N \rightarrow \pi\pi N$ data of HYAMS 73 and GRAYER 74.

7 Average of the analyses of three data sets in the K-matrix model. Uses the data of BATLEY 08A, HYAMS 73, and GRAYER 74, partially of COHEN 80 or ETKIN 82B.

8 From the K_{e4} data of BATLEY 08A and $\pi N \rightarrow \pi\pi N$ data of HYAMS 73.9 From the K_{e4} data of BATLEY 08A and $\pi N \rightarrow \pi\pi N$ data of PROTOPOPOESCU 73, GRAYER 74, and ESTABROOKS 74.10 From a mean of three different $f_0(500)$ parametrizations. Uses 40k events.

11 From an isobar model using 2.6k events.

12 Reanalysis of ABLIKIM 04A, PISLAK 01, and HYAMS 73 data.

13 Using the N/D method.

14 From the solution of the Roy equation (ROY 71) for the isoscalar S-wave and using a phase-shift analysis of HYAMS 73 and PROTOPOPOESCU 73 data.

15 Reanalysis of the data from PROTOPOPOESCU 73, ESTABROOKS 74, GRAYER 74, ROSSELET 77, PISLAK 03, and AKHMETSHIN 04.

16 From a mean of six different analyses and $f_0(500)$ parameterizations.17 Using data on $\psi(2S) \rightarrow J/\psi\pi\pi$ from BAI 00E and on $\mathcal{T}(nS) \rightarrow \mathcal{T}(mS)\pi\pi$ from BUTLER 94B and ALEXANDER 98.

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

19 From a combined analysis of HYAMS 73, AUGUSTIN 89, AITALA 01B, and PISLAK 01.

20 A similar analysis (KOMADA 01) finds $(580^{+79}_{-30})-i(190^{+107}_{-49})$ MeV.

21 Coupled channel reanalysis of BATON 70, BENSINGER 71, BAILLON 72, HYAMS 73, HYAMS 75, ROSSELET 77, COHEN 80, and ETKIN 82B using the uniformizing variable.

22 Using the inverse amplitude method and data of ESTABROOKS 73, GRAYER 74, and PROTOPOPOESCU 73.

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

24 Average and spread of 4 variants (“up” and “down”) of KAMINSKI 97B 3-channel model.

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

26 Demonstrates explicitly that $f_0(500)$ and $f_0(1370)$ are two different poles.

27 Analysis of data from FALVARD 88.

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

29 Analysis of data from OCHS 73, GRAYER 74, and ROSSELET 77.

30 Coupled-channel analysis using data from PROTOPOPOESCU 73, HYAMS 73, HYAMS 75, GRAYER 74, ESTABROOKS 74, ESTABROOKS 75, FROGGATT 77, CORDEEN 79, BISWAS 81.

31 Analysis of data from APEL 73, GRAYER 74, CASON 76, PAWLICKI 77. Includes spread and errors of 4 solutions.

32 Analysis of data from BATON 70, BENSINGER 71, COLTON 71, BAILLON 72, PROTOPOPOESCU 73, and WALKER 67.

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

NODE=M014M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

(400–550) OUR ESTIMATE

NODE=M014M

→ UNCHECKED ←

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

513 ± 32	33	MURAMATSU 02	CLEO	$e^+e^- \approx 10$ GeV
$478^{+24}_{-23} \pm 17$		AITALA 01B	E791	$D^+ \rightarrow \pi^- \pi^+ \pi^+$
563^{+58}_{-29}	34	ISHIDA 01		$\mathcal{T}(3S) \rightarrow \mathcal{T} \pi \pi$
555	35	ASNER 00	CLE2	$\tau^- \rightarrow \pi^- \pi^0 \pi^0 \nu_\tau$
540 ± 36		ISHIDA 00B		$p\bar{p} \rightarrow \pi^0 \pi^0 \pi^0$
750 ± 4		ALEKSEEV 99	SPEC	$1.78 \pi^- p_{\text{polar}} \rightarrow \pi^- \pi^+ n$
744 ± 5		ALEKSEEV 98	SPEC	$1.78 \pi^- p_{\text{polar}} \rightarrow \pi^- \pi^+ n$
759 ± 5	36	TROYAN 98		$5.2 n p \rightarrow n p \pi^+ \pi^-$

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

33 Statistical uncertainty only.

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

35 From the best fit of the Dalitz plot.

36 6σ effect, no PWA.

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

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

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

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

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

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

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

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NODE=M014M;LINKAGE=D

$f_0(500)$ BREIT-WIGNER WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

(400–700) OUR ESTIMATE

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

335± 67	44 MURAMATSU	02	CLEO	$e^+e^- \approx 10$ GeV
324 $^{+42}_{-40} \pm 21$	AITALA	01B	E791	$D^+ \rightarrow \pi^-\pi^+\pi^+$
372 $^{+229}_{-95}$	45 ISHIDA	01		$\Upsilon(3S) \rightarrow \Upsilon\pi\pi$
540	46 ASNER	00	CLE2	$\tau^- \rightarrow \pi^-\pi^0\pi^0\nu_\tau$
372± 80	ISHIDA	00B		$p\bar{p} \rightarrow \pi^0\pi^0\pi^0$
119± 13	ALEKSEEV	99	SPEC	1.78 $\pi^- p_{\text{polar}} \rightarrow \pi^-\pi^+n$
77± 22	ALEKSEEV	98	SPEC	1.78 $\pi^- p_{\text{polar}} \rightarrow \pi^-\pi^+n$
35± 12	47 TROYAN	98		5.2 $np \rightarrow np\pi^+\pi^-$
780± 60	ALDE	97	GAM2	450 $pp \rightarrow pp\pi^0\pi^0$
385± 70	48 ISHIDA	97		$\pi\pi \rightarrow \pi\pi$
290± 54	49 SVEC	96	RVUE	6–17 $\pi N_{\text{polar}} \rightarrow \pi^+\pi^-N$
~ 880	50,51 TORNQVIST	96	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}, K\pi, \eta\pi$
460± 40	52,53 ANISOVICH	95	RVUE	$\pi^-p \rightarrow \pi^0\pi^0n,$ $\bar{p}p \rightarrow \pi^0\pi^0\pi^0, \pi^0\pi^0\eta, \pi^0\eta\eta$
~ 3200	54 ACHASOV	94	RVUE	$\pi\pi \rightarrow \pi\pi$
494± 58	49 AUGUSTIN	89	DM2	

44 Statistical uncertainty only.

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

46 From the best fit of the Dalitz plot.

47 6σ effect, no PWA.

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

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

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

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

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

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

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

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$f_0(500)$ DECAY MODES

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

NODE=M014215;NODE=M014

DESIG=1;OUR EST;→ UNCHECKED ←

DESIG=5;OUR EST;→ UNCHECKED ←

 $f_0(500)$ PARTIAL WIDTHS

$\Gamma(\gamma\gamma)$				Γ_2
VALUE (keV)	DOCUMENT ID	TECN	COMMENT	
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
1.7 ± 0.4	55 HOFERICHTER11	RVUE	Compilation	
3.08 ± 0.82	56 MENNESSIER 11	RVUE	Compilation	
2.08 ± 0.2 ^{+0.07} _{-0.04}	57 MOUSSALLAM11	RVUE	Compilation	
2.08	58 MAO 09	RVUE	Compilation	
1.2 ± 0.4	59 BERNABEU 08	RVUE		
3.9 ± 0.6	56 MENNESSIER 08	RVUE	$\gamma\gamma \rightarrow \pi^+\pi^-, \pi^0\pi^0$	
1.8 ± 0.4	60 OLLER 08	RVUE	Compilation	
1.68 ± 0.15	60,61 OLLER 08A	RVUE	Compilation	
3.1 ± 0.5	62,63 PENNINGTON 08	RVUE	Compilation	
2.4 ± 0.4	63,64 PENNINGTON 08	RVUE	Compilation	
4.1 ± 0.3	65 PENNINGTON 06	RVUE	$\gamma\gamma \rightarrow \pi^0\pi^0$	
3.8 ± 1.5	66,67 BOGLIONE 99	RVUE	$\gamma\gamma \rightarrow \pi^+\pi^-, \pi^0\pi^0$	
5.4 ± 2.3	66 MORGAN 90	RVUE	$\gamma\gamma \rightarrow \pi^+\pi^-, \pi^0\pi^0$	
10 ± 6	COURAU 86	DM1	$e^+e^- \rightarrow \pi^+\pi^- e^+e^-$	

NODE=M014220

NODE=M014W2
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OCCUR=2

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

56 Using an analytic K-matrix model.

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

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

59 Using p, n polarizabilities from PDG 06 and fitting to $\pi\pi$ phase motion from GARCIA-MARTIN 07 and σ -poles from GARCIA-MARTIN 07 and CAPRINI 06.

60 Using twice-subtracted dispersion integrals.

61 Supersedes OLLER 08.

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

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

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

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

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

67 Supersedes MORGAN 90.

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NODE=M014W2;LINKAGE=BL

 $f_0(500)$ REFERENCES

ALBALADEJO 12	PR D86 034003	M. Albaladejo, J.A. Oller	(MURC)
GARCIA-MAR... 11	PRL 107 072001	R. Garcia-Martin <i>et al.</i>	(MADR, CRAC)
GARCIA-MAR... 11A	PR D83 074004	R. Garcia-Martin <i>et al.</i>	(MADR, CRAC)
HOFERICHTER 11	EPJ C71 1743	M. Hoferichter, D.R. Phillips, C. Schat	(BONN+)
MENNESSIER 11	PL B696 40	G. Mennessier, S. Narison, X.-G. Wang	
MOUSSALLAM 11	EPJ C71 1814	B. Moussallam	
BATLEY 10	PL B686 101	J.R. Batley <i>et al.</i>	(CERN NA48/2 Collab.)
BATLEY 10C	EPJ C70 635	J.R. Batley <i>et al.</i>	(CERN NA48/2 Collab.)
MENNESSIER 10	PL B688 59	G. Mennessier, S. Narison, X.-G. Wang	
MAO 09	PR D79 116008	Y. Mao <i>et al.</i>	
BATLEY 08A	EPJ C54 411	J.R. Batley <i>et al.</i>	(CERN NA48/2 Collab.)
BERNABEU 08	PRL 100 241804	J. Bernabeu, J. Prades	(IFIC, GRAN)
CAPRINI 08	PR D77 114019	I. Caprini	
MENNESSIER 08	PL B665 205	G. Mennessier, S. Narison, W. Ochs	
OLLER 08	PL B659 201	J.A. Oller, L. Roca, C. Schat	(MURC, UBA)
OLLER 08A	EPJ A37 15	J.A. Oller, L. Roca	(MURC)
PENNINGTON 08	EPJ C56 1	M.R. Pennington <i>et al.</i>	
UEHARA 08A	PR D78 052004	S. Uehara <i>et al.</i>	(BELLE Collab.)
ABLIKIM 07A	PL B645 19	M. Ablikim <i>et al.</i>	(BES Collab.)
BONVICINI 07	PR D76 012001	G. Bonvicini <i>et al.</i>	(CLEO Collab.)
BUGG 07A	JP G34 151	D.V. Bugg <i>et al.</i>	
GARCIA-MAR... 07	PR D76 074034	R. Garcia-Martin, J.R. Pelaez, F.J. Yndurain	
MORI 07	PR D75 051101	T. Mori <i>et al.</i>	(BELLE Collab.)
ANISOVICH 06	IJMP A21 3615	V.V. Anisovich	
CAPRINI 06	PRL 96 132001	I. Caprini, G. Colangelo, H. Leutwyler	(BCIP+)
PDG 06	JP G33 1	W.-M. Yao <i>et al.</i>	(PDG Collab.)
PENNINGTON 06	PRL 97 011601	M.R. Pennington	
ZHOU 05	JHEP 0502 043	Z.Y. Zhou <i>et al.</i>	

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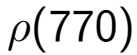
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REFID=51184

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ABLIKIM	04A	PL B598 149	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=49740
AKHMETSHIN	04	PL B578 285	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=49609
GALLEGOS	04	PR D69 074033	A. Gallegos <i>et al.</i>		REFID=49769
PELAEZ	04A	MPL A19 2879	J.R. Pelaez		REFID=50347
BUGG	03	PL B572 1	D.V. Bugg		REFID=49586
PISLAK	03	PR D67 072004	S. Pislak <i>et al.</i>	(BNL E865 Collab.)	REFID=49344
Also		PR D81 119903E	S. Pislak <i>et al.</i>	(BNL E865 Collab.)	REFID=53337
MURAMATSU	02	PRL 89 251802	H. Muramatsu <i>et al.</i>	(CLEO Collab.)	REFID=49081
Also		PRL 90 059901 (erratum)	H. Muramatsu <i>et al.</i>	(CLEO Collab.)	REFID=49385
AITALA	01B	PRL 86 770	E.M. Aitala <i>et al.</i>	(FNAL E791 Collab.)	REFID=48005
BLACK	01	PR D64 014031	D. Black <i>et al.</i>		REFID=48314
COLANGELO	01	NP B603 125	G. Colangelo, J. Gasser, H. Leytwyler		REFID=49180
ISHIDA	01	PL B518 47	M. Ishida <i>et al.</i>		REFID=48354
KOMADA	01	PL B508 31	T. Komada <i>et al.</i>		REFID=48541
PISLAK	01	PRL 87 221801	S. Pislak <i>et al.</i>	(BNL E865 Collab.)	REFID=48433
Also		PR D67 072004	S. Pislak <i>et al.</i>	(BNL E865 Collab.)	REFID=49344
Also		PRL 105 019901E	S. Pislak <i>et al.</i>	(BNL E865 Collab.)	REFID=53338
SUROVTSEV	01	PR D63 054024	Y.S. Surovtsev, D. Krupa, M. Nagy		REFID=48310
ASNER	00	PR D61 012002	D.M. Asner <i>et al.</i>	(CLEO Collab.)	REFID=47339
BAI	00E	PR D62 032002	J. Bai <i>et al.</i>	(BES Collab.)	REFID=47955
ISHIDA	00B	PTP 104 203	M. Ishida <i>et al.</i>		REFID=48358
ALEKSEEV	99	NP B541 3	I.G. Alekseev <i>et al.</i>		REFID=46614
BOGLIONE	99	EPJ C9 11	M. Boglione, M.R. Pennington		REFID=46931
HANNAH	99	PR D60 017502	T. Hannah		REFID=46935
KAMINSKI	99	EPJ C9 141	R. Kaminski, L. Lesniak, B. Loiseau	(CRAC, PARIN)	REFID=46927
OLLER	99	PR D60 099906 (erratum)	J.A. Oller <i>et al.</i>		REFID=46899
OLLER	99B	NP A652 407 (erratum)	J.A. Oller, E. Oset		REFID=46924
OLLER	99C	PR D60 074023	J.A. Oller, E. Oset		REFID=47386
ALEKSEEV	98	PAN 61 174	I.G. Alekseev <i>et al.</i>		REFID=46328
ALEXANDER	98	PR D58 052004	J.P. Alexander <i>et al.</i>	(CLEO Collab.)	REFID=46329
ANISOVICH	98B	SPU 41 419	V.V. Anisovich <i>et al.</i>		REFID=46331
		Translated from UFN 168 481.			
LOCHER	98	EPJ C4 317	M.P. Locher <i>et al.</i>	(PSI)	REFID=46372
TROYAN	98	JINRRC 5-91 33	Yu. Troyan <i>et al.</i>		REFID=46615
ALDE	97	PL B397 350	D.M. Alde <i>et al.</i>	(GAMS Collab.)	REFID=45392
DOBADO	97	PR D56 3057	A. Dobado, J.R. Pelaez		REFID=53964
ISHIDA	97	PTP 98 1005	S. Ishida <i>et al.</i>	(TOKY, MIYA, KEK)	REFID=45998
KAMINSKI	97B	PL B413 130	R. Kaminski, L. Lesniak, B. Loiseau	(CRAC, IPN)	REFID=45778
Also		PTP 95 745	S. Ishida <i>et al.</i>	(TOKY, MIYA, KEK)	REFID=45770
SVEC	96	PR D53 2343	M. Svec	(MCGI)	REFID=44509
TORNQVIST	96	PRL 76 1575	N.A. Tornqvist, M. Roos	(HELS)	REFID=44507
ALDE	95B	ZPHY C66 375	D.M. Alde <i>et al.</i>	(GAMS Collab.)	REFID=44375
ANISOVICH	95	PL B355 363	V.V. Anisovich <i>et al.</i>	(PNPI, SERP)	REFID=44442
JANSSEN	95	PR D52 2690	G. Janssen <i>et al.</i>	(STON, ADL, JULI)	REFID=44508
ACHASOV	94	PR D49 5779	N.N. Achasov, G.N. Shestakov	(NOVM)	REFID=44087
AMSLER	94D	PL B333 277	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=44093
ANISOVICH	94	PL B323 233	V.V. Anisovich <i>et al.</i>	(Crystal Barrel Collab.)	REFID=43659
BUTLER	94B	PR D49 40	F. Butler <i>et al.</i>	(CLEO Collab.)	REFID=43799
KAMINSKI	94	PR D50 3145	R. Kaminski, L. Lesniak, J.P. Maillet	(CRAC+)	REFID=45771
ZOU	94B	PR D50 591	B.S. Zou, D.V. Bugg	(LOQM)	REFID=44072
ZOU	93	PR D48 R3948	B.S. Zou, D.V. Bugg	(LOQM)	REFID=43672
BEHREND	92	ZPHY C56 381	H.J. Behrend	(CELLO Collab.)	REFID=43172
ARMSTRONG	91B	ZPHY C52 389	T.A. Armstrong <i>et al.</i>	(ATHU, BARI, BIRM+)	REFID=41862
BOYER	90	PR D42 1350	J. Boyer <i>et al.</i>	(Mark II Collab.)	REFID=41362
MARSISKE	90	PR D41 3324	H. Marsiske <i>et al.</i>	(Crystal Ball Collab.)	REFID=41351
MORGAN	90	ZPHY C48 623	D. Morgan, M.R. Pennington	(RAL, DURH)	REFID=41583
AUGUSTIN	89	NP B320 1	J.E. Augustin, G. Cosme	(DM2 Collab.)	REFID=41004
ASTON	88	NP B296 493	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)	REFID=40262
FALVARD	88	PR D38 2706	A. Falvard <i>et al.</i>	(CLER, FRAS, LALO+)	REFID=40576
COURAU	86	NP B271 1	A. Courau <i>et al.</i>	(CLER, LALO)	REFID=44510
VANBEVEREN	86	ZPHY C30 615	E. van Beveren <i>et al.</i>	(NIJM, BIEL)	REFID=45769
CASON	83	PR D28 1586	N.M. Cason <i>et al.</i>	(NDAM, ANL)	REFID=20752
ETKIN	82B	PR D25 1786	A. Etkin <i>et al.</i>	(BNL, CUNY, TUFTS, VAND)	REFID=20390
BISWAS	81	PRL 47 1378	N.N. Biswas <i>et al.</i>	(NDAM, ANL)	REFID=21106
COHEN	80	PR D22 2595	D. Cohen <i>et al.</i>	(ANL) IJP	REFID=20381
MUKHIN	80	JETPL 32 601	K.N. Mukhin <i>et al.</i>	(KIAE)	REFID=44528
		Translated from ZETFP 32 616.			
CORDEN	79	NP B157 250	M.J. Corden <i>et al.</i>	(BIRM, RHEL, TELA+) JP	REFID=20374
ESTABROOKS	79	PR D19 2678	P. Estabrooks	(CARL)	REFID=20375
FROGGATT	77	NP B129 89	C.D. Froggatt, J.L. Petersen	(GLAS, NORD)	REFID=21072
PAWLICKI	77	PR D15 3196	A.J. Pawlicki <i>et al.</i>	(ANL) IJ	REFID=20367
ROSSELET	77	PR D15 574	L. Rosselet <i>et al.</i>	(GEVA, SACL)	REFID=11004
CASON	76	PRL 36 1485	N.M. Cason <i>et al.</i>	(NDAM, ANL) IJ	REFID=21064
ESTABROOKS	75	NP B95 322	P.G. Estabrooks, A.D. Martin	(DURH)	REFID=20642
HYAMS	75	NP B100 205	B.D. Hyams <i>et al.</i>	(CERN, MPIM)	REFID=20355
SRINIVASAN	75	PR D12 681	V. Srinivasan <i>et al.</i>	(NDAM, ANL)	REFID=21062
ESTABROOKS	74	NP B79 301	P.G. Estabrooks, A.D. Martin	(DURH)	REFID=20111
GRAYER	74	NP B75 189	G. Grayer <i>et al.</i>	(CERN, MPIM)	REFID=20113
APEL	73	PL 41B 542	W.D. Apel <i>et al.</i>	(KARL, PISA)	REFID=44532
ESTABROOKS	73	Tallahassee	P.G. Estabrooks <i>et al.</i>	(CERN, MPIM)	REFID=20345
HYAMS	73	NP B64 134	B.D. Hyams <i>et al.</i>	(CERN, MPIM)	REFID=20107
OCHS	73	Thesis	W. Ochs	(MPIM, MUNI)	REFID=20349
PROTOPOP...	73	PR D7 1279	S.D. Protopopescu <i>et al.</i>	(LBL)	REFID=20108
BAILLON	72	PL 38B 555	P.H. Baillon <i>et al.</i>	(SLAC)	REFID=20093
BASDEVANT	72	PL 41B 178	J.L. Basdevant, C.D. Froggatt, J.L. Petersen	(CERN)	REFID=20095
BEIER	72B	PRL 29 511	E.W. Beier <i>et al.</i>	(PENN)	REFID=44530
BENSINGER	71	PL 36B 134	J.R. Bensinger <i>et al.</i>	(WISC)	REFID=21006
COLTON	71	PR D3 2028	E.P. Colton <i>et al.</i>	(LBL, FNAL, UCLA+)	REFID=44533
ROY	71	PL 36B 353	S.M. Roy		REFID=51107
BATON	70	PL 33B 528	J.P. Baton, G. Laurens, J. Reignier	(SACL)	REFID=20086
WALKER	67	RMP 39 695	W.D. Walker	(WISC)	REFID=20960



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

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$\rho(770)$ MASS

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

NEUTRAL ONLY, e^+e^-

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
775.26 ± 0.25 OUR AVERAGE				
775.02 ± 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 $e^+e^- \rightarrow \pi^+\pi^-$

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OCCUR=3

OCCUR=3

CHARGED ONLY, τ DECAYS and e^+e^-

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

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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±	$0.0 \bar{p}p \rightarrow \pi^+\pi^-\pi^0$

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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 -	$5 \pi^-\pi^0$
766.8 ± 1.5	9650	²⁷ PISUT	68	RVUE -	$1.7-3.2 \pi^-\pi^0 p, t < 10$
767 ± 6	900	²⁵ EISNER	67	HBC -	$4.2 \pi^-\pi^0 p, t < 10$

NODE=M009M2
NODE=M009M2

OCCUR=2

NEUTRAL ONLY, PHOTOPRODUCED

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
769.0± 1.0 OUR AVERAGE				
771 ± 2 $^{+2}_{-1}$	63.5k	28 ABRAMOWICZ12	ZEUS	$ep \rightarrow e\pi^+\pi^-p$
770 ± 2 ±1	79k	29 BREITWEG	98B ZEUS	50–100 γp
767.6± 2.7		BARTALUCCI 78	CNTR	$\gamma p \rightarrow e^+e^-p$
775 ± 5		GLADDING 73	CNTR	2.9–4.7 γp
767 ± 4	1930	BALLAM 72	HBC	2.8 γp
770 ± 4	2430	BALLAM 72	HBC	4.7 γp
765 ±10		ALVENSLEB... 70	CNTR	$\gamma A, t < 0.01$
767.7± 1.9	140k	BIGGS 70	CNTR	$< 4.1 \gamma C \rightarrow \pi^+\pi^-C$
765 ± 5	4000	ASBURY 67B	CNTR	$\gamma + Pb$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
771 ± 2	79k	30 BREITWEG	98B ZEUS	50–100 γp

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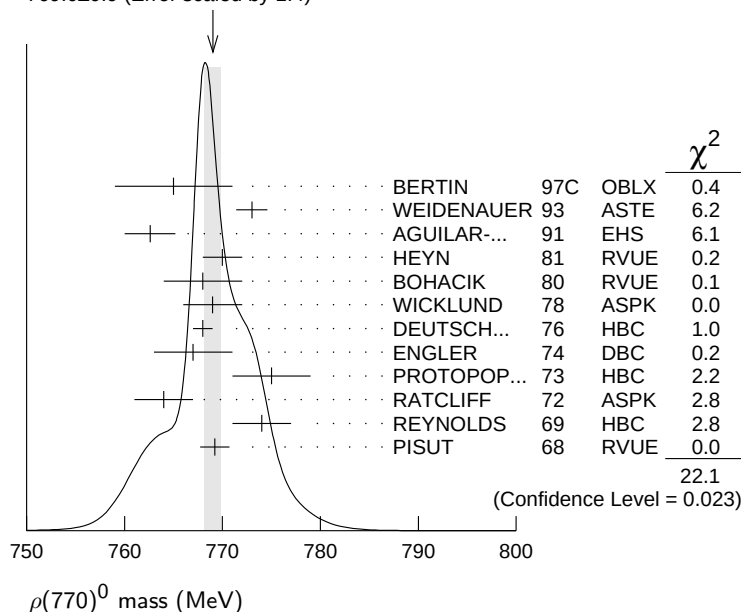
NEUTRAL ONLY, OTHER REACTIONS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
769.0±0.9 OUR AVERAGE Error includes scale factor of 1.4. See the ideogram below.					
765 ±6		BERTIN 97C	OBLX		0.0 $\bar{p}p \rightarrow \pi^+\pi^-\pi^0$
773 ±1.6		WEIDENAUER 93	ASTE		$\bar{p}p \rightarrow \pi^+\pi^-\omega$
762.6±2.6		AGUILAR-... 91	EHS		400 pp
770 ±2		31 HEYN 81	RVUE		Pion form factor
768 ±4		32,33 BOHACIK 80	RVUE	0	
769 ±3		26 WICKLUND 78	ASPK	0	3,4,6 $\pi^\pm N$
768 ±1	76000	DEUTSCH... 76	HBC	0	16 π^+p
767 ±4	4100	ENGLER 74	DBC	0	6 $\pi^+n \rightarrow \pi^+\pi^-p$
775 ±4	32000	32 PROTOPOP... 73	HBC	0	7.1 $\pi^+p, t < 0.4$
764 ±3	6800	RATCLIFF 72	ASPK	0	15 $\pi^-p, t < 0.3$
774 ±3	1700	REYNOLDS 69	HBC	0	2.26 π^-p
769.2±1.5	13300	34 PISUT 68	RVUE	0	1.7–3.2 $\pi^-p, t < 10$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
773.5±2.5		35 COLANGELO 01	RVUE		$\pi\pi \rightarrow \pi\pi$
762.3±0.5±1.2	600k	36 ABELE 99E	CBAR	0	0.0 $\bar{p}p \rightarrow \pi^+\pi^-\pi^0$
777 ±2	4943	37 ADAMS 97	E665		470 $\mu p \rightarrow \mu XB$
770 ±2		38 BOGOLYUB... 97	MIRA		32 $\bar{p}p \rightarrow \pi^+\pi^-X$
768 ±8		38 BOGOLYUB... 97	MIRA		32 $pp \rightarrow \pi^+\pi^-X$
761.1±2.9		DUBNICKA 89	RVUE		π form factor
777.4±2.0		39 CHABAUD 83	ASPK	0	17 π^-p polarized
769.5±0.7		32,33 LANG 79	RVUE	0	
770 ±9		33 ESTABROOKS 74	RVUE	0	17 $\pi^-p \rightarrow \pi^+\pi^-n$
773.5±1.7	11200	25 JACOBS 72	HBC	0	2.8 π^-p
775 ±3	2250	HYAMS 68	OSPK	0	11.2 π^-p

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OCCUR=2

WEIGHTED AVERAGE
 769.0±0.9 (Error scaled by 1.4)



- ¹ Using the GOUNARIS 68 parametrization with the complex phase of the ρ - ω interference and leaving the masses and widths of the $\rho(1450)$, $\rho(1700)$, and $\rho(2150)$ resonances as free parameters of the fit.
- ² A combined fit of AKHMETSHIN 07, AULCHENKO 06, and AULCHENKO 05.
- ³ Supersedes ACHASOV 05A.
- ⁴ A fit of the SND data from 400 to 1000 MeV using parameters of the $\rho(1450)$ and $\rho(1700)$ from a fit of the data of BARKOV 85, BISELLO 89 and ANDERSON 00A.
- ⁵ Using the GOUNARIS 68 parametrization with the complex phase of the ρ - ω interference.
- ⁶ Update of AKHMETSHIN 02.
- ⁷ Assuming $m_{\rho^+} = m_{\rho^-}$, $\Gamma_{\rho^+} = \Gamma_{\rho^-}$.
- ⁸ From the GOUNARIS 68 parametrization of the pion form factor.
- ⁹ Assuming $m_{\rho^+} = m_{\rho^-} = m_{\rho^0}$, $\Gamma_{\rho^+} = \Gamma_{\rho^-} = \Gamma_{\rho^0}$.
- ¹⁰ Without limitations on masses and widths.
- ¹¹ Assuming $m_{\rho^0} = m_{\rho^\pm}$, $g_{\rho^0\pi\pi} = g_{\rho^\pm\pi\pi}$.
- ¹² Using the data of BARKOV 85 in the hidden local symmetry model.
- ¹³ From the fit to $e^+e^- \rightarrow \pi^+\pi^-$ data from the compilations of HEYN 81 and BARKOV 85, including the GOUNARIS 68 parametrization of the pion form factor.
- ¹⁴ A fit of BARKOV 85 data assuming the direct $\omega\pi\pi$ coupling.
- ¹⁵ Applying the S-matrix formalism to the BARKOV 85 data.
- ¹⁶ Includes BARKOV 85 data. Model-dependent width definition.
- ¹⁷ $|F_\pi(0)|^2$ fixed to 1.
- ¹⁸ From the GOUNARIS 68 parametrization of the pion form factor.
- ¹⁹ The error combines statistical and systematic uncertainties. Supersedes BARATE 97M.
- ²⁰ $\rho(1700)$ mass and width fixed at 1700 MeV and 235 MeV respectively.
- ²¹ From the GOUNARIS 68 parametrization of the pion form factor. The second error is a model error taking into account different parametrizations of the pion form factor.
- ²² Using the data of BARATE 97M and the effective chiral Lagrangian.
- ²³ From a fit of the model-independent parameterization of the pion form factor to the data of BARATE 97M.
- ²⁴ Assuming the equality of ρ^+ and ρ^- masses and widths.
- ²⁵ Mass errors enlarged by us to $\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.
- ²⁶ Phase shift analysis. Systematic errors added corresponding to spread of different fits.
- ²⁷ From fit of 3-parameter relativistic P -wave Breit-Wigner to total mass distribution. Includes BATON 68, MILLER 67B, ALFF-STEINBERGER 66, HAGOPIAN 66, HAGOPIAN 66B, JACOBS 66B, JAMES 66, WEST 66, BLIEDEN 65 and CARMONY 64.
- ²⁸ Using the KUHN 90 parametrization of the pion form factor, neglecting ρ - ω interference.
- ²⁹ From the parametrization according to SOEDING 66.
- ³⁰ From the parametrization according to ROSS 66.
- ³¹ HEYN 81 includes all spacelike and timelike F_π values until 1978.
- ³² From pole extrapolation.
- ³³ From phase shift analysis of GRAYER 74 data.
- ³⁴ Includes MALAMUD 69, ARMENISE 68, BACON 67, HUWE 67, MILLER 67B, ALFF-STEINBERGER 66, HAGOPIAN 66, HAGOPIAN 66B, JACOBS 66B, JAMES 66, WEST 66, GOLDBERGER 64, ABOLINS 63.
- ³⁵ Breit-Wigner mass from a phase-shift analysis of HYAMS 73 and PROTOPODESCU 73 data.
- ³⁶ Using relativistic Breit-Wigner and taking into account ρ - ω interference.
- ³⁷ Systematic errors not evaluated.
- ³⁸ Systematic effects not studied.
- ³⁹ From fit of 3-parameter relativistic Breit-Wigner to helicity-zero part of P -wave intensity. CHABAUD 83 includes data of GRAYER 74.

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NODE=M009M0P;LINKAGE=AB
 NODE=M009M;LINKAGE=B5
 NODE=M009M;LINKAGE=B6
 NODE=M009M;LINKAGE=B
 NODE=M009M;LINKAGE=C
 NODE=M009M;LINKAGE=H
 NODE=M009M;LINKAGE=R

NODE=M009M;LINKAGE=CL

NODE=M009M;LINKAGE=BL
 NODE=M009M;LINKAGE=A1
 NODE=M009M;LINKAGE=QQ
 NODE=M009M;LINKAGE=G

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

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
-0.7±0.8 OUR AVERAGE	Error includes scale factor of 1.5. See the ideogram below.				
-2.4±0.8		⁴⁰ SCHAELE	05C	ALEP	$\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$
0.4±0.7±0.6	1.98M	⁴¹ ALOISIO	03	KLOE	$1.02 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
1.3±1.1±2.0	500k	⁴¹ ACHASOV	02	SND	$1.02 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
1.6±0.6±1.7	600k	ABELE	99E	CBAR	$0.0 \bar{p} p \rightarrow \pi^+ \pi^- \pi^0$
-4 ±4	3000	⁴² REYNOLDS	69	HBC	-0 $2.26 \pi^- p$
-5 ±5	3600	⁴² FOSTER	68	HBC	±0 $0.0 \bar{p} p$
2.4±2.1	22950	⁴³ PISUT	68	RVUE	$\pi N \rightarrow \rho N$

NODE=M009D

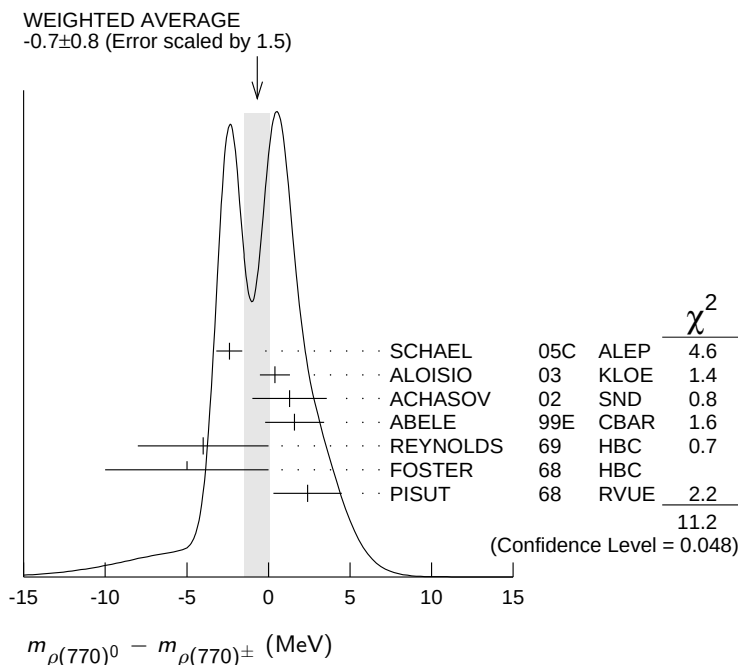
NODE=M009D

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

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

42 From quoted masses of charged and neutral modes.

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



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

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

$\rho(770)$ RANGE PARAMETER

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

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

$\rho(770)$ WIDTH

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

NEUTRAL ONLY, e^+e^-

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
147.8 ± 0.9 OUR AVERAGE		Error includes scale factor of 2.0. See the ideogram below.			
149.59±0.67		45 LEES	12G	BABR	$e^+e^- \rightarrow \pi^+\pi^-\gamma$
145.98±0.75±0.50	900k	46 AKHMETSHIN	07		$e^+e^- \rightarrow \pi^+\pi^-$
146.1 ± 0.8 ± 1.5	800k	47,48 ACHASOV	06	SND	$e^+e^- \rightarrow \pi^+\pi^-$
143.85±1.33±0.80	114k	49,50 AKHMETSHIN	04	CMD2	$e^+e^- \rightarrow \pi^+\pi^-$
147.3 ± 1.5 ± 0.7	1.98M	51 ALOISIO	03	KLOE	1.02 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
151.1 ± 2.6 ± 3.0	500k	51 ACHASOV	02	SND	0 1.02 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
150.5 ± 3.0		52 BARKOV	85	OLYA	0 $e^+e^- \rightarrow \pi^+\pi^-$

NODE=M009D;LINKAGE=SC

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

NODE=M009D1

NODE=M009D1

NODE=M009D;LINKAGE=WO

NODE=M009R

NODE=M009R

NODE=M009R

NODE=M009220

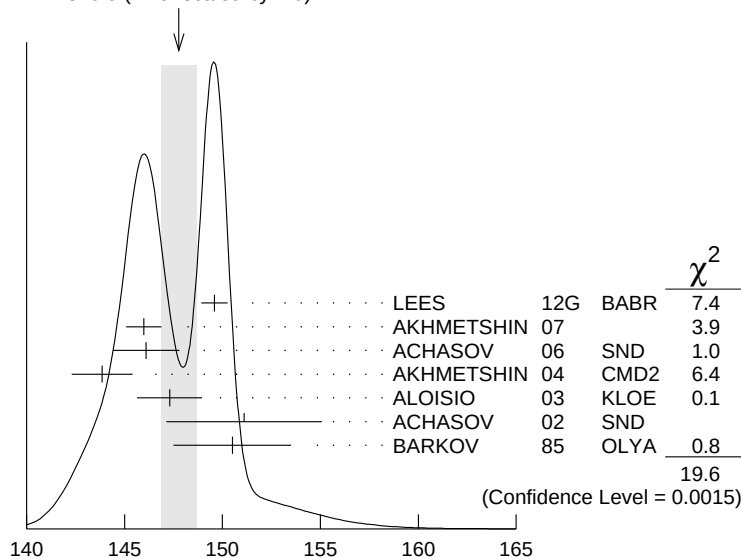
NODE=M009220

NODE=M009W0
NODE=M009W0

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

143.9 ±1.3 ±1.1	1.98M	53	ALOISIO	03	KLOE	$1.02 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$	OCCUR=2
147.4 ±1.5 ±0.7	1.98M	54	ALOISIO	03	KLOE	$1.02 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$	OCCUR=3
149.8 ±2.2 ±2.0	500k	55	ACHASOV	02	SND	$1.02 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$	OCCUR=3
147.9 ±1.5 ±7.5		56	BENAYOUN	98	RVUE	$e^+ e^- \rightarrow \pi^+ \pi^- , \mu^+ \mu^-$	
153.5 ±1.3 ±4.6		57	GARDNER	98	RVUE	$0.28-0.92 e^+ e^- \rightarrow \pi^+ \pi^-$	
145.0 ±1.7		58	O'CONNELL	97	RVUE	$e^+ e^- \rightarrow \pi^+ \pi^-$	
142.5 ±3.5		59	BERNICA	94	RVUE	$e^+ e^- \rightarrow \pi^+ \pi^-$	
138 ±1		60	GESHKEN...	89	RVUE	$e^+ e^- \rightarrow \pi^+ \pi^-$	

WEIGHTED AVERAGE
147.8±0.9 (Error scaled by 2.0)



Neutral only, $e^+ e^-$

CHARGED ONLY, τ DECAYS and $e^+ e^-$

VALUE (MeV) EVTS DOCUMENT ID TECN CHG COMMENT

149.1±0.8 OUR FIT

149.1±0.8 OUR AVERAGE

148.1±0.4±1.7	5.4M	61,62	FUJIKAWA	08	BELL	$\pm$	$\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$
149.0±1.2		62,63	SCHAEEL	05c	ALEP		$\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$
149.9±2.3±2.0	500k	51	ACHASOV	02	SND	$\pm$	$1.02 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
150.4±1.4±1.4	87k	64,65	ANDERSON	00A	CLE2		$\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$

NODE=M009W5
NODE=M009W5

OCCUR=2

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

143.7±1.3±1.2	1.98M	51	ALOISIO	03	KLOE	$\pm$	$1.02 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$	
142.9±1.3±1.4	1.98M	54	ALOISIO	03	KLOE	$-$	$1.02 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$	OCCUR=2
144.7±1.4±1.2	1.98M	54	ALOISIO	03	KLOE	$+$	$1.02 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$	OCCUR=3
150.2±2.0 ^{+0.7} _{-1.6}		66	SANZ-CILLERO	03	RVUE		$\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$	
150.9±2.2±2.0	500k	55	ACHASOV	02	SND		$1.02 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$	OCCUR=4

MIXED CHARGES, OTHER REACTIONS

VALUE (MeV) EVTS DOCUMENT ID TECN CHG COMMENT

149.5±1.3	600k	67	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	68 CAPRARO 87	SPEC	—	$200 \pi^- \text{Cu} \rightarrow \pi^- \pi^0 \text{Cu}$
154 ±20	967	68 CAPRARO 87	SPEC	—	$200 \pi^- \text{Pb} \rightarrow \pi^- \pi^0 \text{Pb}$
150 ± 5		HUSTON 86	SPEC	+	$202 \pi^+ \text{A} \rightarrow \pi^+ \pi^0 \text{A}$
146 ±12	6500	69 BYERLY 73	OSPK	—	$5 \pi^- p$
148.2± 4.1	9650	70 PISUT 68	RVUE	—	$1.7\text{--}3.2 \pi^- p, t < 10$
146 ±13	900	EISNER 67	HBC	—	$4.2 \pi^- p, t < 10$

NODE=M009W2
 NODE=M009W2

OCCUR=2

NEUTRAL ONLY, PHOTOPRODUCED

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
151.7± 2.6 OUR AVERAGE				
155 ± 5 ± 2	63.5k	71 ABRAMOWICZ12	ZEUS	$ep \rightarrow e \pi^+ \pi^- p$
146 ± 3 ±13	79k	72 BREITWEG 98B	ZEUS	$50\text{--}100 \gamma p$
150.9± 3.0		BARTALUCCI 78	CNTR	$\gamma p \rightarrow e^+ e^- p$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
138 ± 3	79k	73 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

OCCUR=2

OCCUR=2

NEUTRAL ONLY, OTHER REACTIONS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
150.9± 1.7 OUR AVERAGE Error includes scale factor of 1.1.					
122 ±20		BERTIN 97C	OBLX		$0.0 \bar{p}p \rightarrow \pi^+ \pi^- \pi^0$
145.7± 5.3		WEIDENAUER 93	ASTE		$\bar{p}p \rightarrow \pi^+ \pi^- \omega$
144.9± 3.7		DUBNICKA 89	RVUE		π form factor
148 ± 6		74,75 BOHACIK 80	RVUE	0	
152 ± 9		69 WICKLUND 78	ASPK	0	$3,4,6 \pi^\pm p N$
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	$2.26 \pi^- p$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
147.0± 2.5	600k	76 ABELE 99E	CBAR	0	$0.0 \bar{p}p \rightarrow \pi^+ \pi^- \pi^0$
146 ± 3	4943	77 ADAMS 97	E665		$470 \mu p \rightarrow \mu X B$
160.0 ⁺ 4.1 — 4.0		78 CHABAUD 83	ASPK	0	$17 \pi^- p$ polarized
155 ± 1		79 HEYN 81	RVUE	0	π form factor
148.0± 1.3		74,75 LANG 79	RVUE	0	
146 ±14	4100	ENGLER 74	DBC	0	$6 \pi^+ n \rightarrow \pi^+ \pi^- p$
143 ±13		75 ESTABROOKS 74	RVUE	0	$17 \pi^- p \rightarrow \pi^+ \pi^- n$
160 ±10	32000	74 PROTOPOP... 73	HBC	0	$7.1 \pi^+ p, t < 0.4$
145 ±12	2250	68 HYAMS 68	OSPK	0	$11.2 \pi^- p$
163 ±15	13300	80 PISUT 68	RVUE	0	$1.7\text{--}3.2 \pi^- p, t < 10$

NODE=M009W0R
 NODE=M009W0R

⁴⁵ Using the GOUNARIS 68 parametrization with the complex phase of the ρ - ω interference and leaving the masses and widths of the $\rho(1450)$, $\rho(1700)$, and $\rho(2150)$ resonances as free parameters of the fit.

NODE=M009W0;LINKAGE=LE

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

NODE=M009W;LINKAGE=AK
 NODE=M009W0;LINKAGE=AC
 NODE=M009W0;LINKAGE=SN

⁴⁷ Supersedes ACHASOV 05A.

⁴⁸ A fit of the SND data from 400 to 1000 MeV using parameters of the $\rho(1450)$ and $\rho(1700)$ from a fit of the data of BARKOV 85, BISELLO 89 and ANDERSON 00A.

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

NODE=M009W5;LINKAGE=GS
 NODE=M009W5;LINKAGE=P2

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

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

NODE=M009W;LINKAGE=CH
 NODE=M009W;LINKAGE=K

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

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

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

⁵⁴ Without limitations on masses and widths.

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

NODE=M009W;LINKAGE=HC
 NODE=M009W;LINKAGE=K2

⁵⁶ Using the data of BARKOV 85 in the hidden local symmetry model.

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

NODE=M009W;LINKAGE=G8

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

NODE=M009W5;LINKAGE=Z
 NODE=M009W;LINKAGE=LB
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 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		81 SCHAEEL	05C ALEP	$\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$
$3.6 \pm 1.8 \pm 1.7$	1.98M	82 ALOISIO	03 KLOE	$1.02 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$

NODE=M009W6
 NODE=M009W6

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

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

NODE=M009W16
 NODE=M009W16

- 81 From the combined fit of the τ^- data from ANDERSON 00A and SCHAEEL 05C and e^+e^- data from the compilation of BARKOV 85, AKHMETSHIN 04, and ALOISIO 05. Supersedes BARATE 97M.
- 82 Assuming $m_{\rho^+} = m_{\rho^-}$, $\Gamma_{\rho^+} = \Gamma_{\rho^-}$.
- 83 Without limitations on masses and widths.

NODE=M009W6;LINKAGE=SC

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

$\rho(770)$ DECAY MODES

	Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
Γ_1	$\pi\pi$	~ 100	%
$\rho(770)^\pm$ decays			
Γ_2	$\pi^\pm \pi^0$	~ 100	%
Γ_3	$\pi^\pm \gamma$	$(4.5 \pm 0.5) \times 10^{-4}$	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=M009225;NODE=M009

DESIG=1;OUR EVAL;→ UNCHECKED ←

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

$\rho(770)^0$ decays

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

NODE=M009;CLUMP=B

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

DESIG=60

DESIG=40

DESIG=8

DESIG=80

DESIG=6

DESIG=4

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

DESIG=22

DESIG=30

DESIG=9

DESIG=10

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

LINKAGE=MD2

CONSTRAINED FIT INFORMATION

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

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

x_3	-100
Γ	15 -15
	x_2 x_3

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

DESIG=11

DESIG=3

CONSTRAINED FIT INFORMATION

An overall fit to the total width, a partial width, and 7 branching ratios uses 21 measurements and one constraint to determine 9 parameters. The overall fit has a $\chi^2 = 6.0$ for 13 degrees of freedom.

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

x_7	-100							
x_8	-5	0						
x_9	-1	0	1					
x_{10}	-1	0	0	0				
x_{11}	2	-3	0	0	0			
x_{12}	0	0	-8	-9	0	0		
x_{14}	-1	0	0	0	0	0	0	
Γ	0	0	4	5	0	0	-54	0
	x_6	x_7	x_8	x_9	x_{10}	x_{11}	x_{12}	x_{14}

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

DESIG=12
DESIG=60
DESIG=40
DESIG=8
DESIG=80
DESIG=6
DESIG=4
DESIG=22

$\rho(770)$ PARTIAL WIDTHS

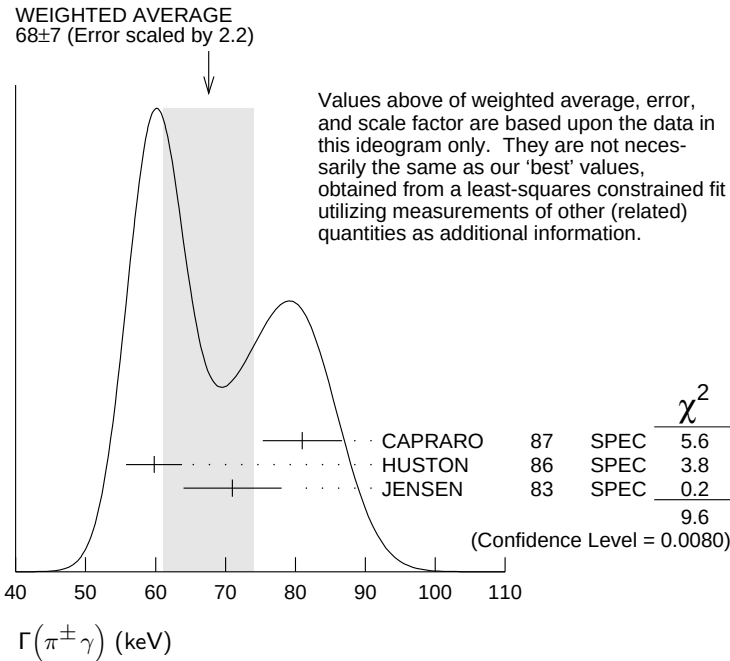
NODE=M009230

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

Γ_3

NODE=M009W3
NODE=M009W3

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



$\Gamma(e^+e^-)$ Γ_{12}

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

NODE=M009W4
 NODE=M009W4

OCCUR=2

 $\Gamma(\pi^0\gamma)$ Γ_8

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

NODE=M009W31
 NODE=M009W31

 $\Gamma(\eta\gamma)$ Γ_9

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

NODE=M009W32
 NODE=M009W32

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

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

NODE=M009W33
 NODE=M009W33

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

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

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

NODE=M009233

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

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

NODE=M009G4
 NODE=M009G4

- ⁹¹ Supersedes ACHASOV 05A.
⁹² A fit of the SND data from 400 to 1000 MeV using parameters of the $\rho(1450)$ and $\rho(1700)$ from a fit of the data of BARKOV 85, BISELLO 89 and ANDERSON 00A.
⁹³ A simultaneous fit of $e^+e^- \rightarrow \pi^+\pi^-, \pi^+\pi^-\pi^0, \pi^0\gamma, \eta\gamma$ data.

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

NODE=M009G4;LINKAGE=BE

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

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

NODE=M009G1
 NODE=M009G1

- ⁹⁴ From a combined fit of $\sigma(e^+e^- \rightarrow \eta\gamma)$ with $\eta \rightarrow 3\pi^0$ and $\eta \rightarrow \pi^+\pi^-\pi^0$, and fixing $B(\eta \rightarrow 3\pi^0) / B(\eta \rightarrow \pi^+\pi^-\pi^0) = 1.44 \pm 0.04$. Recalculated by us from the cross section at the peak. Supersedes ACHASOV 00D and ACHASOV 06A.
⁹⁵ From the $\eta \rightarrow 2\gamma$ decay and using $B(\eta \rightarrow \gamma\gamma) = 39.43 \pm 0.26\%$.
⁹⁶ From the $\eta \rightarrow 3\pi^0$ decay and using $B(\eta \rightarrow 3\pi^0) = (32.24 \pm 0.29) \times 10^{-2}$.
⁹⁷ The combined fit from 600 to 1380 MeV taking into account $\rho(770)$, $\omega(782)$, $\phi(1020)$, and $\rho(1450)$ (mass and width fixed at 1450 MeV and 310 MeV respectively).
⁹⁸ Recalculated by us from the cross section in the peak.
⁹⁹ A simultaneous fit of $e^+e^- \rightarrow \pi^+\pi^-, \pi^+\pi^-\pi^0, \pi^0\gamma, \eta\gamma$ data.

NODE=M009G1;LINKAGE=AH

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

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

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

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

VALUE (units 10^{-8})

EVTS

DOCUMENT ID

TECN

COMMENT

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

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

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

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

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

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

¹⁰⁰ Using $\sigma_{\phi \rightarrow \pi^0\gamma}$ from ACHASOV 00 and $m_\rho = 775.97$ MeV in the model with the energy-independent phase of ρ - ω interference equal to $(-10.2 \pm 7.0)^\circ$.

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

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

NODE=M009G2
NODE=M009G2

NODE=M009G;LINKAGE=SH

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

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

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

VALUE (units 10^{-9})

EVTS

DOCUMENT ID

TECN

COMMENT

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

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

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

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

¹⁰⁴ Statistical significance is less than 3σ .

NODE=M009G3
NODE=M009G3

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

$\rho(770)$ BRANCHING RATIOS

NODE=M009235

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

$$\Gamma_4/\Gamma_1$$

VALUE (units 10^{-4})

CL%

DOCUMENT ID

TECN

CHG

COMMENT

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

NODE=M009R4
NODE=M009R4

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

$$\Gamma_5/\Gamma_1$$

VALUE (units 10^{-4})

CL%

DOCUMENT ID

TECN

CHG

COMMENT

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

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

35±40 JAMES 66 HBC + $2.1 \pi^+ p$

NODE=M009R1
NODE=M009R1

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

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

VALUE (units 10^{-5})

DOCUMENT ID

TECN

COMMENT

4.60±0.28 OUR FIT**4.6 ±0.2 ±0.2**

ANTIPOV 89 SIGM $\pi^- \text{Cu} \rightarrow \mu^+\mu^-\pi^- \text{Cu}$

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

8.2 $^{+1.6}_{-3.6}$ ¹⁰⁵ROTHWELL 69 CNTR Photoproduction

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

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

NODE=M009R5
NODE=M009R5

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

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

VALUE (units 10^{-4})

DOCUMENT ID

TECN

COMMENT

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

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

NODE=M009R3
NODE=M009R3

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

$$\Gamma_9/\Gamma$$

VALUE (units 10^{-4})

EVTS

DOCUMENT ID

TECN

CHG

COMMENT

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

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

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

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

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

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

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

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

NODE=M009R7
NODE=M009R7

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

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

NODE=M009R13
NODE=M009R13

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

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

NODE=M009R11
NODE=M009R11

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

VALUE (units 10^{-4})	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$1.01^{+0.54}_{-0.36} \pm 0.34$		1.2M 116	ACHASOV 03D	RVUE	$0.44-2.00 e^+e^- \rightarrow \pi^+\pi^-\pi^0$
<1.2	90		VASSERMAN 88B	ND	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$

NODE=M009R10
NODE=M009R10

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

VALUE	CL%	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
~ 0.01		BRAMON 86	RVUE	0	$J/\psi \rightarrow \omega \pi^0$
<0.01	84	117 ABRAMS 71	HBC	0	$3.7 \pi^+ p$

NODE=M009R6
NODE=M009R6

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

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

NODE=M009R8
NODE=M009R8

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

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
0.0099 ± 0.0016 OUR FIT				
0.0099 ± 0.0016		119 DOLINSKY 91	ND	$e^+e^- \rightarrow \pi^+\pi^-\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.0111 ± 0.0014		120 VASSERMAN 88	ND	$e^+e^- \rightarrow \pi^+\pi^-\gamma$
<0.005	90	121 VASSERMAN 88	ND	$e^+e^- \rightarrow \pi^+\pi^-\gamma$

NODE=M009R12
NODE=M009R12

OCCUR=2

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

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

NODE=M009R9
NODE=M009R9

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

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

NODE=M009R15
NODE=M009R15

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

DOCUMENT ID

TECN

COMMENT

NODE=M009R16
NODE=M009R16

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

<0.7

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

EVTS

DOCUMENT ID

TECN

COMMENT

NODE=M009R14
NODE=M009R14**4.5±0.8 OUR FIT****4.5^{+0.9}_{-0.8} OUR AVERAGE**5.2^{+1.5}_{-1.3} ± 0.6 190 126 AKHMETSHIN 04B CMD2 0.6^{-0.97}_{0.0} $e^+ e^- \rightarrow \pi^0 \pi^0 \gamma$ 4.1^{+1.0}_{-0.9} ± 0.3 295 127 ACHASOV 02F SND 0.36^{-0.97}_{0.0} $e^+ e^- \rightarrow \pi^0 \pi^0 \gamma$

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

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

OCCUR=2

105 Possibly large ρ - ω interference leads us to increase the minus error.106 Result contains $11 \pm 11\%$ correction using SU(3) for central value. The error on the correction takes account of possible ρ - ω interference and the upper limit agrees with the upper limit of $\omega \rightarrow \mu^+ \mu^-$ from this experiment.NODE=M009R5;LINKAGE=R
NODE=M009R5;LINKAGE=W107 HYAMS 67's mass resolution is 20 MeV. The ω region was excluded.108 The ρ' contribution is not taken into account.NODE=M009R5;LINKAGE=H
NODE=M009R;LINKAGE=KS
NODE=M009R7;LINKAGE=AO109 ACHASOV 07B reports $[\Gamma(\rho(770) \rightarrow \eta \gamma)/\Gamma_{\text{total}}] \times [B(\rho(770) \rightarrow e^+ e^-)] = (1.32 \pm 0.14 \pm 0.08) \times 10^{-8}$ which we divide by our best value $B(\rho(770) \rightarrow e^+ e^-) = (4.72 \pm 0.05) \times 10^{-5}$. Our first error is their experiment's error and our second error is the systematic error from using our best value. Supersedes ACHASOV 00D and ACHASOV 06A.110 Solution corresponding to constructive ω - ρ interference.NODE=M009R7;LINKAGE=A
NODE=M009R;LINKAGE=AK
NODE=M009R7;LINKAGE=AZ
NODE=M009R;LINKAGE=BQ111 Using $B(\rho \rightarrow e^+ e^-) = (4.67 \pm 0.09) \times 10^{-5}$ and $B(\eta \rightarrow \gamma \gamma) = 39.43 \pm 0.26\%$.112 Not independent of the corresponding $\Gamma(e^+ e^-) \times \Gamma(\eta \gamma)/\Gamma_{\text{total}}^2$.113 The combined fit from 600 to 1380 MeV taking into account $\rho(770)$, $\omega(782)$, $\phi(1020)$, and $\rho(1450)$ (mass and width fixed at 1450 MeV and 310 MeV respectively).114 Using $B(\rho \rightarrow e^+ e^-) = (4.75 \pm 0.10) \times 10^{-5}$ from AKHMETSHIN 02 and $B(\eta \rightarrow 3\pi^0) = (32.24 \pm 0.29) \times 10^{-2}$.

NODE=M009R;LINKAGE=BX

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

NODE=M009R7;LINKAGE=C

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

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

120 Superseded by DOLINSKY 91.

121 Structure radiation due to quark rearrangement in the decay.

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

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

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

NODE=M009R14;LINKAGE=AH

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

NODE=M009R;LINKAGE=FF

128 Superseded by ACHASOV 02F.

NODE=M009R;LINKAGE=GF

$\rho(770)$ REFERENCES

NODE=M009

ABRAMOWICZ	12	EPJ C72 1869	H. Abramowicz <i>et al.</i>	(ZEUS Collab.)	REFID=54274
LEES	12G	PR D86 032013	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=54299
BENAYOUN	10	EPJ C65 211	M. Benayoun <i>et al.</i>		REFID=53212
ACHASOV	09A	JETP 109 379	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=53101
ACHASOV	08	Translated from ZETF 136 442.			
ACHASOV	08	JETP 107 61	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=52258
FUJIKAWA	08	Translated from ZETF 134 80.			
FUJIKAWA	08	PR D78 072006	M. Fujikawa <i>et al.</i>	(BELLE Collab.)	REFID=52536
ACHASOV	07B	PR D76 077101	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=51942
AKHMETSHIN	07	PL B648 28	R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=51615
ACHASOV	06	JETP 103 380	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=51113
ACHASOV	06A	Translated from ZETF 130 437.			
ACHASOV	06A	PR D74 014016	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=51133
AULCHENKO	06	JETPL 84 413	V.M. Aulchenko <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=51513
ACHASOV	05A	Translated from ZETFP 84 491.			
ACHASOV	05A	JETP 101 1053	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=51045
AKHMETSHIN	05	Translated from ZETF 128 1201.			
AKHMETSHIN	05A	PL B605 26	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=50330
AKHMETSHIN	05A	PL B613 29	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=50508
ALOISIO	05	PL B606 12	A. Aloisio <i>et al.</i>	(KLOE Collab.)	REFID=51112
AULCHENKO	05	JETPL 82 743	V.M. Aulchenko <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=51060
SCHAEEL	05C	Translated from ZETFP 82 841.			
AKHMETSHIN	04	PRPL 421 191	S. Schaeel <i>et al.</i>	(ALEPH Collab.)	REFID=50845
AKHMETSHIN	04B	PL B578 285	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=49609
ACHASOV	03	PL B580 119	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=49610
ACHASOV	03D	PL B559 171	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=49187
ACHASOV	03D	PR D68 052006	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=49577
ALOISIO	03	PL B561 55	A. Aloisio <i>et al.</i>	(KLOE Collab.)	REFID=49404
SANZ-CILLERO	03	EPJ C27 587	J.J. Sanz-Cillero, A. Pich		REFID=49399
ACHASOV	02	PR D65 032002	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=48549
ACHASOV	02F	PL B537 201	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=48816
AKHMETSHIN	02	PL B527 161	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=48565
AKHMETSHIN	01B	PL B509 217	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=48167
COLANGELO	01	NP B603 125	G. Colangelo, J. Gasser, H. Leytwyler		REFID=49180
PICH	01	PR D63 093005	A. Pich, J. Portoles		REFID=48313
ACHASOV	00	EPJ C12 25	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47417
ACHASOV	00D	JETPL 72 282	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47882
ACHASOV	00G	Translated from ZETFP 72 411.			
ACHASOV	00G	JETPL 71 355	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47929
AKHMETSHIN	00	Translated from ZETFP 71 519.			
ANDERSON	00A	PL B475 190	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=47421
ABELE	99E	PR D61 112002	S. Anderson <i>et al.</i>	(CLEO Collab.)	REFID=47468
BENAYOUN	98	PL B469 270	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)	REFID=47414
BREITWEG	98B	EPJ C2 269	M. Benayoun <i>et al.</i>	(IPNP, NOVO, ADLD+)	REFID=45859
GARDNER	98	EPJ C2 247	J. Breitweg <i>et al.</i>	(ZEUS Collab.)	REFID=46354
Also	98	PR D57 2716	S. Gardner, H.B. O'Connell		REFID=46366
ABELE	97	PR D62 019903 (errata)	S. Gardner, H.B. O'Connell		REFID=47981
ADAMS	97	PL B391 191	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)	REFID=45415
BARATE	97M	ZPHY C74 237	M.R. Adams <i>et al.</i>	(E665 Collab.)	REFID=45533
BERTIN	97C	ZPHY C76 15	R. Barate <i>et al.</i>	(ALEPH Collab.)	REFID=45622
BOGOLYUB...	97	PL B408 476	A. Bertin <i>et al.</i>	(OBELIX Collab.)	REFID=45701
O'CONNELL	97	PAN 60 46	M.Y. Bogolyubsky <i>et al.</i>	(MOSU, SERP)	REFID=45393
BENAYOUN	96	Translated from YAF 60 53.			
BERNICHIA	94	NP A623 559	H.B. O'Connell <i>et al.</i>	(ADLD)	REFID=45860
WEIDENAUER	93	ZPHY C72 221	M. Benayoun <i>et al.</i>	(IPNP, NOVO)	REFID=45753
AGUILAR...	91	PR D50 4454	A. Bernichia, G. Lopez Castro, J. Pestieau	(LOUV+)	REFID=44097
DOLINSKY	91	ZPHY C59 387	P. Weidenauer <i>et al.</i>	(ASTERIX Collab.)	REFID=43585
KUHN	90	ZPHY C50 405	M. Aguilar-Benitez <i>et al.</i>	(LEBC-EHS Collab.)	REFID=41637
ANTIPOV	89	PRPL 202 99	S.I. Dolinsky <i>et al.</i>	(NOVO)	REFID=41369
BISELLO	89	ZPHY C48 445	J.H. Kuhn <i>et al.</i>	(MPIM)	REFID=45862
DOLINSKY	89	ZPHY C42 185	Y.M. Antipov <i>et al.</i>	(SERP, JINR, BGNA+)	REFID=40739
DUBNICKA	89	PL B220 321	D. Bisello <i>et al.</i>	(DM2 Collab.)	REFID=40740
GESHKEN...	89	ZPHY C42 511	S.I. Dolinsky <i>et al.</i>	(NOVO)	REFID=41003
KURDADZE	88	JP G15 1349	S. Dubnicka <i>et al.</i>	(JINR, SLOV)	REFID=44082
VASSERMAN	88	ZPHY C45 351	B.V. Geshkenbein	(ITEP)	REFID=41017
VASSERMAN	88B	JETPL 47 512	L.M. Kurdadze <i>et al.</i>	(NOVO)	REFID=41121
AULCHENKO	87C	Translated from ZETFP 47 432.			
CAPRARO	87	SJNP 47 1035	I.B. Vasserman <i>et al.</i>	(NOVO)	REFID=41019
BRAMON	86	Translated from YAF 47 1635.			
HUSTON	86	SJNP 48 480	I.B. Vasserman <i>et al.</i>	(NOVO)	REFID=41020
KURDADZE	86	Translated from YAF 48 753.			
BARKOV	85	IYF 87-90 Preprint	V.M. Aulchenko <i>et al.</i>	(NOVO)	REFID=41370
DRUZHININ	84	NP B288 659	L. Capraro <i>et al.</i>	(CLER, FRAS, MILA+)	REFID=40003
CHABAUD	83	PL B173 97	A. Bramon, J. Casulleras	(BARC)	REFID=22102
JENSEN	83	PR D33 3199	J. Huston <i>et al.</i>	(ROCH, FNAL, MINN)	REFID=20137
HEYN	81	JETPL 43 643	L.M. Kurdadze <i>et al.</i>	(NOVO)	REFID=40287
BOHACIK	80	Translated from ZETFP 43 497.			
LANG	79	NP B256 365	L.M. Barkov <i>et al.</i>	(NOVO)	REFID=20134
BARTALUCCI	78	PL 144B 136	V.P. Druzhinin <i>et al.</i>	(NOVO)	REFID=20561
WICKLUND	78	NP B223 1	V. Chabaud <i>et al.</i>	(CERN, CRAC, MPIM)	REFID=20131
ANDREWS	77	PR D27 26	T. Jensen <i>et al.</i>	(ROCH, FNAL, MINN)	REFID=20132
DEUTSCH...	76	ZPHY C7 169	M.F. Heyn, C.B. Lang	(GRAZ)	REFID=20129
ENGLER	74	PR D21 1342	J. Bohacik, H. Kuhnelt	(SLOV, WIEN)	REFID=20128
ESTABROOKS	74	PR D19 956	C.B. Lang, A. Mas-Parareda	(GRAZ)	REFID=20126
GRAYER	74	NC 44A 587	S. Bartalucci <i>et al.</i>	(DESY, FRAS)	REFID=20122
BYERLY	73	PR D17 1197	A.B. Wicklund <i>et al.</i>	(ANL)	REFID=20124
GLADDING	73	PRL 38 198	D.E. Andrews <i>et al.</i>	(ROCH)	REFID=20120
	76	NP B103 426	M. Deutschmann <i>et al.</i>	(AACH3, BERL, BONN+)	REFID=20119
	74	PR D10 2070	A. Engler <i>et al.</i>	(CMU, CASE)	REFID=20110
	74	NP B79 301	P.G. Estabrooks, A.D. Martin	(DURH)	REFID=20111
	74	NP B75 189	G. Grayer <i>et al.</i>	(CERN, MPIM)	REFID=20113
	73	PR D7 637	W.L. Byerly <i>et al.</i>	(MICH)	REFID=20104
	73	PR D8 3721	G.E. Gladding <i>et al.</i>	(HARV)	REFID=20106

HYAMS	73	NP B64 134	B.D. Hyams <i>et al.</i>	(CERN, MPIM)	REFID=20107
PROTOPOP...	73	PR D7 1279	S.D. Protopopescu <i>et al.</i>	(LBL)	REFID=20108
BALLAM	72	PR D5 545	J. Ballam <i>et al.</i>	(SLAC, LBL, TUFTS)	REFID=20094
BENAKSAS	72	PL 39B 289	D. Benaksas <i>et al.</i>	(ORSAY)	REFID=20096
JACOBS	72	PR D6 1291	L.D. Jacobs	(SACL)	REFID=20101
RATCLIFF	72	PL 38B 345	B.N. Ratcliff <i>et al.</i>	(SLAC)	REFID=20102
ABRAMS	71	PR D4 653	G.S. Abrams <i>et al.</i>	(LBL)	REFID=20090
ALVENSLEB...	70	PRL 24 786	H. Alvensleben <i>et al.</i>	(DESY)	REFID=20085
BIGGS	70	PRL 24 1197	P.J. Biggs <i>et al.</i>	(DARE)	REFID=20087
ERBE	69	PR 188 2060	R. Erbe <i>et al.</i>	(German Bubble Chamber Collab.)	REFID=20074
MALAMUD	69	Argonne Conf. 93	E.I. Malamud, P.E. Schlein	(UCLA)	REFID=20077
REYNOLDS	69	PR 184 1424	B.G. Reynolds <i>et al.</i>	(FSU)	REFID=20080
ROTHWELL	69	PRL 23 1521	P.L. Rothwell <i>et al.</i>	(NEAS)	REFID=20082
WEHMANN	69	PR 178 2095	A.A. Wehmann <i>et al.</i>	(HARV, CASE, SLAC+)	REFID=20084
ARMENISE	68	NC 54A 999	N. Armenise <i>et al.</i>	(BARI, BGNA, FIRZ+)	REFID=20054
BATON	68	PR 176 1574	J.P. Baton, G. Laurens	(SACL)	REFID=20056
CHUNG	68	PR 165 1491	S.U. Chung <i>et al.</i>	(LRL)	REFID=20059
FOSTER	68	NP B6 107	M. Foster <i>et al.</i>	(CERN, CDEF)	REFID=20061
GOUNARIS	68	PRL 21 244	G.J. Gounaris, J.J. Sakurai		REFID=48054
HUSON	68	PL 28B 208	R. Huson <i>et al.</i>	(ORSAY, MILA, UCLA)	REFID=20062
HYAMS	68	NP B7 1	B.D. Hyams <i>et al.</i>	(CERN, MPIM)	REFID=20063
LANZEROTTI	68	PR 166 1365	L.J. Lanzerotti <i>et al.</i>	(HARV)	REFID=20068
PISUT	68	NP B6 325	J. Pisut, M. Roos	(CERN)	REFID=20070
ASBURY	67B	PRL 19 865	J.G. Asbury <i>et al.</i>	(DESY, COLU)	REFID=20038
BACON	67	PR 157 1263	T.C. Bacon <i>et al.</i>	(BNL)	REFID=20039
EISNER	67	PR 164 1699	R.L. Eisner <i>et al.</i>	(PURD)	REFID=20046
HUWE	67	PL 24B 252	D.O. Huwe <i>et al.</i>	(COLU)	REFID=20049
HYAMS	67	PL 24B 634	B.D. Hyams <i>et al.</i>	(CERN, MPIM)	REFID=20050
MILLER	67B	PR 153 1423	D.H. Miller <i>et al.</i>	(PURD)	REFID=20051
ALFF....	66	PR 145 1072	C. Alff-Steinberger <i>et al.</i>	(COLU, RUTG)	REFID=10762
FERBEL	66	PL 21 111	T. Ferbel	(ROCH)	REFID=20028
HAGOPIAN	66	PR 145 1128	V. Hagopian <i>et al.</i>	(PENN, SACL)	REFID=20030
HAGOPIAN	66B	PR 152 1183	V. Hagopian, Y.L. Pan	(PENN, LRL)	REFID=20031
JACOBS	66B	UCRL 16877	L.D. Jacobs	(LRL)	REFID=20033
JAMES	66	PR 142 896	F.E. James, H.L. Kraybill	(YALE, BNL)	REFID=10770
ROSS	66	PR 149 1172	M. Ross, L. Stodolsky		REFID=46380
SOEDING	66	PL B19 702	P. Soeding		REFID=46385
WEST	66	PR 149 1089	E. West <i>et al.</i>	(WISC)	REFID=20035
BLIEDEN	65	PL 19 444	H.R. Blieden <i>et al.</i>	(CERN MMS Collab.)	REFID=20016
CARMONY	64	PRL 12 254	D.D. Carmony <i>et al.</i>	(UCB)	REFID=20578
GOLDHABER	64	PRL 12 336	G. Goldhaber <i>et al.</i>	(LRL, UCB)	REFID=20013
ABOLINS	63	PRL 11 381	M.A. Abolins <i>et al.</i>	(UCSD)	REFID=20006

NODE=M001

 $\omega(782)$

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

 $\omega(782)$ MASS

NODE=M001M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
782.65±0.12 OUR AVERAGE		Error includes scale factor of 1.9. See the ideogram below.		
783.20±0.13±0.16	18680	AKHMETSHIN 05	CMD2	0.60-1.38 $e^+e^- \rightarrow \pi^0\gamma$
782.68±0.09±0.04	11200	¹ AKHMETSHIN 04	CMD2	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
782.79±0.08±0.09	1.2M	² ACHASOV	03D RVUE	0.44-2.00 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
782.7 ±0.1 ±1.5	19500	WURZINGER 95	SPEC	1.33 $p d \rightarrow {}^3\text{He} \omega$
781.96±0.17±0.80	11k	³ AMSLER 94C	CBAR	0.0 $\bar{p}p \rightarrow \omega\eta\pi^0$
782.08±0.36±0.82	3463	⁴ AMSLER 94C	CBAR	0.0 $\bar{p}p \rightarrow \omega\eta\pi^0$
781.96±0.13±0.17	15k	AMSLER 93B	CBAR	0.0 $\bar{p}p \rightarrow \omega\pi^0\pi^0$
782.4 ±0.2	270k	WEIDENAUER 93	ASTE	$\bar{p}p \rightarrow 2\pi^+2\pi^-\pi^0$
782.2 ±0.4	1488	KURDADZE 83B	OLYA	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
782.4 ±0.5	7000	⁵ KEYNE 76	CNTR	$\pi^-p \rightarrow \omega n$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
781.91±0.24		⁶ LEES 12G	BABR	$e^+e^- \rightarrow \pi^+\pi^-\gamma$
781.78±0.10		⁷ BARKOV 87	CMD	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
783.3 ±0.4	433	CORDIER 80	DM1	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
782.5 ±0.8	33260	ROOS 80	RVUE	0.0-3.6 $\bar{p}p$
782.6 ±0.8	3000	BENKHEIRI 79	OMEG	9-12 $\pi^\pm p$
781.8 ±0.6	1430	COOPER 78B	HBC	0.7-0.8 $\bar{p}p \rightarrow 5\pi$
782.7 ±0.9	535	VANAPEL...	78 HBC	7.2 $\bar{p}p \rightarrow \bar{p}p\omega$
783.5 ±0.8	2100	GESSAROLI 77	HBC	11 $\pi^-p \rightarrow \omega n$
782.5 ±0.8	418	AGUILAR-...	72B HBC	3.9,4.6 K^-p
783.4 ±1.0	248	BIZZARRI 71	HBC	0.0 $p\bar{p} \rightarrow K^+K^-\omega$
781.0 ±0.6	510	BIZZARRI 71	HBC	0.0 $p\bar{p} \rightarrow K_1^+K_1^-\omega$
783.7 ±1.0	3583	⁸ COYNE 71	HBC	3.7 $\pi^+p \rightarrow p\pi^+\pi^+\pi^-\pi^0$
784.1 ±1.2	750	ABRAMOVI...	70 HBC	3.9 $\pi^-\pi^0$
783.2 ±1.6		⁹ BIGGS 70B	CNTR	<4.1 $\gamma C \rightarrow \pi^+\pi^-\pi^0$
782.4 ±0.5	2400	BIZZARRI 69	HBC	0.0 $\bar{p}p$

NODE=M001M

OCCUR=2

OCCUR=2

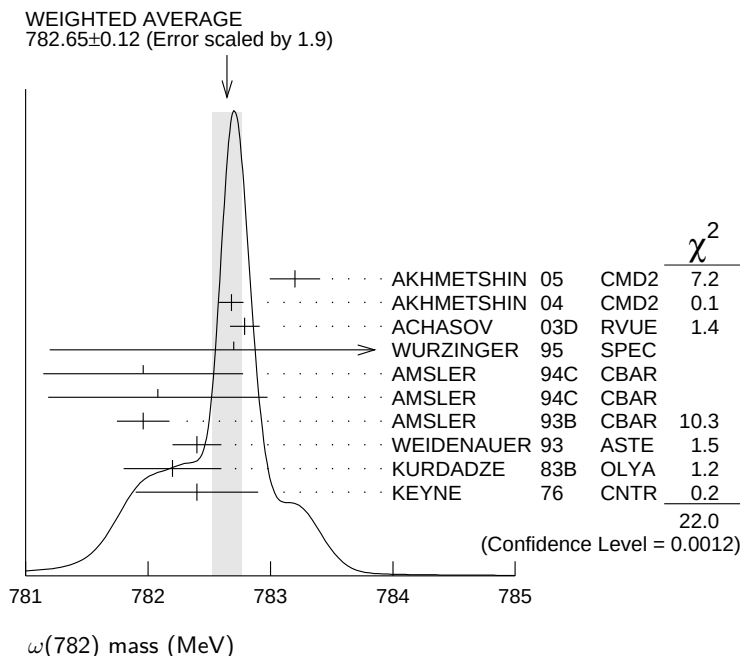
OCCUR=2

- ¹ Update of AKHMETSHIN 00C.
- ² From the combined fit of ANTONELLI 92, ACHASOV 01E, ACHASOV 02E, and ACHASOV 03D data on the $\pi^+\pi^-\pi^0$ and ANTONELLI 92 on the $\omega\pi^+\pi^-$ final states. Supersedes ACHASOV 99E and ACHASOV 02E.
- ³ From the $\eta \rightarrow \gamma\gamma$ decay.
- ⁴ From the $\eta \rightarrow 3\pi^0$ decay.
- ⁵ Observed by threshold-crossing technique. Mass resolution = 4.8 MeV FWHM.
- ⁶ From the $\rho-\omega$ interference in the $\pi^+\pi^-$ mass spectrum using the Breit-Wigner for the ω and leaving its mass and width as free parameters of the fit.
- ⁷ Systematic uncertainties underestimated.
- ⁸ From best-resolution sample of COYNE 71.
- ⁹ From ω - ρ interference in the $\pi^+\pi^-$ mass spectrum assuming ω width 12.6 MeV.

NODE=M001M;LINKAGE=PT
 NODE=M001M;LINKAGE=VH

NODE=M001M;LINKAGE=S1
 NODE=M001M;LINKAGE=S2
 NODE=M001M;LINKAGE=B
 NODE=M001M;LINKAGE=LE

NODE=M001M;LINKAGE=KB
 NODE=M001M;LINKAGE=D
 NODE=M001M;LINKAGE=F



$\omega(782)$ WIDTH

NODE=M001W

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
8.49 ± 0.08 OUR AVERAGE				
8.68 ± 0.23 ± 0.10	11200	¹ AKHMETSHIN 04	CMD2	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
8.68 ± 0.04 ± 0.15	1.2M	² ACHASOV 03D	RVUE	0.44–2.00 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
8.2 ± 0.3	19500	WURZINGER 95	SPEC	1.33 $pd \rightarrow {}^3\text{He}\omega$
8.4 ± 0.1		³ AULCHENKO 87	ND	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
8.30 ± 0.40		BARKOV 87	CMD	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
9.8 ± 0.9	1488	KURDADZE 83B	OLYA	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
9.0 ± 0.8	433	CORDIER 80	DM1	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
9.1 ± 0.8	451	BENAKSAS 72B	OSPK	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
8.13 ± 0.45		⁴ LEES 12G	BABR	$e^+e^- \rightarrow \pi^+\pi^-\gamma$
12 ± 2	1430	COOPER 78B	HBC	0.7–0.8 $\bar{p}p \rightarrow 5\pi$
9.4 ± 2.5	2100	GESSAROLI 77	HBC	11 $\pi^-p \rightarrow \omega n$
10.22 ± 0.43	20000	⁵ KEYNE 76	CNTR	$\pi^-p \rightarrow \omega n$
13.3 ± 2	418	AGUILAR-... 72B	HBC	3.9, 4.6 K^-p
10.5 ± 1.5		BORENSTEIN 72	HBC	2.18 K^-p
7.70 ± 0.9 ± 1.15	940	BROWN 72	MMS	2.5 $\pi^-p \rightarrow n\text{MM}$
10.3 ± 1.4	510	BIZZARRI 71	HBC	0.0 $p\bar{p} \rightarrow K_1^+K_1^-\omega$
12.8 ± 3.0	248	BIZZARRI 71	HBC	0.0 $p\bar{p} \rightarrow K^+K^-\omega$
9.5 ± 1.0	3583	COYNE 71	HBC	3.7 $\pi^+p \rightarrow p\pi^+\pi^+\pi^-\pi^0$

NODE=M001W

OCCUR=2

¹ Update of AKHMETSHIN 00C.

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

³ Relativistic Breit-Wigner includes radiative corrections.

⁴ From the $\rho-\omega$ interference in the $\pi^+\pi^-$ mass spectrum using the Breit-Wigner for the ω and leaving its mass and width as free parameters of the fit.

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

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

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

NODE=M001W;LINKAGE=B

NODE=M001215;NODE=M001

$\omega(782)$ DECAY MODES

	Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	
Γ_1	$\pi^+\pi^-\pi^0$	$(89.2 \pm 0.7) \%$		DESIG=1
Γ_2	$\pi^0\gamma$	$(8.28 \pm 0.28) \%$	S=2.1	DESIG=3
Γ_3	$\pi^+\pi^-$	$(1.53^{+0.11}_{-0.13}) \%$	S=1.2	DESIG=2
Γ_4	neutrals (excluding $\pi^0\gamma$)	$(8^{+8}_{-5}) \times 10^{-3}$	S=1.1	DESIG=13
Γ_5	$\eta\gamma$	$(4.6 \pm 0.4) \times 10^{-4}$	S=1.1	DESIG=6
Γ_6	$\pi^0 e^+ e^-$	$(7.7 \pm 0.6) \times 10^{-4}$		DESIG=14
Γ_7	$\pi^0 \mu^+ \mu^-$	$(1.3 \pm 0.4) \times 10^{-4}$	S=2.1	DESIG=11
Γ_8	$\eta e^+ e^-$			DESIG=18
Γ_9	$e^+ e^-$	$(7.28 \pm 0.14) \times 10^{-5}$	S=1.3	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}	$\pi^0\pi^0\gamma$	$(6.6 \pm 1.1) \times 10^{-5}$		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	$< 2.1 \times 10^{-4}$	CL=90%	NODE=M001;CLUMP=A
Γ_{18}	$2\pi^0$	C	$< 2.1 \times 10^{-4}$	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 51 measurements and one constraint to determine 10 parameters. The overall fit has a $\chi^2 = 51.8$ for 42 degrees of freedom.

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

x_2	22								
x_3	-18	-4							
x_4	-92	-56	1						
x_5	7	7	-1	-9					
x_6	-1	0	0	0	0				
x_7	-1	0	0	0	0	0			
x_9	-38	-33	7	44	-21	0	0		
x_{13}	1	4	0	-2	0	0	0	-1	
x_{15}	0	0	0	0	0	0	0	0	0
	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_9	x_{13}

$\omega(782)$ PARTIAL WIDTHS $\Gamma(\pi^0\gamma)$ Γ_2

VALUE (keV)	EVTs	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
880±50	7815	¹ ACHASOV	13	SND $1.05\text{--}2.00\ e^+e^- \rightarrow \pi^0\pi^0\gamma$
788±12±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. $\Gamma(\eta\gamma)$ 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. $\Gamma(e^+e^-)$ Γ_9

VALUE (keV)	EVTs	DOCUMENT ID	TECN	COMMENT
● ● ● 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 $0.44\text{--}2.00\ e^+e^- \rightarrow \pi^+\pi^-\pi^0\gamma$
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 $B(\omega \rightarrow \pi^+\pi^-) = (1.70 \pm 0.28)\%$. $\omega(782)\ \Gamma(e^+e^-)\Gamma(i)/\Gamma^2(\text{total})$ $\Gamma(e^+e^-)/\Gamma_{\text{total}} \times \Gamma(\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ $\Gamma_9/\Gamma \times \Gamma_1/\Gamma$

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT
6.49±0.11 OUR FIT Error includes scale factor of 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 $0.44\text{--}2.00\ e^+e^- \rightarrow \pi^+\pi^-\pi^0\gamma$
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 $0.4\text{--}1.05\ e^+e^-$

¹ Update of AKHMETSHIN 00C.² Recalculated by us from the cross section in the peak.³ From the combined fit of ANTONELLI 92, ACHASOV 01E, ACHASOV 02E, and ACHASOV 03D data on the $\pi^+\pi^-\pi^0$ and ANTONELLI 92 on the $\omega\pi^+\pi^-$ final states. Supersedes ACHASOV 99E and ACHASOV 02E.⁴ A simultaneous fit of $e^+e^- \rightarrow \pi^+\pi^-, \pi^+\pi^-\pi^0, \pi^0\gamma, \eta\gamma$ data. $\Gamma(e^+e^-)/\Gamma_{\text{total}} \times \Gamma(\pi^0\gamma)/\Gamma_{\text{total}}$ $\Gamma_9/\Gamma \times \Gamma_2/\Gamma$

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

¹ Using $\sigma_\phi \rightarrow \pi^0\gamma$ from ACHASOV 00 and $m_\omega = 782.57$ MeV in the model with the energy-independent phase of ρ - ω interference equal to $(-10.2 \pm 7.0)^\circ$.² Recalculated by us from the cross section in the peak.³ A simultaneous fit of $e^+e^- \rightarrow \pi^+\pi^-, \pi^+\pi^-\pi^0, \pi^0\gamma, \eta\gamma$ data.

NODE=M001218

NODE=M001W1
NODE=M001W1NODE=M001W1;LINKAGE=AC
NODE=M001W1;LINKAGE=ADNODE=M001W2
NODE=M001W2

NODE=M001W2;LINKAGE=DA

NODE=M001W7
NODE=M001W7
→ UNCHECKED ←NODE=M001W7;LINKAGE=3P
NODE=M001W7;LINKAGE=PT
NODE=M001W;LINKAGE=VF

NODE=M001225

NODE=M001G2
NODE=M001G2NODE=M001G;LINKAGE=PT
NODE=M001G;LINKAGE=LP
NODE=M001G;LINKAGE=VH

NODE=M001G2;LINKAGE=BE

NODE=M001G4
NODE=M001G4

NODE=M001G;LINKAGE=SH

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

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

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
1.225±0.058±0.041	800k	¹ ACHASOV	06 SND	$e^+e^- \rightarrow \pi^+\pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1.166±0.036		² BENAYOUN	13 RVUE	0.4–1.05 e^+e^-
1.05 ±0.08		³ DAVIER	13 RVUE	$e^+e^- \rightarrow \pi^+\pi^-(\gamma)$

¹ Supersedes ACHASOV 05A.

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

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

NODE=M001G5
NODE=M001G5

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

NODE=M001G5;LINKAGE=A

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

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

¹ From a combined fit of $\sigma(e^+e^- \rightarrow \eta\gamma)$ with $\eta \rightarrow 3\pi^0$ and $\eta \rightarrow \pi^+\pi^-\pi^0$, and fixing $B(\eta \rightarrow 3\pi^0) / B(\eta \rightarrow \pi^+\pi^-\pi^0) = 1.44 \pm 0.04$. Recalculated by us from the cross section at the peak. Supersedes ACHASOV 00D and ACHASOV 06A.

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

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

⁴ The combined fit from 600 to 1380 MeV taking into account $\rho(770)$, $\omega(782)$, $\phi(1020)$, and $\rho(1450)$ (mass and width fixed at 1450 MeV and 310 MeV respectively).

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

NODE=M001G3
NODE=M001G3

NODE=M001G3;LINKAGE=AH

NODE=M001G;LINKAGE=AH
NODE=M001G;LINKAGE=AK
NODE=M001G;LINKAGE=BQ

NODE=M001G3;LINKAGE=BE

$\omega(782)$ BRANCHING RATIOS

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

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

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.9024±0.0019		¹ AMBROSINO	08G KLOE	1.0–1.03 $e^+e^- \rightarrow \pi^+\pi^-2\pi^0, 2\pi^0\gamma$
0.8965±0.0016±0.0048	1.2M	^{2,3} ACHASOV	03D RVUE	0.44–2.00 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
0.880 ±0.020 ±0.032	11200	^{3,4} AKHMETSHIN	00C CMD2	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
0.8942±0.0062		³ DOLINSKY	89 ND	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$

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

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

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

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

NODE=M001220

NODE=M001R21
NODE=M001R21

NODE=M001R21

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

NODE=M001R;LINKAGE=ZL
NODE=M001R;LINKAGE=KH

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

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
8.09±0.14		¹ AMBROSINO	08G KLOE	$e^+e^- \rightarrow \pi^+\pi^-\pi^0, 2\pi^0\gamma$
9.06±0.20±0.57	18680	^{2,3} AKHMETSHIN	05 CMD2	0.60–1.38 $e^+e^- \rightarrow \pi^0\gamma$
9.34±0.15±0.31	36500	³ ACHASOV	03 SND	0.60–0.97 $e^+e^- \rightarrow \pi^0\gamma$
8.65±0.16±0.42	1.2M	^{4,5} ACHASOV	03D RVUE	0.44–2.00 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
8.39±0.24	9975	⁶ BENAYOUN	96 RVUE	$e^+e^- \rightarrow \pi^0\gamma$
8.88±0.62	10625	³ DOLINSKY	89 ND	$e^+e^- \rightarrow \pi^0\gamma$

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

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

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

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

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

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

NODE=M001R28
NODE=M001R28

NODE=M001R28;LINKAGE=AM
NODE=M001R;LINKAGE=AH
NODE=M001R;LINKAGE=VL
NODE=M001R28;LINKAGE=VF
NODE=M001R28;LINKAGE=ZL
NODE=M001R28;LINKAGE=A1

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

DOCUMENT ID

TECN

COMMENT

9.28±0.31 OUR FIT Error includes scale factor of 2.3.**9.05±0.27 OUR AVERAGE** Error includes scale factor of 1.8.8.97±0.16 AMBROSINO 08G KLOE $e^+e^- \rightarrow \pi^+\pi^-2\pi^0, 2\pi^0\gamma$ 9.94±0.36±0.38 ¹ AULCHENKO 00A SND $e^+e^- \rightarrow \pi^+\pi^-2\pi^0, 2\pi^0\gamma$ 8.4 ±1.3 KEYNE 76 CNTR $\pi^-p \rightarrow \omega n$ 10.9 ±2.5 BENAKSAS 72C OSPK $e^+e^- \rightarrow \pi^0\gamma$ 8.1 ±2.0 BALDIN 71 HLBC $2.9\pi^+p$ 13 ±4 JACQUET 69B HLBC $2.05\pi^+p \rightarrow \pi^+p\omega$

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

9.7 ±0.2 ±0.5 ^{2,3} ACHASOV 03D RVUE $0.44-2.00 e^+e^- \rightarrow \pi^+\pi^-\pi^0$ 9.9 ±0.7 ² DOLINSKY 89 ND $e^+e^- \rightarrow \pi^0\gamma$ ¹ From $\sigma_0^{\omega\pi^0} \rightarrow \pi^0\pi^0\gamma(m_\phi)/\sigma_0^{\omega\pi^0} \rightarrow \pi^+\pi^-\pi^0\pi^0(m_\phi)$ with a phase-space correction factor of 1/1.023.² Not independent of the corresponding $\Gamma(e^+e^-) \times \Gamma(\pi^0\gamma)/\Gamma_{\text{total}}^2$.³ Using ACHASOV 03. Based on 1.2M events.NODE=M001R3
NODE=M001R3

NODE=M001R3;LINKAGE=AL

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

EVTS

DOCUMENT ID

TECN

COMMENT

1.53^{+0.11}_{-0.13} OUR FIT Error includes scale factor of 1.2.**1.49±0.13 OUR AVERAGE** Error includes scale factor of 1.3. See the ideogram below.1.46±0.12±0.02 900k ¹ AKHMETSHIN 07 $e^+e^- \rightarrow \pi^+\pi^-$ 1.30±0.24±0.05 11.2k ² AKHMETSHIN 04 CMD2 $e^+e^- \rightarrow \pi^+\pi^-$ 2.38^{+1.77}_{-0.90}±0.18 5.4k ³ ACHASOV 02E SND $1.1-1.38 e^+e^- \rightarrow \pi^+\pi^-\pi^0$ 2.3 ±0.5 BARKOV 85 OLYA $e^+e^- \rightarrow \pi^+\pi^-$ 1.6^{+0.9}_{-0.7} QUENZER 78 DM1 $e^+e^- \rightarrow \pi^+\pi^-$ 3.6 ±1.9 BENAKSAS 72 OSPK $e^+e^- \rightarrow \pi^+\pi^-$

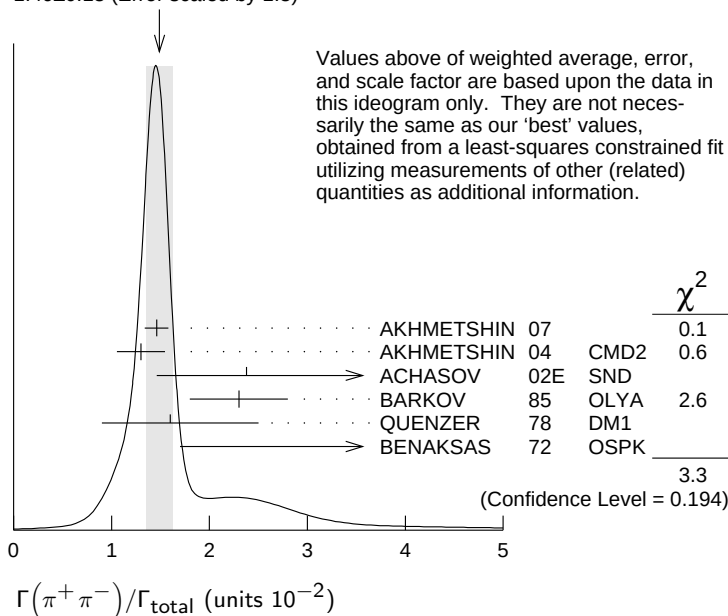
• • • We do not use the following data for averages, fits, limits, etc. • • •

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

1.22±0.30 ALVENSLEB... 71C CNTR Photoproduction

1.3^{+1.2}_{-0.9} MOFFEIT 71 HBC $2.8,4.7\gamma p$ 0.80^{+0.28}_{-0.20} ⁹ BIGGS 70B CNTR $4.2\gamma C \rightarrow \pi^+\pi^-C$ ¹ A combined fit of AKHMETSHIN 07, AULCHENKO 06, and AULCHENKO 05.² Update of AKHMETSHIN 02.³ From the $m_{\pi^+\pi^-}$ spectrum taking into account the interference of the $\rho\pi$ and $\omega\pi$ amplitudes.⁴ Using $\Gamma(\omega \rightarrow e^+e^-)$ from the 2004 Edition of this Review (PDG 04).⁵ Using the data of AKHMETSHIN 02 in the hidden local symmetry model.⁶ Using the data of BARKOV 85.⁷ Using the data of BARKOV 85 in the hidden local symmetry model.⁸ From a model-dependent analysis assuming complete coherence.⁹ Re-evaluated under $\Gamma(\pi^+\pi^-)/\Gamma(\pi^+\pi^-\pi^0)$ by BEHREND 71 using more accurate $\omega \rightarrow \rho$ photoproduction cross-section ratio.NODE=M001R15
NODE=M001R15
NODE=M001R15NODE=M001R15;LINKAGE=AK
NODE=M001R15;LINKAGE=PT
NODE=M001R;LINKAGE=VENODE=M001R;LINKAGE=SN
NODE=M001R;LINKAGE=BY
NODE=M001R15;LINKAGE=H4
NODE=M001R15;LINKAGE=Q
NODE=M001R15;LINKAGE=F
NODE=M001R15;LINKAGE=B

WEIGHTED AVERAGE
1.49±0.13 (Error scaled by 1.3)



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

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

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

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

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

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

³ ROOS 70 combines ABRAMOVICH 70 and BIZZARRI 70.

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

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

¹ Using the data of ALOISIO 02D.

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

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 $\pi^- p$

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

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 $K^- p$

Γ_3/Γ_1

NODE=M001R2

NODE=M001R2

NODE=M001R2

Γ_3/Γ_2

NODE=M001R33

NODE=M001R33

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

NODE=M001R14

NODE=M001R14

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

NODE=M001R1

NODE=M001R1

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

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

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

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

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

NODE=M001R18
NODE=M001R18

NODE=M001R18;LINKAGE=D

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

VALUE	DOCUMENT ID	TECN	COMMENT

0.100 ± 0.008 OUR FIT

0.124 ± 0.021

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

NODE=M001R9
NODE=M001R9

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

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

4.6 ± 0.4 OUR FIT Error includes scale factor of 1.1.

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

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

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

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

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

² Solution corresponding to constructive ω - ρ interference.

³ ACHASOV 07B reports $[\Gamma(\omega(782) \rightarrow \eta\gamma)/\Gamma_{\text{total}}] \times [B(\omega(782) \rightarrow e^+ e^-)] = (3.10 \pm 0.31 \pm 0.11) \times 10^{-8}$ which we divide by our best value $B(\omega(782) \rightarrow e^+ e^-) = (7.28 \pm 0.14) \times 10^{-5}$. Our first error is their experiment's error and our second error is the systematic error from using our best value. Supersedes ACHASOV 00D and ACHASOV 06A.

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

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

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

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

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

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

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

NODE=M001R;LINKAGE=CS

NODE=M001R19;LINKAGE=A1

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

VALUE	DOCUMENT ID	TECN	COMMENT

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

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

¹ Model independent determination.

² Solution corresponding to constructive ω - ρ interference.

NODE=M001R11
NODE=M001R11

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

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

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

7.7 ± 0.6 OUR FIT

7.7 ± 0.6 OUR AVERAGE

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

NODE=M001R23
NODE=M001R23

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

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

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

1.72 ± 0.25 ± 0.14	3k	ARNALDI	09	NA60	158A In-In collisions
0.96 ± 0.23		DZHELYADIN	81B	CNTR	25-33 $\pi^- p \rightarrow \omega n$

NODE=M001R12
 NODE=M001R12

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

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

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

<1.1	AKHMETSHIN 05A	CMD2	0.72-0.84 $e^+ e^-$

NODE=M001R34
 NODE=M001R34

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

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

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

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

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

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

NODE=M001R13
 NODE=M001R13

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

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

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

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

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

<200	90	KURDADZE 86	OLYA	$e^+ e^- \rightarrow \pi^+ \pi^- \pi^0 \pi^0$

NODE=M001R5
 NODE=M001R5

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

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<0.0036 95 WEIDENAUER 90 ASTE $p\bar{p} \rightarrow \pi^+ \pi^- \pi^+ \pi^- \gamma$

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

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

NODE=M001R22
 NODE=M001R22

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

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

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

<0.066	90	KALBFLEISCH 75	HBC	2.18 $K^- p \rightarrow \Lambda \pi^+ \pi^- \gamma$
<0.05	90	FLATTE 66	HBC	1.2 - 1.7 $K^- p \rightarrow \Lambda \pi^+ \pi^- \gamma$

NODE=M001R4
 NODE=M001R4

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

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<1 × 10⁻³ 90 KURDADZE 88 OLYA $e^+ e^- \rightarrow \pi^+ \pi^- \pi^+ \pi^-$

NODE=M001R24
 NODE=M001R24

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

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

6.6 ± 1.1 OUR FIT**6.5 ± 1.2 OUR AVERAGE**

6.4 ^{+2.4} _{-2.0} ± 0.8	190	¹ AKHMETSHIN 04B	CMD2	0.6-0.97 $e^+ e^- \rightarrow \pi^0 \pi^0 \gamma$
6.6 ^{+1.4} _{-1.3} ± 0.6	295	ACHASOV 02F	SND	0.36-0.97 $e^+ e^- \rightarrow \pi^0 \pi^0 \gamma$

NODE=M001R29
 NODE=M001R29

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

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

OCCUR=2

OCCUR=2

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

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

³ Superseded by ACHASOV 02F.

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

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

 Γ_{13}/Γ_1

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

NODE=M001R10
NODE=M001R10

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

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

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

 Γ_{13}/Γ_2

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

NODE=M001R7
NODE=M001R7

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

< 50	90	DOLINSKY	89	ND	$e^+e^- \rightarrow \pi^0\pi^0\gamma$
<1800	95	KEYNE	76	CNTR	$\pi^-p \rightarrow \omega n$
<1500	90	BENAKSAS	72C	OSPK	e^+e^-
<1400		BALDIN	71	HLBC	$2.9 \pi^+p$
<1000	90	BARMIN	64	HLBC	$1.3-2.8 \pi^-p$

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

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

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

NODE=M001R17
NODE=M001R17

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

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

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

NODE=M001R17;LINKAGE=D

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

 Γ_{14}/Γ

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

NODE=M001R32
NODE=M001R32

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

 Γ_{15}/Γ

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT
9.0$\pm$3.1 OUR FIT				
9.0$\pm$2.9$\pm$1.1	18	HEISTER	02C	ALEP $Z \rightarrow \mu^+\mu^- + X$

NODE=M001R30
NODE=M001R30

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

 Γ_{15}/Γ_1

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

NODE=M001R6
NODE=M001R6

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

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

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

 Γ_7/Γ_{15}

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT

NODE=M001R20
NODE=M001R20

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

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

¹ Superseded by DZHELYADIN 81B result above.

NODE=M001R20;LINKAGE=S

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

 Γ_{16}/Γ

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

NODE=M001R27
NODE=M001R27

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

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

¹ From direct 3γ decay search.

NODE=M001R27;LINKAGE=A

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

Violates C conservation.

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.001	90	ALDE	94B	GAM2 $38\pi^- p \rightarrow \eta\pi^0 n$

 Γ_{17}/Γ

NODE=M001R25
 NODE=M001R25
 NODE=M001R25

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

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 $B(\eta \rightarrow \text{charged modes}) = 29.2\%$.				

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

NODE=M001R8
 NODE=M001R8

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

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

 Γ_{17}/Γ_2

NODE=M001R35
 NODE=M001R35
 NODE=M001R35

NODE=M001R35;LINKAGE=ST

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

Violates C conservation and Bose-Einstein statistics.

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<2.59	90	STAROSTIN	09	CRYM $\gamma p \rightarrow 2\pi^0 p$

 Γ_{18}/Γ_2

NODE=M001R36
 NODE=M001R36
 NODE=M001R36

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

Violates C conservation.

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
< 3×10^{-4}	90	PROKOSHKIN	95	GAM2 $38 \pi^- p \rightarrow 3\pi^0 n$

 Γ_{19}/Γ

NODE=M001R26
 NODE=M001R26
 NODE=M001R26

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

Violates C conservation.

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

 Γ_{19}/Γ_2

NODE=M001R37
 NODE=M001R37
 NODE=M001R37

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

Violates C conservation.

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

 Γ_{19}/Γ_1

NODE=M001R31
 NODE=M001R31
 NODE=M001R31

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.

VALUE (GeV)	EVTS	DOCUMENT ID	TECN	COMMENT
0.668 $\pm$ 0.009 $\pm$ 0.003	3k	ARNALDI	09	NA60 158A In-In collisions
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.65 $\pm$ 0.03		DZHELYADIN	81B	CNTR 25-33 $\pi^- p \rightarrow \omega n$

NODE=M001LAM
 NODE=M001LAM

NODE=M001LAM

$\omega(782)$ REFERENCES

NODE=M001

ACHASOV	13	PR D88 054013	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=55584
BENAYOUN	13	EPJ C73 2453	M. Benayoun, P. David, L. DelBuono (PARIN, BERLIN+)		REFID=55357
DAVIER	13	EPJ C73 2597	M. Davier <i>et al.</i>		REFID=55499
LEES	12G	PR D86 032013	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=54299
NIECKNIG	12	EPJ C72 2014	F. Niecknig, B. Kubis, S.P. Schneider	(BONN)	REFID=54305
BENAYOUN	10	EPJ C65 211	M. Benayoun <i>et al.</i>		REFID=53212
ACHASOV	09A	JETP 109 379	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=53101
		Translated from ZETF 136 442.			
ARNALDI	09	PL B677 260	R. Arnaldi <i>et al.</i>	(NA60 Collab.)	REFID=52720
STAROSTIN	09	PR C79 065201	A. Starostin <i>et al.</i>	(Crystal Ball Collab. at MAMI)	REFID=53001
ACHASOV	08	JETP 107 61	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=52258
		Translated from ZETF 134 80.			
AMBROSINO	08G	PL B669 223	F. Ambrosino <i>et al.</i>	(KLOE Collab.)	REFID=52573
ACHASOV	07B	PR D76 077101	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=51942
AKHMETSHIN	07	PL B648 28	R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=51615
ACHASOV	06	JETP 103 380	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=51113
		Translated from ZETF 130 437.			
ACHASOV	06A	PR D74 014016	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=51133
AULCHENKO	06	JETPL 84 413	V.M. Aulchenko <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=51513
		Translated from ZETFP 84 491.			
ACHASOV	05A	JETP 101 1053	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=51045
		Translated from ZETF 128 1201.			
AKHMETSHIN	05	PL B605 26	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=50330
AKHMETSHIN	05A	PR B613 29	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=50508
AULCHENKO	05	JETPL 82 743	V.M. Aulchenko <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=51060
		Translated from ZETFP 82 841.			
AKHMETSHIN	04	PL B578 285	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=49609
AKHMETSHIN	04B	PR B580 119	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=49610
AUBERT,B	04N	PR D70 072004	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=50184
PDG	04	PL B592 1	S. Eidelman <i>et al.</i>	(PDG Collab.)	REFID=49653
ACHASOV	03	PL B559 171	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=49187
ACHASOV	03D	PR D68 052006	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=49577
ALOISIO	03	PL B561 55	A. Aloisio <i>et al.</i>	(KLOE Collab.)	REFID=49404
BENAYOUN	03	EPJ C29 397	M. Benayoun <i>et al.</i>		REFID=49477
ACHASOV	02E	PR D66 032001	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=48815
ACHASOV	02F	PL B537 201	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=48816
AKHMETSHIN	02	PL B527 161	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=48565
ALOISIO	02D	PL B537 21	A. Aloisio <i>et al.</i>	(KLOE Collab.)	REFID=48824
HEISTER	02C	PL B528 19	A. Heister <i>et al.</i>	(ALEPH Collab.)	REFID=48564
ACHASOV	01E	PR D63 072002	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=48311
AKHMETSHIN	01B	PL B509 217	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=48167
BARBERIS	01	PL B507 14	D. Barberis <i>et al.</i>		REFID=48324
ACHASOV	00	EPJ C12 25	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47417
ACHASOV	00D	JETPL 72 282	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47882
		Translated from ZETFP 72 411.			
ACHASOV	00G	JETPL 71 355	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47929
		Translated from ZETFP 71 519.			
AKHMETSHIN	00C	PL B476 33	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=47423
AULCHENKO	00A	JETP 90 927	V.M. Aulchenko <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47953
		Translated from ZETF 117 1067.			
CASE	00	PR D61 032002	T. Case <i>et al.</i>	(Crystal Barrel Collab.)	REFID=47409
ACHASOV	99E	PL B462 365	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47391
GARDNER	99	PR D59 076002	S. Gardner, H.B. O'Connell		REFID=46919
BENAYOUN	98	EPJ C2 269	M. Benayoun <i>et al.</i>	(IPNP, NOVO, ADLD+)	REFID=45859
ABELE	97E	PL B411 361	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)	REFID=45755
BENAYOUN	96	ZPHY C72 221	M. Benayoun <i>et al.</i>	(IPNP, NOVO)	REFID=45753
PROKOSHIN	95	SPD 40 273	Y.D. Prokoshkin, V.D. Samoilenko	(SERP)	REFID=44616
		Translated from DANS 342 610.			
WURZINGER	95	PR C51 443	R. Wurzinger <i>et al.</i>	(BONN, ORSAY, SACL+)	REFID=45209
ALDE	94B	PL B340 122	D.M. Alde <i>et al.</i>	(SERP, BELG, LANL, LAPP+)	REFID=44100
AMSLER	94C	PL B327 425	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=44091
ALDE	93	PAN 56 1229	D.M. Alde <i>et al.</i>	(SERP, LAPP, LANL, BELG+)	REFID=43603
		Translated from YAF 56 137.			
Also		ZPHY C61 35	D.M. Alde <i>et al.</i>	(SERP, LAPP, LANL, BELG+)	REFID=43790
AMSLER	93B	PL B311 362	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=43602
WEIDENAUER	93	ZPHY C59 387	P. Weidenauer <i>et al.</i>	(ASTERIX Collab.)	REFID=43585
ANTONELLI	92	ZPHY C56 15	A. Antonelli <i>et al.</i>	(DM2 Collab.)	REFID=43168
DOLINSKY	91	PRPL 202 99	S.I. Dolinsky <i>et al.</i>	(NOVO)	REFID=41369
WEIDENAUER	90	ZPHY C47 353	P. Weidenauer <i>et al.</i>	(ASTERIX Collab.)	REFID=41368
DOLINSKY	89	ZPHY C42 511	S.I. Dolinsky <i>et al.</i>	(NOVO)	REFID=41003
BITYUKOV	88B	SJNP 47 800	S.I. 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. Dzhelyadin <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. Dzhelyadin <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. Dzhelyadin <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 ZETF 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
0.198±0.009 OUR FIT					
0.230±0.021 OUR AVERAGE					
0.226±0.017±0.014	2300	CZERWINSKI	10	MMS	$pp \rightarrow pp\eta'$
0.40 ±0.22	4800	WURZINGER	96	SPEC	1.68 $pd \rightarrow {}^3\text{He}\eta'$
0.28 ±0.10	1000	BINNIE	79	MMS	0 $\pi^- p \rightarrow n\text{MM}$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
0.20 ±0.04		BAI	04J	BES2	$J/\psi \rightarrow \gamma\gamma\pi^+\pi^-$

NODE=M002W

 $\eta'(958)$ DECAY MODES

NODE=M002215;NODE=M002

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 $\pi^+\pi^-\eta$	(42.9 ±0.7) %	
Γ_2 $\rho^0\gamma$ (including non-resonant $\pi^+\pi^-\gamma$)	(29.1 ±0.5) %	
Γ_3 $\pi^0\pi^0\eta$	(22.2 ±0.8) %	
Γ_4 $\omega\gamma$	(2.75±0.23) %	
Γ_5 $\gamma\gamma$	(2.20±0.08) %	
Γ_6 $3\pi^0$	(2.14±0.20) × 10 ⁻³	
Γ_7 $\mu^+\mu^-\gamma$	(1.08±0.27) × 10 ⁻⁴	
Γ_8 $\pi^+\pi^-\mu^+\mu^-$	< 2.9 × 10 ⁻⁵	90%
Γ_9 $\pi^+\pi^-\pi^0$	(3.8 ±0.4) × 10 ⁻³	
Γ_{10} $\pi^0\rho^0$	< 4 %	90%
Γ_{11} $2(\pi^+\pi^-)$	< 2.4 × 10 ⁻⁴	90%
Γ_{12} $\pi^+\pi^-2\pi^0$	< 2.5 × 10 ⁻³	90%
Γ_{13} $2(\pi^+\pi^-)$ neutrals	< 1 %	95%
Γ_{14} $2(\pi^+\pi^-)\pi^0$	< 1.9 × 10 ⁻³	90%
Γ_{15} $2(\pi^+\pi^-)2\pi^0$	< 1 %	95%

DESIG=1

DESIG=9

DESIG=2

DESIG=7

DESIG=6

DESIG=8

DESIG=20

DESIG=201

DESIG=121

DESIG=18

DESIG=131

DESIG=202

DESIG=132

DESIG=141

DESIG=15

Γ_{16}	$3(\pi^+\pi^-)$	< 3.1	$\times 10^{-5}$	90%	DESIG=203
Γ_{17}	$\pi^+\pi^-e^+e^-$	$(2.4^{+1.3}_{-1.0})$	$\times 10^{-3}$		DESIG=10
Γ_{18}	$\pi^+e^-\nu_e + \text{c.c.}$	< 2.1	$\times 10^{-4}$	90%	DESIG=204
Γ_{19}	γe^+e^-	< 9	$\times 10^{-4}$	90%	DESIG=28
Γ_{20}	$\pi^0\gamma\gamma$	< 8	$\times 10^{-4}$	90%	DESIG=24
Γ_{21}	$4\pi^0$	< 5	$\times 10^{-4}$	90%	DESIG=26
Γ_{22}	e^+e^-	< 2.1	$\times 10^{-7}$	90%	DESIG=150
Γ_{23}	invisible	< 5	$\times 10^{-4}$	90%	DESIG=200

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

NODE=M002;CLUMP=B

Γ_{24}	$\pi^+\pi^-$	P,CP	< 6	$\times 10^{-5}$	90%	DESIG=111
Γ_{25}	$\pi^0\pi^0$	P,CP	< 4	$\times 10^{-4}$	90%	DESIG=25
Γ_{26}	$\pi^0e^+e^-$	C	$[a] < 1.4$	$\times 10^{-3}$	90%	DESIG=16
Γ_{27}	ηe^+e^-	C	$[a] < 2.4$	$\times 10^{-3}$	90%	DESIG=17
Γ_{28}	3γ	C	< 1.0	$\times 10^{-4}$	90%	DESIG=23
Γ_{29}	$\mu^+\mu^-\pi^0$	C	$[a] < 6.0$	$\times 10^{-5}$	90%	DESIG=22
Γ_{30}	$\mu^+\mu^-\eta$	C	$[a] < 1.5$	$\times 10^{-5}$	90%	DESIG=21
Γ_{31}	$e\mu$	LF	< 4.7	$\times 10^{-4}$	90%	DESIG=27

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

LINKAGE=CS

CONSTRAINED FIT INFORMATION

An overall fit to the total width, a partial width, 2 combinations of partial widths obtained from integrated cross section, and 15 branching ratios uses 43 measurements and one constraint to determine 9 parameters. The overall fit has a $\chi^2 = 48.0$ for 35 degrees of freedom.

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

x_2	0							
x_3	-76	-58						
x_4	-19	-23	4					
x_5	-29	-25	32	-1				
x_6	-24	-18	29	1	9			
x_9	0	-2	-3	-1	-1	-1		
x_{17}	-4	-6	-5	-2	-3	-2	0	
Γ	25	5	-19	5	-71	-5	1	3
	x_1	x_2	x_3	x_4	x_5	x_6	x_9	x_{17}

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

$\eta'(958)$ PARTIAL WIDTHS

NODE=M002220

 $\Gamma(\gamma\gamma)$ Γ_5

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
4.35±0.14 OUR FIT				
4.28±0.19 OUR AVERAGE				
4.17±0.10±0.27	2000	⁴ 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		⁵ 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	⁶ 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	⁷ WILLIAMS	88 CBAL	$e^+e^- \rightarrow e^+e^-2\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
4.7 ±0.6 ±0.9	143	⁸ GIDAL	87 MRK2	$e^+e^- \rightarrow e^+e^-\eta\pi^+\pi^-$
4.0 ±0.9		⁹ BARTEL	85E JADE	$e^+e^- \rightarrow e^+e^-2\gamma$

⁴ No non-resonant $\pi^+\pi^-$ contribution found.⁵ Reevaluated by us using $B(\eta' \rightarrow \rho(770)\gamma) = (30.2 \pm 1.3)\%$.⁶ Reevaluated by us using $B(\eta' \rightarrow \gamma\gamma) = (2.11 \pm 0.13)\%$.⁷ Reevaluated by us using $B(\eta' \rightarrow \gamma\gamma) = (2.11 \pm 0.13)\%$.⁸ Superseded by BUTLER 90.⁹ Systematic error not evaluated.NODE=M002W4
NODE=M002W4NODE=M002W4;LINKAGE=AC
NODE=M002W4;LINKAGE=K1
NODE=M002W4;LINKAGE=K2
NODE=M002W4;LINKAGE=K3
NODE=M002W4;LINKAGE=C
NODE=M002W4;LINKAGE=A $\eta'(958) \Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

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

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

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
1.27±0.04 OUR FIT				
1.26±0.07 OUR AVERAGE Error includes scale factor of 1.2.				
1.09±0.04±0.13		BEHREND	91 CELL	$e^+e^- \rightarrow e^+e^-\rho(770)^0\gamma$
1.35±0.09±0.21		AIHARA	87 TPC	$e^+e^- \rightarrow e^+e^-\rho\gamma$
1.13±0.04±0.13	867	ALBRECHT	87B ARG	$e^+e^- \rightarrow e^+e^-\rho\gamma$
1.53±0.09±0.21		ALTHOFF	84E TASS	$e^+e^- \rightarrow e^+e^-\rho\gamma$
1.14±0.08±0.11	243	BERGER	84B PLUT	$e^+e^- \rightarrow e^+e^-\rho\gamma$
1.73±0.34±0.35	95	JENNI	83 MRK2	$e^+e^- \rightarrow e^+e^-\rho\gamma$
1.49±0.13±0.027	213	BARTEL	82B JADE	$e^+e^- \rightarrow e^+e^-\rho\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1.85±0.31±0.24	43	BEHREND	83B CELL	$e^+e^- \rightarrow e^+e^-\rho\gamma$

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

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
0.97±0.05 OUR FIT			
0.92±0.06±0.11			
	¹⁰ KARCH	92 CBAL	$e^+e^- \rightarrow e^+e^-\eta\pi^0\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.95±0.05±0.08	¹¹ KARCH	90 CBAL	$e^+e^- \rightarrow e^+e^-\eta\pi^0\pi^0$
1.00±0.08±0.10	^{11,12} ANTREASYAN	87 CBAL	$e^+e^- \rightarrow e^+e^-\eta\pi^0\pi^0$
¹⁰ Reevaluated by us using $B(\eta \rightarrow \gamma\gamma) = (39.21 \pm 0.34)\%$. Supersedes ANTREASYAN 87 and KARCH 90.			
¹¹ Superseded by KARCH 92.			
¹² Using $BR(\eta \rightarrow 2\gamma) = (38.9 \pm 0.5)\%$.			

NODE=M002G2
NODE=M002G2

NODE=M002G2;LINKAGE=K4

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

NODE=M002225

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

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

NODE=M002225

initial assumptions and strong correlations of the parameters we do not average the parameters in the section below.

$\text{Re}(\alpha)$ 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	¹³ ABLIKIM	11 BES3	$J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$
$-0.072 \pm 0.012 \pm 0.006$	7k	¹⁴ AMELIN	05A VES	$28 \pi^- A \rightarrow \eta \pi^+ \pi^- \pi^- A^*$
$-0.021 \pm 0.018 \pm 0.017$	6.7k	¹⁵ BRIERE	00 CLEO	$10.6 e^+ e^- \rightarrow \eta \pi^+ \pi^- X$
$-0.058 \pm 0.013 \pm 0.003$	5.4k	¹⁶ ALDE	86 GAM2	$38 \pi^- p \rightarrow n \eta \pi^0 \pi^0$
-0.08 ± 0.03		^{16,17} KALBFLEISCH	74 RVUE	$\eta' \rightarrow \eta \pi^+ \pi^-$

¹³ See ABLIKIM 11 for the full correlation matrix.

¹⁴ Superseded by DOROFEEV 07, which found this parameterization unacceptable. See below.

¹⁵ Assuming $\text{Im}(\alpha) = 0$, $C = 0$, and $D = 0$.

¹⁶ Assuming $C = 0$.

¹⁷ From the data of DAUBER 64, RITTENBERG 69, AGUILAR-BENITEZ 72B, JACOBS 73, and DANBURG 73.

NODE=M002A0
NODE=M002A0

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

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

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

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

¹⁸ See ABLIKIM 11 for the full correlation matrix.

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

²⁰ Assuming $C = 0$.

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

NODE=M002IA0
NODE=M002IA0

NODE=M002IA0;LINKAGE=AB
NODE=M002IA0;LINKAGE=AM

NODE=M002IA0;LINKAGE=A
NODE=M002IA0;LINKAGE=KA

C decay parameter

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
$+0.018 \pm 0.009 \pm 0.003$	44k	²² ABLIKIM	11 BES3	$J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$
$0.020 \pm 0.018 \pm 0.004$	7k	²³ AMELIN	05A VES	$28 \pi^- A \rightarrow \eta \pi^+ \pi^- \pi^- A^*$

²² See ABLIKIM 11 for the full correlation matrix.

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

NODE=M002C0
NODE=M002C0

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

D decay parameter

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

²⁴ See ABLIKIM 11 for the full correlation matrix.

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

²⁶ Assuming $C = 0$.

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

NODE=M002D0
NODE=M002D0

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

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

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

NODE=M002227

$$|\text{MATRIX ELEMENT}|^2 \propto 1 + aY + bY^2 + cX + dX^2$$

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	²⁸ ABLIKIM	11	BES3 $J/\psi \rightarrow \gamma\eta\pi^+\pi^-$
$-0.066 \pm 0.016 \pm 0.003$	15k	²⁹ BLIK	09	GAM4 $32.5 \pi^- p \rightarrow \eta' n$
$-0.127 \pm 0.016 \pm 0.008$	20k	³⁰ DOROFEEV	07	VES $27 \pi^- p \rightarrow \eta' n,$ $\pi^- A \rightarrow \eta' \pi^- A^*$

²⁸ See ABLIKIM 11 for the full correlation matrix.

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

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

NODE=M002DPA
NODE=M002DPANODE=M002DPA;LINKAGE=AB
NODE=M002DPA;LINKAGE=BL
NODE=M002DPA;LINKAGE=DO **b decay parameter**

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$-0.069 \pm 0.019 \pm 0.009$	44k	³¹ ABLIKIM	11	BES3 $J/\psi \rightarrow \gamma\eta\pi^+\pi^-$
$-0.063 \pm 0.028 \pm 0.004$	15k	³² BLIK	09	GAM4 $32.5 \pi^- p \rightarrow \eta' n$
$-0.106 \pm 0.028 \pm 0.014$	20k	³³ DOROFEEV	07	VES $27 \pi^- p \rightarrow \eta' n,$ $\pi^- A \rightarrow \eta' \pi^- A^*$

³¹ See ABLIKIM 11 for the full correlation matrix.

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

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

NODE=M002DPB
NODE=M002DPBNODE=M002DPB;LINKAGE=AB
NODE=M002DPB;LINKAGE=BL
NODE=M002DPB;LINKAGE=DO **c decay parameter**

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$+0.019 \pm 0.011 \pm 0.003$	44k	³⁴ ABLIKIM	11	BES3 $J/\psi \rightarrow \gamma\eta\pi^+\pi^-$
$-0.107 \pm 0.096 \pm 0.003$	15k	³⁵ BLIK	09	GAM4 $32.5 \pi^- p \rightarrow \eta' n$
$0.015 \pm 0.011 \pm 0.014$	20k	³⁶ DOROFEEV	07	VES $27 \pi^- p \rightarrow \eta' n,$ $\pi^- A \rightarrow \eta' \pi^- A^*$

³⁴ See ABLIKIM 11 for the full correlation matrix.

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

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

NODE=M002DPC
NODE=M002DPCNODE=M002DPC;LINKAGE=AB
NODE=M002DPC;LINKAGE=BL
NODE=M002DPC;LINKAGE=DO **d decay parameter**

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$-0.073 \pm 0.012 \pm 0.003$	44k	³⁷ ABLIKIM	11	BES3 $J/\psi \rightarrow \gamma\eta\pi^+\pi^-$
$0.018 \pm 0.078 \pm 0.006$	15k	³⁸ BLIK	09	GAM4 $32.5 \pi^- p \rightarrow \eta' n$
$-0.082 \pm 0.017 \pm 0.008$	20k	³⁹ DOROFEEV	07	VES $27 \pi^- p \rightarrow \eta' n,$ $\pi^- A \rightarrow \eta' \pi^- A^*$

³⁷ See ABLIKIM 11 for the full correlation matrix.

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

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

NODE=M002DPD
NODE=M002DPDNODE=M002DPD;LINKAGE=AB
NODE=M002DPD;LINKAGE=BL
NODE=M002DPD;LINKAGE=DO **$\eta'(958) \beta$ PARAMETER**

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

See the "Note on η Decay Parameters" in our 1994 edition Physical Review

D50 1173 (1994), p. 1454.

NODE=M002226

NODE=M002226

 β decay parameter

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
-0.46 ± 0.22 OUR AVERAGE Error includes scale factor of 1.4.				
-0.59 ± 0.18	235	BLIK	08	GAMS $32 \pi^- p \rightarrow \eta' n$
-0.1 ± 0.3		ALDE	87B	GAM2 $38 \pi^- p \rightarrow n3\pi^0$

NODE=M002B0
NODE=M002B0

$\eta'(958)$ BRANCHING RATIOS

NODE=M002230

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

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT

0.429±0.007 OUR FIT

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

0.424±0.011±0.004 1.2k ⁴⁰ PEDLAR 09 CLEO $J/\psi \rightarrow \gamma\eta'$ ⁴⁰ Not independent of other η' branching fractions and ratios in PEDLAR 09.NODE=M002R47
NODE=M002R47

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

0.1228±0.0020 OUR FIT

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

0.123 ±0.014 107 RITTENBERG 69 HBC 1.7–2.7 K^-p 0.10 ±0.04 10 LONDON 66 HBC 2.24 $K^-p \rightarrow \Lambda 2\pi^+ 2\pi^- \pi^0$ 0.07 ±0.04 7 BADIER 65B HBC 3 K^-p NODE=M002R3
NODE=M002R3 $\Gamma(\pi^+\pi^-\eta(\text{neutral decay}))/\Gamma_{\text{total}}$ **0.714 Γ_1/Γ**

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT

0.307±0.005 OUR FIT

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

0.314±0.026 281 RITTENBERG 69 HBC 1.7–2.7 K^-p NODE=M002R1
NODE=M002R1 $\Gamma(\rho^0\gamma(\text{including non-resonant } \pi^+\pi^-\gamma))/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT

0.291±0.006 OUR FIT

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

0.287±0.007±0.004 0.2k ⁴¹ PEDLAR 09 CLEO $J/\psi \rightarrow \gamma\eta'$ 0.329±0.033 298 RITTENBERG 69 HBC 1.7–2.7 K^-p 0.2 ±0.1 20 LONDON 66 HBC 2.24 $K^-p \rightarrow \Lambda\pi^+\pi^-\gamma$ 0.34 ±0.09 35 BADIER 65B HBC 3 K^-p ⁴¹ Not independent of other η' branching fractions and ratios in PEDLAR 09.NODE=M002R6
NODE=M002R6

NODE=M002R6;LINKAGE=PE

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

VALUE	DOCUMENT ID	TECN	COMMENT

0.677±0.017 OUR FIT**0.683±0.020 OUR AVERAGE**

0.677±0.024±0.011

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

0.69 ±0.03

ABLIKIM 06E BES2 $J/\psi \rightarrow \eta'\gamma$ NODE=M002R43
NODE=M002R43 $\Gamma(\rho^0\gamma(\text{including non-resonant } \pi^+\pi^-\gamma))/\Gamma(\pi^+\pi^-\eta(\text{neutral decay}))$ $\Gamma_2/0.714\Gamma_1$

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT

0.949±0.024 OUR FIT**0.97 ±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

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

1.11 ±0.18

JACOBS 73 HBC 2.9 $K^-p \rightarrow \Lambda X^0$ NODE=M002R27
NODE=M002R27 $\Gamma(\pi^0\pi^0\eta)/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT

0.222±0.008 OUR FIT

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

0.235±0.013±0.004 3.2k ⁴² PEDLAR 09 CLEO $J/\psi \rightarrow \gamma\eta'$ ⁴² Not independent of other η' branching fractions and ratios in PEDLAR 09.NODE=M002R48
NODE=M002R48

NODE=M002R48;LINKAGE=PE

 $\Gamma(\pi^0\pi^0\eta(3\pi^0\text{ decay}))/\Gamma_{\text{total}}$ **0.321 Γ_3/Γ**

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT

0.0712±0.0026 OUR FIT

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

0.11 ±0.06 4 BENSINGER 70 DBC 2.2 π^+d NODE=M002R26
NODE=M002R26 $\Gamma(\pi^0\pi^0\eta)/\Gamma(\pi^+\pi^-\eta)$ Γ_3/Γ_1

VALUE	DOCUMENT ID	TECN	COMMENT

0.517±0.026 OUR FIT**0.555±0.043±0.013**PEDLAR 09 CLE3 $J/\psi \rightarrow \eta'\gamma$ NODE=M002R45
NODE=M002R45

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

VALUE	DOCUMENT ID	TECN	COMMENT
0.447 ± 0.012 OUR FIT			
0.43 ± 0.02 ± 0.02	BARBERIS	98C	OMEG 450 $p p \rightarrow p_f \eta' p_s$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.31 ± 0.15	DAVIS	68	HBC 5.5 $K^- p$

NODE=M002R7
NODE=M002R7

$$\Gamma(\omega \gamma) / \Gamma_{\text{total}} \quad \Gamma_4 / \Gamma$$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.0275 ± 0.0023 OUR FIT				
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.0234 ± 0.0030 ± 0.0004	70	⁴³ PEDLAR	09	CLEO $J/\psi \rightarrow \gamma \eta'$
⁴³ Not independent of other η' branching fractions and ratios in PEDLAR 09.				

NODE=M002R49
NODE=M002R49

NODE=M002R49;LINKAGE=PE

$$\Gamma(\omega \gamma) / \Gamma(\pi^+ \pi^- \eta) \quad \Gamma_4 / \Gamma_1$$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.064 ± 0.006 OUR FIT				
0.055 ± 0.007 ± 0.001		PEDLAR	09	CLE3 $J/\psi \rightarrow \eta' \gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.068 ± 0.013	68	ZANFINO	77	ASPK 8.4 $\pi^- p$

NODE=M002R17
NODE=M002R17

$$\Gamma(\omega \gamma) / \Gamma(\pi^0 \pi^0 \eta) \quad \Gamma_4 / \Gamma_3$$

VALUE	DOCUMENT ID	TECN	COMMENT
0.124 ± 0.011 OUR FIT			
0.147 ± 0.016	ALDE	87B	GAM2 38 $\pi^- p \rightarrow n 4 \gamma$

NODE=M002R33
NODE=M002R33

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

VALUE	DOCUMENT ID	TECN	COMMENT
0.428 ± 0.011 OUR FIT			
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.25 ± 0.14	DAUBER	64	HBC 1.95 $K^- p$

NODE=M002R18
NODE=M002R18

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

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.0880 ± 0.0031 OUR FIT				
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.045 ± 0.029	42	RITTENBERG	69	HBC 1.7–2.7 $K^- p$

NODE=M002R4
NODE=M002R4

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

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

NODE=M002R2
NODE=M002R2

$$\Gamma(\gamma \gamma) / \Gamma_{\text{total}} \quad \Gamma_5 / \Gamma$$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
2.20 ± 0.08 OUR FIT				
2.00 ± 0.15 OUR AVERAGE				

NODE=M002R19
NODE=M002R19

1.98 ^{+0.31} _{-0.27} ± 0.07	114	⁴⁴ WICHT	08	BELL $B^\pm \rightarrow K^\pm \gamma \gamma$
2.00 ± 0.18		⁴⁵ STANTON	80	SPEC 8.45 $\pi^- p \rightarrow n \pi^+ \pi^- 2 \gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2.25 ± 0.16 ± 0.03	0.3k	⁴⁶ PEDLAR	09	CLEO $J/\psi \rightarrow \gamma \eta'$
1.8 ± 0.2	6000	⁴⁷ APEL	79	NICE 15–40 $\pi^- p \rightarrow n 2 \gamma$
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 $\pi^- p \rightarrow n X^0$

⁴⁴ 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.

⁴⁵ Includes APEL 79 result.

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

⁴⁷ Data is included in STANTON 80 evaluation.

NODE=M002R19;LINKAGE=W1

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

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

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_5/Γ_1
0.0513±0.0022 OUR FIT				
0.053 ±0.004 ±0.001	PEDLAR	09	CLE3 $J/\psi \rightarrow \eta' \gamma$	

NODE=M002R46
NODE=M002R46

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

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_5/Γ_2
0.0757±0.0033 OUR FIT				
0.080 ±0.008	ABLIKIM	06E	BES2 $J/\psi \rightarrow \eta' \gamma$	

NODE=M002R42
NODE=M002R42

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

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_5/Γ_3
0.099±0.004 OUR FIT				
0.105±0.010 OUR AVERAGE	Error includes scale factor of 1.9.			
0.091±0.009	AMSLER	93	CBAR $0.0 \bar{p} p$	
0.112±0.002±0.006	ALDE	87B	GAM2 $38 \pi^- p \rightarrow n 2\gamma$	

NODE=M002R38
NODE=M002R38

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

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	$\Gamma_5/0.714\Gamma_3$
0.139±0.006 OUR FIT					

NODE=M002R28
NODE=M002R28

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

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

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

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	$(0.714\Gamma_3+0.09\Gamma_4+\Gamma_5)/\Gamma$
0.183±0.006 OUR FIT					

NODE=M002R5
NODE=M002R5

• • • 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 $1.7-2.7 K^- p$	

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

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_6/Γ
2.14±0.20 OUR FIT					
3.56±0.22±0.34	309	ABLIKIM	12E	BES3 $J/\psi \rightarrow \gamma(3\pi^0)$	

NODE=M002R55
NODE=M002R55

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

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_6/Γ_3
96±9 OUR FIT					
78±10 OUR AVERAGE					
86±19	235	BLIK	08	GAMS $32 \pi^- p \rightarrow \eta' n$	
74±15		ALDE	87B	GAM2 $38 \pi^- p \rightarrow n 6\gamma$	
75±18		BINON	84	GAM2 $30-40 \pi^- p \rightarrow n 6\gamma$	

NODE=M002R32
NODE=M002R32

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

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_7/Γ_5
4.9±1.2	33	VIKTOROV	80	CNTR $25,33 \pi^- p \rightarrow 2\mu\gamma$	

NODE=M002R29
NODE=M002R29

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

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT	Γ_8/Γ

NODE=M002R50
NODE=M002R50

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

<0.29	90	48 ABLIKIM	130	BES3 $J/\psi \rightarrow \gamma\eta'$	
<2.4	90	49 NAIK	09	CLEO $J/\psi \rightarrow \gamma\eta'$	

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

49 Not independent of measured value of Γ_8/Γ_1 from NAIK 09.

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

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

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT	Γ_8/Γ_1
<0.5	90	50 NAIK	09	CLEO $J/\psi \rightarrow \gamma\eta'$	

NODE=M002R03
NODE=M002R03

50 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;LINKAGE=NA

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

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT	Γ_8/Γ_2
<1.0	90	ABLIKIM	130	BES3 $J/\psi \rightarrow \gamma\eta'$	

NODE=M002R57
NODE=M002R57

$\Gamma(\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_9/Γ VALUE (units 10^{-3}) EVTS

DOCUMENT ID

TECN

COMMENT

3.8 $\pm$ 0.4 OUR FIT**3.8 $\pm$ 0.4 OUR AVERAGE**3.83 $\pm$ 0.15 $\pm$ 0.39 1014 ABLIKIM 12E BES3 $J/\psi \rightarrow \gamma(\pi^+\pi^-\pi^0)$ 3.7 $^{+1.1}_{-0.9} \pm 0.4$ ⁵¹ NAIK 09 CLEO $J/\psi \rightarrow \gamma\eta'$ ⁵¹ Not independent of measured value of Γ_9/Γ_1 from NAIK 09.NODE=M002R21
NODE=M002R21

NODE=M002R21;LINKAGE=NA

 $\Gamma(\pi^+\pi^-\pi^0)/\Gamma(\pi^+\pi^-\eta)$ Γ_9/Γ_1 VALUE (units 10^{-3}) EVTS

DOCUMENT ID

TECN

COMMENT

8.8 $\pm$ 0.9 OUR FIT**8.28 $^{+2.49}_{-2.12} \pm 0.04$** 20 ⁵² NAIK 09 CLEO $J/\psi \rightarrow \gamma\eta'$ ⁵² 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

NODE=M002R01;LINKAGE=NA

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

VALUE CL%

DOCUMENT ID

TECN

COMMENT

<0.04 90 RITTENBERG 65 HBC $2.7 K^- p$ NODE=M002R10
NODE=M002R10 $\Gamma(2(\pi^+\pi^-))/\Gamma_{\text{total}}$ Γ_{11}/Γ VALUE (units 10^{-4}) CL%

DOCUMENT ID

TECN

COMMENT

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

< 2.4 90 ⁵³ NAIK 09 CLEO $J/\psi \rightarrow \gamma\eta'$ <100 90 RITTENBERG 69 HBC $1.7-2.7 K^- p$ ⁵³ Not independent of measured value of Γ_{11}/Γ_1 from NAIK 09.NODE=M002R24
NODE=M002R24

NODE=M002R24;LINKAGE=NA

 $\Gamma(2(\pi^+\pi^-))/\Gamma(\pi^+\pi^-\eta)$ Γ_{11}/Γ_1 VALUE (units 10^{-3}) CL%

DOCUMENT ID

TECN

COMMENT

<0.6 90 ⁵⁴ NAIK 09 CLEO $J/\psi \rightarrow \gamma\eta'$ ⁵⁴ NAIK 09 reports [$\Gamma(\eta'(958) \rightarrow 2(\pi^+\pi^-))/\Gamma(\eta'(958) \rightarrow \pi^+\pi^-\eta)$] / [$B(\eta \rightarrow 2\gamma)$] < 1.4×10^{-3} which we multiply by our best value $B(\eta \rightarrow 2\gamma) = 39.41 \times 10^{-2}$.NODE=M002R04
NODE=M002R04

NODE=M002R04;LINKAGE=NA

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

DOCUMENT ID

TECN

COMMENT

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

<27 90 ⁵⁵ NAIK 09 CLEO $J/\psi \rightarrow \gamma\eta'$ ⁵⁵ Not independent of measured value of Γ_{12}/Γ_1 from NAIK 09.NODE=M002R51
NODE=M002R51

NODE=M002R51;LINKAGE=NA

 $\Gamma(\pi^+\pi^-2\pi^0)/\Gamma(\pi^+\pi^-\eta)$ Γ_{12}/Γ_1 VALUE (units 10^{-3}) CL%

DOCUMENT ID

TECN

COMMENT

<6 90 ⁵⁶ NAIK 09 CLEO $J/\psi \rightarrow \gamma\eta'$ ⁵⁶ NAIK 09 reports [$\Gamma(\eta'(958) \rightarrow \pi^+\pi^-2\pi^0)/\Gamma(\eta'(958) \rightarrow \pi^+\pi^-\eta)$] / [$B(\eta \rightarrow 2\gamma)$] < 15×10^{-3} which we multiply by our best value $B(\eta \rightarrow 2\gamma) = 39.41 \times 10^{-2}$.NODE=M002R05
NODE=M002R05

NODE=M002R05;LINKAGE=NA

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

VALUE CL%

DOCUMENT ID

TECN

COMMENT

<0.01 95 DANBURG 73 HBC $2.2 K^- p \rightarrow \Lambda X^0$

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

<0.01 90 RITTENBERG 69 HBC $1.7-2.7 K^- p$ NODE=M002R22
NODE=M002R22 $\Gamma(2(\pi^+\pi^-)\pi^0)/\Gamma_{\text{total}}$ Γ_{14}/Γ

VALUE CL%

DOCUMENT ID

TECN

COMMENT

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

<0.002 90 ⁵⁷ NAIK 09 CLEO $J/\psi \rightarrow \gamma\eta'$ <0.01 90 RITTENBERG 69 HBC $1.7-2.7 K^- p$ ⁵⁷ Not independent of measured value of Γ_{14}/Γ_1 from NAIK 09.NODE=M002R23
NODE=M002R23

NODE=M002R23;LINKAGE=NA

$\Gamma(2(\pi^+\pi^-)\pi^0)/\Gamma(\pi^+\pi^-\eta)$ Γ_{14}/Γ_1

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<4	90	58 NAIK	09 CLEO	$J/\psi \rightarrow \gamma\eta'$
58 NAIK 09 reports $[\Gamma(\eta'(958) \rightarrow 2(\pi^+\pi^-)\pi^0)/\Gamma(\eta'(958) \rightarrow \pi^+\pi^-\eta)] / [B(\eta \rightarrow 2\gamma)] < 11 \times 10^{-3}$ which we multiply by our best value $B(\eta \rightarrow 2\gamma) = 39.41 \times 10^{-2}$.				

NODE=M002R06
 NODE=M002R06

NODE=M002R06;LINKAGE=NA

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

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

NODE=M002R16
 NODE=M002R16

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

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
< 3.1	90	59 ABLIKIM	13U BES3	$J/\psi \rightarrow \gamma 3(\pi^+\pi^-)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
< 53	90	60 NAIK	09 CLEO	$J/\psi \rightarrow \gamma\eta'$
<500	95	KALBFLEISCH 64B	HBC	$K^-p \rightarrow \Lambda 2(\pi^+\pi^-)$
59 Using $B(J/\psi \rightarrow \gamma\eta'(958)) = (5.16 \pm 0.15) \times 10^{-3}$.				
60 Not independent of measured value of Γ_{16}/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_{16}/Γ_1

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<1.2	90	61 NAIK	09 CLEO	$J/\psi \rightarrow \gamma\eta'$
61 NAIK 09 reports $[\Gamma(\eta'(958) \rightarrow 3(\pi^+\pi^-))/\Gamma(\eta'(958) \rightarrow \pi^+\pi^-\eta)] / [B(\eta \rightarrow 2\gamma)] < 3.0 \times 10^{-3}$ which we multiply by our best value $B(\eta \rightarrow 2\gamma) = 39.41 \times 10^{-2}$.				

NODE=M002R08
 NODE=M002R08

NODE=M002R08;LINKAGE=NA

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

VALUE (units 10^{-3})	CL%	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	62 ABLIKIM	130 BES3	$J/\psi \rightarrow \gamma\eta'$	
2.5 $^{+1.2}_{-0.9} \pm 0.5$		63 NAIK	09 CLEO	$J/\psi \rightarrow \gamma\eta'$	
<6	90	RITTENBERG	65 HBC	2.7 K^-p	
62 Using $\Gamma_2/\Gamma = (29.3 \pm 0.6)\%$ from PDG 12.					
63 Not independent of measured value of Γ_{17}/Γ_1 from NAIK 09.					

NODE=M002R12
 NODE=M002R12

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

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

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
5.6 $^{+3.0}_{-2.2}$ OUR FIT				
5.52$^{+3.00}_{-2.30} \pm 0.03$	8	64 NAIK	09 CLEO	$J/\psi \rightarrow \gamma\eta'$

NODE=M002R02
 NODE=M002R02

NODE=M002R02;LINKAGE=NA

64 NAIK 09 reports $[\Gamma(\eta'(958) \rightarrow \pi^+\pi^-e^+e^-)/\Gamma(\eta'(958) \rightarrow \pi^+\pi^-\eta)] / [B(\eta \rightarrow 2\gamma)] = (14^{+7}_{-5} \pm 3) \times 10^{-3}$ which we multiply by our best value $B(\eta \rightarrow 2\gamma) = (39.41 \pm 0.20) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

 $\Gamma(\pi^+\pi^-e^+e^-)/\Gamma(\rho^0\gamma(\text{including non-resonant } \pi^+\pi^-\gamma))$ Γ_{17}/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

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

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

NODE=M002R54
 NODE=M002R54

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

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

NODE=M002R40
 NODE=M002R40

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

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

NODE=M002R35
 NODE=M002R35

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

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

NODE=M002R37
 NODE=M002R37

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

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

NODE=M002R39
 NODE=M002R39

 $\Gamma(\text{invisible})/\Gamma_{\text{total}}$ Γ_{23}/Γ

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

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

<9.5 90 ⁶⁵ NAIK 09 CLEO $J/\psi \rightarrow \gamma\eta'$

⁶⁵ Not independent of measured value of Γ_{23}/Γ_1 from NAIK 09.

NODE=M002R52;LINKAGE=NA

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

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

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

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

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

NODE=M002R44
 NODE=M002R44

 $\Gamma(\text{invisible})/\Gamma(\pi^+\pi^-\eta)$ Γ_{23}/Γ_1

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

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

<2.1 90 ⁶⁶ NAIK 09 CLEO $J/\psi \rightarrow \gamma\eta'$

⁶⁶ NAIK 09 reports $[\Gamma(\eta'(958) \rightarrow \text{invisible})/\Gamma(\eta'(958) \rightarrow \pi^+\pi^-\eta)] / [B(\eta \rightarrow 2\gamma)]$
 $< 5.4 \times 10^{-3}$ which we multiply by our best value $B(\eta \rightarrow 2\gamma) = 39.41 \times 10^{-2}$.

NODE=M002R09
 NODE=M002R09

NODE=M002R09;LINKAGE=NA

 $\Gamma(\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{24}/Γ

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

< 0.6 90 ⁶⁷ ABLIKIM 11G BES3 $J/\psi \rightarrow \gamma\pi^+\pi^-$

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

< 29 90 ⁶⁸ MORI 07A BELL $\gamma\gamma \rightarrow \pi^+\pi^-$

< 3.3 90 ⁶⁹ MORI 07A BELL $\gamma\gamma \rightarrow \pi^+\pi^-$

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

<200 90 RITTENBERG 69 HBC $1.7-2.7 K^- p$

⁶⁷ ABLIKIM 11G reports $[\Gamma(\eta'(958) \rightarrow \pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta'(958))] < 2.84 \times 10^{-7}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma\eta'(958)) = 5.15 \times 10^{-3}$.

⁶⁸ Taking into account interference with the $\gamma\gamma \rightarrow \pi^+\pi^-$ continuum.

⁶⁹ Without interference with the $\gamma\gamma \rightarrow \pi^+\pi^-$ continuum.

NODE=M002R20
 NODE=M002R20

OCCUR=2

NODE=M002R20;LINKAGE=AL

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

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

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

< 4×10^{-4} 90 ⁷⁰ ABLIKIM 11G BES3 $J/\psi \rightarrow \gamma\pi^0\pi^0$

⁷⁰ ABLIKIM 11G reports $[\Gamma(\eta'(958) \rightarrow \pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta'(958))] < 2.84 \times 10^{-7}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma\eta'(958)) = 5.15 \times 10^{-3}$.

NODE=M002R53
 NODE=M002R53

NODE=M002R53;LINKAGE=AL

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

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

<45 90 ALDE 87B GAM2 $38 \pi^- p \rightarrow n 4\gamma$

NODE=M002R36
 NODE=M002R36

 $\Gamma(\pi^0 e^+ e^-)/\Gamma_{\text{total}}$ Γ_{26}/Γ

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

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

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

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

NODE=M002R8
 NODE=M002R8

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

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
< 2.4	90	BRIERE	00	CLEO 10.6 $e^+ e^-$

NODE=M002R9
 NODE=M002R9

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

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

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

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

NODE=M002R34
 NODE=M002R34

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

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

NODE=M002R31
 NODE=M002R31

 $\Gamma(\mu^+ \mu^- \eta)/\Gamma_{\text{total}}$ Γ_{30}/Γ

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

NODE=M002R30
 NODE=M002R30

 $\Gamma(e\mu)/\Gamma_{\text{total}}$ Γ_{31}/Γ

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

NODE=M002R41
 NODE=M002R41

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

NODE=M002235

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

NODE=M002235

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

NODE=M002A
 NODE=M002A

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
-0.03 ±0.04 OUR AVERAGE				
-0.019±0.056		AIHARA	87	TPC $2\gamma \rightarrow \pi^+ \pi^- \gamma$
-0.069±0.078	295	GRIGORIAN	75	STRC $2.1 \pi^- p$
0.00 ±0.10	103	KALBFLEISCH	75	HBC $2.18 K^- p \rightarrow \Lambda \pi^+ \pi^- \gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.07 ±0.08	152	RITTENBERG	65	HBC $2.1-2.7 K^- p$

 $\eta'(958)$ REFERENCES

NODE=M002

ABLIKIM	13	PR D87 012009	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=54829
ABLIKIM	13G	PR D87 032006	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=54952
ABLIKIM	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.					
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
VOROBIEV	88	SJNP 48 273	P.V. Vorobiev <i>et al.</i>	(NOVO)	REFID=41023
		Translated from YAF 48 436.			
WILLIAMS	88	PR D38 1365	D.A. Williams <i>et al.</i>	(Crystal Ball Collab.)	REFID=40567
AIHARA	87	PR D35 2650	H. Aihara <i>et al.</i>	(TPC-2 γ Collab.) JP	REFID=40009
ALBRECHT	87B	PL B199 457	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=40265
ALDE	87B	ZPHY C36 603	D.M. Alde <i>et al.</i>	(LANL, BELG, SERP, LAPP)	REFID=40236
ANTREASYAN	87	PR D36 2633	D. Antreasyan <i>et al.</i>	(Crystal Ball Collab.)	REFID=40008
GIDAL	87	PRL 59 2012	G. Gidal <i>et al.</i>	(LBL, SLAC, HARV)	REFID=40223
ALDE	86	PL B177 115	D.M. Alde <i>et al.</i>	(SERP, BELG, LANL, LAPP)	REFID=20310
BARTEL	85E	PL 160B 421	W. Bartel <i>et al.</i>	(JADE Collab.)	REFID=10843
ALTHOFF	84E	PL 147B 487	M. Althoff <i>et al.</i>	(TASSO Collab.)	REFID=20305
BERGER	84B	PL 142B 125	C. Berger	(PLUTO Collab.)	REFID=20306
BINON	84	PL 140B 264	F.G. Binon <i>et al.</i>	(SERP, BELG, LAPP+)	REFID=20307
BEHREND	83B	PL 125B 518 (erratum)	H.J. Behrend <i>et al.</i>	(CELLO Collab.)	REFID=20302
Also		PL 114B 378	H.J. Behrend <i>et al.</i>	(CELLO Collab.)	REFID=20303
JENNI	83	PR D27 1031	P. Jenni <i>et al.</i>	(SLAC, LBL)	REFID=20304
BARTEL	82B	PL 113B 190	W. Bartel <i>et al.</i>	(JADE Collab.)	REFID=20300
DZHELYADIN	81	PL 105B 239	R.I. Dzheilyadin <i>et al.</i>	(SERP)	REFID=10836
STANTON	80	PL B92 353	N.R. Stanton <i>et al.</i>	(OSU, CARL, MCGI+)	REFID=40294
VIKTOROV	80	SJNP 32 520	V.A. Viktorov <i>et al.</i>	(SERP)	REFID=20298
		Translated from YAF 32 1005.			
APEL	79	PL 83B 131	W.D. Apel, K.H. Augenstein, E. Bertolucci	(KARLK+)	REFID=20295
BINNIE	79	PL 83B 141	D.M. Binnie <i>et al.</i>	(LOIC)	REFID=20296
ZANFINO	77	PRL 38 930	C. Zanfino <i>et al.</i>	(CARL, MCGI, OHIO+)	REFID=20293
GRIGORIAN	75	NP B91 232	A. Grigorian <i>et al.</i>	(+)	REFID=20287
KALBFLEISCH	75	PR D11 987	G.R. Kalbfleisch, R.C. Strand, J.W. Chapman	(BNL+)	REFID=20223
DUANE	74	PRL 32 425	A. Duane <i>et al.</i>	(LOIC, SHMP)	REFID=20284
KALBFLEISCH	74	PR D10 916	G.R. Kalbfleisch	(BNL)	REFID=20286
DANBURG	73	PR D8 3744	J.S. Danburg <i>et al.</i>	(BNL, MICH) JP	REFID=20280
JACOBS	73	PR D8 18	S.M. Jacobs <i>et al.</i>	(BRAN, UMD, SYRA+) JP	REFID=20281
AGUILAR-...	72B	PR D6 29	M. Aguilar-Benitez <i>et al.</i>	(BNL)	REFID=20205
APEL	72	PL 40B 680	W.D. Apel <i>et al.</i>	(KARLK, KARLE, PISA)	REFID=20275
DALPIAZ	72	PL 42B 377	P.F. Dalpiaz <i>et al.</i>	(CERN)	REFID=20278
BASILE	71	NC 3A 371	M. Basile <i>et al.</i>	(CERN, BGNA, STRB)	REFID=20270
HARVEY	71	PRL 27 885	E.H. Harvey <i>et al.</i>	(MINN, MICH)	REFID=20272
BENSINGER	70	PL 33B 505	J.R. Bensinger <i>et al.</i>	(WISC)	REFID=20268
RITTENBERG	69	Thesis UCRL 18863	A. Rittenberg	(LRL) I	REFID=20266
DAVIS	68	PL 27B 532	R. Davis <i>et al.</i>	(NWES, ANL)	REFID=20263
LONDON	66	PR 143 1034	G.W. London <i>et al.</i>	(BNL, SYRA) IJP	REFID=11774
BADIER	65B	PL 17 337	J. Badier <i>et al.</i>	(EPOL, SACL, AMST)	REFID=20253
RITTENBERG	65	PRL 15 556	A. Rittenberg, G.R. Kalbfleisch	(LRL, BNL)	REFID=10761
DAUBER	64	PRL 13 449	P.M. Dauber <i>et al.</i>	(UCLA) JP	REFID=20247
KALBFLEISCH	64B	PRL 13 349	G.R. Kalbfleisch, O.I. Dahl, A. Rittenberg	(LRL) JP	REFID=20252

$f_0(980)$

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

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

NODE=M003

NODE=M003

NODE=M003M1

NODE=M003M1

→ UNCHECKED ←

$f_0(980)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
990 ± 20 OUR ESTIMATE				
• • • We do not use the following data for averages, fits, limits, etc. • • •				
989.9 ± 0.4	706	ABLIKIM	12E BES3	$J/\psi \rightarrow \gamma 3\pi$
1003 $^{+5}_{-27}$		1,2 GARCIA-MAR..11	RVUE	Compilation
996 ± 7		1,3 GARCIA-MAR..11	RVUE	Compilation
996 $^{+4}_{-14}$		4 MOUSSALLAM11	RVUE	Compilation
981 ± 43		5 MENNESSIER 10	RVUE	Compilation
1030 $^{+30}_{-10}$		6 ANISOVICH 09	RVUE	0.0 $\bar{p}p, \pi N$
977 $^{+11}_{-9} \pm 1$	44	7 ECKLUND 09	CLEO	4.17 $e^+e^- \rightarrow D_s^- D_s^{*+} + \text{c.c.}$
982.2 ± 1.0 $^{+8.1}_{-8.0}$		8 UEHARA 08A	BELL	10.6 $e^+e^- \rightarrow e^+e^- \pi^0 \pi^0$
976.8 ± 0.3 $^{+10.1}_{-0.6}$	64k	9 AMBROSINO 07	KLOE	1.02 $e^+e^- \rightarrow \pi^0 \pi^0 \gamma$
984.7 ± 0.4 $^{+2.4}_{-3.7}$	64k	10 AMBROSINO 07	KLOE	1.02 $e^+e^- \rightarrow \pi^0 \pi^0 \gamma$
973 ± 3	262 ± 30	11 AUBERT 07Ak	BABR	10.6 $e^+e^- \rightarrow \phi \pi^+ \pi^- \gamma$
970 ± 7	54 ± 9	11 AUBERT 07Ak	BABR	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 $\pi^- C \rightarrow K_S^0 K_S^0 K_L^0 X$
973 ± 1	2438	19 ALOISIO 02D	KLOE	$e^+e^- \rightarrow \pi^0 \pi^0 \gamma$
977 ± 3 ± 2	848	20 AITALA 01A	E791	$D_s^+ \rightarrow \pi^- \pi^+ \pi^+$
969.8 ± 4.5	419	21 ACHASOV 00H	SND	$e^+e^- \rightarrow \pi^0 \pi^0 \gamma$
985 $^{+16}_{-12}$	419	22,23 ACHASOV 00H	SND	$e^+e^- \rightarrow \pi^0 \pi^0 \gamma$
976 ± 5 ± 6		24 AKHMETSHIN 99B	CMD2	$e^+e^- \rightarrow \pi^+ \pi^- \gamma$
977 ± 3 ± 6	268	24 AKHMETSHIN 99C	CMD2	$e^+e^- \rightarrow \pi^0 \pi^0 \gamma$
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	$Z \rightarrow f_0 X$
960 ± 10		ALDE 98	GAM4	
1015 ± 15		28 ANISOVICH 98B	RVUE	Compilation

OCCUR=2

OCCUR=2

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OCCUR=3

1008		30 LOCHER	98 RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$
955 ± 10		29 ALDE	97 GAM2	$450 \rho\rho \rightarrow \rho\rho\pi^0\pi^0$
994 ± 9		31 BERTIN	97C OBLX	$0.0 \bar{\rho}\rho \rightarrow \pi^+\pi^-\pi^0$
993.2 $\pm 6.5 \pm 6.9$		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	$0.0 \bar{\rho}\rho \rightarrow 3\pi^0$
~ 996		35 AMSLER	95D CBAR	$0.0 \bar{\rho}\rho \rightarrow \pi^0\pi^0\pi^0,$ $\pi^0\eta\eta, \pi^0\pi^0\eta$
987 ± 6		36 ANISOVICH	95 RVUE	
1015		JANSSEN	95 RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$
983		37 BUGG	94 RVUE	$\bar{\rho}\rho \rightarrow \eta 2\pi^0$
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	$400 \rho\rho$
979 ± 4		41 ARMSTRONG	91 OMEG	$300 \rho\rho \rightarrow \rho\rho\pi\pi,$ $\rho\rho K\bar{K}$
956 ± 12		BREAKSTONE	90 SFM	$\rho\rho \rightarrow \rho\rho\pi^+\pi^-$
959.4 ± 6.5		29 AUGUSTIN	89 DM2	$J/\psi \rightarrow \omega\pi^+\pi^-$
978 ± 9		29 ABACHI	86B HRS	$e^+e^- \rightarrow \pi^+\pi^-\chi$
985.0 $^{+9.0}_{-39.0}$		ETKIN	82B MPS	$23 \pi^-p \rightarrow n 2K_S^0$
974 ± 4		41 GIDAL	81 MRK2	$J/\psi \rightarrow \pi^+\pi^-\chi$
975		42 ACHASOV	80 RVUE	
986 ± 10		41 AGUILAR-...	78 HBC	$0.7 \bar{\rho}\rho \rightarrow K_S^0 K_S^0$
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 PROTOPODESCU 73.

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

⁴ Pole position. Used Roy equations.

⁵ Average of the analyses of three data sets in the K-matrix model. Uses the data of BATLEY 08A, HYAMS 73, and GRAYER 74, partially of COHEN 80 or ETKIN 82B.

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

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

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

⁹ In the kaon-loop fit.

¹⁰ In the no-structure fit.

¹¹ Systematic errors not estimated.

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 $\pi^-p \rightarrow \pi^0\pi^0n$, $\pi^-p \rightarrow K\bar{K}n$, $\pi^+\pi^- \rightarrow \pi^+\pi^-$, $\bar{\rho}p \rightarrow \pi^0\pi^0\pi^0$, $\pi^0\eta\eta$, $\pi^0\pi^0\eta$, $\pi^+\pi^-\pi^0$, $K^+K^-\pi^0$, $K_S^0 K_S^0 \pi^0$, $K^+K_S^0 \pi^-$ at rest, $\bar{\rho}n \rightarrow \pi^-\pi^-\pi^+$, $K_S^0 K^-\pi^0$, $K_S^0 K_S^0 \pi^-$ 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.

²² Supersedes ACHASOV 98i.

²³ In the "narrow resonance" approximation.

NODE=M003M1;LINKAGE=GC

NODE=M003M1;LINKAGE=GM

NODE=M003M1;LINKAGE=GI

NODE=M003M1;LINKAGE=MU

NODE=M003M1;LINKAGE=ME

NODE=M003M1;LINKAGE=AO

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NODE=M003M1;LINKAGE=UE

NODE=M003M1;LINKAGE=AK

NODE=M003M1;LINKAGE=AS

NODE=M003M1;LINKAGE=NS

NODE=M003M1;LINKAGE=BO

NODE=M003M1;LINKAGE=MO

NODE=M003M1;LINKAGE=AB

NODE=M003M1;LINKAGE=AM

NODE=M003M1;LINKAGE=GR

NODE=M003M1;LINKAGE=AL

NODE=M003M;LINKAGE=KM

NODE=M003M1;LINKAGE=KD

NODE=M003M;LINKAGE=TL

NODE=M003M;LINKAGE=V9

NODE=M003M;LINKAGE=V8

NODE=M003M1;LINKAGE=AI

- 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.

NODE=M003M;LINKAGE=SM

NODE=M003M;LINKAGE=ST

NODE=M003M;LINKAGE=SL

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NODE=M003M1;LINKAGE=LA

NODE=M003M1;LINKAGE=LB

NODE=M003M1;LINKAGE=KL

NODE=M003M1;LINKAGE=CF

NODE=M003M1;LINKAGE=C2

NODE=M003M1;LINKAGE=KM

NODE=M003M1;LINKAGE=L

NODE=M003M1;LINKAGE=K

NODE=M003M1;LINKAGE=B

NODE=M003M;LINKAGE=B

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
40 to 100 OUR ESTIMATE				
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
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	$e^+e^- \rightarrow \pi^0\pi^0\gamma$
122 ± 13	419	16,17 ACHASOV 00H	SND	$e^+e^- \rightarrow \pi^0\pi^0\gamma$
56 ± 20		18 AKHMETSHIN 99C	CMD2	$e^+e^- \rightarrow \pi^0\pi^0\gamma$
65 ± 20		BARBERIS 99	OMEG	450 $pp \rightarrow p_S p_f K^+ K^-$
80 ± 10		BARBERIS 99B	OMEG	450 $pp \rightarrow p_S p_f \pi^+ \pi^-$
80 ± 10		BARBERIS 99C	OMEG	450 $pp \rightarrow p_S p_f \pi^0\pi^0$

NODE=M003W1

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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 $\pi^- p \rightarrow \pi^0\pi^0 n$	
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 $\pi^+ p \rightarrow$ $\pi^+ p\pi^+\pi^-$	

OCCUR=2

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 PROTOPODESCU 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 PROTOPODESCU 73.

⁴ Pole position. Used Roy equations.

⁵ Average of the analyses of three data sets in the K-matrix model. Uses the data of BATLEY 08A, HYAMS 73, and GRAYER 74, partially of COHEN 80 or ETKIN 82B.

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

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

⁸ Breit-Wigner $\pi\pi$ 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.

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.

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- 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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$f_0(980)$ DECAY MODES

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

$f_0(980)$ PARTIAL WIDTHS

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

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

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

³ Supersedes MORGAN 90.

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

⁵ Uses an analytic K-matrix model. Compilation.

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

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

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

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

¹⁰ From analysis allowing arbitrary background unconstrained by unitarity.

¹¹ Data included in MORGAN 90, BOGLIONE 99 analyses.

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

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

Γ_4

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<8.4	90	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	060 BABR	$B^\pm \rightarrow K^\pm \pi^\pm \pi^\mp$
$0.75^{+0.11}_{-0.13}$		² ABLIKIM	05Q BES2	$\chi_{c0} \rightarrow 2\pi^+ 2\pi^-$, $\pi^+ \pi^- K^+ K^-$
0.84 ± 0.02		³ ANISOVICH	02D SPEC	Combined fit
~ 0.68		OLLER	99B RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$
0.67 ± 0.09		⁴ LOVERRE	80 HBC	$4\pi^- p \rightarrow n 2K_S^0$
$0.81^{+0.09}_{-0.04}$		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 060 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	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)
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.)
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.		
ALOISIO	02D	PL B537 21	A. Aloisio <i>et al.</i>	(KLOE Collab.)
ANISOVICH	02D	PAN 65 1545	V.V. Anisovich <i>et al.</i>	
		Translated from YAF 65 1583.		
BRAMON	02	EPJ C26 253	A. Bramon <i>et al.</i>	
ACHASOV	01F	PR D63 094007	N.N. Achasov, V.V. Gubin	(Novosibirsk SND Collab.)
AITALA	01A	PRL 86 765	E.M. Aitala <i>et al.</i>	(FNAL E791 Collab.)
AITALA	01B	PRL 86 770	E.M. Aitala <i>et al.</i>	(FNAL E791 Collab.)
ACHASOV	00B	PL B485 349	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)
AKHMETSHIN	99B	PL B462 371	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)
AKHMETSHIN	99C	PL B462 380	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)
BARBERIS	99	PL B453 305	D. Barberis <i>et al.</i>	(Omega Expt.)
BARBERIS	99B	PL B453 316	D. Barberis <i>et al.</i>	(Omega Expt.)
BARBERIS	99C	PL B453 325	D. Barberis <i>et al.</i>	(Omega Expt.)
BARBERIS	99D	PL B462 462	D. Barberis <i>et al.</i>	(Omega Expt.)
BELLAZZINI	99	PL B467 296	R. Bellazzini <i>et al.</i>	
BOGLIONE	99	EPJ C9 11	M. Boglione, M.R. Pennington	
KAMINSKI	99	EPJ C9 141	R. Kaminski, L. Lesniak, B. Loiseau	(CRAC, PARIN)
OLLER	99	PR D60 099906 (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	
ACHASOV	98I	PL B440 442	M.N. Achasov <i>et al.</i>	
ACKERSTAFF	98Q	EPJ C4 19	K. Akerstaff <i>et al.</i>	(OPAL 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.		

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ANISOVICH	98B	SPU 41 419	V.V. Anisovich <i>et al.</i>	REFID=46331
LOCHER	98	Translated from UFN 168 481.		
ALDE	97	EPJ C4 317	M.P. Locher <i>et al.</i> (PSI)	REFID=46372
BERTIN	97C	PL B397 350	D.M. Alde <i>et al.</i> (GAMS Collab.)	REFID=45392
ISHIDA	96	PL B408 476	A. Bertin <i>et al.</i> (OBELIX Collab.)	REFID=45701
TORNQVIST	96	PTP 95 745	S. Ishida <i>et al.</i> (TOKY, MIYA, KEK)	REFID=45770
ALDE	95B	PRL 76 1575	N.A. Tornqvist, M. Roos (HELS)	REFID=44507
AMSLER	95B	ZPHY C66 375	D.M. Alde <i>et al.</i> (GAMS Collab.)	REFID=44375
AMSLER	95D	PL B342 433	C. Amsler <i>et al.</i> (Crystal Barrel Collab.)	REFID=44377
ANISOVICH	95	PL B355 425	C. Amsler <i>et al.</i> (Crystal Barrel Collab.)	REFID=44441
JANSSEN	95	PL B355 363	V.V. Anisovich <i>et al.</i> (PNPI, SERP)	REFID=44442
AMSLER	94D	PR D52 2690	G. Janssen <i>et al.</i> (STON, ADLD, JULI)	REFID=44508
ANISOVICH	94	PL B333 277	C. Amsler <i>et al.</i> (Crystal Barrel Collab.)	REFID=44093
BUGG	94	PL B323 233	V.V. Anisovich <i>et al.</i> (Crystal Barrel Collab.)	REFID=43659
KAMINSKI	94	PR D50 4412	D.V. Bugg <i>et al.</i> (LOQM)	REFID=44078
ZOU	94B	PR D50 3145	R. Kaminski, L. Lesniak, J.P. Maillet (CRAC+)	REFID=45771
MORGAN	93	PR D50 591	B.S. Zou, D.V. Bugg (LOQM)	REFID=44072
BEHREND	92	PR D48 1185	D. Morgan, M.R. Pennington (RAL, DURH)	REFID=43614
AGUILAR-...	91	ZPHY C56 381	H.J. Behrend (CELLO Collab.)	REFID=43172
ARMSTRONG	91	ZPHY C50 405	M. Aguilar-Benitez <i>et al.</i> (LEBC-EHS Collab.)	REFID=41637
BOYER	90	ZPHY C51 351	T.A. Armstrong <i>et al.</i> (ATHU, BARI, BIRM+)	REFID=41744
BREAKSTONE	90	PR D42 1350	J. Boyer <i>et al.</i> (Mark II Collab.)	REFID=41362
MARSISKE	90	ZPHY C48 569	A.M. Breakstone <i>et al.</i> (ISU, BGNA, CERN+)	REFID=41376
MORGAN	90	PR D41 3324	H. Marsiske <i>et al.</i> (Crystal Ball Collab.)	REFID=41351
OEST	90	ZPHY C48 623	D. Morgan, M.R. Pennington (RAL, DURH)	REFID=41583
ACHASOV	89	ZPHY C47 343	T. Oest <i>et al.</i> (JADE Collab.)	REFID=41358
AUGUSTIN	89	NP B315 465	N.N. Achasov, V.N. Ivanchenko	REFID=48021
VOROBYEV	88	NP B320 1	J.E. Augustin, G. Cosme (DM2 Collab.)	REFID=41004
		SJNP 48 273	P.V. Vorobiev <i>et al.</i> (NOVO)	REFID=41023
ABACHI	86B	Translated from YAF 48 436.		
ETKIN	82B	PRL 57 1990	S. Abachi <i>et al.</i> (PURD, ANL, IND, MICH+)	REFID=20394
GIDAL	81	PR D25 1786	A. Etkin <i>et al.</i> (BNL, CUNY, TUFTS, VAND)	REFID=20390
ACHASOV	80	PL 107B 153	G. Gidal <i>et al.</i> (SLAC, LBL)	REFID=20386
		SJNP 32 566	N.N. Achasov, S.A. Devyanin, G.N. Shestakov (NOVM)	REFID=20458
COHEN	80	Translated from YAF 32 1098.		
LOVERRE	80	PR D22 2595	D. Cohen <i>et al.</i> (ANL) IJP	REFID=20381
AGUILAR-...	78	ZPHY C6 187	P.F. Loverre <i>et al.</i> (CERN, CDEF, MADR+) IJP	REFID=20382
CASON	78	NP B140 73	M. Aguilar-Benitez <i>et al.</i> (MADR, BOMB+)	REFID=20368
LEEPER	77	PRL 41 271	N.M. Cason <i>et al.</i> (NDAM, ANL)	REFID=20370
ROSSELET	77	PR D16 2054	R.J. Leeper <i>et al.</i> (ISU)	REFID=20365
FLATTE	76	PR D15 574	L. Rosselet <i>et al.</i> (GEVA, SACL)	REFID=11004
WETZEL	76	PL 63B 224	S.M. Flatte (CERN)	REFID=20446
SRINIVASAN	75	NP B115 208	W. Wetzel <i>et al.</i> (ETH, CERN, LOIC)	REFID=20362
GRAYER	74	PR D12 681	V. Srinivasan <i>et al.</i> (NDAM, ANL)	REFID=21062
BINNIE	73	NP B75 189	G. Grayer <i>et al.</i> (CERN, MPIM)	REFID=20113
GRAYER	73	PRL 31 1534	D.M. Binnie <i>et al.</i> (LOIC, SHMP)	REFID=20343
HYAMS	73	Tallahassee	G. Grayer <i>et al.</i> (CERN, MPIM)	REFID=20347
PROTOPOP...	73	NP B64 134	B.D. Hyams <i>et al.</i> (CERN, MPIM)	REFID=20107
		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.)

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$a_0(980)$ MASS

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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.

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NODE=M036M1;LINKAGE=BP

NODE=M036M1;LINKAGE=BU

NODE=M036M1;LINKAGE=BT

NODE=M036M1;LINKAGE=V1

NODE=M036M1;LINKAGE=M2

NODE=M036M1;LINKAGE=AN

NODE=M036M1;LINKAGE=BF

NODE=M036M1;LINKAGE=A

NODE=M036M1;LINKAGE=R

$K\bar{K}$ ONLY

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

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

NODE=M036M2
 NODE=M036M2

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

 $a_0(980)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
50 to 100 OUR ESTIMATE Width determination very model dependent. Peak width in $\eta\pi$ is about 60 MeV, but decay width can be much larger.					

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

75.6 $\pm$ 1.6	^{+17.4} _{-10.0}	¹⁶ UEHARA	09A	BELL	$\gamma\gamma \rightarrow \pi^0\eta$
80.2 $\pm$ 3.8	$\pm$ 5.4	¹⁷ BUGG	08A	RVUE 0	$\bar{p}p \rightarrow \pi^0\pi^0\eta$
50 $\pm$ 13	$\pm$ 4	318 ACHARD	02B	L3	$183\text{--}209 e^+e^- \rightarrow e^+e^-\eta\pi^+\pi^-$
72 $\pm$ 16		BARBERIS	00H		$450 p\bar{p} \rightarrow p_f\eta\pi^0 p_S$
61 $\pm$ 19		BARBERIS	00H		$450 p\bar{p} \rightarrow \Delta_f^{++}\eta\pi^- p_S$
~ 42		¹⁸ OLLER	99	RVUE	$\eta\pi, K\bar{K}$
~ 112		¹⁸ OLLER	99B	RVUE	$\pi\pi \rightarrow \eta\pi, K\bar{K}$
71 $\pm$ 7		TEIGE	99	B852	$18.3 \pi^- p \rightarrow \eta\pi^+\pi^- n$
92 $\pm$ 20		¹⁸ ANISOVICH	98B	RVUE	Compilation
65 $\pm$ 10		¹⁹ BERTIN	98B	OBLX $\pm$	$0.0 \bar{p}p \rightarrow K^\pm K_S \pi^\mp$
~ 100		TORNQVIST	96	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}, K\pi, \eta\pi$
202		JANSSEN	95	RVUE	$\eta\pi \rightarrow \eta\pi, K\bar{K}, K\pi, \eta\pi$
54.12 $\pm$ 0.34 $\pm$ 0.12		AMSLER	94C	CBAR	$0.0 \bar{p}p \rightarrow \omega\eta\pi^0$
54 $\pm$ 10		²⁰ AMSLER	92	CBAR	$0.0 \bar{p}p \rightarrow \eta\eta\pi^0$
95 $\pm$ 14	1040	²⁰ ARMSTRONG	91B	OMEG $\pm$	$300 p\bar{p} \rightarrow p\bar{p}\eta\pi^+\pi^-$
62 $\pm$ 15	500	²¹ EVANGELIS...	81	OMEG $\pm$	$12 \pi^- p \rightarrow \eta\pi^+\pi^-\pi^- p$
60 $\pm$ 20	145	²¹ GURTU	79	HBC $\pm$	$4.2 K^- p \rightarrow \Lambda\eta 2\pi$
60 ⁺⁵⁰ ₋₃₀	47	CONFORTO	78	OSPK -	$4.5 \pi^- p \rightarrow pX^-$
86.0 ^{+60.0} _{-50.0}	50	CORDEN	78	OMEG $\pm$	$12\text{--}15 \pi^- p \rightarrow n\eta 2\pi$
44 $\pm$ 22		GRASSLER	77	HBC -	$16 \pi^\mp p \rightarrow p\eta 3\pi$
80 to 300		²² FLATTE	76	RVUE -	$4.2 K^- p \rightarrow \Lambda\eta 2\pi$
16.0 ^{+25.0} _{-16.0}	70	WELLS	75	HBC -	$3.1\text{--}6 K^- p \rightarrow \Lambda\eta 2\pi$
30 $\pm$ 5	150	DEFOIX	72	HBC $\pm$	$0.7 \bar{p}p \rightarrow 7\pi$
40 $\pm$ 15		CAMPBELL	69	DBC $\pm$	$2.7 \pi^+ d$
60 $\pm$ 30	15	MILLER	69B	HBC -	$4.5 K^- N \rightarrow \eta\pi\Lambda$
80 $\pm$ 30	30	AMMAR	68	HBC $\pm$	$5.5 K^- p \rightarrow \Lambda\eta 2\pi$

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

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NODE=M036W1

→ UNCHECKED ←

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NODE=M036W1;LINKAGE=UE

NODE=M036W1;LINKAGE=BU

NODE=M036W1;LINKAGE=AN

NODE=M036W1;LINKAGE=BE

NODE=M036W1;LINKAGE=A

NODE=M036W1;LINKAGE=R

NODE=M036W1;LINKAGE=F

$K\bar{K}$ ONLY

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
92 ± 8		23 ABELE	98	CBAR	$0.0 \bar{p}p \rightarrow K_L^0 K^\pm \pi^\mp$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
~ 24		24 OLLER	99C	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$
~ 25	100	25 ASTIER	67	HBC	$\pm$
57 ± 13	143	26 ROSENFELD	65	RVUE	$\pm$

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

²⁴ T-matrix pole.

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

²⁶ Plus systematic errors.

NODE=M036W2
NODE=M036W2

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

 $a_0(980)$ DECAY MODES

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

NODE=M036215;NODE=M036

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

 $a_0(980)$ PARTIAL WIDTHS

VALUE (keV)	DOCUMENT ID	TECN	Γ_4
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.30 ± 0.10	27 AMSLER	98	RVUE
²⁷ Using $\Gamma_{\gamma\gamma} B(a_0(980) \rightarrow \eta\pi) = 0.24 \pm 0.08$ keV.			

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

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

NODE=M036220

NODE=M036G1
NODE=M036G1

NODE=M036G1;LINKAGE=UE

$\Gamma(\eta\pi) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$	VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT	$\Gamma_1\Gamma_5/\Gamma$
<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	29 BARGIOTTI	03	OBLX		$\bar{p}p$	
0.23 ± 0.05	30 ABELE	98	CBAR		$0.0 \bar{p}p \rightarrow K_L^0 K^\pm \pi^\mp$	
$0.166 \pm 0.01 \pm 0.02$	31 BARBERIS	98C	OMEG		$450 p\bar{p} \rightarrow p_f f_1(1285) p_s$	
• • • We do not use the following data for averages, fits, limits, etc. • • •						
1.20 ± 0.15	32 ANISOVICH	09	RVUE		$0.0 \bar{p}p, \pi N$	
$1.05 \pm 0.07 \pm 0.05$	33 BUGG	08A	RVUE	0	$\bar{p}p \rightarrow \pi^0\pi^0\eta$	
~ 0.60	OLLER	99B	RVUE		$\pi\pi \rightarrow \eta\pi, K\bar{K}$	
0.7 ± 0.3	31 CORDEN	78	OMEG		$12-15 \pi^- p \rightarrow n\eta 2\pi$	
0.25 ± 0.08	31 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 $K^- p \rightarrow \Lambda \eta 2\pi$

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

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

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

32 This is a ratio of couplings.

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

NODE=M036R1

NODE=M036R1

NODE=M036R1

NODE=M036R;LINKAGE=BG

NODE=M036R2;LINKAGE=Q

NODE=M036R2;LINKAGE=L

NODE=M036R2;LINKAGE=AN

NODE=M036R2;LINKAGE=BU

 $a_0(980)$ REFERENCES

AMBROSINO	09F	PL B681 5	F. Ambrosino <i>et al.</i>	(KLOE Collab.)
ANISOVICH	09	IJMP A24 2481	V.V. Anisovich, A.V. Sarantsev	
UEHARA	09A	PR D80 032001	S. Uehara <i>et al.</i>	(BELLE Collab.)
BUGG	08A	PR D78 074023	D.V. Bugg	(LOQM)
ACHASOV	03B	PR D68 014006	N.N. Achasov, A.V. Kiselev	
BARGIOTTI	03	EPJ C26 371	M. Bargiotti <i>et al.</i>	(OBELIX Collab.)
ACHARD	02B	PL B526 269	P. Achard <i>et al.</i>	(L3 Collab.)
ACHASOV	00F	PL B479 53	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)
BARBERIS	00H	PL B488 225	D. Barberis <i>et al.</i>	(WA 102 Collab.)
OLLER	99	PR D60 099906 (erratum)	J.A. Oller <i>et al.</i>	
OLLER	99B	NP A652 407 (erratum)	J.A. Oller, E. Oset	
OLLER	99C	PR D60 074023	J.A. Oller, E. Oset	
TEIGE	99	PR D59 012001	S. Teige <i>et al.</i>	(BNL E852 Collab.)
ABELE	98	PL D57 3860	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
ACHASOV	98B	PL B438 441	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)
AMSLER	98	RMP 70 1293	C. Amsler	
ANISOVICH	98B	SPU 41 419	V.V. Anisovich <i>et al.</i>	
		Translated from UFN 168 481.		
BARBERIS	98C	PL B440 225	D. Barberis <i>et al.</i>	(WA 102 Collab.)
BERTIN	98B	PL B434 180	A. Bertin <i>et al.</i>	(OBELIX Collab.)
TORNQVIST	96	PRL 76 1575	N.A. Tornqvist, M. Roos	(HELS)
JANSEN	95	PR D52 2690	G. Janssen <i>et al.</i>	(STON, ADLD, JULI)
AMSLER	94C	PL B327 425	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
AMSLER	94D	PL B333 277	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
BUGG	94	PR D50 4412	D.V. Bugg <i>et al.</i>	(LOQM)
AMSLER	92	PL B291 347	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
ARMSTRONG	91B	ZPHY C52 389	T.A. Armstrong <i>et al.</i>	(ATHU, BARI, BIRM+)
OEST	90	ZPHY C47 343	T. Oest <i>et al.</i>	(JADE Collab.)
ACHASOV	89	NP B315 465	N.N. Achasov, V.N. Ivanchenko	
VOROBYEV	88	SJNP 48 273	P.V. Vorobiev <i>et al.</i>	(NOVO)
		Translated from YAF 48 436.		
ANTREASYAN	86	PR D33 1847	D. Antreasyan <i>et al.</i>	(Crystal Ball Collab.)
ATKINSON	84E	PL 138B 459	M. Atkinson <i>et al.</i>	(BONN, CERN, GLAS+)
EVANGELIS...	81	NP B178 197	C. Evangelista <i>et al.</i>	(BARI, BONN, CERN+)
DEBILLY	80	NP B176 1	L. de Billy <i>et al.</i>	(CURIN, LAUS, NEUC+)
GURTU	79	NP B151 181	A. Gurtu <i>et al.</i>	(CERN, ZEEM, NIJM, OXF)
CONFORTO	78	LNC 23 419	B. Conforto <i>et al.</i>	(RHEL, TINTO, CHIC+)
CORDEN	78	NP B144 253	M.J. Corden <i>et al.</i>	(BIRM, RHEL, TELA+)
GRASSLER	77	NP B121 189	H. Grassler <i>et al.</i>	(AACH3, BERL, BONN+)
JAFFE	77	PR D15 267,281	R. Jaffe	(MIT)
FLATTE	76	PL 63B 224	S.M. Flatte	(CERN)
GAY	76B	PL 63B 220	J.B. Gay <i>et al.</i>	(CERN, AMST, NIJM) JP
WELLS	75	NP B101 333	J. Wells <i>et al.</i>	(OXF)
DEFOIX	72	NP B44 125	C. Defoix <i>et al.</i>	(CDEF, CERN)
AMMAR	70	PR D2 430	R. Ammar <i>et al.</i>	(KANS, NWES, ANL, WISC)
BARNES	69C	PRL 23 610	V.E. Barnes <i>et al.</i>	(BNL, SYRA)
CAMPBELL	69	PRL 22 1204	J.H. Campbell <i>et al.</i>	(PURD)
MILLER	69B	PL 29B 255	D.H. Miller <i>et al.</i>	(PURD)
Also		PR 188 2011	W.L. Yen <i>et al.</i>	(PURD)
AMMAR	68	PRL 21 1832	R. Ammar <i>et al.</i>	(NWES, ANL)
ASTIER	67	PL 25B 294	A. Astier <i>et al.</i>	(CDEF, CERN, IRAD)
		Includes data of BARLOW 67, CONFORTO 67, and ARMENTEROS 65.		
BARLOW	67	NC 50A 701	J. Barlow <i>et al.</i>	(CERN, CDEF, IRAD, LIPV)
CONFORTO	67	NP B3 469	G. Conforto <i>et al.</i>	(CERN, CDEF, IPNP+)
ARMENTEROS	65	PL 17 344	R. Armenteros <i>et al.</i>	(CERN, CDEF)
ROSENFELD	65	Oxford Conf. 58	A.H. Rosenfeld	(LRL)

NODE=M036

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$\phi(1020)$

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

NODE=M004

 $\phi(1020)$ MASS

NODE=M004M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1019.461±0.019 OUR AVERAGE Error includes scale factor of 1.1. [1019.455 ± 0.020 MeV OUR 2013 AVERAGE Scale factor = 1.1]				
1019.51 ±0.02 ±0.05		¹ LEES	13Q	BABR $e^+e^- \rightarrow K^+K^-\gamma$
1019.30 ±0.02 ±0.10	105k	AKHMETSHIN 06	CMD2	0.98–1.06 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
1019.52 ±0.05 ±0.05	17.4k	AKHMETSHIN 05	CMD2	0.60–1.38 $e^+e^- \rightarrow \eta\gamma$
1019.483±0.011±0.025	272k	² AKHMETSHIN 04	CMD2	$e^+e^- \rightarrow K_L^0 K_S^0$
1019.42 ±0.05	1900k	³ 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		⁴ ACHASOV	00B	SND $e^+e^- \rightarrow \eta\gamma$
1019.38 ±0.07 ±0.08	2200	⁵ AKHMETSHIN 99F	CMD2	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
1019.51 ±0.07 ±0.10	11169	AKHMETSHIN 98	CMD2	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
1019.5 ±0.4		BARBERIS	98	OMEG 450 $pp \rightarrow pp2K^+2K^-$
1019.42 ±0.06	55600	AKHMETSHIN 95	CMD2	$e^+e^- \rightarrow \text{hadrons}$
1019.7 ±0.3	2012	DAVENPORT	86	MPSF 400 $pA \rightarrow 4KX$
1019.7 ±0.1 ±0.1	5079	ALBRECHT	85D	ARG 10 $e^+e^- \rightarrow K^+K^-X$
1019.3 ±0.1	1500	ARENTON	82	AEMS 11.8 polar. $pp \rightarrow KK$
1019.67 ±0.17	25080	⁶ PELLINEN	82	RVUE
1019.52 ±0.13	3681	BUKIN	78C	OLYA $e^+e^- \rightarrow \text{hadrons}$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
1019.441±0.008±0.080	542k	⁷ AKHMETSHIN 08	CMD2	1.02 $e^+e^- \rightarrow K^+K^-$
1019.63 ±0.07	12540	⁸ AUBERT,B	05J	BABR $D^0 \rightarrow \bar{K}^0 K^+ K^-$
1019.8 ±0.7		ARMSTRONG	86	OMEG 85 $\pi^+/pp \rightarrow \pi^+/p4Kp$
1020.1 ±0.11	5526	⁸ ATKINSON	86	OMEG 20–70 γp
1019.7 ±1.0		BEBEK	86	CLEO $e^+e^- \rightarrow \Upsilon(4S)$
1019.411±0.008	642k	⁹ DIKSTRA	86	SPEC 100–200 $\pi^\pm, \bar{p}, p, K^\pm$, on Be
1020.9 ±0.2		⁸ FRAME	86	OMEG 13 $K^+p \rightarrow \phi K^+p$
1021.0 ±0.2		⁸ ARMSTRONG	83B	OMEG 18.5 $K^-p \rightarrow K^-K^+\Lambda$
1020.0 ±0.5		⁸ ARMSTRONG	83B	OMEG 18.5 $K^-p \rightarrow K^-K^+\Lambda$
1019.7 ±0.3		⁸ BARATE	83	GOLI 190 $\pi^-Be \rightarrow 2\mu X$
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	⁸ BALDI	77	CNTR 10 $\pi^-p \rightarrow \pi^- \phi p$
1018.9 ±0.6	800	COHEN	77	ASPK 6 $\pi^\pm N \rightarrow K^+K^-N$
1019.7 ±0.5	454	KALBFLEISCH	76	HBC 2.18 $K^-p \rightarrow \Lambda K \bar{K}$
1019.4 ±0.8	984	BESCH	74	CNTR 2 $\gamma p \rightarrow pK^+K^-$
1020.3 ±0.4	100	BALLAM	73	HBC 2.8–9.3 γp
1019.4 ±0.7		BINNIE	73B	CNTR $\pi^-p \rightarrow \phi n$
1019.6 ±0.5	120	¹⁰ AGUILAR-...	72B	HBC 3.9,4.6 $K^-p \rightarrow \Lambda K^+K^-$
1019.9 ±0.5	100	¹⁰ AGUILAR-...	72B	HBC 3.9,4.6 $K^-p \rightarrow K^-pK^+K^-$
1020.4 ±0.5	131	COLLEY	72	HBC 10 $K^+p \rightarrow K^+p\phi$
1019.9 ±0.3	410	STOTTLE...	71	HBC 2.9 $K^-p \rightarrow \Sigma/\Lambda K \bar{K}$

NODE=M004M

NEW

OCCUR=2

OCCUR=2

OCCUR=2

- 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.
- ² Update of AKHMETSHIN 99D
- ³ From the combined fit assuming that the total $\phi(1020)$ production cross section is saturated by those of K^+K^- , $K_S^0 K_L^0$, $\pi^+\pi^-\pi^0$, and $\eta\gamma$ decays modes and using ACHASOV 00B for the $\eta\gamma$ decay mode.
- ⁴ Using a total width of 4.43 ± 0.05 MeV. Systematic uncertainty included.
- ⁵ Using a total width of 4.43 ± 0.05 MeV.
- ⁶ PELLINEN 82 review includes AKERLOF 77, DAUM 81, BALDI 77, AYRES 74, DE-GROOT 74.
- ⁷ Strongly correlated with AKHMETSHIN 04.
- ⁸ Systematic errors not evaluated.
- ⁹ Weighted and scaled average of 12 measurements of DIJKSTRA 86.
- ¹⁰ Mass errors enlarged by us to $\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.

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

NODE=M004W

NODE=M004W

NEW

 $\phi(1020)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
4.266±0.031 OUR AVERAGE		Error includes scale factor of 1.2. [4.26±0.04 MeV OUR 2013 AVERAGE Scale factor = 1.4]		
4.29 ±0.04 ±0.07		¹ LEES	13Q	BABR $e^+e^- \rightarrow K^+K^-\gamma$
4.30 ±0.06 ±0.17	105k	AKHMETSHIN 06	CMD2	0.98–1.06 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
4.280±0.033±0.025	272k	² AKHMETSHIN 04	CMD2	$e^+e^- \rightarrow K_L^0 K_S^0$
4.21 ±0.04	1900k	³ ACHASOV	01E	SND $e^+e^- \rightarrow K^+K^-, K_S^0 K_L^0, \pi^+\pi^-\pi^0$
4.44 ±0.09	55600	AKHMETSHIN 95	CMD2	$e^+e^- \rightarrow$ hadrons
4.5 ±0.7	1500	ARENTON	82	AEMS 11.8 polar. $pp \rightarrow KK$
4.2 ±0.6	766	⁴ IVANOV	81	OLYA $1-1.4 e^+e^- \rightarrow K^+K^-$
4.3 ±0.6		⁴ CORDIER	80	DM1 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
4.36 ±0.29	3681	⁴ BUKIN	78C	OLYA $e^+e^- \rightarrow$ hadrons
4.4 ±0.6	984	⁴ BESCH	74	CNTR $2\gamma p \rightarrow pK^+K^-$
4.67 ±0.72	681	⁴ BALAKIN	71	OSPK $e^+e^- \rightarrow$ hadrons
4.09 ±0.29		BIZOT	70	OSPK $e^+e^- \rightarrow$ hadrons
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
4.24 ±0.02 ±0.03	542k	⁵ AKHMETSHIN 08	CMD2	1.02 $e^+e^- \rightarrow K^+K^-$
4.28 ±0.13	12540	⁶ AUBERT,B	05J	BABR $D^0 \rightarrow \bar{K}^0 K^+K^-$
4.45 ±0.06	271k	DIJKSTRA	86	SPEC 100 π^- Be
3.6 ±0.8	337	⁴ COOPER	78B	HBC $0.7-0.8 \bar{p}p \rightarrow K_S^0 K_L^0 \pi^+\pi^-$
4.5 ±0.50	1300	^{4,6} AKERLOF	77	SPEC 400 $pA \rightarrow K^+K^-X$
4.5 ±0.8	500	^{4,6} AYRES	74	ASPK $3-6 \pi^- p \rightarrow K^+K^-n, K^-p \rightarrow K^+K^-\Lambda/\Sigma^0$
3.81 ±0.37		COSME	74B	OSPK $e^+e^- \rightarrow K_L^0 K_S^0$
3.8 ±0.7	454	⁴ BORENSTEIN	72	HBC $2.18 K^-p \rightarrow K\bar{K}n$

- 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.
- ² Update of AKHMETSHIN 99D
- ³ From the combined fit assuming that the total $\phi(1020)$ production cross section is saturated by those of K^+K^- , $K_S^0 K_L^0$, $\pi^+\pi^-\pi^0$, and $\eta\gamma$ decays modes and using ACHASOV 00B for the $\eta\gamma$ decay mode.
- ⁴ Width errors enlarged by us to $4\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.
- ⁵ Strongly correlated with AKHMETSHIN 04.
- ⁶ Systematic errors not evaluated.

NODE=M004W;LINKAGE=C

NODE=M004W;LINKAGE=GS

NODE=M004W;LINKAGE=AE

NODE=M004W;LINKAGE=D

NODE=M004W;LINKAGE=AH

NODE=M004W;LINKAGE=A

NODE=M004215;NODE=M004

 $\phi(1020)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
Γ_1 K^+K^-	(48.9 ±0.5) %	S=1.1
Γ_2 $K_L^0 K_S^0$	(34.2 ±0.4) %	S=1.1
Γ_3 $\rho\pi + \pi^+\pi^-\pi^0$	(15.32 ±0.32) %	S=1.1
Γ_4 $\rho\pi$		
Γ_5 $\pi^+\pi^-\pi^0$		
Γ_6 $\eta\gamma$	(1.309±0.024) %	S=1.2
Γ_7 $\pi^0\gamma$	(1.27 ±0.06) × 10 ⁻³	

DESIG=1

DESIG=2

DESIG=24

DESIG=16

DESIG=3

DESIG=4

DESIG=7

Γ_8	$\ell^+ \ell^-$	—		
Γ_9	$e^+ e^-$	$(2.954 \pm 0.030) \times 10^{-4}$	S=1.1	
Γ_{10}	$\mu^+ \mu^-$	$(2.87 \pm 0.19) \times 10^{-4}$		
Γ_{11}	$\eta e^+ e^-$	$(1.15 \pm 0.10) \times 10^{-4}$		
Γ_{12}	$\pi^+ \pi^-$	$(7.4 \pm 1.3) \times 10^{-5}$		
Γ_{13}	$\omega \pi^0$	$(4.7 \pm 0.5) \times 10^{-5}$		
Γ_{14}	$\omega \gamma$	< 5	%	CL=84%
Γ_{15}	$\rho \gamma$	< 1.2	$\times 10^{-5}$	CL=90%
Γ_{16}	$\pi^+ \pi^- \gamma$	$(4.1 \pm 1.3) \times 10^{-5}$		
Γ_{17}	$f_0(980) \gamma$	$(3.22 \pm 0.19) \times 10^{-4}$	S=1.1	
Γ_{18}	$\pi^0 \pi^0 \gamma$	$(1.13 \pm 0.06) \times 10^{-4}$		
Γ_{19}	$\pi^+ \pi^- \pi^+ \pi^-$	$(4.0 \pm 2.8_{-2.2}) \times 10^{-6}$		
Γ_{20}	$\pi^+ \pi^+ \pi^- \pi^- \pi^0$	< 4.6	$\times 10^{-6}$	CL=90%
Γ_{21}	$\pi^0 e^+ e^-$	$(1.12 \pm 0.28) \times 10^{-5}$		
Γ_{22}	$\pi^0 \eta \gamma$	$(7.27 \pm 0.30) \times 10^{-5}$	S=1.5	
Γ_{23}	$a_0(980) \gamma$	$(7.6 \pm 0.6) \times 10^{-5}$		
Γ_{24}	$K^0 \bar{K}^0 \gamma$	< 1.9	$\times 10^{-8}$	CL=90%
Γ_{25}	$\eta'(958) \gamma$	$(6.25 \pm 0.21) \times 10^{-5}$		
Γ_{26}	$\eta \pi^0 \pi^0 \gamma$	< 2	$\times 10^{-5}$	CL=90%
Γ_{27}	$\mu^+ \mu^- \gamma$	$(1.4 \pm 0.5) \times 10^{-5}$		
Γ_{28}	$\rho \gamma \gamma$	< 1.2	$\times 10^{-4}$	CL=90%
Γ_{29}	$\eta \pi^+ \pi^-$	< 1.8	$\times 10^{-5}$	CL=90%
Γ_{30}	$\eta \mu^+ \mu^-$	< 9.4	$\times 10^{-6}$	CL=90%
Γ_{31}	$\eta U \rightarrow \eta e^+ e^-$	< 1	$\times 10^{-6}$	CL=90%

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

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

NODE=M004;CLUMP=A

DESIG=258

CONSTRAINED FIT INFORMATION

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

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

x_2	-72									
x_3	-53	-21								
x_6	-13	7	2							
x_7	-5	3	1	5						
x_9	30	-25	-10	-32	-15					
x_{10}	-4	3	1	3	2	-11				
x_{12}	-2	1	0	2	1	-5	1			
x_{13}	-2	2	1	2	1	-7	1	0		
x_{17}	0	0	0	0	0	0	0	0	0	
x_{18}	-6	4	2	17	3	-17	2	1	1	0
x_{19}	0	0	0	0	0	-1	0	0	0	0
x_{23}	0	0	0	0	0	0	0	0	0	0
x_{25}	-4	2	1	32	2	-10	1	1	1	0
	x_1	x_2	x_3	x_6	x_7	x_9	x_{10}	x_{12}	x_{13}	x_{17}
x_{19}	0									
x_{23}	0	0								
x_{25}	5	0	0							
	x_{18}	x_{19}	x_{23}							

$\phi(1020)$ PARTIAL WIDTHS

NODE=M004218

 $\Gamma(\eta\gamma)$ Γ_6

VALUE (keV)	DOCUMENT ID	TECN	COMMENT

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

58.9±0.5±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±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±0.017±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±0.006±0.022	² AKHMETSHIN	11	CMD2	1.02 $e^+e^- \rightarrow \phi$
1.32 ±0.05 ±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±0.018±0.017 AMBROSINO 05 KLOE 1.02 $e^+e^- \rightarrow \mu^+\mu^-$ ¹ Weighted average of Γ_{ee} and $\sqrt{\Gamma_{ee}\Gamma_{\mu\mu}}$ from AMBROSINO 05 assuming lepton universality.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=M004W9
NODE=M004W9

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 $e^+e^- \rightarrow K^+K^-\gamma$ ¹ Using a phenomenological model based on KUHN 90 with a sum of Breit-Wigner resonances for $\rho(770)$, $\omega(782)$, $\phi(1020)$ and their higher mass excitations. The first error combines statistical and systematic uncertainties. The second one is due to the parametrization of the charged kaon form factor and mass calibration.NODE=M004G01
NODE=M004G01

NODE=M004G01;LINKAGE=A

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

NODE=M004224

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

VALUE (units 10 ⁻⁵)	EVTS	DOCUMENT ID	TECN	COMMENT

14.46±0.23 OUR FIT Error includes scale factor of 1.1.**14.24±0.30 OUR AVERAGE**

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

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

VALUE (units 10 ⁻⁵)	EVTS	DOCUMENT ID	TECN	COMMENT

10.10±0.13 OUR FIT**10.06±0.16 OUR AVERAGE**

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

NODE=M004G6
NODE=M004G6

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

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT
4.53 ± 0.10 OUR FIT	Error includes scale factor of 1.1.			
4.46 ± 0.12 OUR AVERAGE				
4.51 $\pm 0.16 \pm 0.11$	105k	AKHMETSHIN 06	CMD2	$0.98-1.06 e^+e^- \rightarrow \pi^+\pi^-\pi^0$
4.30 $\pm 0.08 \pm 0.21$		AUBERT,B	04N BABR	$10.6 e^+e^- \rightarrow \pi^+\pi^-\pi^0\gamma$
4.665 $\pm 0.042 \pm 0.261$	400k	¹ ACHASOV	01E SND	$e^+e^- \rightarrow K^+K^-, K_S K_L, \pi^+\pi^-\pi^0$
4.35 $\pm 0.27 \pm 0.08$	11169	³ AKHMETSHIN 98	CMD2	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
4.38 ± 0.12		BENAYOUN 10	RVUE	$0.4-1.05 e^+e^-$

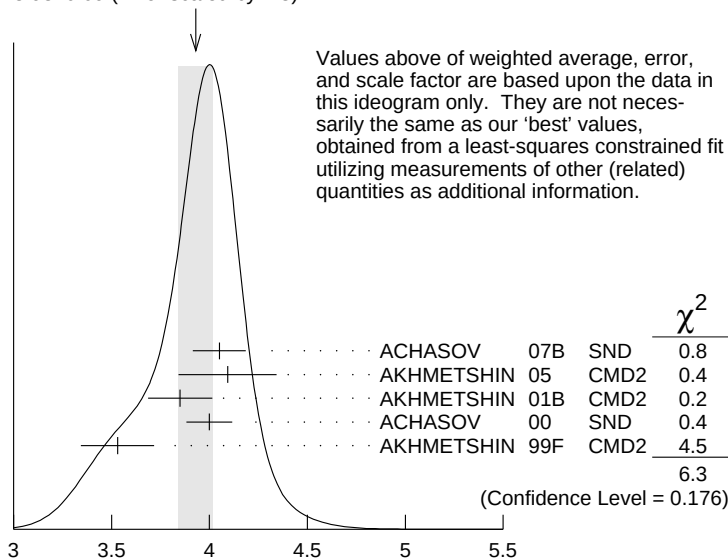
NODE=M004G7
NODE=M004G7

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

VALUE (units 10^{-6})	EVTs	DOCUMENT ID	TECN	COMMENT
3.87 ± 0.07 OUR FIT	Error includes scale factor of 1.2.			
3.93 ± 0.09 OUR AVERAGE	Error includes scale factor of 1.3. See the ideogram below.			
4.050 $\pm 0.067 \pm 0.118$	33k	⁴ ACHASOV	07B SND	$0.6-1.38 e^+e^- \rightarrow \eta\gamma$
4.093 $^{+0.040}_{-0.043} \pm 0.247$	17.4k	⁵ AKHMETSHIN 05	CMD2	$0.60-1.38 e^+e^- \rightarrow \eta\gamma$
3.850 $\pm 0.041 \pm 0.159$	23k	^{6,7} AKHMETSHIN 01B	CMD2	$e^+e^- \rightarrow \eta\gamma$
4.00 $\pm 0.04 \pm 0.11$		⁸ ACHASOV 00	SND	$e^+e^- \rightarrow \eta\gamma$
3.53 $\pm 0.08 \pm 0.17$	2200	^{9,10} AKHMETSHIN 99F	CMD2	$e^+e^- \rightarrow \eta\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
4.19 ± 0.06		¹¹ BENAYOUN 10	RVUE	$0.4-1.05 e^+e^-$

NODE=M004G2
NODE=M004G2

WEIGHTED AVERAGE
3.93 $\pm$ 0.09 (Error scaled by 1.3)



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

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

VALUE (units 10^{-7})	EVTs	DOCUMENT ID	TECN	COMMENT
3.74 ± 0.18 OUR FIT				
3.71 ± 0.21 OUR AVERAGE				
3.75 $\pm 0.11 \pm 0.29$	18680	AKHMETSHIN 05	CMD2	$0.60-1.38 e^+e^- \rightarrow \pi^0\gamma$
3.67 $\pm 0.10^{+0.27}_{-0.25}$		¹² ACHASOV 00	SND	$e^+e^- \rightarrow \pi^0\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
4.29 ± 0.11		¹¹ BENAYOUN 10	RVUE	$0.4-1.05 e^+e^-$

NODE=M004G3
NODE=M004G3

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

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

VALUE (units 10^{-8})

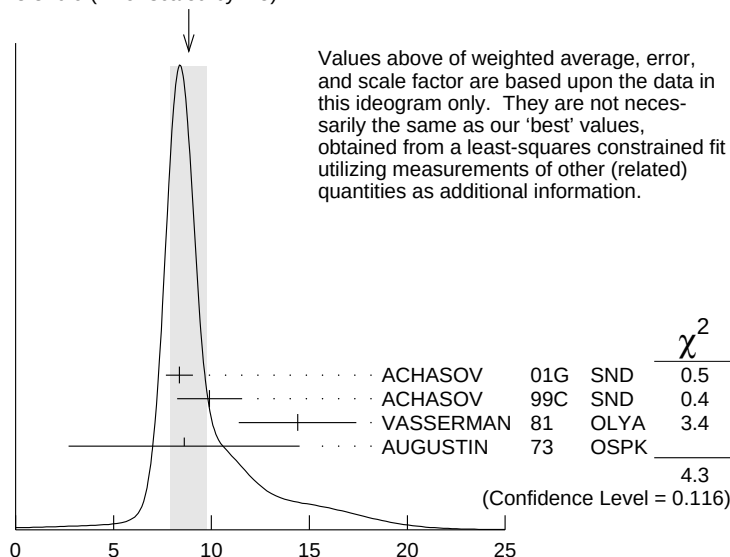
DOCUMENT ID

TECN

COMMENT

NODE=M004G5
NODE=M004G5**8.5 $^{+0.5}_{-0.6}$ OUR FIT****8.8 ± 0.9 OUR AVERAGE** Error includes scale factor of 1.5. See the ideogram below.

8.36 $\pm 0.59 \pm 0.37$	ACHASOV	01G	SND	$e^+e^- \rightarrow \mu^+\mu^-$
9.9 $\pm 1.4 \pm 0.9$	⁹ ACHASOV	99C	SND	$e^+e^- \rightarrow \mu^+\mu^-$
14.4 ± 3.0	³ VASSERMAN	81	OLYA	$e^+e^- \rightarrow \mu^+\mu^-$
8.6 ± 5.9	³ AUGUSTIN	73	OSPK	$e^+e^- \rightarrow \mu^+\mu^-$

WEIGHTED AVERAGE
8.8 ± 0.9 (Error scaled by 1.5)

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

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

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

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

VALUE (units 10^{-8})

DOCUMENT ID

TECN

COMMENT

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

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

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

3.31 ± 0.99	¹³ BENAYOUN	13	RVUE	0.4–1.05 e^+e^-

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

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

VALUE (units 10^{-8})

DOCUMENT ID

TECN

COMMENT

NODE=M004G11
NODE=M004G11**1.40 ± 0.15 OUR FIT****1.37 $\pm 0.17 \pm 0.01$** ^{14,15}AMBROSINO 08G KLOE $e^+e^- \rightarrow \pi^+\pi^-2\pi^0, 2\pi^0\gamma$

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

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

VALUE (units 10^{-8})

DOCUMENT ID

TECN

COMMENT

NODE=M004G9
NODE=M004G9**3.34 ± 0.17 OUR FIT****3.33 $^{+0.04+0.19}_{-0.09-0.20}$** ¹⁶AMBROSINO 07 KLOE $e^+e^- \rightarrow \pi^0\pi^0\gamma$

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

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

VALUE (units 10^{-9}) EVTS

DOCUMENT ID

TECN

COMMENT

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

- ¹ From the combined fit assuming that the total $\phi(1020)$ production cross section is saturated by those of K^+K^- , $K_S^0 K_L^0$, $\pi^+\pi^-\pi^0$, and $\eta\gamma$ decays modes and using ACHASOV 00B for the $\eta\gamma$ decay mode.
- ² Update of AKHMETSHIN 99D
- ³ Recalculated by us from the cross section in the peak.
- ⁴ From a combined fit of $\sigma(e^+e^- \rightarrow \eta\gamma)$ with $\eta \rightarrow 3\pi^0$ and $\eta \rightarrow \pi^+\pi^-\pi^0$, and fixing $B(\eta \rightarrow 3\pi^0) / B(\eta \rightarrow \pi^+\pi^-\pi^0) = 1.44 \pm 0.04$. Recalculated by us from the cross section at the peak. Supersedes ACHASOV 00D and ACHASOV 06A.
- ⁵ From the $\eta \rightarrow 2\gamma$ decay and using $B(\eta \rightarrow \gamma\gamma) = 39.43 \pm 0.26\%$.
- ⁶ From the $\eta \rightarrow 3\pi^0$ decay and using $B(\eta \rightarrow 3\pi^0) = (32.24 \pm 0.29) \times 10^{-2}$.
- ⁷ The combined fit from 600 to 1380 MeV taking into account $\rho(770)$, $\omega(782)$, $\phi(1020)$, and $\rho(1450)$ (mass and width fixed at 1450 MeV and 310 MeV respectively).
- ⁸ From the $\eta \rightarrow 2\gamma$ decay and using $B(\eta \rightarrow 2\gamma) = (39.21 \pm 0.34) \times 10^{-2}$.
- ⁹ Recalculated by the authors from the cross section in the peak.
- ¹⁰ From the $\eta \rightarrow \pi^+\pi^-\pi^0$ decay and using $B(\eta \rightarrow \pi^+\pi^-\pi^0) = (23.1 \pm 0.5) \times 10^{-2}$.
- ¹¹ A simultaneous fit of $e^+e^- \rightarrow \pi^+\pi^-, \pi^+\pi^-\pi^0, \pi^0\gamma, \eta\gamma$ data.
- ¹² From the $\pi^0 \rightarrow 2\gamma$ decay and using $B(\pi^0 \rightarrow 2\gamma) = (98.798 \pm 0.032) \times 10^{-2}$.
- ¹³ 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.
- ¹⁴ Recalculated by the authors from the cross section at the peak.
- ¹⁵ 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.
- ¹⁶ Calculated by the authors from the cross section at the peak.

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
 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

 $\phi(1020)$ BRANCHING RATIOS

$\Gamma(K^+K^-)/\Gamma_{\text{total}}$					Γ_1/Γ
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
0.489±0.005 OUR FIT Error includes scale factor of 1.1.					
0.493±0.010 OUR AVERAGE					
0.492±0.012	2913	AKHMETSHIN 95	CMD2	$e^+e^- \rightarrow K^+K^-$	
0.44 ±0.05	321	KALBFLEISCH 76	HBC	$2.18 K^-p \rightarrow \Lambda K^+K^-$	
0.49 ±0.06	270	DEGROOT 74	HBC	$4.2 K^-p \rightarrow \Lambda\phi$	
0.540±0.034	565	BALAKIN 71	OSPK	$e^+e^- \rightarrow K^+K^-$	
0.48 ±0.04	252	LINDSEY 66	HBC	$2.1-2.7 K^-p \rightarrow \Lambda K^+K^-$	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.493±0.003±0.007		¹ AKHMETSHIN 11	CMD2	$1.02 e^+e^- \rightarrow K^+K^-$	
0.476±0.017	1000k	² ACHASOV 01E	SND	$e^+e^- \rightarrow K^+K^-, K_S^0 K_L^0, \pi^+\pi^-\pi^0$	

$\Gamma(K_L^0 K_S^0)/\Gamma_{\text{total}}$					Γ_2/Γ
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
0.342±0.004 OUR FIT Error includes scale factor of 1.1.					
0.331±0.009 OUR AVERAGE					
0.335±0.010	40644	AKHMETSHIN 95	CMD2	$e^+e^- \rightarrow K_L^0 K_S^0$	
0.326±0.035		DOLINSKY 91	ND	$e^+e^- \rightarrow K_L^0 K_S^0$	
0.310±0.024		DRUZHININ 84	ND	$e^+e^- \rightarrow K_L^0 K_S^0$	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.336±0.002±0.006		¹ AKHMETSHIN 11	CMD2	$1.02 e^+e^- \rightarrow K_S^0 K_L^0$	
0.351±0.013	500k	² ACHASOV 01E	SND	$e^+e^- \rightarrow K^+K^-, K_S^0 K_L^0, \pi^+\pi^-\pi^0$	
0.27 ±0.03	133	KALBFLEISCH 76	HBC	$2.18 K^-p \rightarrow \Lambda K_L^0 K_S^0$	
0.257±0.030	95	BALAKIN 71	OSPK	$e^+e^- \rightarrow K_L^0 K_S^0$	
0.40 ±0.04	167	LINDSEY 66	HBC	$2.1-2.7 K^-p \rightarrow \Lambda K_L^0 K_S^0$	

NODE=M004R2
 NODE=M004R2

$\Gamma(K_L^0 K_S^0)/\Gamma(K^+K^-)$					Γ_2/Γ_1
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
0.698±0.014 OUR FIT Error includes scale factor of 1.1.					
0.740±0.031 OUR AVERAGE					
0.70 ±0.06	2732	BUKIN 78C	OLYA	$e^+e^- \rightarrow K_L^0 K_S^0$	
0.82 ±0.08		LOSTY 78	HBC	$4.2 K^-p \rightarrow \phi \text{ hyperon}$	
0.71 ±0.05		LAVEN 77	HBC	$10 K^-p \rightarrow K^+K^-\Lambda$	
0.71 ±0.08		LYONS 77	HBC	$3-4 K^-p \rightarrow \Lambda\phi$	
0.89 ±0.10	144	AGUILAR-... 72B	HBC	$3.9, 4.6 K^-p$	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.68 ±0.03		³ AKHMETSHIN 95	CMD2	$e^+e^- \rightarrow K_L^0 K_S^0, K^+K^-$	

NODE=M004R19
 NODE=M004R19

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

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

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.411±0.005 OUR FIT	Error includes scale factor of 1.1.			
0.45 ±0.04 OUR AVERAGE				
0.44 ±0.07		LONDON	66 HBC	2.24 $K^- p \rightarrow \Lambda K \bar{K}$
0.48 ±0.07	52	BADIER	65B HBC	3 $K^- p$
0.40 ±0.10	34	SCHLEIN	63 HBC	1.95 $K^- p \rightarrow \Lambda K \bar{K}$

NODE=M004R5
NODE=M004R5

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

$$\Gamma_3/\Gamma$$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.1532±0.0032 OUR FIT	Error includes scale factor of 1.1.			
0.151 ±0.009 OUR AVERAGE	Error includes scale factor of 1.7.			
0.161 ±0.008	11761	AKHMETSHIN 95	CMD2	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
0.143 ±0.007		DOLINSKY 91	ND	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.155 ±0.002 ±0.005		¹ AKHMETSHIN 11	CMD2	1.02 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
0.159 ±0.008	400k	² ACHASOV	01E SND	$e^+e^- \rightarrow K^+K^-, K_S^0 K_L^0, \pi^+\pi^-\pi^0$
0.145 ±0.009 ±0.003	11169	⁴ AKHMETSHIN 98	CMD2	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
0.139 ±0.007		⁵ PARROUR	76B OSPK	e^+e^-

NODE=M004R3
NODE=M004R3

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

$$\Gamma_3/\Gamma_1$$

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

NODE=M004R20
NODE=M004R20

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

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

VALUE	DOCUMENT ID	TECN	COMMENT
0.184±0.005 OUR FIT	Error includes scale factor of 1.1.		
0.24 ±0.04 OUR AVERAGE			
0.237±0.039	CERRADA	77B HBC	4.2 $K^- p \rightarrow \Lambda 3\pi$
0.30 ±0.15	LONDON	66 HBC	2.24 $K^- p \rightarrow \Lambda \pi^+\pi^-\pi^0$

NODE=M004R6
NODE=M004R6

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

$$\Gamma_3/\Gamma_2$$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.448±0.012 OUR FIT	Error includes scale factor of 1.1.			
0.51 ±0.05 OUR AVERAGE				
0.56 ±0.07	3681	BUKIN	78C OLYA	$e^+e^- \rightarrow K_L^0 K_S^0, \pi^+\pi^-\pi^0$
0.47 ±0.06	516	COSME	74 OSPK	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$

NODE=M004R7
NODE=M004R7

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

$$\Gamma_5/\Gamma$$

VALUE	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
≈ 0.0087		1.98M	^{6,7} ALOISIO	03 KLOE	1.02 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
<0.0006	90		⁸ ACHASOV	02 SND	1.02 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
<0.23	90		⁸ CORDIER	80 DM1	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
<0.20	90		⁸ PARROUR	76B OSPK	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$

NODE=M004R46
NODE=M004R46

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

$$\Gamma_6/\Gamma$$

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

NODE=M004R11
NODE=M004R11

OCCUR=2

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

DOCUMENT ID TECN COMMENT

1.27 $\pm$ 0.06 OUR FIT**1.31 $\pm$ 0.13 OUR AVERAGE**1.30 $\pm$ 0.13DRUZHININ 84 ND $e^+e^- \rightarrow 3\gamma$ 1.4 $\pm$ 0.5

32

COSME 76 OSPK e^+e^-

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

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

VALUE DOCUMENT ID TECN COMMENT

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

10.9 $\pm$ 0.3 ^{+0.7}_{-0.8} ACHASOV 00 SND $e^+e^- \rightarrow \eta\gamma, \pi^0\gamma$ $\Gamma(e^+e^-)/\Gamma_{\text{total}}$ Γ_9/Γ VALUE (units 10^{-4}) EVTS

DOCUMENT ID TECN COMMENT

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

DOCUMENT ID TECN COMMENT

2.87 $\pm$ 0.19 OUR FIT**2.5 $\pm$ 0.4 OUR AVERAGE**2.69 $\pm$ 0.46 ²⁶ HAYES 71 CNTR 8.3,9.8 $\gamma C \rightarrow \mu^+\mu^- X$ 2.17 $\pm$ 0.60 ²⁶ EARLES 70 CNTR 6.0 $\gamma C \rightarrow \mu^+\mu^- X$

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

2.87 $\pm$ 0.20 $\pm$ 0.14 ²⁷ ACHASOV 01G SND $e^+e^- \rightarrow \mu^+\mu^-$ 3.30 $\pm$ 0.45 $\pm$ 0.32 ⁴ ACHASOV 99C SND $e^+e^- \rightarrow \mu^+\mu^-$ 4.83 $\pm$ 1.02 ²⁸ VASSERMAN 81 OLYA $e^+e^- \rightarrow \mu^+\mu^-$ 2.87 $\pm$ 1.98 ²⁸ AUGUSTIN 73 OSPK $e^+e^- \rightarrow \mu^+\mu^-$ $\Gamma(\eta e^+e^-)/\Gamma_{\text{total}}$ Γ_{11}/Γ VALUE (units 10^{-4}) EVTS

DOCUMENT ID TECN COMMENT

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

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

1.13 $\pm$ 0.14 $\pm$ 0.07 183 ³¹ AKHMETSHIN 01 CMD2 $e^+e^- \rightarrow \eta e^+e^-$ 1.21 $\pm$ 0.14 $\pm$ 0.09 130 ³² AKHMETSHIN 01 CMD2 $e^+e^- \rightarrow \eta e^+e^-$ 1.04 $\pm$ 0.20 $\pm$ 0.08 42 ³³ AKHMETSHIN 01 CMD2 $e^+e^- \rightarrow \eta e^+e^-$ $\Gamma(\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{12}/Γ VALUE (units 10^{-4}) CL% DOCUMENT ID TECN COMMENT

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

0.71 $\pm$ 0.11 $\pm$ 0.09 ⁴ ACHASOV 00C SND $e^+e^- \rightarrow \pi^+\pi^-$ 0.65 ^{+0.38}_{-0.29} ⁴ GOLUBEV 86 ND $e^+e^- \rightarrow \pi^+\pi^-$ 2.01 ^{+1.07}_{-0.84} ⁴ VASSERMAN 81 OLYA $e^+e^- \rightarrow \pi^+\pi^-$ <6.6 95 BUKIN 78B OLYA $e^+e^- \rightarrow \pi^+\pi^-$ <2.7 95 ALVENSLEB... 72 CNTR 6.7 $\gamma C \rightarrow C\pi^+\pi^-$ NODE=M004R17
NODE=M004R17NODE=M004R42
NODE=M004R42NODE=M004R16
NODE=M004R16NODE=M004R10
NODE=M004R10NODE=M004R24
NODE=M004R24OCCUR=2
OCCUR=3
OCCUR=4NODE=M004R18
NODE=M004R18

$\Gamma(\omega\pi^0)/\Gamma_{\text{total}}$ Γ_{13}/Γ VALUE (units 10^{-5})

DOCUMENT ID

TECN

COMMENT

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

OCCUR=2

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

4.4±0.6

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

~ 5.4

37 ACHASOV 00E SND $e^+e^- \rightarrow \pi^0\pi^0\gamma$ 5.5^{+1.6}_{-1.4}±0.335,38 AULCHENKO 00A SND $e^+e^- \rightarrow \pi^+\pi^-\pi^0\pi^0$ 4.8^{+1.9}_{-1.7}±0.837 ACHASOV 99 SND $e^+e^- \rightarrow \pi^+\pi^-\pi^0\pi^0$ $\Gamma(\omega\gamma)/\Gamma_{\text{total}}$ Γ_{14}/Γ

VALUE CL%

DOCUMENT ID

TECN

COMMENT

<0.05

84

LINDSEY

66

HBC

2.1–2.7 $K^-p \rightarrow \Lambda\pi^+\pi^-$ neutralsNODE=M004R14
NODE=M004R14 $\Gamma(\rho\gamma)/\Gamma_{\text{total}}$ Γ_{15}/Γ VALUE (units 10^{-4}) CL%

DOCUMENT ID

TECN

COMMENT

< 0.12

90

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

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

< 7

90

AKHMETSHIN 97C

CMD2

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

<200

84

LINDSEY

66

HBC

2.1–2.7 $K^-p \rightarrow \Lambda\pi^+\pi^-$ neutralsNODE=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

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

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

< 0.3

90

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

<600

90

KALBFLEISCH 75

HBC

2.18 $K^-p \rightarrow$ $\Lambda\pi^+\pi^-\gamma$

< 70

90

COSME

74

OSPK

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

<400

90

LINDSEY

65

HBC

2.1–2.7 $K^-p \rightarrow$ $\Lambda\pi^+\pi^-$ neutralsNODE=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}±0.18

42

AMBROSINO

07

KLOE

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

2.90±0.21±1.54

43

AKHMETSHIN 99C

CMD2

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

OCCUR=3

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

4.47±0.21

2438

44

ALOISIO

02D

KLOE

 $e^+e^- \rightarrow \pi^0\pi^0\gamma$ 3.5 ±0.3 ^{+1.3}_{-0.5}

419

45,46

ACHASOV

00H

SND

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

1.93±0.46±0.50

27188

47

AKHMETSHIN 99B

CMD2

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

3.05±0.25±0.72

268

48

AKHMETSHIN 99C

CMD2

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

1.5 ±0.5

268

49

AKHMETSHIN 99C

CMD2

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

OCCUR=2

3.42±0.30±0.36

164

45

ACHASOV

98I

SND

 $e^+e^- \rightarrow 5\gamma$

< 1

90

50

AKHMETSHIN 97C

CMD2

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

< 7

90

51

AKHMETSHIN 97C

CMD2

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

OCCUR=2

< 20

90

DRUZHININ

87

ND

 $e^+e^- \rightarrow \pi^0\pi^0\gamma$ $\Gamma(f_0(980)\gamma)/\Gamma(\eta\gamma)$ Γ_{17}/Γ_6 VALUE (units 10^{-2}) 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

45

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 $\pm$ 0.06 OUR AVERAGE1.07 $\pm$ 0.01 $\pm$ 0.06
-0.03 -0.0652 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

46,53 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})

EVTS

DOCUMENT ID

TECN

COMMENT

0.86 $\pm$ 0.04 OUR FIT**0.865 $\pm$ 0.070 $\pm$ 0.017**

419

53

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 $\Gamma(\pi^+\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{20}/Γ VALUE (units 10^{-6})

CL%

EVTS

DOCUMENT ID

TECN

COMMENT

< 4.6

90

AKHMETSHIN 00E CMD2 $e^+e^- \rightarrow \pi^+\pi^-\pi^+\pi^0$

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

<150

95

BARKOV

88

CMD

 $e^+e^- \rightarrow \pi^+\pi^-\pi^+\pi^0$ NODE=M004R27
NODE=M004R27 $\Gamma(\pi^0e^+e^-)/\Gamma_{\text{total}}$ Γ_{21}/Γ VALUE (units 10^{-5})

CL%

EVTS

DOCUMENT ID

TECN

COMMENT

1.12 $\pm$ 0.28 OUR AVERAGE1.01 $\pm$ 0.28 $\pm$ 0.29

52

54

ACHASOV 02D SND $e^+e^- \rightarrow \pi^0e^+e^-$ 1.22 $\pm$ 0.34 $\pm$ 0.21

46

55

AKHMETSHIN 01C CMD2 $e^+e^- \rightarrow \pi^0e^+e^-$

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

<12

90

DOLINSKY

88

ND

 $e^+e^- \rightarrow \pi^0e^+e^-$ NODE=M004R31
NODE=M004R31 $\Gamma(\pi^0\eta\gamma)/\Gamma_{\text{total}}$ Γ_{22}/Γ VALUE (units 10^{-5})

CL%

EVTS

DOCUMENT ID

TECN

COMMENT

7.27 $\pm$ 0.30 OUR AVERAGE Error includes scale factor of 1.5. See the ideogram below.7.06 $\pm$ 0.22

16.9k

56

AMBROSINO 09F KLOE 1.02 $e^+e^- \rightarrow \eta\pi^0\gamma$ 8.51 $\pm$ 0.51 $\pm$ 0.57

607

57

ALOISIO 02C KLOE $e^+e^- \rightarrow \eta\pi^0\gamma$ 7.96 $\pm$ 0.60 $\pm$ 0.40

197

58

ALOISIO 02C KLOE $e^+e^- \rightarrow \eta\pi^0\gamma$ 8.8 $\pm$ 1.4 $\pm$ 0.9

36

59

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

57,60

AMBROSINO 09F KLOE 1.02 $e^+e^- \rightarrow \eta\pi^0\gamma$ 7.12 $\pm$ 0.13 $\pm$ 0.22

3.6k

58,61

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

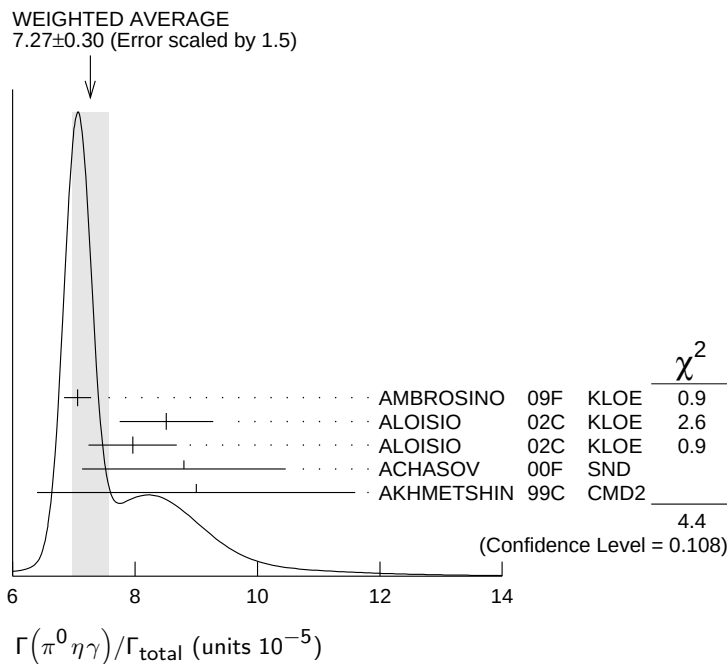
ND

 $e^+e^- \rightarrow \pi^0\eta\gamma$ NODE=M004R32
NODE=M004R32

OCCUR=2

OCCUR=2

OCCUR=3

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

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
7.6±0.6 OUR FIT					
7.6±0.6 OUR AVERAGE					
7.4±0.7			62 ALOISIO	02C KLOE	$e^+e^- \rightarrow \eta\pi^0\gamma$
8.8±1.7	36		63 ACHASOV	00F SND	$e^+e^- \rightarrow \eta\pi^0\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
11 ±2			64 GOKALP	02 RVUE	$e^+e^- \rightarrow \eta\pi^0\gamma$
<500	90		DOLINSKY	91 ND	$e^+e^- \rightarrow \pi^0\eta\gamma$

NODE=M004R33
NODE=M004R33

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

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

NODE=M004R47
NODE=M004R47

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

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

NODE=M004R48
NODE=M004R48

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

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

NODE=M004R25
NODE=M004R25

OCCUR=2

OCCUR=2

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

DOCUMENT ID

TECN

COMMENT

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

9

73

AKHMETSHIN 00F

CMD2

 $e^+e^- \rightarrow \pi^+\pi^-\pi^+\pi^- \geq 2\gamma$ NODE=M004R43
NODE=M004R43 $\Gamma(\eta'(958)\gamma)/\Gamma(\eta\gamma)$ Γ_{25}/Γ_6 VALUE (units 10^{-3}) EVTS

DOCUMENT ID

TECN

COMMENT

4.77±0.15 OUR FIT**4.78±0.20 OUR AVERAGE**

4.77±0.09±0.19

3407

AMBROSINO 07A

KLOE

1.02 $e^+e^- \rightarrow \pi^+\pi^-7\gamma$

4.70±0.47±0.31

120

74

ALOISIO 02E

KLOE

1.02 $e^+e^- \rightarrow \pi^+\pi^-3\gamma$ 6.5 ^{+1.7}_{-1.5} ±0.8

21

AKHMETSHIN 00B

CMD2

 $e^+e^- \rightarrow \pi^+\pi^-3\gamma$

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

9.5 ^{+5.2}_{-4.0} ±1.4

6

75

AKHMETSHIN 97B

CMD2

 $e^+e^- \rightarrow \pi^+\pi^-3\gamma$ NODE=M004R34
NODE=M004R34 $\Gamma(\eta\pi^0\pi^0\gamma)/\Gamma_{\text{total}}$ Γ_{26}/Γ VALUE (units 10^{-5}) CL%

DOCUMENT ID

TECN

COMMENT

<2

90

AULCHENKO 98

SND

 $e^+e^- \rightarrow 7\gamma$ NODE=M004R36
NODE=M004R36 $\Gamma(\mu^+\mu^-\gamma)/\Gamma_{\text{total}}$ Γ_{27}/Γ VALUE (units 10^{-5}) EVTS

DOCUMENT ID

TECN

COMMENT

1.43±0.45±0.14

27188

47

AKHMETSHIN 99B

CMD2

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

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

2.3 ±1.0

824 ± 33

76

AKHMETSHIN 97C

CMD2

 $e^+e^- \rightarrow \mu^+\mu^-\gamma$ NODE=M004R35
NODE=M004R35 $\Gamma(\rho\gamma\gamma)/\Gamma_{\text{total}}$ Γ_{28}/Γ VALUE (units 10^{-4}) CL%

DOCUMENT ID

TECN

COMMENT

<1.2

90

AULCHENKO 08

CMD2

 $\phi \rightarrow \pi^+\pi^-\gamma\gamma$

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

<5

90

AKHMETSHIN 98

CMD2

 $e^+e^- \rightarrow \pi^+\pi^-\gamma\gamma$ NODE=M004R37
NODE=M004R37 $\Gamma(\eta\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{29}/Γ VALUE (units 10^{-5}) CL%

DOCUMENT ID

TECN

COMMENT

< 1.8

90

AKHMETSHIN 00E

CMD2

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

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

< 6.1

90

AULCHENKO 08

CMD2

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

<30

90

AKHMETSHIN 98

CMD2

 $e^+e^- \rightarrow \pi^+\pi^-\gamma\gamma$ NODE=M004R38
NODE=M004R38 $\Gamma(\eta\mu^+\mu^-)/\Gamma_{\text{total}}$ Γ_{30}/Γ VALUE (units 10^{-6}) CL%

DOCUMENT ID

TECN

COMMENT

<9.4

90

AKHMETSHIN 01

CMD2

 $e^+e^- \rightarrow \eta e^+e^-$ NODE=M004R45
NODE=M004R45 $\Gamma(\eta U \rightarrow \eta e^+e^-)/\Gamma_{\text{total}}$ Γ_{31}/Γ

VALUE CL%

DOCUMENT ID

TECN

COMMENT

<1 × 10⁻⁶

90

77

BABUSCI 13B

KLOE

1.02 $e^+e^- \rightarrow \eta e^+e^-$ NODE=M004R01
NODE=M004R01

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

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

³ Theoretical analysis of BRAMON 00 taking into account phase-space difference, electromagnetic radiative corrections, as well as isospin breaking, predicts 0.62. FLOREZ-BAEZ 08 predicts 0.63 considering also structure-dependent radiative corrections. FISCHBACH 02 calculates additional corrections caused by the close threshold and predicts 0.68. See also BENAYOUN 01 and DUBYNSKIY 07. BENAYOUN 12 obtains 0.71 ± 0.01 in the HLS model.

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

⁵ Using $\Gamma(\phi) = 4.1$ MeV. If interference between the $\rho\pi$ and 3π modes is neglected, the fraction of the $\rho\pi$ is more than 80% at the 90% confidence level.

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

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

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

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

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

- 10 From $\pi^+\pi^-\pi^0$ decay mode of η .
 11 From 2γ decay mode of η .
 12 From $3\pi^0$ decay mode of η .
 13 ACHASOV 07B reports $[\Gamma(\phi(1020) \rightarrow \eta\gamma)/\Gamma_{\text{total}}] \times [\text{B}(\phi(1020) \rightarrow e^+e^-)] = (4.050 \pm 0.067 \pm 0.118) \times 10^{-6}$ which we divide by our best value $\text{B}(\phi(1020) \rightarrow e^+e^-) = (2.954 \pm 0.030) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value. Supersedes ACHASOV 00D and ACHASOV 06A.
 14 Using $\text{B}(\phi \rightarrow e^+e^-) = (2.98 \pm 0.04) \times 10^{-4}$ and $\text{B}(\eta \rightarrow \gamma\gamma) = 39.43 \pm 0.26\%$.
 15 Not independent of the corresponding $\Gamma(e^+e^-) \times \Gamma(\eta\gamma)/\Gamma_{\text{total}}^2$.
 16 Using $\text{B}(\phi \rightarrow e^+e^-) = (2.99 \pm 0.08) \times 10^{-4}$ and $\text{B}(\eta \rightarrow 3\pi^0) = (32.24 \pm 0.29) \times 10^{-2}$.
 17 The combined fit from 600 to 1380 MeV taking into account $\rho(770)$, $\omega(782)$, $\phi(1020)$, and $\rho(1450)$ (mass and width fixed at 1450 MeV and 310 MeV respectively).
 18 From the $\eta \rightarrow 2\gamma$ decay and using $\text{B}(\phi \rightarrow e^+e^-) = (2.99 \pm 0.08) \times 10^{-4}$.
 19 From $\pi^+\pi^-\pi^0$ decay mode of η and using $\text{B}(\phi \rightarrow e^+e^-) = (2.99 \pm 0.08) \times 10^{-4}$.
 20 Reanalysis of DRUZHININ 84, DOLINSKY 89, and DOLINSKY 91 taking into account a triangle anomaly contribution.
 21 Using $\text{B}(\phi \rightarrow e^+e^-) = (2.98 \pm 0.04) \times 10^{-4}$.
 22 Not independent of the corresponding $\Gamma(e^+e^-) \times \Gamma(\pi^0\gamma)/\Gamma_{\text{total}}^2$.
 23 From the $\pi^0 \rightarrow 2\gamma$ decay and using $\text{B}(\phi \rightarrow e^+e^-) = (2.99 \pm 0.08) \times 10^{-4}$.
 24 From the combined fit assuming that the total $\phi(1020)$ production cross section is saturated by those of K^+K^- , $K_S K_L$, $\pi^+\pi^-\pi^0$, and $\eta\gamma$ decays modes and using ACHASOV 00B for the $\eta\gamma$ decay mode.
 25 Using total width 4.2 MeV. They detect 3π mode and observe significant interference with ω tail. This is accounted for in the result quoted above.
 26 Neglecting interference between resonance and continuum.
 27 Using $\text{B}(\phi \rightarrow e^+e^-) = (2.91 \pm 0.07) \times 10^{-4}$.
 28 Recalculated by us using $\text{B}(\phi \rightarrow e^+e^-) = (2.99 \pm 0.08) \times 10^{-4}$.
 29 Using $\text{B}(\eta \rightarrow \gamma\gamma) = (39.25 \pm 0.32)\%$, $\text{B}(\phi \rightarrow \eta\gamma) = (1.26 \pm 0.06)\%$, and $\text{B}(\phi \rightarrow e^+e^-) = (3.00 \pm 0.06) \times 10^{-4}$.
 30 The average of the branching ratios separately obtained from the $\eta \rightarrow \gamma\gamma$, $3\pi^0$, $\pi^+\pi^-\pi^0$ decays.
 31 From $\eta \rightarrow \gamma\gamma$ decays and using $\text{B}(\eta \rightarrow \gamma\gamma) = (39.33 \pm 0.25) \times 10^{-2}$, $\text{B}(\eta \rightarrow \pi^+\pi^-\gamma) = (4.75 \pm 11) \times 10^{-2}$, and $\text{B}(\phi \rightarrow \eta\gamma) = (1.297 \pm 0.033) \times 10^{-2}$.
 32 From $\eta \rightarrow 3\pi^0$ decays and using $\text{B}(\pi^0 \rightarrow \gamma\gamma) = (98.798 \pm 0.033) \times 10^{-2}$, $\text{B}(\eta \rightarrow 3\pi^0) = (32.24 \pm 0.29) \times 10^{-2}$, $\text{B}(\eta \rightarrow \pi^+\pi^-\gamma) = (4.75 \pm 0.11) \times 10^{-2}$, and $\text{B}(\phi \rightarrow \eta\gamma) = (1.297 \pm 0.033) \times 10^{-2}$.
 33 From $\eta \rightarrow \pi^+\pi^-\pi^0$ decays and using $\text{B}(\pi^0 \rightarrow \gamma\gamma) = (98.798 \pm 0.033) \times 10^{-2}$, $\text{B}(\pi^0 \rightarrow e^+e^-\gamma) = (1.198 \pm 0.032) \times 10^{-2}$, $\text{B}(\eta \rightarrow \pi^+\pi^-\pi^0) = (23.0 \pm 0.4) \times 10^{-2}$, $\text{B}(\phi \rightarrow \pi^+\pi^-\pi^0) = (15.5 \pm 0.6) \times 10^{-2}$, and $\text{B}(\phi \rightarrow \eta\gamma) = (1.297 \pm 0.033) \times 10^{-2}$.
 34 Using the 1996 and 1998 data.
 35 $(2.3 \pm 0.3)\%$ correction for other decay modes of the $\omega(782)$ applied.
 36 Not independent of the corresponding $\Gamma(\omega\pi^0) \times \Gamma(e^+e^-) / \Gamma^2(\text{total})$.
 37 Using the 1996 data.
 38 Using the 1998 data.
 39 Supersedes AKHMETSHIN 97C.
 40 For $E_\gamma > 20$ MeV and assuming that $\text{B}(\phi(1020) \rightarrow f_0(980)\gamma)$ is negligible. Supersedes AKHMETSHIN 97C.
 41 For $E_\gamma > 20$ MeV and assuming that $\text{B}(\phi(1020) \rightarrow f_0(980)\gamma)$ is negligible.
 42 Obtained by the authors taking into account the $\pi^+\pi^-$ decay mode. Includes a component due to $\pi\pi$ production via the $f_0(500)$ meson. Supersedes ALOISIO 02D.
 43 From the combined fit of the photon spectra in the reactions $e^+e^- \rightarrow \pi^+\pi^-\gamma$, $\pi^0\pi^0\gamma$.
 44 From the negative interference with the $f_0(500)$ meson of AITALA 01B using the ACHASOV 89 parameterization for the $f_0(980)$, a Breit-Wigner for the $f_0(500)$, and ACHASOV 01F for the $\rho\pi$ contribution. Superseded by AMBROSINO 07.
 45 Assuming that the $\pi^0\pi^0\gamma$ final state is completely determined by the $f_0\gamma$ mechanism, neglecting the decay $\text{B}(\phi \rightarrow K\bar{K}\gamma)$ and using $\text{B}(f_0 \rightarrow \pi^+\pi^-) = 2\text{B}(f_0 \rightarrow \pi^0\pi^0)$.
 46 Using the value $\text{B}(\phi \rightarrow \eta\gamma) = (1.338 \pm 0.053) \times 10^{-2}$.
 47 For $E_\gamma > 20$ MeV. Supersedes AKHMETSHIN 97C.
 48 Neglecting other intermediate mechanisms ($\rho\pi$, $\sigma\gamma$).
 49 A narrow pole fit taking into account $f_0(980)$ and $f_0(1200)$ intermediate mechanisms.
 50 For destructive interference with the Bremsstrahlung process
 51 For constructive interference with the Bremsstrahlung process
 52 Supersedes ALOISIO 02D.
 53 Supersedes ACHASOV 98I. Excluding $\omega\pi^0$.
 54 Using various branching ratios from the 2000 Edition of this Review (PDG 00).

NODE=M004R11;LINKAGE=Z3
 NODE=M004R11;LINKAGE=A
 NODE=M004R11;LINKAGE=C
 NODE=M004R11;LINKAGE=AO

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

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

NODE=M004R17;LINKAGE=AH
 NODE=M004R17;LINKAGE=AK
 NODE=M004R;LINKAGE=3G
 NODE=M004R;LINKAGE=AE

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 NODE=M004R;LINKAGE=VM

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 NODE=M004R28;LINKAGE=VS
 NODE=M004R28;LINKAGE=K1
 NODE=M004R;LINKAGE=1N
 NODE=M004R;LINKAGE=2N

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

NODE=M004R;LINKAGE=SL

NODE=M004R;LINKAGE=KD

NODE=M004R;LINKAGE=AI

NODE=M004R;LINKAGE=U8
 NODE=M004R;LINKAGE=3N
 NODE=M004R;LINKAGE=SM
 NODE=M004R;LINKAGE=ST
 NODE=M004R30;LINKAGE=A
 NODE=M004R30;LINKAGE=B
 NODE=M004R26;LINKAGE=MB
 NODE=M004R;LINKAGE=V8
 NODE=M004R;LINKAGE=DS

- 55 Using $B(\pi^0 \rightarrow \gamma\gamma) = 0.98798 \pm 0.00032$, $B(\phi \rightarrow \eta\gamma) = (1.297 \pm 0.033) \times 10^{-2}$, and $B(\eta \rightarrow \pi^+\pi^-\gamma) = (4.75 \pm 0.11) \times 10^{-2}$.
- 56 Combined results of $\eta \rightarrow \gamma\gamma$ and $\eta \rightarrow \pi^+\pi^-\pi^0$ decay modes measurements.
- 57 From the decay mode $\eta \rightarrow \gamma\gamma$.
- 58 From the decay mode $\eta \rightarrow \pi^+\pi^-\pi^0$.
- 59 Supersedes ACHASOV 98B.
- 60 Using $B(\phi \rightarrow \eta\gamma) = (1.304 \pm 0.025)\%$, $B(\eta \rightarrow 3\pi^0) = (32.56 \pm 0.23)\%$, and $B(\eta \rightarrow \gamma\gamma) = (39.31 \pm 0.20)\%$.
- 61 Using $B(\phi \rightarrow \eta\gamma) = (1.304 \pm 0.025)\%$, $B(\eta \rightarrow 3\pi^0) = (32.56 \pm 0.23)\%$, and $B(\eta \rightarrow \pi^+\pi^-\pi^0) = (22.73 \pm 0.28)\%$.
- 62 Using $M_{a_0(980)} = 984.8$ MeV and assuming $a_0(980)\gamma$ dominance.
- 63 Assuming $a_0(980)\gamma$ dominance in the $\eta\pi^0\gamma$ final state.
- 64 Using data of ACHASOV 00F.
- 65 Using results of ALOISIO 02D and assuming that $f_0(980)$ decays into $\pi\pi$ only and $a_0(980)$ into $\eta\pi$ only.
- 66 AMBROSINO 07A reports $[\Gamma(\phi(1020) \rightarrow \eta'(958)\gamma)/\Gamma_{\text{total}}] / [B(\phi(1020) \rightarrow \eta\gamma)] = (4.77 \pm 0.09 \pm 0.19) \times 10^{-3}$ which we multiply by our best value $B(\phi(1020) \rightarrow \eta\gamma) = (1.309 \pm 0.024) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.
- 67 Averaging AULCHENKO 03B with AULCHENKO 99.
- 68 Using $B(\phi \rightarrow \eta\gamma) = (1.297 \pm 0.033)\%$.
- 69 Using the value $B(\phi \rightarrow \eta\gamma) = (1.26 \pm 0.06) \times 10^{-2}$.
- 70 Using $B(\phi \rightarrow K_L^0 K_S^0) = (33.8 \pm 0.6)\%$.
- 71 Averaging AKHMETSHIN 00B with AKHMETSHIN 00F.
- 72 Using the value $B(\eta' \rightarrow \eta\pi^+\pi^-) = (43.7 \pm 1.5) \times 10^{-2}$ and $B(\eta \rightarrow \gamma\gamma) = (39.25 \pm 0.31) \times 10^{-2}$.
- 73 Using various branching ratios of K_S^0 , K_L^0 , η , η' from the 2000 edition (The European Physical Journal **C15** 1 (2000)) of this Review.
- 74 From the decay mode $\eta' \rightarrow \eta\pi^+\pi^-$, $\eta \rightarrow \gamma\gamma$.
- 75 Superseded by AKHMETSHIN 00B.
- 76 For $E_\gamma > 20$ MeV.
- 77 For a narrow vector U with mass between 5 and 470 MeV, from the combined analysis of $\eta \rightarrow \pi^+\pi^-\pi^0$ and $\eta \rightarrow \pi^0\pi^0\pi^0$ from ARCHILLI 12. Measured 90% CL limits as a function of m_U range from 2.2×10^{-8} to 10^{-6} .

NODE=M004R;LINKAGE=5H

NODE=M004R32;LINKAGE=AM
 NODE=M004R;LINKAGE=C1
 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 $\phi \rightarrow \pi^+\pi^-\pi^0$

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

NODE=M004D1

NODE=M004D1

VALUE (units 10^{-2})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
9.1±1.2 OUR AVERAGE					
$10.1 \pm 4.4 \pm 1.7$	80k		¹ AKHMETSHIN 06	CMD2	$1.017-1.021 e^+e^- \rightarrow \pi^+\pi^-\pi^0$
$9.0 \pm 1.1 \pm 0.6$	1.98M		^{2,3} ALOISIO	03 KLOE	$1.02 e^+e^- \rightarrow \pi^+\pi^-\pi^0$

NODE=M004D1

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

$-6 < a_1 < 6$	500k		³ ACHASOV	02 SND	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
$-16 < a_1 < 11$	90	9.8k	^{1,4} AKHMETSHIN 98	CMD2	$e^+e^- \rightarrow \pi^+\pi^-\gamma\gamma$

¹ Dalitz plot analysis taking into account interference between the contact and $\rho\pi$ amplitudes.

² From a fit without limitations on charged and neutral ρ masses and widths.

³ Recalculated by us to match the notations of AKHMETSHIN 98.

⁴ Assuming zero phase for the contact term.

NODE=M004D1;LINKAGE=AK

NODE=M004D;LINKAGE=L1
 NODE=M004D;LINKAGE=L3
 NODE=M004D1;LINKAGE=KL

$\phi(1020)$ REFERENCES

NODE=M004

BABUSCI	13B	PL B720 111	D. Babusci <i>et al.</i>	(KLOE-2 Collab.)	REFID=55068
BENAYOUN	13	EPJ C73 2453	M. Benayoun, P. David, L. DelBuono	(PARIN, BERLIN+)	REFID=55357
LEES	13Q	PR D88 032013	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=55404
ARCHILLI	12	PL B706 251	F. Archilli <i>et al.</i>	(KLOE-2 Collab.)	REFID=53951
BENAYOUN	12	EPJ C72 1848	M. Benayoun <i>et al.</i>		REFID=54281
NIECKNIG	12	EPJ C72 2014	F. Niecknig, B. Kubis, S.P. Schneider	(BONN)	REFID=54305
AKHMETSHIN	11	PL B695 412	R. Akhmetshin <i>et al.</i>	(CMD2 Collab.)	REFID=53645
ACHASOV	10A	PR D81 057102	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=53352
BENAYOUN	10	EPJ C65 211	M. Benayoun <i>et al.</i>		REFID=53212
AMBROSINO	09C	PL B679 10	F. Ambrosino <i>et al.</i>	(KLOE Collab.)	REFID=52969
AMBROSINO	09F	PL B681 5	F. Ambrosino <i>et al.</i>	(KLOE Collab.)	REFID=53105
AKHMETSHIN	08	PL B669 217	R.R. Akhmetshin <i>et al.</i>	(CMD-2 Collab.)	REFID=52572
AMBROSINO	08G	PL B669 223	F. Ambrosino <i>et al.</i>	(KLOE Collab.)	REFID=52573
AULCHENKO	08	JETPL 88 85	V. Aulchenko <i>et al.</i>	(CMD-2 Collab.)	REFID=52268
Translated from ZETFP 88 93.					
FLOREZ-BAEZ	08	PR D78 077301	F.V. Florez-Baez, G. Lopez Castro		REFID=52584
ACHASOV	07B	PR D76 077101	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=51942
AMBROSINO	07	EPJ C49 473	F. Ambrosino <i>et al.</i>	(KLOE Collab.)	REFID=51616
AMBROSINO	07A	PL B648 267	F. Ambrosino <i>et al.</i>	(KLOE Collab.)	REFID=51646
DUBYSKIY	07	PR D75 113001	S. Dubynskiy <i>et al.</i>		REFID=51719
ACHASOV	06A	PR D74 014016	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=51133
AKHMETSHIN	06	PL B642 203	R.R. Akhmetshin <i>et al.</i>	(CMD-2 Collab.)	REFID=51465
AKHMETSHIN	05	PL B605 26	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=50330
AMBROSINO	05	PL B608 199	F. Ambrosino <i>et al.</i>	(KLOE Collab.)	REFID=50453
AUBERT,B	05J	PR D72 052008	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=50824
AKHMETSHIN	04	PL B578 285	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=49609
AUBERT,B	04N	PR D70 072004	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=50184
ALOISIO	03	PL B561 55	A. Aloisio <i>et al.</i>	(KLOE Collab.)	REFID=49404
AULCHENKO	03B	JETP 97 24	V.M. Aulchenko <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=49613
Translated from ZETFP 124 28.					
ACHASOV	02	PR D65 032002	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=48549
ACHASOV	02D	JETPL 75 449	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=48814
Translated from ZETFP 75 539.					
ALOISIO	02C	PL B536 209	A. Aloisio <i>et al.</i>	(KLOE Collab.)	REFID=48823
ALOISIO	02D	PL B537 21	A. Aloisio <i>et al.</i>	(KLOE Collab.)	REFID=48824
ALOISIO	02E	PL B541 45	A. Aloisio <i>et al.</i>	(KLOE Collab.)	REFID=48825
FISCHBACH	02	PL B526 355	E. Fischbach, A.W. Overhauser, B. Woodahl		REFID=48575
GOKALP	02	JP G28 2783	A. Gokalp <i>et al.</i>		REFID=49167
ACHASOV	01B	PL B504 275	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=48111
ACHASOV	01E	PR D63 072002	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=48311
ACHASOV	01F	PR D63 094007	N.N. Achasov, V.V. Gubin	(Novosibirsk SND Collab.)	REFID=48312
ACHASOV	01G	PRL 86 1698	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=48315
AITALA	01B	PRL 86 770	E.M. Aitala <i>et al.</i>	(FNAL E791 Collab.)	REFID=48005
AKHMETSHIN	01	PL B501 191	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=48110
AKHMETSHIN	01B	PL B509 217	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=48167
AKHMETSHIN	01C	PL B503 237	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=48323
BENAYOUN	01	EPJ C22 503	M. Benayoun, H.B. O'Connell		REFID=48570
ACHASOV	00	EPJ C12 25	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47417
ACHASOV	00B	JETP 90 17	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47425
Translated from ZETFP 117 22.					
ACHASOV	00C	PL B474 188	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47431
ACHASOV	00D	JETPL 72 282	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47882
Translated from ZETFP 72 411.					
ACHASOV	00E	NP B569 158	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47927
ACHASOV	00F	PL B479 53	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47928
ACHASOV	00H	PL B485 349	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47930
AKHMETSHIN	00B	PL B473 337	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=47422
AKHMETSHIN	00E	PL B491 81	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=47936
AKHMETSHIN	00F	PL B494 26	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=47937
AULCHENKO	00A	JETP 90 927	V.M. Aulchenko <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47953
Translated from ZETFP 117 1067.					
BRAMON	00	PL B486 406	A. Bramon <i>et al.</i>		REFID=47969
PDG	00	EPJ C15 1	D.E. Groom <i>et al.</i>	(PDG Collab.)	REFID=47469
ACHASOV	99	PL B449 122	M.N. Achasov <i>et al.</i>		REFID=46896
ACHASOV	99C	PL B456 304	M.N. Achasov <i>et al.</i>		REFID=46939
AKHMETSHIN	99B	PL B462 371	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=47392
AKHMETSHIN	99C	PL B462 380	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=47393
AKHMETSHIN	99D	PL B466 385	R.R. Akhmetshin <i>et al.</i>		REFID=47397
Also					
AKHMETSHIN	99F	PL B508 217 (errata)	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=48328
AULCHENKO	99	PL B460 242	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=47473
Translated from ZETFP 69 87.					
ACHASOV	98B	PL B438 441	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=46317
ACHASOV	98F	JETPL 68 573	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=46321
ACHASOV	98I	PL B440 442	M.N. Achasov <i>et al.</i>		REFID=46600
AKHMETSHIN	98	PL B434 426	R.R. Akhmetshin <i>et al.</i>	(CMD-2 Collab.)	REFID=46325
AULCHENKO	98	PL B436 199	V.M. Aulchenko <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=46336
BARBERIS	98	PL B432 436	D. Barberis <i>et al.</i>	(Omega Expt.)	REFID=46344
AKHMETSHIN	97B	PL B415 445	R.R. Akhmetshin <i>et al.</i>	(NOVO, BOST, PITT+)	REFID=45801
AKHMETSHIN	97C	PL B415 452	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=45802
BENAYOUN	96	ZPHY C72 221	M. Benayoun <i>et al.</i>	(IPNP, NOVO)	REFID=45753
AKHMETSHIN	95	PL B364 199	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=44617
DOLINSKY	91	PRPL 202 99	S.I. Dolinsky <i>et al.</i>	(NOVO)	REFID=41369
KUHN	90	ZPHY C48 445	J.H. Kuhn <i>et al.</i>	(MPIM)	REFID=45862
ACHASOV	89	NP B315 465	N.N. Achasov, V.N. Ivanchenko		REFID=48021
DOLINSKY	89	ZPHY C42 511	S.I. Dolinsky <i>et al.</i>	(NOVO)	REFID=41003
BARKOV	88	SJNP 47 248	L.M. Barkov <i>et al.</i>	(NOVO)	REFID=41024
Translated from YAF 47 393.					
DOLINSKY	88	SJNP 48 277	S.I. Dolinsky <i>et al.</i>	(NOVO)	REFID=41022
Translated from YAF 48 442.					
DRUZHININ	87	ZPHY C37 1	V.P. Druzhinin <i>et al.</i>	(NOVO)	REFID=40448
ARMSTRONG	86	PL 166B 245	T.A. Armstrong <i>et al.</i>	(ATHU, BARI, BIRM+)	REFID=20563
ATKINSON	86	ZPHY C30 521	M. Atkinson <i>et al.</i>	(BONN, CERN, GLAS+)	REFID=20564
BEBEK	86	PRL 56 1893	C. Bebek <i>et al.</i>	(CLEO Collab.)	REFID=11540
DAVENPORT	86	PR D33 2519	T.F. Davenport	(TUFTS, ARIZ, FNAL, FSU, NDAM+)	REFID=20567
DIJKSTRA	86	ZPHY C31 375	H. Dijkstra <i>et al.</i>	(ANIK, BRIS, CERN+)	REFID=20568
FRAME	86	NP B276 667	D. Frame <i>et al.</i>	(GLAS)	REFID=20569
GOLUBEV	86	SJNP 44 409	V.B. Golubev <i>et al.</i>	(NOVO)	REFID=40449
Translated from YAF 44 633.					

ALBRECHT	85D	PL 153B 343	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=20562
GOLUBEV	85	SJNP 41 756	V.B. Golubev <i>et al.</i>	(NOVO)	REFID=40450
		Translated from YAF 41 1183.			
DRUZHININ	84	PL 144B 136	V.P. Druzhinin <i>et al.</i>	(NOVO)	REFID=20561
ARMSTRONG	83B	NP B224 193	T.A. Armstrong <i>et al.</i>	(BARI, BIRM, CERN+)	REFID=20558
BARATE	83	PL 121B 449	R. Barate <i>et al.</i>	(SACL, LOIC, SHMP, IND)	REFID=12177
KURDADZE	83C	JETPL 38 366	L.M. Kurdadze <i>et al.</i>	(NOVO)	REFID=20560
		Translated from ZETFP 38 306.			
ARENTON	82	PR D25 2241	M.W. Arenton <i>et al.</i>	(ANL, ILL)	REFID=20556
PELLINEN	82	PS 25 599	A. Pellinen, M. Roos	(HELS)	REFID=20557
DAUM	81	PL 100B 439	C. Daum <i>et al.</i>	(AMST, BRIS, CERN, CRAC+)	REFID=20552
IVANOV	81	PL 107B 297	P.M. Ivanov <i>et al.</i>	(NOVO)	REFID=20553
Also		Private Comm.	S.I. Eidelman	(NOVO)	REFID=20554
VASSERMAN	81	PL 99B 62	I.B. Vasserman <i>et al.</i>	(NOVO)	REFID=20555
Also		SJNP 35 240	L.M. Kurdadze <i>et al.</i>		REFID=47475
		Translated from YAF 35 352.			
CORDIER	80	NP B172 13	A. Cordier <i>et al.</i>	(LALO)	REFID=20240
CORDIER	79	PL 81B 389	A. Cordier <i>et al.</i>	(LALO)	REFID=20549
BUKIN	78B	SJNP 27 521	A.D. Bukin <i>et al.</i>	(NOVO)	REFID=20545
		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. Stottlemeyer	(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

$b_1(1235)$

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

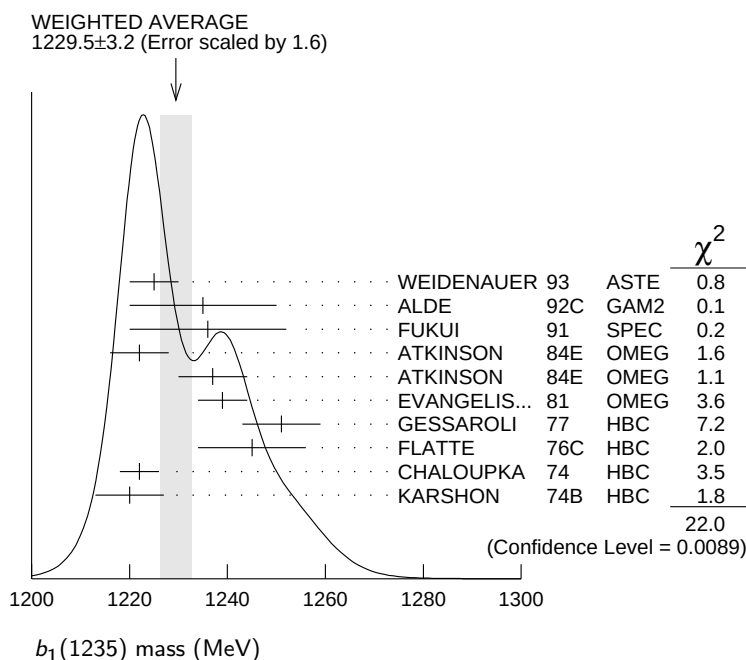
NODE=M011

 $b_1(1235)$ 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 $\pi^+ Z \rightarrow Z\pi\omega$

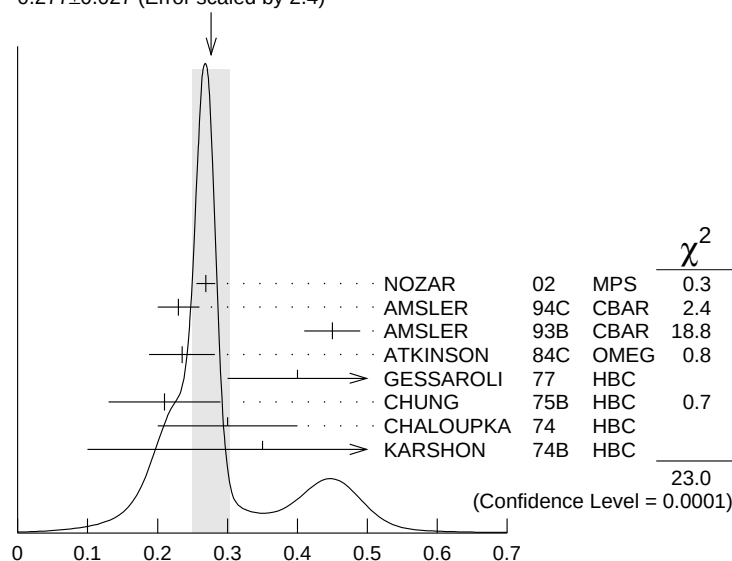
NODE=M011220

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

$a_1(1260)$

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

See also our review under the $a_1(1260)$ in PDG 06, Journal of Physics (generic for all A,B,E,G) **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

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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

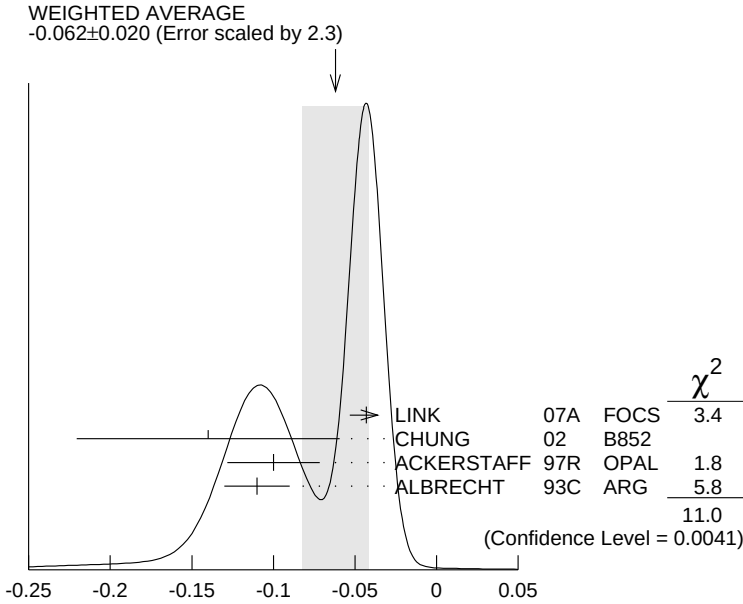
D-wave/S-wave AMPLITUDE RATIO IN DECAY OF a₁(1260) → ρπ

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. Ackerstaff <i>et al.</i>	(OPAL Collab.)
BUSKULIC	96	ZPHY C70 579	D. Buskulic <i>et al.</i>	(ALEPH Collab.)
AKERS	95P	ZPHY C67 45	R. Akers <i>et al.</i>	(OPAL Collab.)
ALAM	94	PR D50 43	M.S. Alam <i>et al.</i>	(CLEO Collab.)
ALBRECHT	93C	ZPHY C58 61	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
DECKER	93A	ZPHY C58 445	R. Decker <i>et al.</i>	
ANDO	92	PL B291 496	A. Ando <i>et al.</i>	(KEK, KYOT, NIRS, SAGA+)
KUHN	92	ZPHY C56 661	J.H. Kuhn, E. Mirkes	
IVANOV	91	ZPHY C49 563	Y.P. Ivanov, A.A. Osipov, M.K. Volkov	(JINR)
ARMSTRONG	90	ZPHY C48 213	T.A. Armstrong, M. Benayoun, W. Beusch	(WA76 Coll.)
FEINDT	90	ZPHY C48 681	M. Feindt	(HAMB)
KUHN	90	ZPHY C48 445	J.H. Kuhn <i>et al.</i>	(MPIM)
ISGUR	89	PR D39 1357	N. Isgur, C. Morningstar, C. Reader	(TNTO)
BOWLER	88	PL B209 99	M.G. Bowler	(OXF)
BAND	87	PL B198 297	H.R. Band <i>et al.</i>	(MAC Collab.)
TORNQVIST	87	ZPHY C36 695	N.A. Tornqvist	(HELS)
ALBRECHT	86B	ZPHY C33 7	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
RUCKSTUHL	86	PRL 56 2132	W. Ruckstuhl <i>et al.</i>	(DELCO Collab.)
SCHMIDKE	86	PRL 57 527	W.B. Schmidke <i>et al.</i>	(Mark II Collab.)
BELLINI	85	SJNP 41 781	D. Bellini <i>et al.</i>	
Translated from YAF 41 1223.				
ZIELINSKI	84C	PRL 52 1195	M. Zielinski <i>et al.</i>	(ROCH, MINN, FNAL)
LONGACRE	82	PR D26 82	R.S. Longacre	(BNL)
DANKOWY...	81	PRL 46 580	J.A. 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 B9B 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

REFID=53356
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REFID=20882
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 REFID=20572
 REFID=20872
 REFID=20868
 REFID=20852
 REFID=20571

$f_2(1270)$

$$I^G(J^{PC}) = 0^+(2^{++})$$

NODE=M005

 $f_2(1270)$ MASS

NODE=M005M

NODE=M005M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1275.1 ± 1.2 OUR AVERAGE Error includes scale factor of 1.1.				
1262 $\pm \frac{1}{2}$ ±8		ABLIKIM	06V	BES2 $e^+e^- \rightarrow J/\psi \rightarrow \gamma\pi^+\pi^-$
1275 ±15		ABLIKIM	05	BES2 $J/\psi \rightarrow \phi\pi^+\pi^-$
1283 ±5		ALDE	98	GAM4 $100\pi^-p \rightarrow \pi^0\pi^0n$
1278 ±5		¹ BERTIN	97C	OBLX $0.0\bar{p}p \rightarrow \pi^+\pi^-\pi^0$
1272 ±8	200k	PROKOSHKIN	94	GAM2 $38\pi^-p \rightarrow \pi^0\pi^0n$
1269.7 ±5.2	5730	AUGUSTIN	89	DM2 $e^+e^- \rightarrow 5\pi$
1283 ±8	400	² ALDE	87	GAM4 $100\pi^-p \rightarrow 4\pi^0n$
1274 ±5		² AUGUSTIN	87	DM2 $J/\psi \rightarrow \gamma\pi^+\pi^-$
1283 ±6		³ LONGACRE	86	MPS $22\pi^-p \rightarrow n2K_S^0$
1276 ±7		COURAU	84	DLCO $e^+e^- \rightarrow e^+e^-\pi^+\pi^-$
1273.3 ±2.3		⁴ CHABAUD	83	ASPK $17\pi^-p$ polarized
1280 ±4		⁵ CASON	82	STRC $8\pi^+p \rightarrow \Delta^{++}\pi^0\pi^0$
1281 ±7	11600	GIDAL	81	MRK2 J/ψ decay
1282 ±5		⁶ CORDEN	79	OMEG $12-15\pi^-p \rightarrow n2\pi$
1269 ±4	10k	APEL	75	NICE $40\pi^-p \rightarrow n2\pi^0$
1272 ±4	4600	ENGLER	74	DBC $6\pi^+n \rightarrow \pi^+\pi^-p$
1277 ±4	5300	FLATTE	71	HBC $7.0\pi^+p$
1273 ±8		² STUNTEBECK	70	HBC $8\pi^-p, 5.4\pi^+d$
1265 ±8		BOESEBECK	68	HBC $8\pi^+p$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1270 ±8		⁷ ANISOVICH	09	RVUE $0.0\bar{p}p, \pi N$
1277 ±6	870	⁸ SCHEGELSKY	06A	RVUE $\gamma\gamma \rightarrow K_S^0 K_S^0$
1251 ±10		TIKHOMIROV	03	SPEC $40.0\pi^-C \rightarrow K_S^0 K_S^0 K_L^0 X$
1260 ±10		⁹ ALDE	97	GAM2 $450pp \rightarrow pp\pi^0\pi^0$
1278 ±6		⁹ GRYGOREV	96	SPEC $40\pi^-N \rightarrow K_S^0 K_S^0 X$
1262 ±11		AGUILAR-...	91	EHS $400pp$
1275 ±10		AKER	91	CBAR $0.0\bar{p}p \rightarrow 3\pi^0$
1220 ±10		BREAKSTONE	90	SFM $pp \rightarrow pp\pi^+\pi^-$
1288 ±12		ABACHI	86B	HRS $e^+e^- \rightarrow \pi^+\pi^-X$
1284 ±30	3k	BINON	83	GAM2 $38\pi^-p \rightarrow n2\eta$
1280 ±20	3k	APEL	82	CNTR $25\pi^-p \rightarrow n2\pi^0$
1284 ±10	16000	DEUTSCH...	76	HBC $16\pi^+p$
1258 ±10	600	TAKAHASHI	72	HBC $8\pi^-p \rightarrow n2\pi$
1275 ±13		ARMENISE	70	HBC $9\pi^+n \rightarrow p\pi^+\pi^-$
1261 ±5	1960	² ARMENISE	68	DBC $5.1\pi^+n \rightarrow p\pi^+MM^-$
1270 ±10	360	² ARMENISE	68	DBC $5.1\pi^+n \rightarrow p\pi^0MM$
1268 ±6		¹⁰ JOHNSON	68	HBC $3.7-4.2\pi^-p$

¹ T-matrix pole.² Mass errors enlarged by us to $\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.³ From a partial-wave analysis of data using a K-matrix formalism with 5 poles.⁴ From an energy-independent partial-wave analysis.⁵ From an amplitude analysis of the reaction $\pi^+\pi^- \rightarrow 2\pi^0$.⁶ From an amplitude analysis of $\pi^+\pi^- \rightarrow \pi^+\pi^-$ scattering data.⁷ 4-poles, 5-channel K matrix fit.⁸ From analysis of L3 data at 91 and 183–209 GeV.⁹ Systematic uncertainties not estimated.¹⁰ JOHNSON 68 includes BONDAR 63, LEE 64, DERADO 65, EISNER 67.

OCCUR=2

OCCUR=2

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=AN

NODE=M005M;LINKAGE=SC

NODE=M005M;LINKAGE=QQ

NODE=M005M;LINKAGE=J

 $f_2(1270)$ WIDTH

NODE=M005W

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT

NODE=M005W

185.1^{+2.9}_{-2.4} OUR FIT Error includes scale factor of 1.5.

184.2^{+4.0}_{-2.4} OUR AVERAGE Error includes scale factor of 1.5. See the ideogram below.

175	± 6		ABLIKIM	06V	BES2	$e^+e^- \rightarrow J/\psi \rightarrow \gamma\pi^+\pi^-$
190	± 20		ABLIKIM	05	BES2	$J/\psi \rightarrow \phi\pi^+\pi^-$
171	± 10		ALDE	98	GAM4	$100\pi^-p \rightarrow \pi^0\pi^0n$
204	± 20		11 BERTIN	97C	OBLX	$0.0\bar{p}p \rightarrow \pi^+\pi^-\pi^0$
192	± 5	200k	PROKOSHKIN	94	GAM2	$38\pi^-p \rightarrow \pi^0\pi^0n$
180	± 24		AGUILAR-...	91	EHS	400 pp
169	± 9	5730	12 AUGUSTIN	89	DM2	$e^+e^- \rightarrow 5\pi$
150	± 30	400	12 ALDE	87	GAM4	$100\pi^-p \rightarrow 4\pi^0n$
186	± 9		13 LONGACRE	86	MPS	$22\pi^-p \rightarrow n2K_S^0$
179.2 ^{+6.9} _{-6.6}			14 CHABAUD	83	ASPK	$17\pi^-p$ polarized
160	± 11		DENNEY	83	LASS	$10\pi^+N$
196	± 10	3k	APEL	82	CNTR	$25\pi^-p \rightarrow n2\pi^0$
152	± 9		15 CASON	82	STRC	$8\pi^+p \rightarrow \Delta^{++}\pi^0\pi^0$
186	± 27	11600	GIDAL	81	MRK2	J/ψ decay
216	± 13		16 CORDEN	79	OMEG	$12-15\pi^-p \rightarrow n2\pi$
190	± 10	10k	APEL	75	NICE	$40\pi^-p \rightarrow n2\pi^0$
192	± 16	4600	ENGLER	74	DBC	$6\pi^+n \rightarrow \pi^+\pi^-p$
183	± 15	5300	FLATTE	71	HBC	$7\pi^+p \rightarrow \Delta^{++}f_2$
196	± 30		12 STUNTEBECK	70	HBC	$8\pi^-p, 5.4\pi^+d$
216	± 20	1960	12 ARMENISE	68	DBC	$5.1\pi^+n \rightarrow p\pi^+MM^-$
128	± 27		12 BOESEBECK	68	HBC	$8\pi^+p$
176	± 21		12,17 JOHNSON	68	HBC	$3.7-4.2\pi^-p$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
194	± 36		18 ANISOVICH	09	RVUE	$0.0\bar{p}p, \pi N$
195	± 15	870	19 SCHEGELSKY	06A	RVUE	$\gamma\gamma \rightarrow K_S^0 K_S^0$
121	± 26		TIKHOMIROV	03	SPEC	$40.0\pi^-C \rightarrow K_S^0 K_S^0 K_L^0 X$
187	± 20		20 ALDE	97	GAM2	$450pp \rightarrow pp\pi^0\pi^0$
184	± 10		20 GRYGOREV	96	SPEC	$40\pi^-N \rightarrow K_S^0 K_S^0 X$
200	± 10		AKER	91	CBAR	$0.0\bar{p}p \rightarrow 3\pi^0$
240	± 40	3k	BINON	83	GAM2	$38\pi^-p \rightarrow n2\eta$
187	± 30	650	12 ANTIPOV	77	CIBS	$25\pi^-p \rightarrow p3\pi$
225	± 38	16000	DEUTSCH...	76	HBC	$16\pi^+p$
166	± 28	600	12 TAKAHASHI	72	HBC	$8\pi^-p \rightarrow n2\pi$
173	± 53		12 ARMENISE	70	HBC	$9\pi^+n \rightarrow p\pi^+\pi^-$

OCCUR=2

OCCUR=2

11 T-matrix pole.

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

13 From a partial-wave analysis of data using a K-matrix formalism with 5 poles.

14 From an energy-independent partial-wave analysis.

15 From an amplitude analysis of the reaction $\pi^+\pi^- \rightarrow 2\pi^0$.16 From an amplitude analysis of $\pi^+\pi^- \rightarrow \pi^+\pi^-$ scattering data.

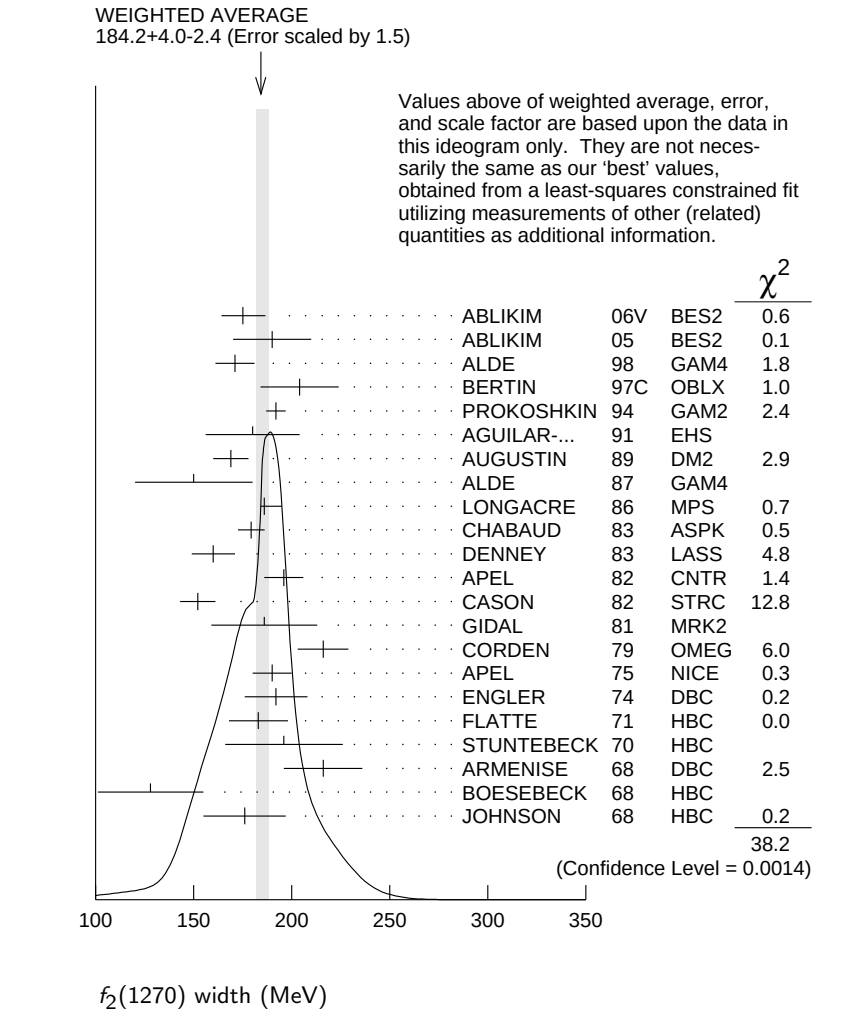
17 JOHNSON 68 includes BONDAR 63, LEE 64, DERADO 65, EISNER 67.

18 4-poles, 5-channel K matrix fit.

19 From analysis of L3 data at 91 and 183–209 GeV.

20 Systematic uncertainties not estimated.

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



$f_2(1270)$ DECAY MODES

Mode		Fraction (Γ_i/Γ)	Scale factor/ Confidence level
Γ_1	$\pi\pi$	$(84.8^{+2.4}_{-1.2})\%$	S=1.2
Γ_2	$\pi^+\pi^-2\pi^0$	$(7.1^{+1.4}_{-2.7})\%$	S=1.3
Γ_3	$K\bar{K}$	$(4.6\pm0.4)\%$	S=2.8
Γ_4	$2\pi^+2\pi^-$	$(2.8\pm0.4)\%$	S=1.2
Γ_5	$\eta\eta$	$(4.0\pm0.8)\times10^{-3}$	S=2.1
Γ_6	$4\pi^0$	$(3.0\pm1.0)\times10^{-3}$	
Γ_7	$\gamma\gamma$	$(1.64\pm0.19)\times10^{-5}$	S=1.9
Γ_8	$\eta\pi\pi$	$<8\times10^{-3}$	CL=95%
Γ_9	$K^0K^-\pi^++\text{c.c.}$	$<3.4\times10^{-3}$	CL=95%
Γ_{10}	e^+e^-	$<6\times10^{-10}$	CL=90%

NODE=M005215;NODE=M005

DESIG=1

DESIG=3

DESIG=4

DESIG=2

DESIG=7

DESIG=9

DESIG=8

DESIG=6

DESIG=5

DESIG=10

CONSTRAINED FIT INFORMATION

An overall fit to the total width, 4 partial widths, a combination of partial widths obtained from integrated cross sections, and 6 branching ratios uses 44 measurements and one constraint to determine 8 parameters. The overall fit has a $\chi^2 = 81.8$ for 37 degrees of freedom.

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

x_2	−91						
x_3	11	−39					
x_4	10	−37	1				
x_5	1	−6	0	0			
x_6	0	−7	0	0	0		
x_7	8	−5	−6	1	0	0	
Γ	−78	71	−11	−8	−1	0	−11
	x_1	x_2	x_3	x_4	x_5	x_6	x_7

Mode	Rate (MeV)	Scale factor
Γ_1 $\pi\pi$	156.9 $^{+4.0}_{-1.2}$	
Γ_2 $\pi^+\pi^-2\pi^0$	13.2 $^{+2.8}_{-5.0}$	1.3
Γ_3 $K\bar{K}$	8.5 ± 0.8	2.9
Γ_4 $2\pi^+2\pi^-$	5.2 ± 0.7	1.2
Γ_5 $\eta\eta$	0.74 ± 0.14	2.1
Γ_6 $4\pi^0$	0.55 ± 0.18	
Γ_7 $\gamma\gamma$	0.00303 ± 0.00035	1.9

$f_2(1270)$ PARTIAL WIDTHS

NODE=M005220

$\Gamma(\pi\pi)$

Γ_1

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT

NODE=M005W1
NODE=M005W1

156.9 $^{+4.0}_{-1.2}$ OUR FIT

157.0 $^{+6.0}_{-1.0}$ ²¹ LONGACRE 86 MPS 22 $\pi^- p \rightarrow n 2K_S^0$

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

152 ± 8 870 ²² SCHEGELSKY 06A RVUE $\gamma\gamma \rightarrow K_S^0 K_S^0$

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

Γ_3

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT

NODE=M005W4
NODE=M005W4

8.5 ± 0.8 OUR FIT Error includes scale factor of 2.9.

9.0 $^{+0.7}_{-0.3}$ ²¹ LONGACRE 86 MPS 22 $\pi^- p \rightarrow n 2K_S^0$

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

7.5 ± 2.0 870 ²² SCHEGELSKY 06A RVUE $\gamma\gamma \rightarrow K_S^0 K_S^0$

$\Gamma(\eta\eta)$

Γ_5

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT

NODE=M005W7
NODE=M005W7

0.74 ± 0.14 OUR FIT Error includes scale factor of 2.1.

1.0 ± 0.1 ²¹ LONGACRE 86 MPS 22 $\pi^- p \rightarrow n 2K_S^0$

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

1.8 ± 0.4 870 ²² SCHEGELSKY 06A RVUE $\gamma\gamma \rightarrow K_S^0 K_S^0$

$\Gamma(\gamma\gamma)$

Γ_7

The value of this width depends on the theoretical model used. Unitary approaches with scalars typically (with exception of PENNINGTON 08) give values clustering around 2.6 keV; without an S -wave contribution, values are systematically higher (typically around 3 keV).

NODE=M005W8
NODE=M005W8

VALUE (keV)	EVTs	DOCUMENT ID	TECN	COMMENT

NODE=M005W8

3.03 ± 0.35 OUR FIT Error includes scale factor of 1.9.

3.14 ± 0.20 ^{23,24} PENNINGTON 08 RVUE Compilation

OCCUR=2

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

3.82±0.30	24,25	PENNINGTON 08	RVUE	Compilation
2.55±0.15	870	22 SCHEGELSKY 06A	RVUE	$\gamma\gamma \rightarrow K_S^0 K_S^0$
2.84±0.35		BOGLIONE 99	RVUE	$\gamma\gamma \rightarrow \pi^+ \pi^-, \pi^0 \pi^0$
2.93±0.23±0.32	26	YABUKI 95	VNS	
2.58±0.13 ^{+0.36} _{-0.27}	27	BEHREND 92	CELL	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^-$
3.10±0.35±0.35	28	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	29	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	30	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	31	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	32	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	33	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	34	BERGER 80B	PLUT	$e^+ e^-$

OCCUR=3

OCCUR=2

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

Γ_{10}

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

NODE=M005W9
NODE=M005W9

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

<1.7	90	VOROBYEV 88	ND	$e^+ e^- \rightarrow \pi^0 \pi^0$
21	From a partial-wave analysis of data using a K-matrix formalism with 5 poles.			
22	From analysis of L3 data at 91 and 183–209 GeV and using SU(3) relations.			
23	Solution A (preferred solution based on χ^2 -analysis).			
24	Dispersion theory based amplitude analysis of BOYER 90, MARSISKE 90, BEHREND 92, and MORI 07.			
25	Solution B (worse than solution A; still acceptable when systematic uncertainties are included).			
26	With a narrow scalar state around 1220 MeV.			
27	Using a unitarized model with a 300 - 500 keV wide scalar at 1100 MeV.			
28	Using the unitarized model of LYTH 85.			
29	Error includes spread of different solutions. Data of MARK2 and CRYSTAL BALL used in the analysis. Authors report strong correlations with $\gamma\gamma$ width of $f_0(1370)$: $\Gamma(f_2) + 1/4 \Gamma(f^0) = 3.6 \pm 0.3$ KeV.			
30	Radiative corrections modify the partial widths; for instance the COURAU 84 value becomes 2.66 ± 0.21 in the calculation of LANDRO 86.			
31	Using the MENNESSIER 83 model.			
32	Superseded by BOYER 90.			
33	If helicity = 2 assumption is not made.			
34	Using mass, width and $B(f_2(1270) \rightarrow 2\pi)$ from PDG 78.			

NODE=M005PW;LINKAGE=L
NODE=M005W1;LINKAGE=SC
NODE=M005W8;LINKAGE=P1
NODE=M005W8;LINKAGE=P3

NODE=M005W8;LINKAGE=P2

NODE=M005W8;LINKAGE=YA
NODE=M005W;LINKAGE=B
NODE=M005W;LINKAGE=A
NODE=M005PW;LINKAGE=C

NODE=M005PW;LINKAGE=B

NODE=M005PW;LINKAGE=X
NODE=M005PW;LINKAGE=V
NODE=M005PW;LINKAGE=H
NODE=M005PW;LINKAGE=A

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

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

$\Gamma_3 \Gamma_7 / \Gamma$

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
0.139±0.019 OUR FIT	Error includes scale factor of 1.9.		
0.091±0.007±0.027	35	ALBRECHT 90G	ARG $e^+ e^- \rightarrow e^+ e^- K^+ K^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.104±0.007±0.072	36	ALBRECHT 90G	ARG $e^+ e^- \rightarrow e^+ e^- K^+ K^-$
35	Using an incoherent background.		
36	Using a coherent background.		

NODE=M005223

NODE=M005G1
NODE=M005G1

OCCUR=2

NODE=M005G1;LINKAGE=A
NODE=M005G1;LINKAGE=K

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

$\Gamma_5 \Gamma_7 / \Gamma$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
11.5^{+1.8+4.5}_{-2.0-3.7}	37	UEHARA 10A	BELL $10.6 e^+ e^- \rightarrow e^+ e^- \eta\eta$

NODE=M005G02
NODE=M005G02

37 Including interference with the $f_2'(1525)$ (parameters fixed to the values from the 2008 edition of this review, PDG 08) and $f_0(\Upsilon)$.

NODE=M005G02;LINKAGE=UE

Helicity-0/Helicity-2 RATIO IN $\gamma\gamma \rightarrow f_2(1270) \rightarrow \pi\pi$

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
$3.7 \pm 0.3^{+15.9}_{-2.9}$	UEHARA	08A BELL	$10.6 e^+ e^- \rightarrow e^+ e^- \pi^0 \pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
13	38,39 PENNINGTON 08	RVUE	Compilation
26	39,40 PENNINGTON 08	RVUE	Compilation
38 Solution A (preferred solution based on χ^2 -analysis).			
39 Dispersion theory based amplitude analysis of BOYER 90, MARSISKE 90, BEHREND 92, and MORI 07.			
40 Solution B (worse than solution A; still acceptable when systematic uncertainties are included).			

NODE=M005HR0
NODE=M005HR0

OCCUR=2
OCCUR=3

NODE=M005HR0;LINKAGE=P1
NODE=M005HR0;LINKAGE=P3

NODE=M005HR0;LINKAGE=P2

 $f_2(1270)$ BRANCHING RATIOS

$\Gamma(\pi\pi)/\Gamma_{\text{total}}$	VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_1/Γ
$0.848^{+0.024}_{-0.012}$ OUR FIT	Error includes scale factor of 1.2.					
0.837 ± 0.020 OUR AVERAGE						
0.849 ± 0.025			CHABAUD	83	ASPK	$17 \pi^- p$ polarized
0.85 ± 0.05	250		BEAUPRE	71	HBC	$8 \pi^+ p \rightarrow \Delta^{++} f_2$
0.8 ± 0.04	600		OH	70	HBC	$1.26 \pi^- p \rightarrow \pi^+ \pi^- n$

NODE=M005225

NODE=M005R10
NODE=M005R10

$\Gamma(\pi^+ \pi^- 2\pi^0)/\Gamma(\pi\pi)$	VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_2/Γ_1
Should be twice $\Gamma(2\pi^+ 2\pi^-)/\Gamma(\pi\pi)$ if decay is $\rho\rho$. (See ASCOLI 68D.)						
$0.084^{+0.018}_{-0.033}$ OUR FIT	Error includes scale factor of 1.3.					
0.15 ± 0.06	600		EISENBERG	74	HBC	$4.9 \pi^+ p \rightarrow \Delta^{++} f_2$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
0.07			EMMS	75D	DBC	$4 \pi^+ n \rightarrow p f_2$

NODE=M005R2

NODE=M005R2
NODE=M005R2

$\Gamma(K\bar{K})/\Gamma(\pi\pi)$	VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_3/Γ_1
We average only experiments which either take into account $f_2(1270)$ - $a_2(1320)$ interference explicitly or demonstrate that $a_2(1320)$ production is negligible.						
$0.054^{+0.005}_{-0.006}$ OUR FIT	Error includes scale factor of 2.8.					
$0.041^{+0.004}_{-0.005}$ OUR AVERAGE						
0.045 ± 0.01			41 BARGIOTTI	03	OBLX	$\bar{p}p$
$0.037^{+0.008}_{-0.021}$			ETKIN	82B	MPS	$23 \pi^- p \rightarrow n 2K_S^0$
0.045 ± 0.009			CHABAUD	81	ASPK	$17 \pi^- p$ polarized
0.039 ± 0.008			LOVERRE	80	HBC	$4 \pi^- p \rightarrow K\bar{K}N$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
0.052 ± 0.025			ABLIKIM	04E	BES2	$J/\psi \rightarrow \omega K^+ K^-$
0.036 ± 0.005			42 COSTA...	80	OMEG	$1-2.2 \pi^- p \rightarrow K^+ K^- n$
0.030 ± 0.005			43 MARTIN	79	RVUE	
0.027 ± 0.009			44 POLYCHRO...	79	STRC	$7 \pi^- p \rightarrow n 2K_S^0$
0.025 ± 0.015			EMMS	75D	DBC	$4 \pi^+ n \rightarrow p f_2$
0.031 ± 0.012	20		ADERHOLZ	69	HBC	$8 \pi^+ p \rightarrow K^+ K^- \pi^+ p$

NODE=M005R3

NODE=M005R3

NODE=M005R3

$\Gamma(2\pi^+ 2\pi^-)/\Gamma(\pi\pi)$	VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_4/Γ_1
0.033 ± 0.005 OUR FIT	Error includes scale factor of 1.2.					
0.033 ± 0.004 OUR AVERAGE	Error includes scale factor of 1.1.					
0.024 ± 0.006	160		EMMS	75D	DBC	$4 \pi^+ n \rightarrow p f_2$
0.051 ± 0.025	70		EISENBERG	74	HBC	$4.9 \pi^+ p \rightarrow \Delta^{++} f_2$
$0.043^{+0.007}_{-0.011}$	285		LOUIE	74	HBC	$3.9 \pi^- p \rightarrow n f_2$
0.037 ± 0.007	154		ANDERSON	73	DBC	$6 \pi^+ n \rightarrow p f_2$
0.047 ± 0.013			OH	70	HBC	$1.26 \pi^- p \rightarrow \pi^+ \pi^- n$

NODE=M005R1
NODE=M005R1

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

VALUE (units 10^{-3})

DOCUMENT ID

TECN

COMMENT

4.0±0.8 OUR FIT Error includes scale factor of 2.1.**2.9±0.5 OUR AVERAGE**

2.7±0.7	BINON	05	GAMS	33 $\pi^- p \rightarrow \eta\eta n$
2.8±0.7	ALDE	86D	GAM4	100 $\pi^- p \rightarrow 2\eta n$
5.2±1.7	BINON	83	GAM2	38 $\pi^- p \rightarrow 2\eta n$

NODE=M005R7
 NODE=M005R7

$\Gamma(\eta\eta)/\Gamma(\pi\pi)$ Γ_5/Γ_1

VALUE

CL%

DOCUMENT ID

TECN

COMMENT

0.003±0.001

BARBERIS

00E

450 $p p \rightarrow p_f \eta \eta p_s$

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

<0.05	95	EDWARDS	82F	CBAL	$e^+ e^- \rightarrow e^+ e^- 2\eta$
<0.016	95	EMMS	75D	DBC	$4 \pi^+ n \rightarrow p f_2$
<0.09	95	EISENBERG	74	HBC	$4.9 \pi^+ p \rightarrow \Delta^{++} f_2$

NODE=M005R6
 NODE=M005R6

$\Gamma(4\pi^0)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE

EVTS

DOCUMENT ID

TECN

COMMENT

0.0030±0.0010 OUR FIT**0.003 ±0.001** 400 ± 50 ALDE 87 GAM4 100 $\pi^- p \rightarrow 4\pi^0 n$

NODE=M005R11
 NODE=M005R11

$\Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE (units 10^{-5})

DOCUMENT ID

TECN

COMMENT

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

$1.57 \pm 0.01^{+1.39}_{-0.14}$	UEHARA	08A	BELL	10.6 $e^+ e^- \rightarrow e^+ e^- \pi^0 \pi^0$

NODE=M005R13
 NODE=M005R13

$\Gamma(\eta\pi\pi)/\Gamma(\pi\pi)$ Γ_8/Γ_1

VALUE

CL%

DOCUMENT ID

TECN

COMMENT

<0.010

95

EMMS

75D

DBC

 $4 \pi^+ n \rightarrow p f_2$

NODE=M005R5
 NODE=M005R5

$\Gamma(K^0 K^- \pi^+ + \text{c.c.})/\Gamma(\pi\pi)$ Γ_9/Γ_1

VALUE

CL%

DOCUMENT ID

TECN

COMMENT

<0.004

95

EMMS

75D

DBC

 $4 \pi^+ n \rightarrow p f_2$

NODE=M005R4
 NODE=M005R4

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

VALUE (units 10^{-10})

CL%

DOCUMENT ID

TECN

COMMENT

<6

90

ACHASOV

00K

SND

 $e^+ e^- \rightarrow \pi^0 \pi^0$ ⁴¹ Coupled channel analysis of $\pi^+ \pi^- \pi^0$, $K^+ K^- \pi^0$, and $K^\pm K_S^0 \pi^\mp$.⁴² Re-evaluated by CHABAUD 83.⁴³ Includes PAWLICKI 77 data.⁴⁴ Takes into account the $f_2(1270)$ - $f_2'(1525)$ interference.

NODE=M005R12
 NODE=M005R12

NODE=M005R;LINKAGE=BG
 NODE=M005R3;LINKAGE=D
 NODE=M005R3;LINKAGE=F
 NODE=M005R3;LINKAGE=M

$f_2(1270)$ REFERENCES

NODE=M005

UEHARA	10A	PR D82 114031	S. Uehara <i>et al.</i>	(BELLE Collab.)	REFID=53641
ANISOVICH	09	IJMP A24 2481	V.V. Anisovich, A.V. Sarantsev		REFID=52719
PDG	08	PL B667 1	C. Amsler <i>et al.</i>	(PDG Collab.)	REFID=52166
PENNINGTON	08	EPJ C56 1	M.R. Pennington <i>et al.</i>		REFID=52303
UEHARA	08A	PR D78 052004	S. Uehara <i>et al.</i>	(BELLE Collab.)	REFID=52309
MORI	07	PR D75 051101	T. Mori <i>et al.</i>	(BELLE Collab.)	REFID=51652
ABLIKIM	06V	PL B642 441	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51507
SCHEGELSKY	06A	EPJ A27 207	V.A. Schegelsky <i>et al.</i>		REFID=51185
ABLIKIM	05	PL B607 243	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50450
BINON	05	PAN 68 960	F. Binon <i>et al.</i>		REFID=50780
		Translated from YAF 68 998.			
ABLIKIM	04E	PL B603 138	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50174
BARGIOTTI	03	EPJ C26 371	M. Bargiotti <i>et al.</i>	(OBELIX Collab.)	REFID=49217
TIKHOMIROV	03	PAN 66 828	G.D. Tikhomirov <i>et al.</i>		REFID=49423
		Translated from YAF 66 860.			
ACHASOV	00K	PL B492 8	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47933
BARBERIS	00E	PL B479 59	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=47961
BOGLIONE	99	EPJ C9 11	M. Boglione, M.R. Pennington		REFID=46931
ALDE	98	EPJ A3 361	D. Alde <i>et al.</i>	(GAM4 Collab.)	REFID=46605
Also		PAN 62 405	D. Alde <i>et al.</i>	(GAMS Collab.)	REFID=46914
		Translated from YAF 62 446.			
ALDE	97	PL B397 350	D.M. Alde <i>et al.</i>	(GAMS Collab.)	REFID=45392
BERTIN	97C	PL B408 476	A. Bertin <i>et al.</i>	(OBELIX Collab.)	REFID=45701
GRYGOREV	96	PAN 59 2105	V.K. Grigoriev, O.N. Baloshin, B.P. Barkov	(ITEP)	REFID=45566
		Translated from YAF 59 2187.			
YABUKI	95	JPSJ 64 435	F. Yabuki <i>et al.</i>	(VENUS Collab.)	REFID=46384
PROKOSHKIN	94	SPD 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
ALDE	87	Translated from YAF 48 436 PL B198 286	D.M. Alde <i>et al.</i>	(LANL, BRUX, SERP, LAPP)	REFID=40221
AUGUSTIN	87	ZPHY C36 369	J.E. Augustin <i>et al.</i>	(LALO, CLER, FRAS+)	REFID=40268
ABACHI	86B	PRL 57 1990	S. Abachi <i>et al.</i>	(PURD, ANL, IND, MICH+)	REFID=20394
AIHARA	86B	PRL 57 404	H. Aihara <i>et al.</i>	(TPC-2 γ Collab.)	REFID=20764
ALDE	86D	NP B269 485	D.M. Alde <i>et al.</i>	(BELG, LAPP, SERP, CERN+)	REFID=20765
LANDRO	86	PL B172 445	M. Landro, K.J. Mork, H.A. Olsen	(UTRO)	REFID=20767
LONGACRE	86	PL B177 223	R.S. Longacre <i>et al.</i>	(BNL, BRAN, CUNY+)	REFID=20768
LYTH	85	JP G11 459	D.H. Lyth		REFID=42169
BEHREND	84B	ZPHY C23 223	H.J. Behrend <i>et al.</i>	(CELLO Collab.)	REFID=20757
BERGER	84	ZPHY C26 199	C. Berger <i>et al.</i>	(PLUTO Collab.)	REFID=20760
COURAU	84	PL 147B 227	A. Courau <i>et al.</i>	(CIT, SLAC)	REFID=20758
SMITH	84C	PR D30 851	J.R. Smith <i>et al.</i>	(SLAC, LBL, HARV)	REFID=20759
BINON	83	NC 78A 313	F.G. Binon <i>et al.</i>	(BELG, LAPP, SERP+)	REFID=20750
Also		SJNP 38 561	F.G. Binon <i>et al.</i>	(BELG, LAPP, SERP+)	REFID=20751
CHABAUD	83	Translated from YAF 38 934 NP B223 1	V. Chabaud <i>et al.</i>	(CERN, CRAC, MPIM)	REFID=20131
DENNEY	83	PR D28 2726	D.L. Denney <i>et al.</i>	(IOWA, MICH)	REFID=20754
MENNESSIER	83	ZPHY C16 241	G. Mennessier	(MONP)	REFID=20393
APEL	82	NP B201 197	W.D. Apel <i>et al.</i>	(KARLK, KARLE, PISA, SERP+)	REFID=20745
CASON	82	PRL 48 1316	N.M. Cason <i>et al.</i>	(NDAM, ANL)	REFID=20746
EDWARDS	82F	PL 110B 82	C. Edwards <i>et al.</i>	(CIT, HARV, PRIN+)	REFID=20747
ETKIN	82B	PR D25 1786	A. Etkin <i>et al.</i>	(BNL, CUNY, TUFTS, VAND)	REFID=20390
BRANDELIK	81B	ZPHY C10 117	R. Brandelik <i>et al.</i>	(TASSO Collab.)	REFID=20741
CHABAUD	81	APP B12 575	V. Chabaud <i>et al.</i>	(CERN, CRAC, MPIM)	REFID=20742
GIDAL	81	PL 107B 153	G. Gidal <i>et al.</i>	(SLAC, LBL)	REFID=20386
ROUSSARIE	81	PL 105B 304	A. Roussarie <i>et al.</i>	(SLAC, LBL)	REFID=20388
BERGER	80B	PL 94B 254	C. Berger <i>et al.</i>	(PLUTO Collab.)	REFID=20736
COSTA...	80	NP B175 402	G. Costa de Beauregard <i>et al.</i>	(BARI, BONN+)	REFID=20737
LOVERRE	80	ZPHY C6 187	P.F. Loverre <i>et al.</i>	(CERN, CDEF, MADR+)	REFID=20382
CORDEN	79	NP B157 250	M.J. Corden <i>et al.</i>	(BIRM, RHEL, TELA+)	REFID=20374
MARTIN	79	NP B158 520	A.D. Martin, E.N. Ozmutlu	(DURH)	REFID=20377
POLYCHRO...	79	PR D19 1317	V.A. Polychronakos <i>et al.</i>	(NDAM, ANL)	REFID=20378
PDG	78	PL 75B 1	C. Bricman <i>et al.</i>		REFID=40124
ANTIPOV	77	NP B119 45	Y.M. Antipov <i>et al.</i>	(SERP, GEVA)	REFID=20728
PAWLICKI	77	PR D15 3196	A.J. Pawlicki <i>et al.</i>	(ANL)	REFID=20367
DEUTSCH...	76	NP B103 426	M. 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, TINTO) JP	REFID=20335
STUNTEBECK	70	PL 32B 391	P.H. Stuntebeck <i>et al.</i>	(NDAM)	REFID=20696
ADERHOLZ	69	NP B11 259	M. Aderholz <i>et al.</i>	(AACH3, BERL, CERN+)	REFID=20687
ARMENISE	68	NC 54A 999	N. Armenise <i>et al.</i>	(BARI, BGNA, FIRZ+)	REFID=20054
ASCOLI	68D	PRL 21 1712	G. Ascoli <i>et al.</i>	(ILL)	REFID=20681
BOESEBECK	68	NP B4 501	K. Boesebeck <i>et al.</i>	(AACH, BERL, CERN)	REFID=20585
JOHNSON	68	PR 176 1651	P.B. Johnson <i>et al.</i>	(NDAM, PURD, SLAC)	REFID=20065
EISNER	67	PR 164 1699	R.L. Eisner <i>et al.</i>	(PURD)	REFID=20046
DERADO	65	PRL 14 872	I. Derado <i>et al.</i>	(NDAM)	REFID=20668
LEE	64	PRL 12 342	Y.Y. Lee <i>et al.</i>	(MICH)	REFID=20663
BONDAR	63	PL 5 153	L. Bondar <i>et al.</i>	(AACH, BIRM, BONN, DESY+)	REFID=20657

$f_1(1285)$

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

NODE=M008

$f_1(1285)$ MASS

NODE=M008M

NODE=M008M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1281.9 ± 0.5 OUR AVERAGE		Error includes scale factor of 1.8. See the ideogram below.		
1281.16 ± 0.39 ± 0.45		¹ LEES	12X BABR	$\tau^- \rightarrow \pi^- f_1(1285) \nu_\tau$
1285.1 ± 1.0 $\begin{smallmatrix} +1.6 \\ -0.3 \end{smallmatrix}$		² ABLIKIM	11J BES3	$J/\psi \rightarrow \omega(\eta \pi^+ \pi^-)$
1281 ± 2 ± 1		AUBERT	07AU BABR	$10.6 e^+ e^- \rightarrow f_1(1285) \pi^+ \pi^- \gamma$
1276.1 ± 8.1 ± 8.0	203	BAI	04J BES2	$J/\psi \rightarrow \gamma \gamma \pi^+ \pi^-$
1274 ± 6	237	ABDALLAH	03H DLPH	$91.2 e^+ e^- \rightarrow K_S^0 K^\pm \pi^\mp + X$
1280 ± 4		ACCIARRI	01G L3	
1288 ± 4 ± 5	20k	ADAMS	01B B852	$18 \text{ GeV } \pi^- p \rightarrow K^+ K^- \pi^0 n$
1284 ± 6	1400	ALDE	97B GAM4	$100 \pi^- p \rightarrow \eta \pi^0 \pi^0 n$
1281 ± 1		BARBERIS	97B OMEG	$450 pp \rightarrow pp2(\pi^+ \pi^-)$
1281 ± 1		BARBERIS	97C OMEG	$450 pp \rightarrow pp K_S^0 K^\pm \pi^\mp$
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. ● ● ●				
1281.9 ± 0.5		⁵ SOSA	99 SPEC	$pp \rightarrow p_{\text{slow}} (K_S^0 K^+ \pi^-) p_{\text{fast}}$
1282.8 ± 0.6		⁵ SOSA	99 SPEC	$pp \rightarrow p_{\text{slow}} (K_S^0 K^- \pi^+) p_{\text{fast}}$
1270 ± 10		AMELIN	95 VES	$37 \pi^- N \rightarrow \pi^- \pi^+ \pi^- \gamma N$
1280 ± 2		ABATZIS	94 OMEG	$450 pp \rightarrow pp2(\pi^+ \pi^-)$
1282 ± 4		ARMSTRONG	93C E760	$p\bar{p} \rightarrow \pi^0 \eta \eta \rightarrow 6\gamma$
1270 ± 6 ± 10		ARMSTRONG	92C OMEG	$300 pp \rightarrow pp \pi^+ \pi^- \gamma$
1281 ± 1		ARMSTRONG	89E OMEG	$300 pp \rightarrow pp2(\pi^+ \pi^-)$
1279 ± 6 ± 10	16	BECKER	87 MRK3	$e^+ e^- \rightarrow \phi K \bar{K} \pi$
1286 ± 9		GIDAL	87 MRK2	$e^+ e^- \rightarrow e^+ e^- \eta \pi^+ \pi^-$
1287 ± 5	353	BITYUKOV	84B SPEC	$32 \pi^- p \rightarrow K^+ K^- \pi^0 n$
~ 1279		⁶ TORNQVIST	82B RVUE	
1275 ± 6	31	BROMBERG	80 SPEC	$100 \pi^- p \rightarrow K \bar{K} \pi X$
1288 ± 9	200	GURTU	79 HBC	$4.2 K^- p \rightarrow n \eta 2\pi$
~ 1275.0	46	⁷ STANTON	79 CNTR	$8.5 \pi^- p \rightarrow n 2\gamma 2\pi$
1271 ± 10	34	CORDEN	78 OMEG	$12-15 \pi^- p \rightarrow K^+ K^- \pi n$

OCCUR=2

1295 ±12	85	CORDEN	78	OMEG	12-15 $\pi^- p \rightarrow n5\pi$
1292 ±10	150	DEFOIX	72	HBC	0.7 $\bar{p}p \rightarrow 7\pi$
1280 ± 3	500	⁸ THUN	72	MMS	13.4 $\pi^- p$
1303 ± 8		BARDADIN...	71	HBC	8 $\pi^+ p \rightarrow p6\pi$
1283 ± 6		BOESEBECK	71	HBC	16.0 $\pi p \rightarrow p5\pi$
1270 ±10		CAMPBELL	69	DBC	2.7 $\pi^+ d$
1285 ± 7		LORSTAD	69	HBC	0.7 $\bar{p}p$, 4,5-body
1290 ± 7		D'ANDLAU	68	HBC	1.2 $\bar{p}p$, 5-6 body

OCCUR=2

¹ Using the $2\pi^+2\pi^-$ and $\pi^+\pi^-\eta$ modes of $f_1(1285)$ decay.

² The selected process is $J/\psi \rightarrow \omega a_0(980)\pi$.

³ Supersedes ABATZIS 94, ARMSTRONG 89E.

⁴ From partial wave analysis of $K^+ \bar{K}^0 \pi^-$ system.

⁵ No systematic error given.

⁶ From a unitarized quark-model calculation.

⁷ From phase shift analysis of $\eta\pi^+\pi^-$ system.

⁸ Seen in the missing mass spectrum.

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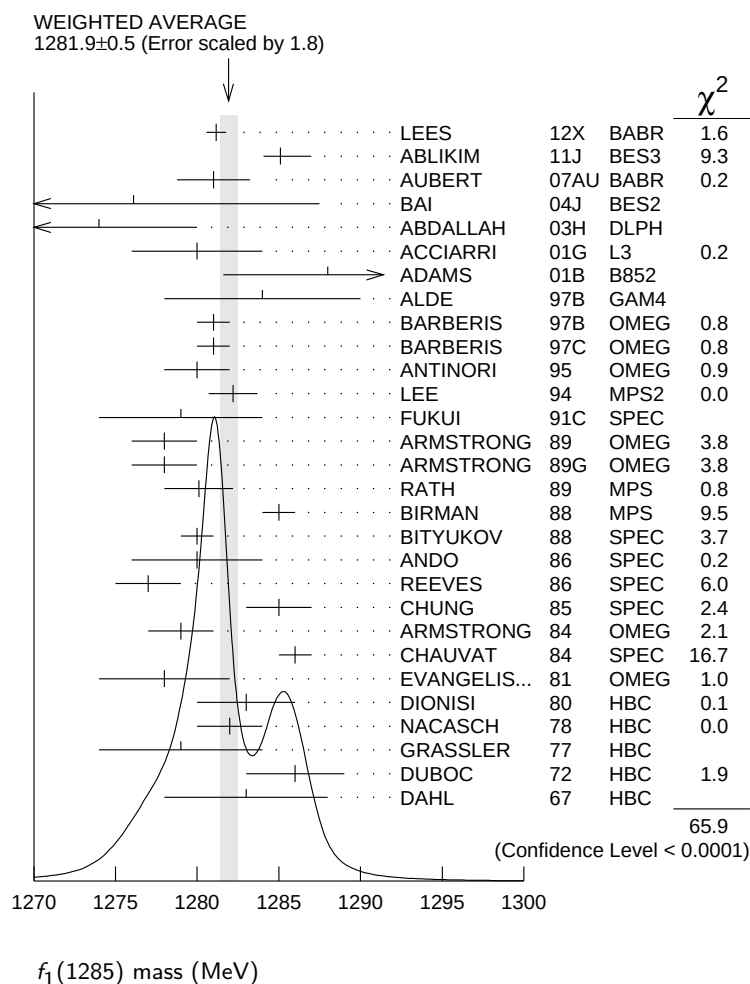
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NODE=M008M;LINKAGE=N1

NODE=M008M;LINKAGE=T

NODE=M008M;LINKAGE=P

NODE=M008M;LINKAGE=S



$f_1(1285)$ WIDTH

NODE=M008W

Only experiments giving width error less than 20 MeV are kept for averaging.

NODE=M008W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
24.2 ± 1.1 OUR AVERAGE		Error includes scale factor of 1.3. See the ideogram below.		
22.0 ± 3.1 ^{+2.0} _{-1.5}		⁹ ABLIKIM	11J BES3	$J/\psi \rightarrow \omega(\eta\pi^+\pi^-)$
35 ± 6 ± 4		AUBERT	07AU BABR	10.6 $e^+e^- \rightarrow f_1(1285)\pi^+\pi^-\gamma$
40.0 ± 8.6 ± 9.3	203	BAI	04J BES2	$J/\psi \rightarrow \gamma\gamma\pi^+\pi^-$
29 ± 12	237	ABDALLAH	03H DLPH	91.2 $e^+e^- \rightarrow K_S^0 K^\pm \pi^\mp + X$

NODE=M008W

45 ± 9 ± 7	20k	ADAMS	01B	B852	18 GeV $\pi^- p \rightarrow K^+ K^- \pi^0 n$	
55 ± 18	1400	ALDE	97B	GAM4	100 $\pi^- p \rightarrow \eta \pi^0 \pi^0 n$	
24 ± 3		BARBERIS	97B	OMEG	450 $pp \rightarrow pp2(\pi^+ \pi^-)$	
20 ± 2		BARBERIS	97C	OMEG	450 $pp \rightarrow ppK_S^0 K^\pm \pi^\mp$	
36 ± 5		10 ANTINORI	95	OMEG	300,450 $pp \rightarrow pp2(\pi^+ \pi^-)$	
29.0 ± 4.1		LEE	94	MPS2	18 $\pi^- p \rightarrow K^+ \bar{K}^0 2\pi^- p$	
25 ± 4	140	ARMSTRONG	89	OMEG	300 $pp \rightarrow K \bar{K} \pi pp$	
22 ± 2	4750	11 BIRMAN	88	MPS	8 $\pi^- p \rightarrow K^+ \bar{K}^0 \pi^- n$	
25 ± 4	504	BITYUKOV	88	SPEC	32.5 $\pi^- p \rightarrow K^+ K^- \pi^0 n$	
19 ± 5		ANDO	86	SPEC	8 $\pi^- p \rightarrow \eta \pi^+ \pi^- n$	
32 ± 8	420	REEVES	86	SPEC	6.6 $p\bar{p} \rightarrow KK\pi X$	
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 $\bar{p}p \rightarrow K\bar{K}3\pi$	
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●						
18.2 ± 1.2		12 SOSA	99	SPEC	$pp \rightarrow p_{\text{slow}} (K_S^0 K^+ \pi^-)$	
19.4 ± 1.5		12 SOSA	99	SPEC	$pp \rightarrow p_{\text{slow}} (K_S^0 K^- \pi^+)$	OCCUR=2
40 ± 5		ABATZIS	94	OMEG	450 $pp \rightarrow pp2(\pi^+ \pi^-)$	
31 ± 5		ARMSTRONG	89E	OMEG	300 $pp \rightarrow pp2(\pi^+ \pi^-)$	
41 ± 12		ARMSTRONG	89G	OMEG	85 $\pi^+ p \rightarrow 4\pi\pi p$, $pp \rightarrow 4\pi pp$	
17.9 ± 10.9	60	RATH	89	MPS	21.4 $\pi^- p \rightarrow K_S^0 K_S^0 \pi^0 n$	
14 $^{+20}_{-14}$ ± 10	16	BECKER	87	MRK3	$e^+ e^- \rightarrow \phi K\bar{K}\pi$	
26 ± 12		EVANGELIS...	81	OMEG	12 $\pi^- p \rightarrow \eta \pi^+ \pi^- \pi^- p$	
25 ± 15	200	GURTU	79	HBC	4.2 $K^- p \rightarrow n\eta 2\pi$	
~ 10		13 STANTON	79	CNTR	8.5 $\pi^- p \rightarrow n2\gamma 2\pi$	
24 ± 18	210	GRASSLER	77	HBC	16 $\pi^\mp p$	
28 ± 5	150	14 DEFOIX	72	HBC	0.7 $\bar{p}p \rightarrow 7\pi$	
46 ± 9	180	14 DUBOC	72	HBC	1.2 $\bar{p}p \rightarrow 2K4\pi$	
37 ± 5	500	15 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		14 LORSTAD	69	HBC	0.7 $\bar{p}p$, 4,5-body	
35 ± 10		14 DAHL	67	HBC	1.6–4.2 $\pi^- p$	

⁹ The selected process is $J/\psi \rightarrow \omega a_0(980)\pi$.

¹⁰ Supersedes ABATZIS 94, ARMSTRONG 89E.

¹¹ From partial wave analysis of $K^+ \bar{K}^0 \pi^-$ system.

¹² No systematic error given.

¹³ From phase shift analysis of $\eta \pi^+ \pi^-$ system.

¹⁴ Resolution is not unfolded.

¹⁵ Seen in the missing mass spectrum.

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NODE=M008W;LINKAGE=B

NODE=M008W;LINKAGE=A

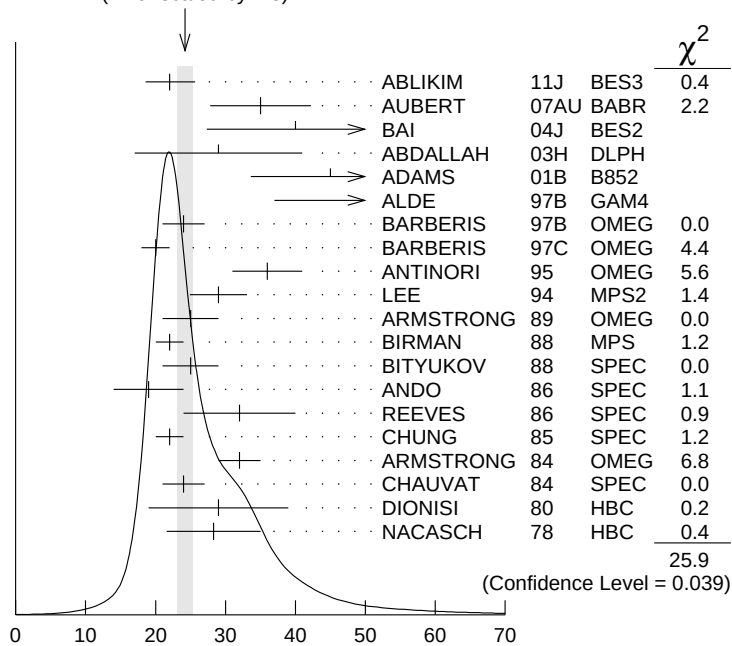
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NODE=M008W;LINKAGE=P

NODE=M008W;LINKAGE=R

NODE=M008W;LINKAGE=S

WEIGHTED AVERAGE
24.2±1.1 (Error scaled by 1.3)



$f_1(1285)$ width (MeV)

$f_1(1285)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
Γ_1 4π	$(33.1^{+2.1}_{-1.8})\%$	S=1.3
Γ_2 $\pi^0\pi^0\pi^+\pi^-$	$(22.0^{+1.4}_{-1.2})\%$	S=1.3
Γ_3 $2\pi^+2\pi^-$	$(11.0^{+0.7}_{-0.6})\%$	S=1.3
Γ_4 $\rho^0\pi^+\pi^-$	$(11.0^{+0.7}_{-0.6})\%$	S=1.3
Γ_5 $\rho^0\rho^0$	seen	
Γ_6 $4\pi^0$	$< 7 \times 10^{-4}$	CL=90%
Γ_7 $\eta\pi^+\pi^-$	$(35 \pm 15)\%$	
Γ_8 $\eta\pi\pi$	$(52.4^{+1.9}_{-2.2})\%$	S=1.2
Γ_9 $a_0(980)\pi$ [ignoring $a_0(980) \rightarrow K\bar{K}$]	$(36 \pm 7)\%$	
Γ_{10} $\eta\pi\pi$ [excluding $a_0(980)\pi$]	$(16 \pm 7)\%$	
Γ_{11} $K\bar{K}\pi$	$(9.0 \pm 0.4)\%$	S=1.1
Γ_{12} $K\bar{K}^*(892)$	not seen	
Γ_{13} $\pi^+\pi^-\pi^0$	$(3.0 \pm 0.9) \times 10^{-3}$	
Γ_{14} $\rho^\pm\pi^\mp$	$< 3.1 \times 10^{-3}$	CL=95%
Γ_{15} $\gamma\rho^0$	$(5.5 \pm 1.3)\%$	S=2.8
Γ_{16} $\phi\gamma$	$(7.4 \pm 2.6) \times 10^{-4}$	
Γ_{17} $\gamma\gamma^*$		
Γ_{18} $\gamma\gamma$		

NODE=M008215;NODE=M008

DESIG=21

DESIG=22

DESIG=20

DESIG=191

DESIG=23;OUR EST;→ UNCHECKED ←

DESIG=7

DESIG=198

DESIG=3

DESIG=4

DESIG=5

DESIG=1

DESIG=6

DESIG=197

DESIG=199

DESIG=13

DESIG=10

DESIG=9

DESIG=8

CONSTRAINED FIT INFORMATION

An overall fit to 7 branching ratios uses 16 measurements and one constraint to determine 5 parameters. The overall fit has a $\chi^2 = 24.7$ for 12 degrees of freedom.

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

x_9	-17			
x_{10}	-8	-95		
x_{11}	46	-9	-4	
x_{15}	-36	-4	-2	-34
	x_1	x_9	x_{10}	x_{11}

$f_1(1285) \Gamma(i) \Gamma(\gamma\gamma) / \Gamma(\text{total})$

NODE=M008217

$\Gamma(\eta\pi\pi) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$		$\Gamma_8 \Gamma_{18} / \Gamma = (\Gamma_9 + \Gamma_{10}) \Gamma_{18} / \Gamma$			
VALUE (keV)	CL%	DOCUMENT ID	TECN	COMMENT	
<0.62	95	GIDAL	87	MRK2	$e^+ e^- \rightarrow e^+ e^- \eta \pi^+ \pi^-$

NODE=M008G2
NODE=M008G2

$\Gamma(\eta\pi\pi) \times \Gamma(\gamma\gamma^*)/\Gamma_{\text{total}}$			$\Gamma_8\Gamma_{17}/\Gamma = (\Gamma_9+\Gamma_{10})\Gamma_{17}/\Gamma$		
VALUE (keV)	EVTs	DOCUMENT ID	TECN	COMMENT	
1.4 ± 0.4 OUR AVERAGE		Error includes scale factor of 1.4.			
1.18 $\pm 0.25\pm 0.20$	26	^{16,17} AIHARA	88B	TPC	$e^+e^-\rightarrow e^+e^-\eta\pi^+\pi^-$
2.30 $\pm 0.61\pm 0.42$		^{16,18} GIDAL	87	MRK2	$e^+e^-\rightarrow e^+e^-\eta\pi^+\pi^-$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
1.8 $\pm 0.3 \pm 0.3$	420	¹⁹ ACHARD	02B	L3	183–209 $e^+e^-\rightarrow e^+e^-\eta\pi^+\pi^-$

NODE=M008G3
NODE=M008G3¹⁶ Assuming a ρ -pole form factor.¹⁷ Published value multiplied by $\eta\pi\pi$ branching ratio 0.49.¹⁸ Published value divided by 2 and multiplied by the $\eta\pi\pi$ branching ratio 0.49.¹⁹ Published value multiplied by the $\eta\pi\pi$ branching ratio 0.52.NODE=M008G3;LINKAGE=A
NODE=M008G3;LINKAGE=F
NODE=M008G3;LINKAGE=B
NODE=M008G3;LINKAGE=AC

$f_1(1285) \text{ BRANCHING RATIOS}$

NODE=M008220

$\Gamma(K\bar{K}\pi)/\Gamma(4\pi)$				Γ_{11}/Γ_1	
VALUE		DOCUMENT ID	TECN	COMMENT	
0.271±0.016 OUR FIT		Error includes scale factor of 1.3.			
0.271±0.016 OUR AVERAGE		Error includes scale factor of 1.2.			
0.265 ±0.014	20	BARBERIS	97C	OMEG 450	$pp\rightarrow ppK_S^0K^\pm\pi^\mp$
0.28 ±0.05	21	ARMSTRONG	89E	OMEG 300	$pp\rightarrow pp f_1(1285)$
0.37 ±0.03 ±0.05	22	ARMSTRONG	89G	OMEG 85	$\pi p\rightarrow 4\pi X$

NODE=M008R1
NODE=M008R1²⁰ Using $2(\pi^+ \pi^-)$ data from BARBERIS 97B.²¹ Assuming $\rho\pi\pi$ and $a_0(980)\pi$ intermediate states.²² 4π consistent with being entirely $\rho\pi\pi$.NODE=M008R1;LINKAGE=B
NODE=M008R1;LINKAGE=M
NODE=M008R1;LINKAGE=A

$\Gamma(\pi^0 \pi^0 \pi^+ \pi^-) / \Gamma_{\text{total}}$		$\Gamma_2 / \Gamma = \frac{2}{3} \Gamma_1 / \Gamma$	
VALUE		DOCUMENT ID	
$0.220^{+0.014}_{-0.012}$	OUR FIT	Error includes scale factor of 1.3.	

NODE=M008R18
NODE=M008R18

$\Gamma(2\pi^+ 2\pi^-)/\Gamma_{\text{total}}$		$\Gamma_3/\Gamma = \frac{1}{3}\Gamma_1/\Gamma$	
<u>VALUE</u>	<u>DOCUMENT ID</u>		
$0.110^{+0.007}_{-0.006}$ OUR FIT		Error includes scale factor of 1.3.	

NODE=M008R17
NODE=M008R17

$\Gamma(\rho^0 \pi^+ \pi^-)/\Gamma_{\text{total}}$		$\Gamma_4/\Gamma = \frac{1}{3}\Gamma_1/\Gamma$	
VALUE	DOCUMENT ID		
$0.110^{+0.007}_{-0.006}$ OUR FIT		Error includes scale factor of 1.3.	

NODE=M008R19
NODE=M008R19

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

$$\Gamma_4 / \Gamma_3$$

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
1.0 ± 0.4	GRASSLER	77	HBC 16 GeV $\pi^\pm p$

NODE=M008R6
NODE=M008R6

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

$$\Gamma_5 / \Gamma$$

VALUE	DOCUMENT ID	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •		
seen	BARBERIS	00C 450 $pp \rightarrow p_f 4\pi p_s$

NODE=M008R21
NODE=M008R21

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

$$\Gamma_6 / \Gamma$$

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

NODE=M008R8
NODE=M008R8

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

$$\Gamma_{13} / \Gamma_7$$

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.86 ± 0.16 ± 0.20	2.3k	²³ DOROFEEV	11	VES $\pi^- N \rightarrow \pi^- f_1(1285) N$
²³ Value obtained selecting the region corresponding to $f_0(980)$ in the $\pi^+ \pi^-$ mass spectrum.				

NODE=M008R02
NODE=M008R02

NODE=M008R02;LINKAGE=DO

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

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

VALUE	DOCUMENT ID
0.524 ^{+0.019} _{-0.022} OUR FIT	Error includes scale factor of 1.2.

NODE=M008R22
NODE=M008R22

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

$$\Gamma_1 / \Gamma_8 = \Gamma_1 / (\Gamma_9 + \Gamma_{10})$$

VALUE	DOCUMENT ID	TECN	COMMENT
0.63 ± 0.06 OUR FIT Error includes scale factor of 1.2.			
0.41 ± 0.14 OUR AVERAGE			
0.37 ± 0.11 ± 0.11	BOLTON	92	MRK3 $J/\psi \rightarrow \gamma f_1(1285)$
0.64 ± 0.40	GURTU	79	HBC 4.2 $K^- p$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.93 ± 0.30	²⁴ GRASSLER	77	HBC 16 $\pi^\mp p$
²⁴ Assuming $\rho \pi \pi$ and $a_0(980)\pi$ intermediate states.			

NODE=M008R4
NODE=M008R4

NODE=M008R4;LINKAGE=M

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

$$\Gamma_3 / \Gamma_8$$

VALUE	DOCUMENT ID	TECN	COMMENT
0.28 ± 0.02 ± 0.02	²⁵ LEES	12X	BABR $\tau^- \rightarrow \pi^- f_1(1285) \nu_\tau$
²⁵ 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%	EVTS	DOCUMENT ID	TECN	COMMENT
0.69 ± 0.13 OUR FIT					
0.69 ^{+0.13} _{-0.12} OUR AVERAGE					
0.72 ± 0.15			GURTU	79	HBC 4.2 $K^- p$
0.6 ^{+0.3} _{-0.2}			CORDEN	78	OMEG 12-15 $\pi^- p$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
>0.69	95	318	ACHARD	02B	L3 183-209 $e^+ e^- \rightarrow e^+ e^- \eta \pi^+ \pi^-$
0.28 ± 0.07	1400		ALDE	97B	GAM4 100 $\pi^- p \rightarrow \eta \pi^0 \pi^0 n$
1.0 ± 0.3			GRASSLER	77	HBC 16 $\pi^\mp p$

NODE=M008R3
NODE=M008R3

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

$$\Gamma_{11} / \Gamma_8 = \Gamma_{11} / (\Gamma_9 + \Gamma_{10})$$

VALUE	DOCUMENT ID	TECN	COMMENT
0.171 ± 0.013 OUR FIT Error includes scale factor of 1.1.			
0.170 ± 0.012 OUR AVERAGE			
0.166 ± 0.01 ± 0.008	BARBERIS	98C	OMEG 450 $pp \rightarrow p_f f_1(1285) p_s$
0.42 ± 0.15	GURTU	79	HBC 4.2 $K^- p$
0.5 ± 0.2	²⁶ CORDEN	78	OMEG 12-15 $\pi^- p$
0.20 ± 0.08	²⁷ DEFOIX	72	HBC 0.7 $\bar{p} p \rightarrow 7\pi$
0.16 ± 0.08	CAMPBELL	69	DBC 2.7 $\pi^+ d$

NODE=M008R2
NODE=M008R2

²⁶CORDEN 78 assumes low-mass $\eta \pi \pi$ region is dominantly 1^{++} . See BARBERIS 98C and MANAK 00A for discussion.

NODE=M008R2;LINKAGE=CD

²⁷ $K\bar{K}$ system characterized by the $I = 1$ threshold enhancement. (See under $a_0(980)$).

NODE=M008R2;LINKAGE=K

$\Gamma(K\bar{K}^*(892))/\Gamma_{\text{total}}$ Γ_{12}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	NACASCH 78	HBC	$0.7, 0.76 \bar{p}p \rightarrow K\bar{K}3\pi$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
seen	²⁸ ACHARD 07	L3	$183-209 e^+e^- \rightarrow e^+e^- K_S^0 K^\pm \pi^\mp$

²⁸ A clear signal of 19.8 ± 4.4 events observed at high Q^2 .

NODE=M008R5
NODE=M008R5

NODE=M008R5;LINKAGE=CH

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

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
$0.30 \pm 0.055 \pm 0.074$	2.3k	²⁹ DOROFEEV 11	VES	$\pi^- N \rightarrow \pi^- f_1(1285) N$

²⁹ Value obtained selecting the region corresponding to $f_0(980)$ in the $\pi^+\pi^-$ mass spectrum. The systematic error includes the uncertainty on the partial width $f_1 \rightarrow \eta\pi\pi$ obtained from PDG 10 data.

NODE=M008R01
NODE=M008R01

NODE=M008R01;LINKAGE=DO

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

VALUE (%)	CL%	DOCUMENT ID	TECN	COMMENT
<0.31	95	DOROFEEV 11	VES	$\pi^- N \rightarrow \pi^- f_1(1285) N$

NODE=M008R03
NODE=M008R03

 $\Gamma(\gamma\rho^0)/\Gamma_{\text{total}}$ Γ_{15}/Γ

VALUE (units 10^{-2})	CL%	DOCUMENT ID	TECN	COMMENT
5.5 ± 1.3 OUR FIT	Error includes scale factor of 2.8.			
$2.8 \pm 0.7 \pm 0.6$		AMELIN 95	VES	$37 \pi^- N \rightarrow \pi^- \pi^+ \pi^- \gamma N$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<5	95	BITYUKOV 91B	SPEC	$32 \pi^- p \rightarrow \pi^+ \pi^- \gamma n$

NODE=M008R15
NODE=M008R15

 $\Gamma(\gamma\rho^0)/\Gamma(2\pi^+2\pi^-)$ $\Gamma_{15}/\Gamma_3 = \Gamma_{15}/\frac{1}{3}\Gamma_1$

VALUE	DOCUMENT ID	TECN	COMMENT
0.50 ± 0.13 OUR FIT	Error includes scale factor of 2.5.		
0.45 ± 0.18	³⁰ COFFMAN 90	MRK3	$J/\psi \rightarrow \gamma\gamma\pi^+\pi^-$

³⁰ Using $B(J/\psi \rightarrow \gamma f_1(1285) \rightarrow \gamma\gamma\rho^0) = 0.25 \times 10^{-4}$ and $B(J/\psi \rightarrow \gamma f_1(1285) \rightarrow \gamma 2\pi^+ 2\pi^-) = 0.55 \times 10^{-4}$ given by MIR 88.

NODE=M008R13
NODE=M008R13

NODE=M008R13;LINKAGE=E

 $\Gamma(\eta\pi\pi)/\Gamma(\gamma\rho^0)$ $\Gamma_8/\Gamma_{15} = (\Gamma_9 + \Gamma_{10})/\Gamma_{15}$

VALUE	DOCUMENT ID	TECN	COMMENT
9.5 ± 2.0 OUR FIT	Error includes scale factor of 2.5.		
7.9 ± 0.9 OUR AVERAGE			
$10.0 \pm 1.0 \pm 2.0$	BARBERIS 98C	OMEG 450	$pp \rightarrow p_f f_1(1285) p_s$
7.5 ± 1.0	³¹ ARMSTRONG 92C	OMEG 300	$pp \rightarrow pp\pi^+\pi^-\gamma, pp\eta\pi^+\pi^-$

³¹ Published value multiplied by 1.5.

NODE=M008R16
NODE=M008R16

NODE=M008R16;LINKAGE=B

 $\Gamma(\gamma\rho^0)/\Gamma(K\bar{K}\pi)$ Γ_{15}/Γ_{11}

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
>0.035	90	³² COFFMAN 90	MRK3	$J/\psi \rightarrow \gamma\gamma\pi^+\pi^-$
³² Using $B(J/\psi \rightarrow \gamma f_1(1285) \rightarrow \gamma\gamma\rho^0) = 0.25 \times 10^{-4}$ and $B(J/\psi \rightarrow \gamma f_1(1285) \rightarrow \gamma K\bar{K}\pi) = 0.72 \times 10^{-3}$.				

NODE=M008R12
NODE=M008R12

NODE=M008R12;LINKAGE=F

 $\Gamma(\phi\gamma)/\Gamma(K\bar{K}\pi)$ Γ_{16}/Γ_{11}

VALUE (units 10^{-2})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$0.82 \pm 0.21 \pm 0.20$		19	BITYUKOV 88	SPEC	$32.5 \pi^- p \rightarrow K^+ K^- \pi^0 n$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.50	95		BARBERIS 98C	OMEG 450	$pp \rightarrow p_f f_1(1285) p_s$
<0.93	95		AMELIN 95	VES	$37 \pi^- N \rightarrow \pi^- \pi^+ \pi^- \gamma N$

NODE=M008R9
NODE=M008R9

$f_1(1285)$ REFERENCES

NODE=M008

LEES	12X	PR D86 092010	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=54714
ABLIKIM	11J	PRL 107 182001	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=53931
DOROFEEV	11	EPJ A47 68	V. Dorofeev <i>et al.</i>	(SERP, MIPT)	REFID=16755
PDG	10	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. Bityukov <i>et al.</i>	(SERP)	REFID=41864
		Translated from YAF 54 529			
FUKUI	91C	PL B267 293	S. Fukui <i>et al.</i>	(SUGI, NAGO, KEK, KYOT+)	REFID=41748
COFFMAN	90	PR D41 1410	D.M. Coffman <i>et al.</i>	(Mark III Collab.)	REFID=41350
ARMSTRONG	89	PL B221 216	T.A. Armstrong <i>et al.</i>	(CERN, CDEF, BIRM+)	REFID=40729
ARMSTRONG	89E	PL B228 536	T.A. Armstrong, M. Benayoun	(ATHU, BARI, BIRM+)	REFID=41011
ARMSTRONG	89G	ZPHY C43 55	T.A. Armstrong <i>et al.</i>	(CERN, BIRM, BARI+)	REFID=40930
RATH	89	PR D40 693	M.G. Rath <i>et al.</i>	(NDAM, BRAN, BNL, CUNY+)	REFID=40924
AIHARA	88B	PL B209 107	H. Aihara <i>et al.</i>	(TPC-2 γ Collab.)	REFID=40572
BIRMAN	88	PRL 61 1557	A. Birman <i>et al.</i>	(BNL, FSU, IND, MASD) JP	REFID=40568
BITYUKOV	88	PL B203 327	S.I. Bityukov <i>et al.</i>	(SERP)	REFID=40569
MIR	88	Photon-Photon 88, 126	R. Mir	(Mark III Collab.)	REFID=41574
		Conference			
ALDE	87	PL B198 286	D.M. Alde <i>et al.</i>	(LANL, BRUX, SERP, LAPP)	REFID=40221
BECKER	87	PRL 59 186	J.J. Becker <i>et al.</i>	(Mark III Collab.)	REFID=40015
GIDAL	87	PRL 59 2012	G. Gidal <i>et al.</i>	(LBL, SLAC, HARV)	REFID=40223
ANDO	86	PRL 57 1296	A. Ando <i>et al.</i>	(KEK, KYOT, NIRS, SAGA+) IJP	REFID=20891
REEVES	86	PR D34 1960	D.F. Reeves <i>et al.</i>	(FLOR, BNL, IND+) JP	REFID=20936
CHUNG	85	PRL 55 779	S.U. Chung <i>et al.</i>	(BNL, FLOR, IND+) JP	REFID=20934
ARMSTRONG	84	PL 146B 273	T.A. Armstrong <i>et al.</i>	(ATHU, BARI, BIRM+) JP	REFID=20929
BITYUKOV	84B	PL 144B 133	S.I. Bityukov <i>et al.</i>	(SERP)	REFID=20468
CHAUVAT	84	PL 148B 382	P. Chauvat <i>et al.</i>	(CERN, CLER, UCLA+)	REFID=20932
TORNQVIST	82B	NP B203 268	N.A. Tornqvist	(HELS)	REFID=20573
EVANGELIS...	81	NP B178 197	C. Evangelista <i>et al.</i>	(BARI, BONN, CERN+)	REFID=20462
BROMBERG	80	PR D22 1513	C.M. Bromberg <i>et al.</i>	(CIT, FNAL, ILLC+)	REFID=20922
DIONISI	80	NP B169 1	C. Dionisi <i>et al.</i>	(CERN, MADR, CDEF+)	REFID=20924
GURTU	79	NP B151 181	A. Gurtu <i>et al.</i>	(CERN, ZEEM, NIJM, OXF)	REFID=20456
STANTON	79	PRL 42 346	N.R. Stanton <i>et al.</i>	(OSU, CARL, MCGI+) JP	REFID=20887
CORDEN	78	NP B144 253	M.J. Corden <i>et al.</i>	(BIRM, RHEL, TELA+) JP	REFID=20452
NACASCH	78	NP B135 203	R. Nacasch <i>et al.</i>	(PARIS, MADR, CERN)	REFID=20919
GRASSLER	77	NP B121 189	H. Grassler <i>et al.</i>	(AACH3, BERL, BONN+)	REFID=20447
DEFOIX	72	NP B44 125	C. Defoix <i>et al.</i>	(CDEF, CERN)	REFID=20435
DUBOC	72	NP B46 429	J. Duboc <i>et al.</i>	(PARIS, LIVP)	REFID=20339
THUN	72	PRL 28 1733	R. Thun <i>et al.</i>	(STON, NEAS)	REFID=20911
BARDADIN-...	71	PR D4 2711	M. Bardadin-Otwinowska <i>et al.</i>	(WARS)	REFID=20196
BOESEBECK	71	PL 34B 659	K. Boesebeck	(AACH, BERL, BONN, CERN, CRAC+)	REFID=20905
CAMPBELL	69	PRL 22 1204	J.H. Campbell <i>et al.</i>	(PURD)	REFID=20419
LORSTAD	69	NP B14 63	B. Lorstad <i>et al.</i>	(CDEF, CERN) JP	REFID=20901
D'ANDLAU	68	NP B5 693	C. d'Andlau <i>et al.</i>	(CDEF, CERN, IRAD+) IJP	REFID=20897
DAHL	67	PR 163 1377	O.I. Dahl <i>et al.</i>	(LRL) IJP	REFID=20321

$\eta(1295)$

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

See also the mini-review under $\eta(1405)$

NODE=M037

NODE=M037

NODE=M037M

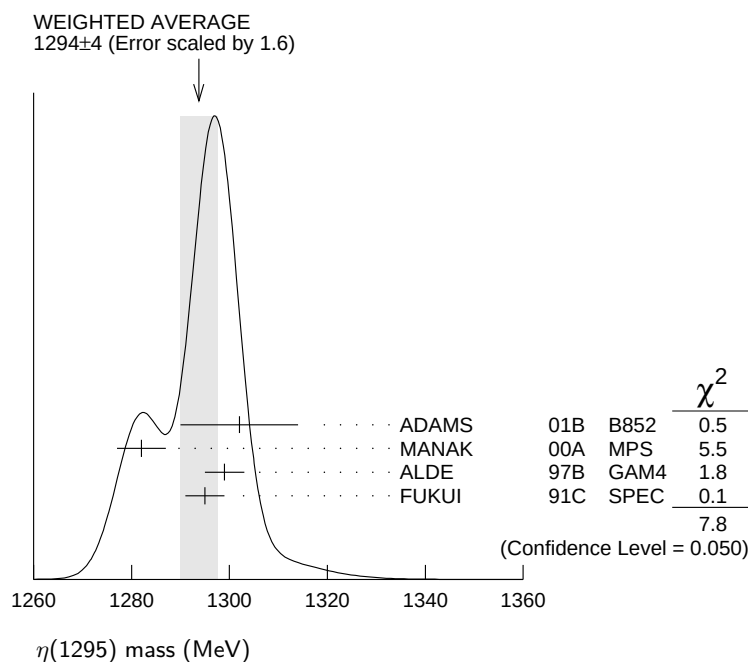
NODE=M037M

 $\eta(1295)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1294 ± 4 OUR AVERAGE	Error includes scale factor of 1.6. See the ideogram below.			
$1302 \pm 9 \pm 8$	20k	ADAMS	01B B852	$18 \text{ GeV } \pi^- p \rightarrow K^+ K^- \pi^0 n$
1282 ± 5	9082	MANAK	00A MPS	$18 \pi^- p \rightarrow \eta \pi^+ \pi^- n$
1299 ± 4	2100	ALDE	97B GAM4	$100 \pi^- p \rightarrow \eta \pi^0 \pi^0 n$
1295 ± 4		FUKUI	91C SPEC	$8.95 \pi^- p \rightarrow \eta \pi^+ \pi^- n$

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

1264 ± 8	¹ AUGUSTIN	90	DM2	$J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$
~ 1275	STANTON	79	CNTR	$8.4 \pi^- p \rightarrow n \eta 2\pi$



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

NODE=M037M;LINKAGE=AG

 $\eta(1295)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
55 ± 5 OUR AVERAGE				
$57 \pm 23 \pm 21$	20k	ADAMS	01B B852	$18 \text{ GeV } \pi^- p \rightarrow K^+ K^- \pi^0 n$
66 ± 13	9082	MANAK	00A MPS	$18 \pi^- p \rightarrow \eta \pi^+ \pi^- n$
53 ± 6		FUKUI	91C SPEC	$8.95 \pi^- p \rightarrow \eta \pi^+ \pi^- n$

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

< 40	2100	ALDE	97B GAM4	$100 \pi^- p \rightarrow \eta \pi^0 \pi^0 n$
44 ± 20	² AUGUSTIN	90	DM2	$J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$
~ 70	STANTON	79	CNTR	$8.4 \pi^- p \rightarrow n \eta 2\pi$

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

NODE=M037W

NODE=M037W

NODE=M037W;LINKAGE=AG

$\eta(1295)$ DECAY MODES

NODE=M037215;NODE=M037

Mode	Fraction (Γ_i/Γ)
Γ_1 $\eta\pi^+\pi^-$	seen
Γ_2 $a_0(980)\pi$	seen
Γ_3 $\gamma\gamma$	
Γ_4 $\eta\pi^0\pi^0$	seen
Γ_5 $\eta(\pi\pi)_{S\text{-wave}}$	seen
Γ_6 $\sigma\eta$	
Γ_7 $K\bar{K}\pi$	

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

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

NODE=M037220

 $\Gamma(\eta\pi^+\pi^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_1\Gamma_3/\Gamma$ NODE=M037G2
NODE=M037G2

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

 $\Gamma(K\bar{K}\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_7\Gamma_3/\Gamma$ NODE=M037G3
NODE=M037G3

VALUE (keV)	CL%	DOCUMENT ID	TECN	COMMENT
<0.014	90	3,4 AHOHE	05 CLE2	10.6 $e^+e^- \rightarrow e^+e^-K_S^0K^\pm\pi^\mp$

³ Using $\eta(1295)$ mass and width 1294 MeV and 55 MeV, respectively.⁴ Assuming three-body phase-space decay to $K_S^0K^\pm\pi^\mp$.NODE=M037G3;LINKAGE=AH
NODE=M037G3;LINKAGE=B3 **$\eta(1295)$ BRANCHING RATIOS**

NODE=M037225

 $\Gamma(a_0(980)\pi)/\Gamma_{\text{total}}$ Γ_2/Γ NODE=M037R1
NODE=M037R1

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 $\pi^-p \rightarrow n\eta 2\pi$

 $\Gamma(a_0(980)\pi)/\Gamma(\eta\pi^0\pi^0)$ Γ_2/Γ_4 NODE=M037R2
NODE=M037R2

VALUE	DOCUMENT ID	TECN	COMMENT
0.65±0.10	⁵ ALDE	97B GAM4	100 $\pi^-p \rightarrow \eta\pi^0\pi^0n$

⁵ Assuming that $a_0(980)$ decays only to $\eta\pi$.

NODE=M037R2;LINKAGE=A

 $\Gamma(\eta(\pi\pi)_{S\text{-wave}})/\Gamma(\eta\pi^0\pi^0)$ Γ_5/Γ_4 NODE=M037R4
NODE=M037R4

VALUE	DOCUMENT ID	TECN	COMMENT
0.35±0.10	ALDE	97B GAM4	100 $\pi^-p \rightarrow \eta\pi^0\pi^0n$

 $\Gamma(a_0(980)\pi)/\Gamma(\sigma\eta)$ Γ_2/Γ_6 NODE=M037R5
NODE=M037R5

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.48±0.22	9082	MANAK	00A MPS	18 $\pi^-p \rightarrow \eta\pi^+\pi^-n$

 $\eta(1295)$ REFERENCES

NODE=M037

AHOHE	05	PR D71 072001	R. Ahohe <i>et al.</i>	(CLEO Collab.)
ACCIARRI	01G	PL B501 1	M. Acciarri <i>et al.</i>	(L3 Collab.)
ADAMS	01B	PL B516 264	G.S. Adams <i>et al.</i>	(BNL E852 Collab.)
MANAK	00A	PR D62 012003	J.J. Manak <i>et al.</i>	(BNL E852 Collab.)
ALDE	97B	PAN 60 386	D. Alde <i>et al.</i>	(GAMS Collab.)
Translated from YAF 60 458.				
BERTIN	97	PL B400 226	A. Bertin <i>et al.</i>	(OBELIX Collab.)
AUGUSTIN	92	PR D46 1951	J.E. Augustin, G. Cosme	(DM2 Collab.)
FUKUI	91C	PL B267 293	S. Fukui <i>et al.</i>	(SUGI, NAGO, KEK, KYOT+)
AUGUSTIN	90	PR D42 10	J.E. Augustin <i>et al.</i>	(DM2 Collab.)
AIHARA	88C	PR D38 1	H. Aihara <i>et al.</i>	(TPC-2γ Collab.)
BIRMAN	88	PRL 61 1557	A. Birman <i>et al.</i>	(BNL, FSU, IND, MASD) JP
ANTREASYAN	87	PR D36 2633	D. Antreasyan <i>et al.</i>	(Crystal Ball Collab.)
ANDO	86	PRL 57 1296	A. Ando <i>et al.</i>	(KEK, KYOT, NIRS, SAGA+) IJP
STANTON	79	PRL 42 346	N.R. Stanton <i>et al.</i>	(OSU, CARL, MCGI+) JP

REFID=50764
 REFID=48319
 REFID=49649
 REFID=47989
 REFID=45396
 REFID=45417
 REFID=41584
 REFID=41748
 REFID=41352
 REFID=40564
 REFID=40568
 REFID=40008
 REFID=20891
 REFID=20887

$\pi(1300)$

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

NODE=M058

 $\pi(1300)$ MASS

NODE=M058M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1300±100 OUR ESTIMATE				
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
1345± 8±10	18k	¹ SCHEGELSKY 06	RVUE	$\gamma\gamma \rightarrow \pi^+\pi^-\pi^0$
1200± 40	90k	SALVINI 04	OBLX	$\bar{p}p \rightarrow 2\pi^+2\pi^-$
1343± 15±24		CHUNG 02	B852	$18.3 \pi^-p \rightarrow \pi^+\pi^-\pi^-p$
1375± 40		ABELE 01	CBAR	$0.0 \bar{p}d \rightarrow \pi^-4\pi^0p$
1275± 15		BERTIN 97D	OBLX	$0.05 \bar{p}p \rightarrow 2\pi^+2\pi^-$
~ 1114		ABELE 96	CBAR	$0.0 \bar{p}p \rightarrow 5\pi^0$
1190± 30		ZIELINSKI 84	SPEC	$200 \pi^+Z \rightarrow Z3\pi$
1240± 30		BELLINI 82	SPEC	$40 \pi^-A \rightarrow A3\pi$
1273± 50		² AARON 81	RVUE	
1342± 20		BONESINI 81	OMEG	$12 \pi^-p \rightarrow p3\pi$
~ 1400		DAUM 81B	SPEC	$63,94 \pi^-p$

¹ From analysis of L3 data at 183–209 GeV.² Uses multichannel Aitchison-Bowler model (BOWLER 75). Uses data from DAUM 80 and DANKOWYCH 81.

NODE=M058M

→ UNCHECKED ←

NODE=M058M;LINKAGE=SC

NODE=M058M;LINKAGE=E

 $\pi(1300)$ WIDTH

NODE=M058W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
200 to 600 OUR ESTIMATE				
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
260± 20±30	18k	³ SCHEGELSKY 06	RVUE	$\gamma\gamma \rightarrow \pi^+\pi^-\pi^0$
470±120	90k	SALVINI 04	OBLX	$\bar{p}p \rightarrow 2\pi^+2\pi^-$
449± 39±47		CHUNG 02	B852	$18.3 \pi^-p \rightarrow \pi^+\pi^-\pi^-p$
268± 50		ABELE 01	CBAR	$0.0 \bar{p}d \rightarrow \pi^-4\pi^0p$
218±100		BERTIN 97D	OBLX	$0.05 \bar{p}p \rightarrow 2\pi^+2\pi^-$
~ 340		ABELE 96	CBAR	$0.0 \bar{p}p \rightarrow 5\pi^0$
440± 80		ZIELINSKI 84	SPEC	$200 \pi^+Z \rightarrow Z3\pi$
360±120		BELLINI 82	SPEC	$40 \pi^-A \rightarrow A3\pi$
580±100		⁴ AARON 81	RVUE	
220± 70		BONESINI 81	OMEG	$12 \pi^-p \rightarrow p3\pi$
~ 600		DAUM 81B	SPEC	$63,94 \pi^-p$

³ From analysis of L3 data at 183–209 GeV.⁴ Uses multichannel Aitchison-Bowler model (BOWLER 75). Uses data from DAUM 80 and DANKOWYCH 81.

NODE=M058W

→ UNCHECKED ←

NODE=M058W;LINKAGE=SC

NODE=M058W;LINKAGE=E

 $\pi(1300)$ DECAY MODES

NODE=M058215;NODE=M058

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \rho\pi$	seen
$\Gamma_2 \quad \pi(\pi\pi)S\text{-wave}$	seen
$\Gamma_3 \quad \gamma\gamma$	

DESIG=1;OUR EST;→ UNCHECKED ←

DESIG=3;OUR EST;→ UNCHECKED ←

DESIG=4

 $\pi(1300)$ $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

NODE=M058218

$\Gamma(\rho\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$				$\Gamma_1\Gamma_3/\Gamma$
VALUE (keV)	CL%	DOCUMENT ID	TECN	COMMENT
<0.085	90	ACCIARRI 97T	L3	$e^+e^- \rightarrow e^+e^-\pi^+\pi^-\pi^0$

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

<0.8	95	⁵ SCHEGELSKY 06	RVUE	$\gamma\gamma \rightarrow \pi^+\pi^-\pi^0$
<0.54	90	ALBRECHT 97B	ARG	$e^+e^- \rightarrow e^+e^-\pi^+\pi^-\pi^0$

⁵ From analysis of L3 data at 183–209 GeV.

NODE=M058G1

NODE=M058G1

NODE=M058G1;LINKAGE=SC

$\pi(1300)$ BRANCHING RATIOS **$\Gamma(\pi\pi)_{S\text{-wave}}/\Gamma(\rho\pi)$**

VALUE	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
2.2 $\pm$ 0.4		90k	SALVINI	04	OBLX $\bar{p}p \rightarrow 2\pi^+ 2\pi^-$
seen			CHUNG	02	B852 $18.3 \pi^- p \rightarrow \pi^+ 2\pi^- p$
<0.15	90		ABELE	01	CBAR $0.0 \bar{p}d \rightarrow \pi^- 4\pi^0 p$
2.12			⁶ AARON	81	RVUE

⁶ Uses multichannel Aitchison-Bowler model (BOWLER 75). Uses data from DAUM 80 and DANKOWYCH 81.

NODE=M058220

 NODE=M058R1
 NODE=M058R1

NODE=M058R1;LINKAGE=E

 $\pi(1300)$ REFERENCES

SCHEGELSKY 06	EPJ A27 199	V.A. Schegelsky <i>et al.</i>	
SALVINI 04	EPJ C35 21	P. Salvini <i>et al.</i>	(OBELIX Collab.)
CHUNG 02	PR D65 072001	S.U. Chung <i>et al.</i>	(BNL E852 Collab.)
ABELE 01	EPJ C19 667	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
ACCIARRI 97T	PL B413 147	M. Acciarri <i>et al.</i>	(L3 Collab.)
ALBRECHT 97B	ZPHY C74 469	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
BERTIN 97D	PL B414 220	A. Bertin <i>et al.</i>	(OBELIX Collab.)
ABELE 96	PL B380 453	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
ZIELINSKI 84	PR D30 1855	M. Zielinski <i>et al.</i>	(ROCH, MINN, FNAL)
BELLINI 82	PRL 48 1697	G. Bellini <i>et al.</i>	(MILA, BGNA, JINR)
AARON 81	PR D24 1207	R.A. Aaron, R.S. Longacre	(NEAS, BNL)
BONESINI 81	PL 103B 75	M. Bonesini <i>et al.</i>	(MILA, LIVP, DARE+)
DANKOWYCH... 81	PRL 46 580	J.A. Dankowych <i>et al.</i>	(TNTO, BNL, CARL+)
DAUM 81B	NP B182 269	C. Daum <i>et al.</i>	(AMST, CERN, CRAC, MPIM+)
DAUM 80	PL 89B 281	C. Daum <i>et al.</i>	(AMST, CERN, CRAC, MPIM+)
BOWLER 75	NP B97 227	M.G. Bowler <i>et al.</i>	(OXFTP, DARE)

NODE=M058

 REFID=51186
 REFID=53226
 REFID=48837
 REFID=48334
 REFID=45761
 REFID=45418
 REFID=45763
 REFID=45011
 REFID=20881
 REFID=21134
 REFID=20870
 REFID=21130
 REFID=20572
 REFID=20872
 REFID=20868
 REFID=20571

NODE=M012

 $a_2(1320)$

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

 $a_2(1320)$ MASS

VALUE (MeV)	DOCUMENT ID

1318.3 $^{+0.5}_{-0.6}$ OUR AVERAGE Includes data from the 4 datablocks that follow this one.
 Error includes scale factor of 1.2.

NODE=M012205

NODE=M012M0

3 π MODE

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	CHG	COMMENT

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

 NODE=M012M1
 NODE=M012M1

1319.0 $^{+1.0}_{-1.3}$ OUR AVERAGE Error includes scale factor of 1.4. See the ideogram below.

1321 $\pm$ 1 $^{+0}_{-7}$	420k	ALEKSEEV	10	COMP	190 $\pi^- Pb \rightarrow \pi^- \pi^- \pi^+ Pb'$
1326 $\pm$ 2 $\pm$ 2		CHUNG	02	B852	18.3 $\pi^- p \rightarrow \pi^+ \pi^- \pi^- p$
1317 $\pm$ 3		BARBERIS	98B		450 $pp \rightarrow p_f \pi^+ \pi^- \pi^0 p_s$
1323 $\pm$ 4 $\pm$ 3		ACCIARRI	97T	L3	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^- \pi^0$
1320 $\pm$ 7		ALBRECHT	97B	ARG	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^- \pi^0$
1311.3 $\pm$ 1.6 $\pm$ 3.0	72.4k	AMELIN	96	VES	36 $\pi^- p \rightarrow \pi^+ \pi^- \pi^0 n$
1310 $\pm$ 5		ARMSTRONG	90	OMEG 0	300.0 $pp \rightarrow pp \pi^+ \pi^- \pi^0$
1323.8 $\pm$ 2.3	4022	AUGUSTIN	89	DM2 $\pm$	$J/\psi \rightarrow \rho^\pm a_2^\mp$
1320.6 $\pm$ 3.1	3562	AUGUSTIN	89	DM2 0	$J/\psi \rightarrow \rho^0 a_2^0$
1317 $\pm$ 2	25k	¹ DAUM	80C	SPEC $-$	63,94 $\pi^- p \rightarrow 3\pi p$
1320 $\pm$ 10	1097	¹ BALTAY	78B	HBC $+0$	15 $\pi^+ p \rightarrow p 4\pi$
1306 $\pm$ 8		FERRERSORIA	78	OMEG $-$	9 $\pi^- p \rightarrow p 3\pi$
1318 $\pm$ 7	1.6k	¹ EMMS	75	DBC 0	4 $\pi^+ n \rightarrow p(3\pi)^0$
1315 $\pm$ 5		¹ ANTIPOV	73C	CNTR $-$	25,40 $\pi^- p \rightarrow p \eta \pi^-$
1306 $\pm$ 9	1580	CHALOUPKA	73	HBC $-$	3.9 $\pi^- p$

OCCUR=2

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

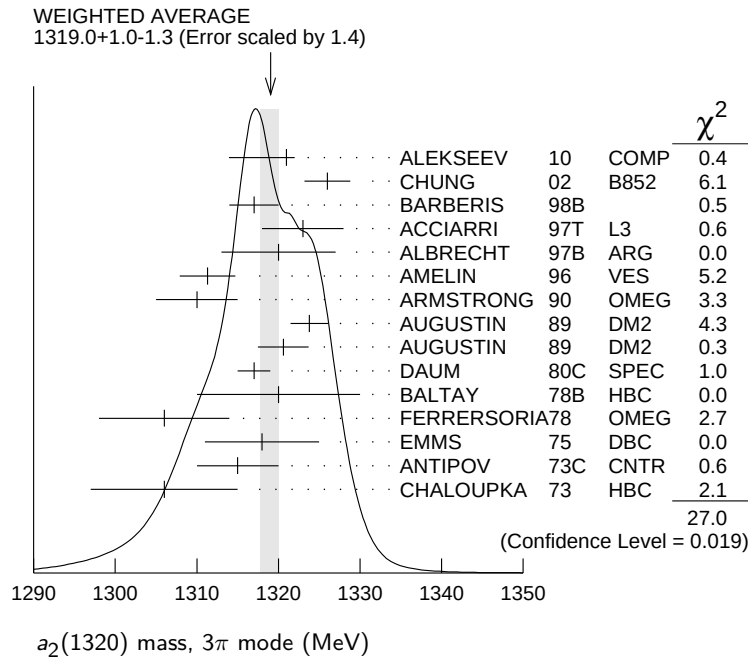
1300 ± 2 ± 4	18k	² SCHEGELSKY 06	RVUE 0	$\gamma\gamma \rightarrow \pi^+\pi^-\pi^0$	
1305 ± 14		CONDO 93	SHF	$\gamma p \rightarrow n\pi^+\pi^+\pi^-$	
1310 ± 2		¹ EVANGELIS...	81 OMEG -	$12 \pi^- p \rightarrow 3\pi p$	
1343 ± 11	490	BALTAY 78B	HBC 0	$15 \pi^+ p \rightarrow \Delta 3\pi$	OCCUR=2
1309 ± 5	5k	BINNIE 71	MMS -	$\pi^- p$ near a_2 thresh- old	OCCUR=2
1299 ± 6	28k	BOWEN 71	MMS -	$5 \pi^- p$	
1300 ± 6	24k	BOWEN 71	MMS +	$5 \pi^+ p$	OCCUR=2
1309 ± 4	17k	BOWEN 71	MMS -	$7 \pi^- p$	OCCUR=3
1306 ± 4	941	ALSTON-...	70 HBC +	$7.0 \pi^+ p \rightarrow 3\pi p$	

¹From a fit to $J^P = 2^+ \rho\pi$ partial wave.

²From analysis of L3 data at 183–209 GeV.

NODE=M012M1;LINKAGE=P

NODE=M012M1;LINKAGE=SC



K $\bar{K}$ MODE

VALUE (MeV) EVTS DOCUMENT ID TECN CHG COMMENT

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

1318.1 ± 0.7 OUR AVERAGE

1319 ± 5	4700	^{3,4} CLELAND	82B SPEC +	$50 \pi^+ p \rightarrow K_S^0 K^+ p$	OCCUR=2
1324 ± 6	5200	^{3,4} CLELAND	82B SPEC -	$50 \pi^- p \rightarrow K_S^0 K^- p$	OCCUR=3
1320 ± 2	4000	CHABAUD 80	SPEC -	$17 \pi^- A \rightarrow K_S^0 K^- A$	
1312 ± 4	11000	CHABAUD 78	SPEC -	$9.8 \pi^- p \rightarrow K^- K_S^0 p$	
1316 ± 2	4730	CHABAUD 78	SPEC -	$18.8 \pi^- p \rightarrow K^- K_S^0 p$	OCCUR=2
1318 ± 1		^{3,5} MARTIN 78D	SPEC -	$10 \pi^- p \rightarrow K_S^0 K^- p$	
1320 ± 2	2724	MARGULIE 76	SPEC -	$23 \pi^- p \rightarrow K^- K_S^0 p$	
1313 ± 4	730	FOLEY 72	CNTR -	$20.3 \pi^- p \rightarrow K^- K_S^0 p$	
1319 ± 3	1500	⁵ GRAYER 71	ASPK -	$17.2 \pi^- p \rightarrow K^- K_S^0 p$	

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

1304 ± 10	870	⁶ SCHEGELSKY 06A	RVUE 0	$\gamma\gamma \rightarrow K_S^0 K_S^0$	
1330 ± 11	1000	^{3,4} CLELAND 82B	SPEC +	$30 \pi^+ p \rightarrow K_S^0 K^+ p$	
1324 ± 5	350	HYAMS 78	ASPK +	$12.7 \pi^+ p \rightarrow K^+ K_S^0 p$	

³From a fit to $J^P = 2^+$ partial wave.

⁴Number of events evaluated by us.

⁵Systematic error in mass scale subtracted.

⁶From analysis of L3 data at 91 and 183–209 GeV.

NODE=M012M2;LINKAGE=P

NODE=M012M2;LINKAGE=W

NODE=M012M2;LINKAGE=S

NODE=M012M2;LINKAGE=SC

$\eta\pi$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

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

NODE=M012M3
 NODE=M012M3

1317.7±1.4 OUR AVERAGE

1308 ±9		BARBERIS	00H		450 $p p \rightarrow p_f \eta \pi^0 p_s$
1316 ±9		BARBERIS	00H		450 $p p \rightarrow \Delta_f^{++} \eta \pi^- p_s$
1317 ±1 ±2		THOMPSON	97	MPS	18 $\pi^- p \rightarrow \eta \pi^- p$
1315 ±5 ±2		⁷ AMSLER	94D	CBAR	0.0 $\bar{p} p \rightarrow \pi^0 \pi^0 \eta$
1325.1±5.1		AOYAGI	93	BKEI	$\pi^- p \rightarrow \eta \pi^- p$
1317.7±1.4±2.0		BELADIDZE	93	VES	37 $\pi^- N \rightarrow \eta \pi^- N$
1323 ±8	1000	⁸ KEY	73	OSPK	6 $\pi^- p \rightarrow p \pi^- \eta$

OCCUR=2

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

1309	± 4		ANISOVICH	09	RVUE		$\bar{p} p, \pi N$
1324	± 5		ARMSTRONG	93C	E760	0	$\bar{p} p \rightarrow \pi^0 \eta \eta \rightarrow 6 \gamma$
1336.2	± 1.7	2561	DELFOSE	81	SPEC	+	$\pi^\pm p \rightarrow p \pi^\pm \eta$
1330.7	± 2.4	1653	DELFOSE	81	SPEC	-	$\pi^\pm p \rightarrow p \pi^\pm \eta$
1324	± 8	6200	^{8,9} CONFORTO	73	OSPK	-	$6 \pi^- p \rightarrow p \text{MM}^-$

OCCUR=2

⁷ The systematic error of 2 MeV corresponds to the spread of solutions.⁸ Error includes 5 MeV systematic mass-scale error.⁹ Missing mass with enriched MMS = $\eta \pi^-$, $\eta = 2\gamma$.

NODE=M012M3;LINKAGE=DD
 NODE=M012M3;LINKAGE=E
 NODE=M012M3;LINKAGE=M

 $\eta'\pi$ MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

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

NODE=M012M4
 NODE=M012M4

1322 ± 7 OUR AVERAGE

1318 ± 8 $^{+3}_{-5}$		IVANOV	01	B852	18 $\pi^- p \rightarrow \eta' \pi^- p$
1327.0±10.7		BELADIDZE	93	VES	37 $\pi^- N \rightarrow \eta' \pi^- N$

 $a_2(1320)$ WIDTH

NODE=M012210

3 π MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

NODE=M012W1
 NODE=M012W1

105.0 $^{+1.6}_{-1.9}$ OUR AVERAGE

110	± 2	$^{+2}_{-15}$	420k	ALEKSEEV	10	COMP	190	$\pi^- Pb \rightarrow \pi^- \pi^- \pi^+ Pb'$
108	± 3	± 15		CHUNG	02	B852	18.3	$\pi^- p \rightarrow \pi^+ \pi^- \pi^- p$
120	± 10			BARBERIS	98B		450	$pp \rightarrow p_f \pi^+ \pi^- \pi^0 p_s$
105	± 10	± 11		ACCIARRI	97T	L3		$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^- \pi^0$
120	± 10			ALBRECHT	97B	ARG		$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^- \pi^0$
103.0	± 6.0	± 3.3	72.4k	AMELIN	96	VES	36	$\pi^- p \rightarrow \pi^+ \pi^- \pi^0 n$
120	± 10			ARMSTRONG	90	OMEG 0	300.0	$pp \rightarrow p p \pi^+ \pi^- \pi^0$
107.0	± 9.7		4022	AUGUSTIN	89	DM2 $\pm$	$J/\psi \rightarrow \rho^\pm a_2^\mp$	
118.5	± 12.5		3562	AUGUSTIN	89	DM2 0	$J/\psi \rightarrow \rho^0 a_2^0$	
97	± 5			¹⁰ EVANGELIS...	81	OMEG $-$	12	$\pi^- p \rightarrow 3\pi p$
96	± 9		25k	¹⁰ DAUM	80C	SPEC $-$	63,94	$\pi^- p \rightarrow 3\pi p$
110	± 15		1097	¹⁰ BALTAY	78B	HBC $+0$	15	$\pi^+ p \rightarrow p 4\pi$
112	± 18		1.6k	¹⁰ EMMS	75	DBC 0	4	$\pi^+ n \rightarrow p(3\pi)^0$
122	± 14		1.2k	^{10,11} WAGNER	75	HBC 0	7	$\pi^+ p \rightarrow \Delta^{++}(3\pi)^0$
115	± 15			¹⁰ ANTIPOV	73C	CNTR $-$	25,40	$\pi^- p \rightarrow p \eta \pi^-$
99	± 15		1580	CHALOUPKA	73	HBC $-$	3.9	$\pi^- p$
105	± 5		28k	BOWEN	71	MMS $-$	5	$\pi^- p$
99	± 5		24k	BOWEN	71	MMS $+$	5	$\pi^+ p$
103	± 5		17k	BOWEN	71	MMS $-$	7	$\pi^- p$

OCCUR=2

OCCUR=2

OCCUR=3

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

117 ± 6 ± 20	18k	¹² SCHEGELSKY	06	RVUE	0	$\gamma\gamma \rightarrow \pi^+ \pi^- \pi^0$
120 ± 40		CONDO	93	SHF		$\gamma p \rightarrow n \pi^+ \pi^+ \pi^-$
115 ± 14	490	BALTAY	78B	HBC	0	$15 \pi^+ p \rightarrow \Delta 3\pi$
72 ± 16	5k	BINNIE	71	MMS	—	$\pi^- p$ near a_2 thresh- old
79 ± 12	941	ALSTON-...	70	HBC	+	$7.0 \pi^+ p \rightarrow 3\pi p$

OCCUR=2

OCCUR=2

¹⁰ From a fit to $J^P = 2^+ \rho\pi$ partial wave.

¹¹ Width errors enlarged by us to $4\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.

¹² From analysis of L3 data at 183–209 GeV.

NODE=M012W1;LINKAGE=P

NODE=M012W1;LINKAGE=S

NODE=M012W1;LINKAGE=SC

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

VALUE (MeV) DOCUMENT ID

107 ± 5 OUR ESTIMATE

110.4 ± 1.7 OUR AVERAGE Includes data from the 2 datablocks that follow this one.

NODE=M012W0

NODE=M012W0

→ UNCHECKED ←

$K\bar{K}$ MODE

VALUE (MeV) EVTS DOCUMENT ID TECN CHG COMMENT

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

NODE=M012W2

NODE=M012W2

109.8 ± 2.4 OUR AVERAGE

112 ± 20	4700	^{13,14} CLELAND	82B	SPEC	+	$50 \pi^+ p \rightarrow K_S^0 K^+ p$
120 ± 25	5200	^{13,14} CLELAND	82B	SPEC	—	$50 \pi^- p \rightarrow K_S^0 K^- p$
106 ± 4	4000	CHABAUD	80	SPEC	—	$17 \pi^- A \rightarrow K_S^0 K^- A$
126 ± 11	11000	CHABAUD	78	SPEC	—	$9.8 \pi^- p \rightarrow K^- K_S^0 p$
101 ± 8	4730	CHABAUD	78	SPEC	—	$18.8 \pi^- p \rightarrow K^- K_S^0 p$
113 ± 4		^{13,15} MARTIN	78D	SPEC	—	$10 \pi^- p \rightarrow K_S^0 K^- p$
105 ± 8	2724	¹⁵ MARGULIE	76	SPEC	—	$23 \pi^- p \rightarrow K^- K_S^0 p$
113 ± 19	730	FOLEY	72	CNTR	—	$20.3 \pi^- p \rightarrow K^- K_S^0 p$
123 ± 13	1500	¹⁵ GRAYER	71	ASPK	—	$17.2 \pi^- p \rightarrow K^- K_S^0 p$

OCCUR=2

OCCUR=3

OCCUR=2

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

120 ± 15	870	¹⁶ SCHEGELSKY	06A	RVUE	0	$\gamma\gamma \rightarrow K_S^0 K_S^0$
121 ± 51	1000	^{13,14} CLELAND	82B	SPEC	+	$30 \pi^+ p \rightarrow K_S^0 K^+ p$
110 ± 18	350	HYAMS	78	ASPK	+	$12.7 \pi^+ p \rightarrow K^+ K_S^0 p$

¹³ From a fit to $J^P = 2^+$ partial wave.

¹⁴ Number of events evaluated by us.

¹⁵ Width errors enlarged by us to $4\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.

¹⁶ From analysis of L3 data at 91 and 183–209 GeV.

NODE=M012W2;LINKAGE=P

NODE=M012W2;LINKAGE=W

NODE=M012W2;LINKAGE=S

NODE=M012W2;LINKAGE=SC

$\eta\pi$ MODE

VALUE (MeV) EVTS DOCUMENT ID TECN CHG COMMENT

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

NODE=M012W3

NODE=M012W3

111.1 ± 2.4 OUR AVERAGE

115 ± 20		BARBERIS	00H			$450 p p \rightarrow p_f \eta \pi^0 p_s$
112 ± 14		BARBERIS	00H			$450 p p \rightarrow$ $\Delta_f^{++} \eta \pi^- p_s$
112 ± 3 ± 2		¹⁷ AMSLER	94D	CBAR		$0.0 \bar{p} p \rightarrow \pi^0 \pi^0 \eta$
103 ± 6 ± 3		BELADIDZE	93	VES		$37 \pi^- N \rightarrow \eta \pi^- N$
112.2 ± 5.7	2561	DELFOSSÉ	81	SPEC	+	$\pi^\pm p \rightarrow p \pi^\pm \eta$
116.6 ± 7.7	1653	DELFOSSÉ	81	SPEC	—	$\pi^\pm p \rightarrow p \pi^\pm \eta$
108 ± 9	1000	KEY	73	OSPK	—	$6 \pi^- p \rightarrow p \pi^- \eta$

OCCUR=2

OCCUR=2

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

110 ± 4		ANISOVICH	09	RVUE		$\bar{p} p, \pi N$
127 ± 2 ± 2		¹⁸ THOMPSON	97	MPS		$18 \pi^- p \rightarrow \eta \pi^- p$
118 ± 10		ARMSTRONG	93C	E760	0	$\bar{p} p \rightarrow \pi^0 \eta \eta \rightarrow 6\gamma$
104 ± 9	6200	¹⁹ CONFORTO	73	OSPK	—	$6 \pi^- p \rightarrow p \pi^- \eta$

¹⁷ The systematic error of 2 MeV corresponds to the spread of solutions.

¹⁸ Resolution is not unfolded.

¹⁹ Missing mass with enriched MMS = $\eta \pi^-$, $\eta = 2\gamma$.

NODE=M012W3;LINKAGE=DD

NODE=M012W3;LINKAGE=A

NODE=M012W3;LINKAGE=M

$\eta'\pi$ MODE

VALUE (MeV) DOCUMENT ID TECN COMMENT

119 ± 25 OUR AVERAGE

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

NODE=M012W4

NODE=M012W4

$a_2(1320)$ DECAY MODES

NODE=M012215;NODE=M012

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
Γ_1 3π	(70.1 $\pm$ 2.7) %	S=1.2
Γ_2 $\rho(770)\pi$		
Γ_3 $f_2(1270)\pi$		
Γ_4 $\rho(1450)\pi$		
Γ_5 $\eta\pi$	(14.5 $\pm$ 1.2) %	
Γ_6 $\omega\pi\pi$	(10.6 $\pm$ 3.2) %	S=1.3
Γ_7 $K\bar{K}$	(4.9 $\pm$ 0.8) %	
Γ_8 $\eta'(958)\pi$	(5.3 $\pm$ 0.9) $\times 10^{-3}$	
Γ_9 $\pi^\pm\gamma$	(2.68 $\pm$ 0.31) $\times 10^{-3}$	
Γ_{10} $\gamma\gamma$	(9.4 $\pm$ 0.7) $\times 10^{-6}$	
Γ_{11} e^+e^-	< 5 $\times 10^{-9}$	CL=90%

DESIG=1
DESIG=11
DESIG=12
DESIG=13
DESIG=3
DESIG=4
DESIG=2
DESIG=8
DESIG=7
DESIG=9
DESIG=10

CONSTRAINED FIT INFORMATION

An overall fit to 5 branching ratios uses 18 measurements and one constraint to determine 4 parameters. The overall fit has a $\chi^2 = 9.3$ for 15 degrees of freedom.

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

x_5	10		
x_6	-89	-46	
x_7	-1	-2	-24
	x_1	x_5	x_6

 $a_2(1320)$ PARTIAL WIDTHS

NODE=M012220

 $\Gamma(\eta\pi)$ **Γ_5**

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

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

18.5 $\pm$ 3.0 870 ²⁰ SCHEGELSKY 06A RVUE 0 $\gamma\gamma \rightarrow K_S^0 K_S^0$

²⁰ From analysis of L3 data at 91 and 183–209 GeV, using $\Gamma(a_2(1320) \rightarrow \gamma\gamma) = 0.91$ keV and SU(3) relations.

NODE=M012W6
NODE=M012W6

NODE=M012W6;LINKAGE=SC

 $\Gamma(K\bar{K})$ **Γ_7**

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

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

7.0 $^{+2.0}_{-1.5}$ 870 ²¹ SCHEGELSKY 06A RVUE 0 $\gamma\gamma \rightarrow K_S^0 K_S^0$

²¹ From analysis of L3 data at 91 and 183–209 GeV, using $\Gamma(a_2(1320) \rightarrow \gamma\gamma) = 0.91$ keV and SU(3) relations.

NODE=M012W5
NODE=M012W5

NODE=M012W5;LINKAGE=SC

 $\Gamma(\pi^\pm\gamma)$ **Γ_9**

VALUE (keV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

287 $\pm$ 30 OUR AVERAGE

284 $\pm$ 25 $\pm$ 25 7100 MOLCHANOV 01 SELX 600 $\pi^- A \rightarrow \pi^+\pi^-\pi^- A$
295 $\pm$ 60 CIHANGIR 82 SPEC + 200 $\pi^+ A$

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

461 $\pm$ 110 ²² MAY 77 SPEC $\pm$ 9.7 γA

²² Assuming one-pion exchange.

NODE=M012W7
NODE=M012W7

NODE=M012W;LINKAGE=M2

$\Gamma(\gamma\gamma)$ Γ_{10}

VALUE (keV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
1.00±0.06 OUR AVERAGE					
0.98±0.05±0.09		ACCIARRI	97T	L3	$e^+e^- \rightarrow e^+e^-\pi^+\pi^-\pi^0$
0.96±0.03±0.13		ALBRECHT	97B	ARG	$e^+e^- \rightarrow e^+e^-\pi^+\pi^-\pi^0$
1.26±0.26±0.18	36	BARU	90	MD1	$e^+e^- \rightarrow e^+e^-\pi^+\pi^-\pi^0$
1.00±0.07±0.15	415	BEHREND	90C	CELL 0	$e^+e^- \rightarrow e^+e^-\pi^+\pi^-\pi^0$
1.03±0.13±0.21		BUTLER	90	MRK2	$e^+e^- \rightarrow e^+e^-\pi^+\pi^-\pi^0$
1.01±0.14±0.22	85	OEST	90	JADE	$e^+e^- \rightarrow e^+e^-\pi^0\eta$
0.90±0.27±0.15	56	²³ ALTHOFF	86	TASS 0	$e^+e^- \rightarrow e^+e^-3\pi$
1.14±0.20±0.26		²⁴ ANTREASYAN	86	CBAL 0	$e^+e^- \rightarrow e^+e^-\pi^0\eta$
1.06±0.18±0.19		BERGER	84C	PLUT 0	$e^+e^- \rightarrow e^+e^-3\pi$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.81±0.19 ^{+0.42} _{-0.11}	35	²³ BEHREND	83B	CELL 0	$e^+e^- \rightarrow e^+e^-3\pi$
0.77±0.18±0.27	22	²⁴ EDWARDS	82F	CBAL 0	$e^+e^- \rightarrow e^+e^-\pi^0\eta$
²³ From $\rho\pi$ decay mode.					
²⁴ From $\eta\pi^0$ decay mode.					

NODE=M012W9
 NODE=M012W9

NODE=M012W;LINKAGE=F
 NODE=M012W;LINKAGE=G

 $\Gamma(e^+e^-)$ Γ_{11}

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
< 0.56	90	ACHASOV	00K	SND $e^+e^- \rightarrow \pi^0\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<25	90	VOROBYEV	88	ND $e^+e^- \rightarrow \pi^0\eta$

NODE=M012W10
 NODE=M012W10

 $a_2(1320) \Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

NODE=M012223

 $\Gamma(3\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_1\Gamma_{10}/\Gamma$

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.65±0.02±0.02	18k	²⁵ SCHEGELSKY	06	RVUE $\gamma\gamma \rightarrow \pi^+\pi^-\pi^0$
²⁵ From analysis of L3 data at 183–209 GeV.				

NODE=M012G2
 NODE=M012G2

NODE=M012G2;LINKAGE=SC

 $\Gamma(\eta\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_5\Gamma_{10}/\Gamma$

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.145 ^{+0.097} _{-0.034}	²⁶ UEHARA	09A	BELL $e^+e^- \rightarrow e^+e^-\eta\pi^0$
²⁶ From the D_2 -wave. The fraction of the D_0 -wave is $3.4^{+2.3}_{-1.1}\%$.			

NODE=M012G01
 NODE=M012G01

NODE=M012G01;LINKAGE=UE

 $\Gamma(K\bar{K}) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_7\Gamma_{10}/\Gamma$

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
0.126±0.007±0.028	²⁷ ALBRECHT	90G	ARG $e^+e^- \rightarrow e^+e^-K^+K^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.081±0.006±0.027	²⁸ ALBRECHT	90G	ARG $e^+e^- \rightarrow e^+e^-K^+K^-$
²⁷ Using an incoherent background.			
²⁸ Using a coherent background.			

NODE=M012G1
 NODE=M012G1

OCCUR=2

NODE=M012G1;LINKAGE=A
 NODE=M012G1;LINKAGE=B

 $a_2(1320) \text{ BRANCHING RATIOS}$

NODE=M012225

 $[\Gamma(f_2(1270)\pi) + \Gamma(\rho(1450)\pi)]/\Gamma(\rho(770)\pi)$ $(\Gamma_3+\Gamma_4)/\Gamma_2$

VALUE	CL%	DOCUMENT ID	TECN	CHG	COMMENT
<0.12	90	ABRAMOVI...	70B	HBC	— $3.93 \pi^- p$

NODE=M012R9
 NODE=M012R9

$\Gamma(\eta\pi)/\Gamma(3\pi)$ Γ_5/Γ_1

VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
0.207±0.018 OUR FIT					
0.213±0.020 OUR AVERAGE					
0.18 ±0.05		FORINO	76	HBC	11 $\pi^- p$
0.22 ±0.05	52	ANTIPOV	73	CNTR	40 $\pi^- p$
0.211±0.044	149	CHALOUPKA	73	HBC	3.9 $\pi^- p$
0.246±0.042	167	ALSTON-...	71	HBC	7.0 $\pi^+ p$
0.25 ±0.09	15	BOECKMANN	70	HBC	5.0 $\pi^+ p$
0.23 ±0.08	22	ASCOLI	68	HBC	5 $\pi^- p$
0.12 ±0.08		CHUNG	68	HBC	3.2 $\pi^- p$
0.22 ±0.09		CONTE	67	HBC	11.0 $\pi^- p$

NODE=M012R3
 NODE=M012R3

 $\Gamma(\omega\pi\pi)/\Gamma(3\pi)$ Γ_6/Γ_1

VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
0.15±0.05 OUR FIT	Error includes scale factor of 1.3.				
0.15±0.05 OUR AVERAGE	Error includes scale factor of 1.3. See the ideogram below.				
0.28±0.09	60	DIAZ	74	DBC	0 6 $\pi^+ n$
0.18±0.08	29	KARSHON	74	HBC	Avg. of above two
0.10±0.05	279	CHALOUPKA	73	HBC	3.9 $\pi^- p$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.29±0.08	140	29 KARSHON	74	HBC	0 4.9 $\pi^+ p$
0.10±0.04	60	29 KARSHON	74	HBC	+ 4.9 $\pi^+ p$
0.19±0.08		DEFOIX	73	HBC	0 0.7 $\bar{p} p$

NODE=M012R12
 NODE=M012R12

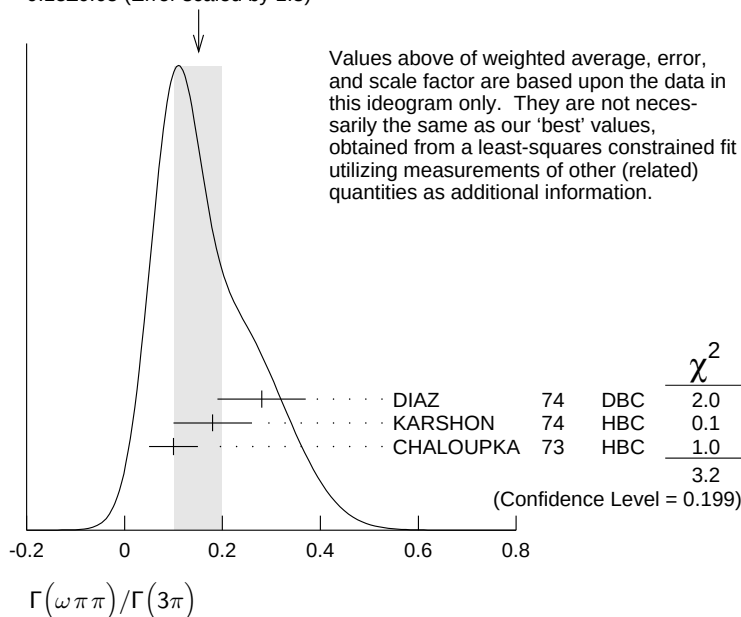
OCCUR=3

OCCUR=2

NODE=M012R12;LINKAGE=K

²⁹ KARSHON 74 suggest an additional $I = 0$ state strongly coupled to $\omega\pi\pi$ which could explain discrepancies in branching ratios and masses. We use a central value and a systematic spread.

WEIGHTED AVERAGE
 0.15±0.05 (Error scaled by 1.3)

 $\Gamma(K\bar{K})/\Gamma(3\pi)$ Γ_7/Γ_1

VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
0.070±0.012 OUR FIT					
0.078±0.017		CHABAUD	78	RVUE	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.011±0.003	30	BERTIN	98B	OBLX	0.0 $\bar{p} p \rightarrow K^\pm K_s \pi^\mp$
0.056±0.014	50	31 CHALOUPKA	73	HBC	3.9 $\pi^- p$
0.097±0.018	113	31 ALSTON-...	71	HBC	+ 7.0 $\pi^+ p$
0.06 ±0.03		31 ABRAMOV...	70B	HBC	3.93 $\pi^- p$
0.054±0.022	31	CHUNG	68	HBC	3.2 $\pi^- p$

NODE=M012R1
 NODE=M012R1

³⁰ Using 4 π data from BERTIN 97D.

³¹ Included in CHABAUD 78 review.

NODE=M012R1;LINKAGE=BE
 NODE=M012R1;LINKAGE=C

$\Gamma(K\bar{K})/\Gamma(\eta\pi)$ Γ_7/Γ_5

VALUE	DOCUMENT ID	TECN	COMMENT

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

0.08 ± 0.02	³² BERTIN	98B	OBLX 0.0 $\bar{p}p \rightarrow K^\pm K_s^\mp \pi^\mp$

³² Using $\eta\pi\pi$ data from AMSLER 94D.

NODE=M012R14
NODE=M012R14

NODE=M012R14;LINKAGE=BE

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

VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

0.162 ± 0.012 OUR FIT

0.140 ± 0.028 OUR AVERAGE

0.13 ± 0.04		ESPIGAT	72	HBC	± 0.0 $\bar{p}p$
0.15 ± 0.04	34	BARNHAM	71	HBC	+ 3.7 $\pi^+ p$

NODE=M012R2
NODE=M012R2

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

VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

0.054 ± 0.009 OUR FIT

0.048 ± 0.012 OUR AVERAGE

0.05 ± 0.02		TOET	73	HBC	+ 5 $\pi^+ p$
0.09 ± 0.04		TOET	73	HBC	0 5 $\pi^+ p$
0.03 ± 0.02	8	DAMERI	72	HBC	− 11 $\pi^- p$
0.06 ± 0.03	17	BARNHAM	71	HBC	+ 3.7 $\pi^+ p$

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

0.020 ± 0.004	³³ ESPIGAT	72	HBC	± 0.0 $\bar{p}p$

³³ Not averaged because of discrepancy between masses from $K\bar{K}$ and $\rho\pi$ modes.

NODE=M012R8
NODE=M012R8

OCCUR=2

NODE=M012R8;LINKAGE=A

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

VALUE	CL%	DOCUMENT ID	TECN	CHG	COMMENT

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

<0.006	95	ALDE	92B	GAM2	38,100 $\pi^- p \rightarrow \eta' \pi^0 n$
<0.02	97	BARNHAM	71	HBC	+ 3.7 $\pi^+ p$
0.004 ± 0.004		BOESEBECK	68	HBC	+ 8 $\pi^+ p$

NODE=M012R4
NODE=M012R4

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

VALUE	CL%	DOCUMENT ID	TECN	CHG	COMMENT

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

<0.011	90	EISENSTEIN	73	HBC	− 5 $\pi^- p$
<0.04		ALSTON-...	71	HBC	+ 7.0 $\pi^+ p$
0.04 $\begin{smallmatrix} +0.03 \\ -0.04 \end{smallmatrix}$		BOECKMANN	70	HBC	0 5.0 $\pi^+ p$

NODE=M012R5
NODE=M012R5

 $\Gamma(\eta'(958)\pi)/\Gamma(\eta\pi)$ Γ_8/Γ_5

VALUE	DOCUMENT ID	TECN	COMMENT

0.037 ± 0.006 OUR AVERAGE

0.032 ± 0.009	ABELE	97C	CBAR 0.0 $\bar{p}p \rightarrow \pi^0 \pi^0 \eta'$
0.047 ± 0.010 ± 0.004	³⁴ BELADIDZE	93	VES 37 $\pi^- N \rightarrow a_2^- N$
0.034 ± 0.008 ± 0.005	BELADIDZE	92	VES 36 $\pi^- C \rightarrow a_2^- C$

³⁴ Using $B(\eta' \rightarrow \pi^+ \pi^- \eta) = 0.441$, $B(\eta \rightarrow \gamma\gamma) = 0.389$ and $B(\eta \rightarrow \pi^+ \pi^- \pi^0) = 0.236$.

NODE=M012R13
NODE=M012R13

NODE=M012R13;LINKAGE=A

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

VALUE	DOCUMENT ID	TECN	COMMENT

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

0.005 $\begin{smallmatrix} +0.005 \\ -0.003 \end{smallmatrix}$	³⁵ EISENBERG	72	HBC 4.3, 5.25, 7.5 γp

³⁵ Pion-exchange model used in this estimation.

NODE=M012R11
NODE=M012R11

NODE=M012R11;LINKAGE=R

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

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

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

<6	90	ACHASOV	00K	SND $e^+ e^- \rightarrow \pi^0 \pi^0$

NODE=M012R15
NODE=M012R15

a₂(1320) REFERENCES

NODE=M012

ALEKSEEV	10	PRL 104 241803	M.G. Alekseev <i>et al.</i>	(COMPASS Collab.)	REFID=53356
ANISOVICH	09	IJMP A24 2481	V.V. Anisovich, A.V. Sarantsev		REFID=52719
UEHARA	09A	PR D80 032001	S. Uehara <i>et al.</i>	(BELLE Collab.)	REFID=53002
SCHEGELSKY	06	EPJ A27 199	V.A. Schegelsky <i>et al.</i>		REFID=51186
SCHEGELSKY	06A	EPJ A27 207	V.A. Schegelsky <i>et al.</i>		REFID=51185
CHUNG	02	PR D65 072001	S.U. Chung <i>et al.</i>	(BNL E852 Collab.)	REFID=48837
IVANOV	01	PRL 86 3977	E.I. Ivanov <i>et al.</i>	(BNL E852 Collab.)	REFID=48317
MOLCHANOV	01	PL B521 171	V.V. Molchanov <i>et al.</i>	(FNAL SELEX Collab.)	REFID=48559
ACHASOV	00K	PL B492 8	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47933
BARBERIS	00H	PL B488 225	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=47964
BARBERIS	98B	PL B422 399	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=46345
BERTIN	98B	PL B434 180	A. Bertin <i>et al.</i>	(OBELIX Collab.)	REFID=46351
ABELE	97C	PL B404 179	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)	REFID=45531
ACCIARRI	97T	PL B413 147	M. Acciarri <i>et al.</i>	(L3 Collab.)	REFID=45761
ALBRECHT	97B	ZPHY C74 469	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=45418
THOMPSON	97	PRL 79 1630	D.R. Thompson <i>et al.</i>	(BNL E852 Collab.)	REFID=45584
AMELIN	96	ZPHY C70 71	D.V. Amelin <i>et al.</i>	(SERP, TBIL)	REFID=44649
AMSLER	94D	PL B333 277	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=44093
AOYAGI	93	PL B314 246	H. Aoyagi <i>et al.</i>	(BKEI Collab.)	REFID=43599
ARMSTRONG	93C	PL B307 394	T.A. Armstrong <i>et al.</i>	(FNAL, FERR, GENO+)	REFID=43587
BELADIDZE	93	PL B313 276	G.M. Beladidze <i>et al.</i>	(VES Collab.)	REFID=43598
CONDO	93	PR D48 3045	G.T. Condo <i>et al.</i>	(SLAC Hybrid Collab.)	REFID=43600
ALDE	92B	ZPHY C54 549	D.M. Alde <i>et al.</i>	(SERP, BELG, LANL, LAPP+)	REFID=41852
BELADIDZE	92	ZPHY C54 235	G.M. Beladidze <i>et al.</i>	(VES Collab.)	REFID=42171
ALBRECHT	90G	ZPHY C48 183	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=41374
ARMSTRONG	90	ZPHY C48 213	T.A. Armstrong, M. Benayoun, W. Beusch	(WA76 Coll.)	REFID=41375
BARU	90	ZPHY C48 581	S.E. Baru <i>et al.</i>	(MD-1 Collab.)	REFID=41366
BEHREND	90C	ZPHY C46 583	H.J. Behrend <i>et al.</i>	(CELLO Collab.)	REFID=41356
BUTLER	90	PR D42 1368	F. Butler <i>et al.</i>	(Mark II Collab.)	REFID=41363
OEST	90	ZPHY C47 343	T. Oest <i>et al.</i>	(JADE Collab.)	REFID=41358
AUGUSTIN	89	NP B320 1	J.E. Augustin, G. Cosme	(DM2 Collab.)	REFID=41004
VOROBYEV	88	SJNP 48 273	P.V. Vorobiev <i>et al.</i>	(NOVO)	REFID=41023
		Translated from YAF 48 436.			
ALTHOFF	86	ZPHY C31 537	M. Althoff <i>et al.</i>	(TASSO Collab.)	REFID=21287
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
CHANGIR	82	PL 117B 123	S. Cihangir <i>et al.</i>	(FNAL, MINN, ROCH)	REFID=21280
CLELAND	82B	NP B208 228	W.E. Cleland <i>et al.</i>	(DURH, GEVA, LAUS+)	REFID=21281
EDWARDS	82F	PL 110B 82	C. Edwards <i>et al.</i>	(CIT, HARV, PRIN+)	REFID=20747
DELFOSSSE	81	NP B183 349	A. Delfosse <i>et al.</i>	(GEVA, LAUS)	REFID=21277
EVANGELIS...	81	NP B178 197	C. Evangelista <i>et al.</i>	(BARI, BONN, CERN+)	REFID=20462
CHABAUD	80	NP B175 189	V. Chabaud <i>et al.</i>	(CERN, MPIM, AMST)	REFID=21274
DAUM	80C	PL 89B 276	C. Daum <i>et al.</i>	(AMST, CERN, CRAC, MPIM+) 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 (generic for all A,B,E,G) **G33** 1 (2006).

$f_0(1370)$ T-MATRIX POLE POSITION

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

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

(1200–1500)– $i(150\text{--}250)$ OUR ESTIMATE

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

$(1290 \pm 50) - i(170^{+20}_{-40})$	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	$\bar{p}p \rightarrow 3\pi^0$
$(1360 \pm 35) - i(150\text{--}300)$	⁵ AMSLER	95C	CBAR	$\bar{p}p \rightarrow \pi^0 \eta\eta$
$(1390 \pm 30) - i(190 \pm 40)$	⁶ AMSLER	95D	CBAR	$\bar{p}p \rightarrow 3\pi^0, \pi^0 \eta\eta, \pi^0 \pi^0 \eta$
1346 – $i249$	^{7,8} JANSSEN	95	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$
1214 – $i168$	^{8,9} TORNQVIST	95	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}, K\pi, \eta\pi$
1364 – $i139$	AMSLER	94D	CBAR	$\bar{p}p \rightarrow \pi^0 \pi^0 \eta$
$(1365^{+20}_{-55}) - i(134 \pm 35)$	ANISOVICH	94	CBAR	$\bar{p}p \rightarrow 3\pi^0, \pi^0 \eta\eta$
$(1340 \pm 40) - i(127^{+30}_{-20})$	¹⁰ BUGG	94	RVUE	$\bar{p}p \rightarrow 3\pi^0, \eta\eta\pi^0, \eta\pi^0 \pi^0$
$(1430 \pm 5) - i(73 \pm 13)$	¹¹ KAMINSKI	94	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$
1420 – $i220$	¹² AU	87	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$

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.

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

VALUE (MeV)	DOCUMENT ID

1200 to 1500 OUR ESTIMATE

NODE=M147

NODE=M147

NODE=M147PP

NODE=M147PP

NODE=M147PP

→ UNCHECKED ←

OCCUR=2

OCCUR=2

OCCUR=2

OCCUR=2

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

NODE=M147205

NODE=M147M

→ UNCHECKED ←

$\pi\pi$ MODE

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1400 ± 40		¹³ AUBERT	09L BABR	$B^\pm \rightarrow \pi^\pm \pi^\pm \pi^\mp$
1470^{+6+72}_{-7-255}		¹⁴ UEHARA	08A BELL	$10.6 e^+ e^- \rightarrow e^+ e^- \pi^0 \pi^0$
1259 ± 55	2.6k	BONVICINI	07 CLEO	$D^+ \rightarrow \pi^- \pi^+ \pi^+$
$1309 \pm 1 \pm 15$		¹⁵ BUGG	07A RVUE	$0.0 p \bar{p} \rightarrow 3 \pi^0$
1449 ± 13	4.3k	¹⁶ GARMASH	06 BELL	$B^+ \rightarrow K^+ \pi^+ \pi^-$
1350 ± 50		ABLIKIM	05 BES2	$J/\psi \rightarrow \phi \pi^+ \pi^-$
$1265 \pm 30^{+20}_{-35}$		ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$
$1434 \pm 18 \pm 9$	848	AITALA	01A E791	$D_s^+ \rightarrow \pi^- \pi^+ \pi^+$
1308 ± 10		BARBERIS	99B OMEG	$450 p p \rightarrow p_s p_f \pi^+ \pi^-$
1315 ± 50		BELLAZZINI	99 GAM4	$450 p p \rightarrow p p \pi^0 \pi^0$
1315 ± 30		ALDE	98 GAM4	$100 \pi^- p \rightarrow \pi^0 \pi^0 n$
1280 ± 55		BERTIN	98 OBLX	$0.05-0.405 \bar{n} p \rightarrow \pi^+ \pi^+ \pi^-$
1186		^{17,18} TORNQVIST	95 RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}, K\pi, \eta\pi$
1472 ± 12		ARMSTRONG	91 OMEG	$300 p p \rightarrow p p \pi\pi, p p K\bar{K}$
1275 ± 20		BREAKSTONE	90 SFM	$62 p p \rightarrow p p \pi^+ \pi^-$
1420 ± 20		AKESSON	86 SPEC	$63 p p \rightarrow p p \pi^+ \pi^-$
1256		FROGGATT	77 RVUE	$\pi^+ \pi^-$ channel

¹³ Breit-Wigner mass.¹⁴ Breit-Wigner mass. May also be the $f_0(1500)$.¹⁵ Reanalysis of ABELE 96C data.¹⁶ Also observed by GARMASH 07 in $B^0 \rightarrow K_S^0 \pi^+ \pi^-$ decays. Supersedes GARMASH 05.¹⁷ Uses data from BEIER 72B, OCHS 73, HYAMS 73, GRAYER 74, ROSSELET 77, CASON 83, ASTON 88, and ARMSTRONG 91B. Coupled channel analysis with flavor symmetry and all light two-pseudoscalars systems.¹⁸ Also observed by ASNER 00 in $\tau^- \rightarrow \pi^- \pi^0 \pi^0 \nu_\tau$ decaysNODE=M147M1
NODE=M147M1NODE=M147M1;LINKAGE=BW
NODE=M147M1;LINKAGE=UE
NODE=M147M1;LINKAGE=BU
NODE=M147M1;LINKAGE=GR
NODE=M147M1;LINKAGE=BB

NODE=M147M1;LINKAGE=FF

 $K\bar{K}$ MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
1440 ± 6	VLADIMIRSK...06	SPEC	$40 \pi^- p \rightarrow K_S^0 K_S^0 n$
1391 ± 10	TIKHOMIROV 03	SPEC	$40.0 \pi^- C \rightarrow K_S^0 K_S^0 K_L^0 X$
1440 ± 50	BOLONKIN 88	SPEC	$40 \pi^- p \rightarrow K_S^0 K_S^0 n$
1463 ± 9	ETKIN 82B	MPS	$23 \pi^- p \rightarrow n 2 K_S^0$
1425 ± 15	WICKLUND 80	SPEC	$6 \pi N \rightarrow K^+ K^- N$
~ 1300	POLYCHRO... 79	STRC	$7 \pi^- p \rightarrow n 2 K_S^0$

 4π MODE $2(\pi\pi)_S + \rho\rho$

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1395 ± 40		ABELE	01 CBAR	$0.0 \bar{p} d \rightarrow \pi^- 4 \pi^0 p$
1374 ± 38		AMSLER	94 CBAR	$0.0 \bar{p} p \rightarrow \pi^+ \pi^- 3 \pi^0$
1345 ± 12		ADAMO	93 OBLX	$\bar{n} p \rightarrow 3 \pi^+ 2 \pi^-$
1386 ± 30		GASPERO	93 DBC	$0.0 \bar{p} n \rightarrow 2 \pi^+ 3 \pi^-$
~ 1410	5751	¹⁹ BETTINI	66 DBC	$0.0 \bar{p} n \rightarrow 2 \pi^+ 3 \pi^-$
¹⁹ $\rho\rho$ dominant.				

 $\eta\eta$ MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$1262^{+51+82}_{-78-103}$	²⁰ UEHARA	10A BELL	$10.6 e^+ e^- \rightarrow e^+ e^- \eta\eta$
1430	AMSLER	92 CBAR	$0.0 \bar{p} p \rightarrow \pi^0 \eta\eta$
1220 ± 40	ALDE	86D GAM4	$100 \pi^- p \rightarrow n 2 \eta$

²⁰ Breit-Wigner mass. May also be the $f_0(1500)$.NODE=M147M3
NODE=M147M3

NODE=M147M3;LINKAGE=BE

NODE=M147M4
NODE=M147M4

NODE=M147M4;LINKAGE=UE

COUPLED CHANNEL MODE

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>

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

1306 ± 20

21 ANISOVICH 03 RVUE

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

NODE=M147M5
 NODE=M147M5

NODE=M147M;LINKAGE=KM

 $f_0(1370)$ BREIT-WIGNER WIDTH

NODE=M147210

<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		22 AUBERT	09L	BABR	$B^\pm \rightarrow \pi^\pm \pi^\pm \pi^\mp$
90 ⁺ ₁₋ 2 ⁺ ₁₋ 50 ₂₂		23 UEHARA	08A	BELL	10.6 $e^+ e^- \rightarrow e^+ e^- \pi^0 \pi^0$
298 ± 21	2.6k	BONVICINI	07	CLEO	$D^+ \rightarrow \pi^- \pi^+ \pi^+$
126 ± 25	4286	24 GARMASH	06	BELL	$B^+ \rightarrow K^+ \pi^+ \pi^-$
265 ± 40		ABLIKIM	05	BES2	$J/\psi \rightarrow \phi \pi^+ \pi^-$
350 ± 100 ⁺ ₆₀		ABLIKIM	05Q	BES2	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$
173 ± 32 ± 6	848	AITALA	01A	E791	$D_s^+ \rightarrow \pi^- \pi^+ \pi^+$
222 ± 20		BARBERIS	99B	OMEG	450 $pp \rightarrow p_s p_f \pi^+ \pi^-$
255 ± 60		BELLAZZINI	99	GAM4	450 $pp \rightarrow pp \pi^0 \pi^0$
190 ± 50		ALDE	98	GAM4	100 $\pi^- p \rightarrow \pi^0 \pi^0 n$
323 ± 13		BERTIN	98	OBLX	0.05–0.405 $\bar{n} p \rightarrow \pi^+ \pi^+ \pi^-$
350	25,26	TORNQVIST	95	RVUE	$\pi\pi \rightarrow \pi\pi, K \bar{K}, K\pi, \eta\pi$
195 ± 33		ARMSTRONG	91	OMEG	300 $pp \rightarrow pp \pi\pi, pp K \bar{K}$
285 ± 60		BREAKSTONE	90	SFM	62 $pp \rightarrow pp \pi^+ \pi^-$
460 ± 50		AKESSON	86	SPEC	63 $pp \rightarrow pp \pi^+ \pi^-$
~ 400	27	FROGGATT	77	RVUE	$\pi^+ \pi^-$ channel

22 The systematic errors are not reported.

23 Breit-Wigner width. May also be the $f_0(1500)$.24 Also observed by GARMASH 07 in $B^0 \rightarrow K_S^0 \pi^+ \pi^-$ decays. Supersedes GARMASH 05.

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

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

27 Width defined as distance between 45 and 135° phase shift.

NODE=M147W1;LINKAGE=NS
 NODE=M147W1;LINKAGE=UE
 NODE=M147W1;LINKAGE=GR
 NODE=M147W1;LINKAGE=BB

NODE=M147W1;LINKAGE=FF
 NODE=M147W1;LINKAGE=E

 $K \bar{K}$ MODE

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>

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

121 ± 15	VLADIMIRSK...06	SPEC	40 $\pi^- p \rightarrow K_S^0 K_S^0 n$
55 ± 26	TIKHOMIROV 03	SPEC	40.0 $\pi^- C \rightarrow K_S^0 K_S^0 K_L^0 X$
250 ± 80	BOLONKIN 88	SPEC	40 $\pi^- p \rightarrow K_S^0 K_S^0 n$
118 ⁺ ₁₆ 138 ₁₆	ETKIN 82B	MPS	23 $\pi^- p \rightarrow n 2 K_S^0$
160 ± 30	WICKLUND 80	SPEC	6 $\pi N \rightarrow K^+ K^- N$
~ 150	POLYCHRO... 79	STRC	7 $\pi^- p \rightarrow n 2 K_S^0$

NODE=M147W2
 NODE=M147W2

 4π MODE $2(\pi\pi)_S + \rho\rho$

<u>VALUE (MeV)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>

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 28 BETTINI	66	DBC	0.0 $\bar{p} n \rightarrow 2\pi^+ 3\pi^-$

28 $\rho\rho$ 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. • • •			
$484^{+246+246}_{-170-263}$	²⁹ UEHARA	10A BELL	$10.6 e^+ e^- \rightarrow e^+ e^- \eta\eta$
250	AMSLER	92 CBAR	$0.0 \bar{p} p \rightarrow \pi^0 \eta\eta$
320 ± 40	ALDE	86D GAM4	$100 \pi^- p \rightarrow n 2\eta$
²⁹ Breit-Wigner width. May also be the $f_0(1500)$.			

NODE=M147W4
 NODE=M147W4

NODE=M147W4;LINKAGE=UE

COUPLED CHANNEL MODE

VALUE (MeV)	DOCUMENT ID	TECN
• • • We do not use the following data for averages, fits, limits, etc. • • •		
147^{+30}_{-50}	³⁰ ANISOVICH	03 RVUE
³⁰ K-matrix pole from combined analysis of $\pi^- p \rightarrow \pi^0 \pi^0 n$, $\pi^- p \rightarrow K \bar{K} n$, $\pi^+ \pi^- \rightarrow \pi^+ \pi^-$, $\bar{p} p \rightarrow \pi^0 \pi^0 \pi^0$, $\pi^0 \eta\eta$, $\pi^0 \pi^0 \eta$, $\pi^+ \pi^- \pi^0$, $K^+ K^- \pi^0$, $K_S^0 K_S^0 \pi^0$, $K^+ K_S^0 \pi^-$ at rest, $\bar{p} n \rightarrow \pi^- \pi^- \pi^+$, $K_S^0 K^- \pi^0$, $K_S^0 K_S^0 \pi^-$ at rest.		

NODE=M147W5
 NODE=M147W5

NODE=M147W;LINKAGE=KM

 $f_0(1370)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \pi\pi$	seen
$\Gamma_2 4\pi$	seen
$\Gamma_3 4\pi^0$	seen
$\Gamma_4 2\pi^+ 2\pi^-$	seen
$\Gamma_5 \pi^+ \pi^- 2\pi^0$	seen
$\Gamma_6 \rho\rho$	dominant
$\Gamma_7 2(\pi\pi)_{S\text{-wave}}$	seen
$\Gamma_8 \pi(1300)\pi$	seen
$\Gamma_9 a_1(1260)\pi$	seen
$\Gamma_{10} \eta\eta$	seen
$\Gamma_{11} K\bar{K}$	seen
$\Gamma_{12} K\bar{K} n\pi$	not seen
$\Gamma_{13} 6\pi$	not seen
$\Gamma_{14} \omega\omega$	not seen
$\Gamma_{15} \gamma\gamma$	seen
$\Gamma_{16} e^+ e^-$	not seen

NODE=M147215;NODE=M147

DESIG=1;OUR EST;→ UNCHECKED ←
 DESIG=10;OUR EST;→ UNCHECKED ←
 DESIG=4;OUR EST;→ UNCHECKED ←
 DESIG=5;OUR EST;→ UNCHECKED ←
 DESIG=6;OUR EST;→ UNCHECKED ←
 DESIG=14;OUR EST;→ UNCHECKED ←
 DESIG=15;OUR EST;→ UNCHECKED ←
 DESIG=16;OUR EVAL;→ UNCHECKED ←
 DESIG=17;OUR EVAL;→ UNCHECKED ←
 DESIG=2;OUR EST;→ UNCHECKED ←
 DESIG=11;OUR EST;→ UNCHECKED ←
 DESIG=18;OUR EVAL;→ UNCHECKED ←
 DESIG=19;OUR EVAL;→ UNCHECKED ←
 DESIG=20;OUR EVAL;→ UNCHECKED ←
 DESIG=12;OUR EST;→ UNCHECKED ←
 DESIG=13;OUR EST;→ UNCHECKED ←

 $f_0(1370)$ PARTIAL WIDTHS

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

NODE=M147217

NODE=M147W11
 NODE=M147W11
 NODE=M147W11

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

Γ_{16}

NODE=M147W12
 NODE=M147W12

 $f_0(1370)$ $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

$\Gamma(\eta\eta) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$121^{+133+169}_{-53-106}$	³¹ UEHARA	10A BELL	$10.6 e^+ e^- \rightarrow e^+ e^- \eta\eta$
³¹ Including interference with the $f_2'(1525)$ (parameters fixed to the values from the 2008 edition of this review, PDG 08) and $f_2(1270)$. May also be the $f_0(1500)$.			

$\Gamma_{10}\Gamma_{15}/\Gamma$

NODE=M147225

NODE=M147G01
 NODE=M147G01

NODE=M147G01;LINKAGE=UE

$f_0(1370)$ BRANCHING RATIOS

NODE=M147220

$\Gamma(\pi\pi)/\Gamma_{\text{total}}$				Γ_1/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.26 ± 0.09	BUGG	96	RVUE	
< 0.15	³² AMSLER	94	CBAR $\bar{p}p \rightarrow \pi^+ \pi^- 3\pi^0$	
< 0.06	GASPERO	93	DBC 0.0 $\bar{p}n \rightarrow \text{hadrons}$	
³² Using AMSLER 95B ($3\pi^0$).				

NODE=M147R3
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	³³ GASPERO	93	DBC 0.0 $\bar{p}n \rightarrow \text{hadrons}$	
³³ Model-dependent evaluation.				

NODE=M147R12
NODE=M147R12

NODE=M147R12;LINKAGE=GA

$\Gamma(2\pi^+ 2\pi^-)/\Gamma(4\pi)$				$\Gamma_4/\Gamma_2 = \Gamma_4/(\Gamma_3 + \Gamma_4 + \Gamma_5)$
VALUE	DOCUMENT ID	TECN	COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.420 ± 0.014	³⁴ GASPERO	93	DBC 0.0 $\bar{p}n \rightarrow 2\pi^+ 3\pi^-$	
³⁴ Model-dependent evaluation.				

NODE=M147R5
NODE=M147R5

NODE=M147R5;LINKAGE=A

$\Gamma(\pi^+ \pi^- 2\pi^0)/\Gamma(4\pi)$				$\Gamma_5/\Gamma_2 = \Gamma_5/(\Gamma_3 + \Gamma_4 + \Gamma_5)$
VALUE	DOCUMENT ID	TECN	COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.512 ± 0.019	³⁵ GASPERO	93	DBC 0.0 $\bar{p}n \rightarrow \text{hadrons}$	
³⁵ Model-dependent evaluation.				

NODE=M147R6
NODE=M147R6

NODE=M147R6;LINKAGE=A

$\Gamma(\rho\rho)/\Gamma(4\pi)$				Γ_6/Γ_2
VALUE	DOCUMENT ID	TECN	COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.26 ± 0.07	ABELE	01B	CBAR 0.0 $\bar{p}d \rightarrow 5\pi p$	

NODE=M147R17
NODE=M147R17

$\Gamma(2(\pi\pi)_{\text{S-wave}})/\Gamma(\pi\pi)$				Γ_7/Γ_1
VALUE	DOCUMENT ID	TECN	COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
5.6 ± 2.6	³⁶ ABELE	01	CBAR 0.0 $\bar{p}d \rightarrow \pi^- 4\pi^0 p$	
³⁶ From the combined data of ABELE 96 and ABELE 96C.				

NODE=M147R15
NODE=M147R15

NODE=M147R;LINKAGE=KZ

$\Gamma(2(\pi\pi)_{\text{S-wave}})/\Gamma(4\pi)$				Γ_7/Γ_2
VALUE	DOCUMENT ID	TECN	COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.51 ± 0.09	ABELE	01B	CBAR 0.0 $\bar{p}d \rightarrow 5\pi p$	

NODE=M147R16
NODE=M147R16

$\Gamma(\rho\rho)/\Gamma(2(\pi\pi)_{\text{S-wave}})$				Γ_6/Γ_7
VALUE	DOCUMENT ID	TECN	COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
large	BARBERIS	00C	450 $pp \rightarrow p_f 4\pi p_s$	
1.6 ± 0.2	AMSLER	94	CBAR $\bar{p}p \rightarrow \pi^+ \pi^- 3\pi^0$	
~ 0.65	GASPERO	93	DBC 0.0 $\bar{p}n \rightarrow \text{hadrons}$	

NODE=M147R10
NODE=M147R10

OCCUR=2

$\Gamma(\pi(1300)\pi)/\Gamma(4\pi)$				Γ_8/Γ_2
VALUE	DOCUMENT ID	TECN	COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.17 ± 0.06	ABELE	01B	CBAR 0.0 $\bar{p}d \rightarrow 5\pi p$	

NODE=M147R18
NODE=M147R18

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

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.06 ± 0.02	ABELE	01B	CBAR $0.0 \bar{p}d \rightarrow 5\pi p$

 Γ_9/Γ_2

NODE=M147R19
 NODE=M147R19

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

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$(28 \pm 11) \times 10^{-3}$	³⁷ ANISOVICH	02D	SPEC Combined fit
$(4.7 \pm 2.0) \times 10^{-3}$	BARBERIS	00E	450 $p\bar{p} \rightarrow p_f \eta \eta p_S$

 $\Gamma_{10}/\Gamma_2 = \Gamma_{10}/(\Gamma_3 + \Gamma_4 + \Gamma_5)$

NODE=M147R14
 NODE=M147R14

³⁷ From a combined K-matrix analysis of Crystal Barrel ($0. \bar{p}\bar{p} \rightarrow \pi^0 \pi^0 \pi^0, \pi^0 \eta \eta, \pi^0 \pi^0 \eta$), GAMS ($\pi p \rightarrow \pi^0 \pi^0 n, \eta \eta n, \eta \eta' n$), and BNL ($\pi p \rightarrow K \bar{K} n$) data.

NODE=M147R14;LINKAGE=CH

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

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

 Γ_{11}/Γ

NODE=M147R11
 NODE=M147R11

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

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.08 ± 0.08	ABLIKIM	05	BES2 $J/\psi \rightarrow \phi \pi^+ \pi^-, \phi K^+ K^-$
0.91 ± 0.20	³⁸ BARGIOTTI	03	OBLX $\bar{p}p$
0.12 ± 0.06	³⁹ ANISOVICH	02D	SPEC Combined fit
$0.46 \pm 0.15 \pm 0.11$	BARBERIS	99D	OMEG 450 $p\bar{p} \rightarrow K^+ K^-, \pi^+ \pi^-$

 Γ_{11}/Γ_1

NODE=M147R13
 NODE=M147R13

³⁸ Coupled channel analysis of $\pi^+ \pi^- \pi^0, K^+ K^- \pi^0$, and $K^\pm K_S^0 \pi^\mp$.
³⁹ From a combined K-matrix analysis of Crystal Barrel ($0. \bar{p}\bar{p} \rightarrow \pi^0 \pi^0 \pi^0, \pi^0 \eta \eta, \pi^0 \pi^0 \eta$), GAMS ($\pi p \rightarrow \pi^0 \pi^0 n, \eta \eta n, \eta \eta' n$), and BNL ($\pi p \rightarrow K \bar{K} n$) data.

NODE=M147R;LINKAGE=BG
 NODE=M147R;LINKAGE=CH

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

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
< 0.03	GASPERO	93	DBC $0.0 \bar{p}n \rightarrow \text{hadrons}$

 Γ_{12}/Γ

NODE=M147R20
 NODE=M147R20

 $\Gamma(6\pi)/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
< 0.22	GASPERO	93	DBC $0.0 \bar{p}n \rightarrow \text{hadrons}$

 Γ_{13}/Γ

NODE=M147R21
 NODE=M147R21

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

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
< 0.13	GASPERO	93	DBC $0.0 \bar{p}n \rightarrow \text{hadrons}$

 Γ_{14}/Γ

NODE=M147R22
 NODE=M147R22

 $f_0(1370)$ REFERENCES

UEHARA	10A	PR D82 114031	S. Uehara <i>et al.</i>	(BELLE Collab.)
ANISOVICH	09	IJMP A24 2481	V.V. Anisovich, A.V. Sarantsev	
AUBERT	09L	PR D79 072006	B. Aubert <i>et al.</i>	(BABAR Collab.)
PDG	08	PL B667 1	C. Amsler <i>et al.</i>	(PDG Collab.)
UEHARA	08A	PR D78 052004	S. Uehara <i>et al.</i>	(BELLE Collab.)
BONVICINI	07	PR D76 012001	G. Bonvicini <i>et al.</i>	(CLEO Collab.)
BUGG	07A	JP G34 151	D.V. Bugg <i>et al.</i>	
GARMASH	07	PR D75 012006	A. Garmash <i>et al.</i>	(BELLE Collab.)
GARMASH	06	PRL 96 251803	A. Garmash <i>et al.</i>	(BELLE Collab.)
PDG	06	JP G33 1	W.-M. Yao <i>et al.</i>	(PDG Collab.)
VLADIMIRSK...	06	PAN 69 493	V.V. Vladimirovsky <i>et al.</i>	(ITEP, Moscow)
		Translated from YAF 69 515.		
ABLIKIM	05	PL B607 243	M. Ablikim <i>et al.</i>	(BES Collab.)
ABLIKIM	05Q	PR D72 092002	M. Ablikim <i>et al.</i>	(BES Collab.)
GARMASH	05	PR D71 092003	A. Garmash <i>et al.</i>	(BELLE Collab.)
ANISOVICH	03	EPJ A16 229	V.V. Anisovich <i>et al.</i>	
BARGIOTTI	03	EPJ C26 371	M. Bargiotti <i>et al.</i>	(OBELIX Collab.)
TIKHOMIROV	03	PAN 66 828	G.D. Tikhomirov <i>et al.</i>	
		Translated from YAF 66 860.		
ANISOVICH	02D	PAN 65 1545	V.V. Anisovich <i>et al.</i>	
		Translated from YAF 65 1583.		

NODE=M147

REFID=53641
 REFID=52719
 REFID=52723
 REFID=52166
 REFID=52309
 REFID=51721
 REFID=53252
 REFID=51594
 REFID=51162
 REFID=51004
 REFID=51191

REFID=50450
 REFID=50958
 REFID=50641
 REFID=49401
 REFID=49217
 REFID=49423
 REFID=48831

ABELE	01	EPJ C19 667	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)	REFID=48334
ABELE	01B	EPJ C21 261	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)	REFID=48356
AITALA	01A	PRL 86 765	E.M. Aitala <i>et al.</i>	(FNAL E791 Collab.)	REFID=48004
ASNER	00	PR D61 012002	D.M. Asner <i>et al.</i>	(CLEO Collab.)	REFID=47339
BARBERIS	00C	PL B471 440	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=47959
BARBERIS	00E	PL B479 59	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=47961
BARBERIS	99B	PL B453 316	D. Barberis <i>et al.</i>	(Omega Expt.)	REFID=46922
BARBERIS	99D	PL B462 462	D. Barberis <i>et al.</i>	(Omega Expt.)	REFID=47395
BELLAZZINI	99	PL B467 296	R. Bellazzini <i>et al.</i>		REFID=47400
KAMINSKI	99	EPJ C9 141	R. Kaminski, L. Lesniak, B. Loiseau	(CRAC, PARIN)	REFID=46927
ALDE	98	EPJ A3 361	D. Alde <i>et al.</i>	(GAM4 Collab.)	REFID=46605
Also		PAN 62 405	D. Alde <i>et al.</i>	(GAMS Collab.)	REFID=46914
ANISOVICH	98B	Translated from YAF 62 446 SPU 41 419	V.V. Anisovich <i>et al.</i>		REFID=46331
BERTIN	98	PR D57 55	A. Bertin <i>et al.</i>	(OBELIX Collab.)	REFID=45782
BARBERIS	97B	PL B413 217	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=45758
BERTIN	97C	PL B408 476	A. Bertin <i>et al.</i>	(OBELIX Collab.)	REFID=45701
ABELE	96	PL B380 453	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)	REFID=45011
ABELE	96B	PL B385 425	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)	REFID=45038
ABELE	96C	NP A609 562	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)	REFID=45076
BUGG	96	NP B471 59	D.V. Bugg, A.V. Sarantsev, B.S. Zou	(LOQM, PNPI)	REFID=45094
AMSLER	95B	PL B342 433	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=44377
AMSLER	95C	PL B353 571	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=44440
AMSLER	95D	PL B355 425	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=44441
JANSSEN	95	PR D52 2690	G. Janssen <i>et al.</i>	(STON, ADLD, JULI)	REFID=44508
TORNQVIST	95	ZPHY C68 647	N.A. Tornqvist	(HELS)	REFID=44529
AMSLER	94	PL B322 431	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.) JPC	REFID=43660
AMSLER	94D	PL B333 277	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=44093
ANISOVICH	94	PL B323 233	V.V. Anisovich <i>et al.</i>	(Crystal Barrel Collab.) JPC	REFID=43659
BUGG	94	PR D50 4412	D.V. Bugg <i>et al.</i>	(LOQM)	REFID=44078
KAMINSKI	94	PR D50 3145	R. Kaminski, L. Lesniak, J.P. Maillet	(CRAC+)	REFID=45771
ADAMO	93	NP A558 13C	A. Adamo <i>et al.</i>	(OBELIX Collab.) JPC	REFID=43657
GASPERO	93	NP A562 407	M. Gaspero	(ROMAI) JPC	REFID=43658
AMSLER	92	PL B291 347	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=43169
ARMSTRONG	91	ZPHY C51 351	T.A. Armstrong <i>et al.</i>	(ATHU, BARI, BIRM+)	REFID=41744
ARMSTRONG	91B	ZPHY C52 389	T.A. Armstrong <i>et al.</i>	(ATHU, BARI, BIRM+)	REFID=41862
BREAKSTONE	90	ZPHY C48 569	A.M. Breakstone <i>et al.</i>	(ISU, BGNA, CERN+)	REFID=41376
MORGAN	90	ZPHY C48 623	D. Morgan, M.R. Pennington	(RAL, DURH)	REFID=41583
ASTON	88	NP B296 493	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)	REFID=40262
BOLONKIN	88	NP B309 426	B.V. Bolonkin <i>et al.</i>	(ITEP, SERP)	REFID=40580
FALVARD	88	PR D38 2706	A. Falvard <i>et al.</i>	(CLER, FRAS, LALO+)	REFID=40576
VOROBYEV	88	SJNP 48 273	P.V. Vorobiev <i>et al.</i>	(NOVO)	REFID=41023
AU	87	PR D35 1633	K.L. Au, D. Morgan, M.R. Pennington	(DURH, RAL)	REFID=40064
AKESSON	86	NP B264 154	T. Akesson <i>et al.</i>	(Axial Field Spec. Collab.)	REFID=21123
ALDE	86D	NP B269 485	D.M. Alde <i>et al.</i>	(BELG, LAPP, SERP, CERN+)	REFID=20765
CASON	83	PR D28 1586	N.M. Cason <i>et al.</i>	(NDAM, ANL)	REFID=20752
ETKIN	82B	PR D25 1786	A. Etkin <i>et al.</i>	(BNL, CUNY, TUFTS, VAND)	REFID=20390
WICKLUND	80	PRL 45 1469	A.B. Wicklund <i>et al.</i>	(ANL)	REFID=20383
BECKER	79	NP B151 46	H. Becker <i>et al.</i>	(MPIM, CERN, ZEEM, CRAC)	REFID=21084
POLYCHRO...	79	PR D19 1317	V.A. Polychronakos <i>et al.</i>	(NDAM, ANL)	REFID=20378
FROGGATT	77	NP B129 89	C.D. Froggatt, J.L. Petersen	(GLAS, NORD)	REFID=21072
ROSSELET	77	PR D15 574	L. Rosselet <i>et al.</i>	(GEVA, SACL)	REFID=11004
GRAYER	74	NP B75 189	G. Grayer <i>et al.</i>	(CERN, MPIM)	REFID=20113
HYAMS	73	NP B64 134	B.D. Hyams <i>et al.</i>	(CERN, MPIM)	REFID=20107
OCHS	73	Thesis	W. Ochs	(MPIM, MUNI)	REFID=20349
BEIER	72B	PRL 29 511	E.W. Beier <i>et al.</i>	(PENN)	REFID=44530
BETTINI	66	NC 42A 695	A. Bettini <i>et al.</i>	(PADO, PISA)	REFID=21361

$h_1(1380)$

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

OMITTED FROM SUMMARY TABLE

Seen in partial-wave analysis of the $K\bar{K}\pi$ system. Needs confirmation.

NODE=M109

NODE=M109

 $h_1(1380)$ MASS

NODE=M109M

NODE=M109M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
1386 ± 19 OUR AVERAGE			
1440 ± 60	ABELE	97H CBAR	$\bar{p}p \rightarrow K_L^0 K_S^0 \pi^0 \pi^0$
1380 ± 20	ASTON	88C LASS	$11 K^- p \rightarrow K_S^0 K^\pm \pi^\mp \Lambda$

 $h_1(1380)$ WIDTH

NODE=M109W

NODE=M109W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
91 ± 30 OUR AVERAGE	Error includes scale factor of 1.1.		
170 ± 80	ABELE	97H CBAR	$\bar{p}p \rightarrow K_L^0 K_S^0 \pi^0 \pi^0$
80 ± 30	ASTON	88C LASS	$11 K^- p \rightarrow K_S^0 K^\pm \pi^\mp \Lambda$

 $h_1(1380)$ DECAY MODES

NODE=M109215;NODE=M109

Mode

 $\Gamma_1 \quad K\bar{K}^*(892) + \text{c.c.}$

DESIG=1

 $h_1(1380)$ REFERENCES

NODE=M109

REFID=45765
REFID=40282

ABELE	97H	PL B415 280	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
ASTON	88C	PL B201 573	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)

NODE=M111

 $\pi_1(1400)$

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

NODE=M111

See also the mini-review under non- $q\bar{q}$ candidates in PDG 06, Journal of Physics (generic for all A,B,E,G) **G33** 1 (2006). **$\pi_1(1400)$ MASS**

NODE=M111M

NODE=M111M

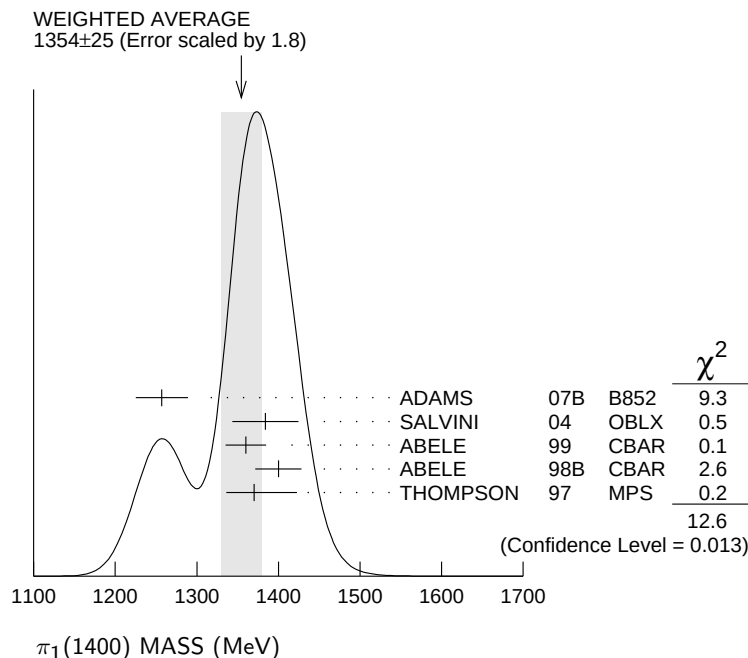
VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
1354 ± 25 OUR AVERAGE		Error includes scale factor of 1.8. See the ideogram below.			
$1257 \pm 20 \pm 25$	23.5k	ADAMS	07B B852		$18 \pi^- p \rightarrow \eta \pi^0 n$
$1384 \pm 20 \pm 35$	90k	SALVINI	04 OBLX		$\bar{p}p \rightarrow 2\pi^+ 2\pi^-$
1360 ± 25		ABELE	99 CBAR		$0.0 \bar{p}p \rightarrow \pi^0 \pi^0 \eta$
$1400 \pm 20 \pm 20$		ABELE	98B CBAR		$0.0 \bar{p}n \rightarrow \pi^- \pi^0 \eta$
$1370 \pm 16 \pm^{+50}_{-30}$		¹ THOMPSON	97 MPS		$18 \pi^- p \rightarrow \eta \pi^- p$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1323.1 ± 4.6		² AOYAGI	93 BKEI		$\pi^- p \rightarrow \eta \pi^- p$
1406 ± 20		³ ALDE	88B GAM4	0	$100 \pi^- p \rightarrow \eta \pi^0 n$

¹ Natural parity exchange, questioned by DZIERBA 03.² Unnatural parity exchange.³ Seen in the P_0 -wave intensity of the $\eta\pi^0$ system, unnatural parity exchange.

NODE=M111M;LINKAGE=B

NODE=M111M;LINKAGE=C

NODE=M111M;LINKAGE=A



$\pi_1(1400)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
330 ±35 OUR AVERAGE					
354 ±64 ± 58	23.5k	ADAMS	07B	B852	$18 \pi^- p \rightarrow \eta \pi^0 n$
378 ±50 ± 50	90k	SALVINI	04	OBLX	$\bar{p} p \rightarrow 2\pi^+ 2\pi^-$
220 ±90		ABELE	99	CBAR	$0.0 \bar{p} p \rightarrow \pi^0 \pi^0 \eta$
310 ±50 + 50 - 30		ABELE	98B	CBAR	$0.0 \bar{p} n \rightarrow \pi^- \pi^0 \eta$
385 ±40 + 65 - 105		⁴ THOMPSON	97	MPS	$18 \pi^- p \rightarrow \eta \pi^- p$
143.2 ±12.5		⁵ AOYAGI	93	BKEI	$\pi^- p \rightarrow \eta \pi^- p$
180 ±20		⁶ ALDE	88B	GAM4 0	$100 \pi^- p \rightarrow \eta \pi^0 n$

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

⁴ Resolution is not unfolded, natural parity exchange, questioned by DZIERBA 03.

⁵ Unnatural parity exchange.

⁶ Seen in the P_0 -wave intensity of the $\eta \pi^0$ system, unnatural parity exchange.

$\pi_1(1400)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \eta \pi^0$	seen
$\Gamma_2 \quad \eta \pi^-$	seen
$\Gamma_3 \quad \eta' \pi$	

$\pi_1(1400)$ BRANCHING RATIOS

$\Gamma(\eta \pi^0)/\Gamma_{\text{total}}$				Γ_1/Γ
VALUE	DOCUMENT ID	TECN	CHG	COMMENT
not seen	PROKOSHKIN	95B	GAM4	$100 \pi^- p \rightarrow \eta \pi^0 n$
not seen	⁷ BUGG	94	RVUE	$\bar{p} p \rightarrow \eta 2\pi^0$
not seen	⁸ APEL	81	NICE 0	$40 \pi^- p \rightarrow \eta \pi^0 n$

⁷ Using Crystal Barrel data.

⁸ A general fit allowing S , D , and P waves (including $m=0$) is not done because of limited statistics.

NODE=M111W

NODE=M111W

NODE=M111W;LINKAGE=QQ

NODE=M111W;LINKAGE=C

NODE=M111W;LINKAGE=A

NODE=M111215;NODE=M111

DESIG=1;OUR EST;→ UNCHECKED ←

DESIG=4;OUR EST;→ UNCHECKED ←

DESIG=3

NODE=M111220

NODE=M111R1

NODE=M111R1

NODE=M111R1;LINKAGE=C

NODE=M111R1;LINKAGE=B

$\Gamma(\eta\pi^-)/\Gamma_{\text{total}}$					Γ_2/Γ
VALUE		DOCUMENT ID	TECN	COMMENT	
• • • 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
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REFID=46602
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REFID=45584
REFID=44619

REFID=44078
REFID=43599
REFID=43598
REFID=41751
REFID=40558
REFID=22913

$\eta(1405)$

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

NODE=M027

A REVIEW GOES HERE – Check our WWW List of Reviews

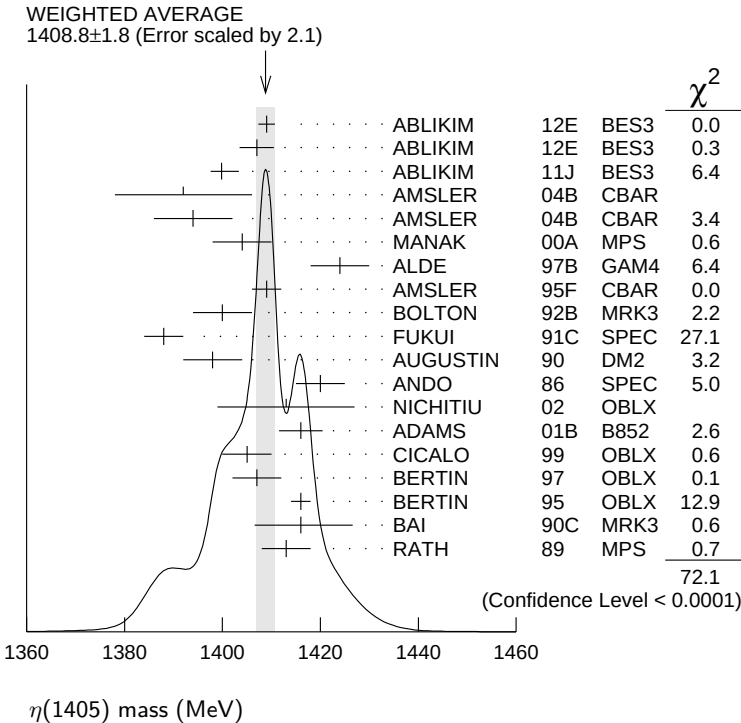
NODE=M027

$\eta(1405)$ MASS

NODE=M027205

NODE=M027MX

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.



$\eta\pi\pi$ MODE

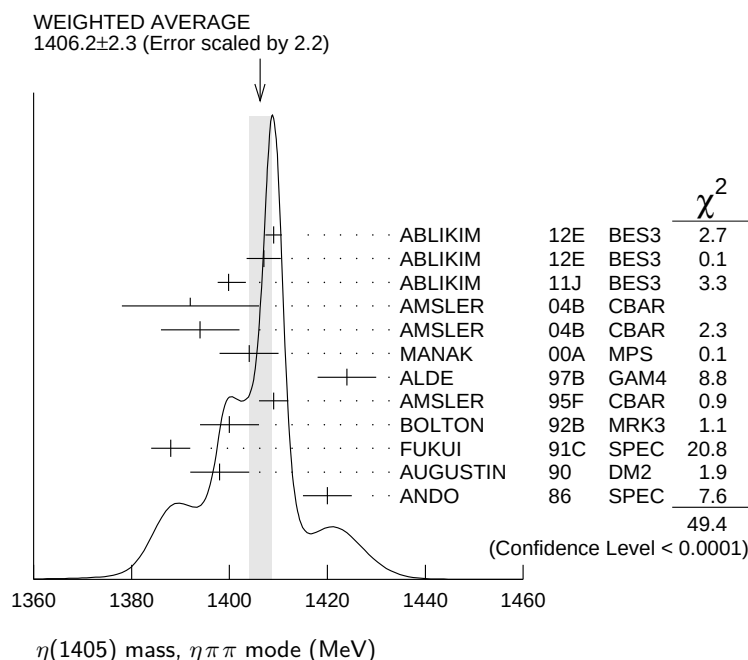
VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

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

1406.2 $\pm$ 2.3 OUR AVERAGE Error includes scale factor of 2.2. See the ideogram below.

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	$J/\psi \rightarrow \omega(\eta\pi^+\pi^-)$	
1392 $\pm$ 14	900 $\pm$ 375	AMSLER	04B CBAR	$0\bar{p}p \rightarrow \pi^+\pi^-\pi^+\pi^-\eta$	OCCUR=2
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	$8\pi^-p \rightarrow \eta\pi^+\pi^-n$	
1385 $\pm$ 7		BAI	99 BES	$J/\psi \rightarrow \gamma\eta\pi^+\pi^-$	

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

 **$K\bar{K}\pi$ MODE ($a_0(980)\pi$ or direct $K\bar{K}\pi$)**

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

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

1413.9 $\pm$ 1.7 OUR AVERAGE Error includes scale factor of 1.1.

1413 $\pm$ 14	3651	4 NICHITIU	02 OBLX		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	$0\bar{p}p \rightarrow K^\pm(K^0)\pi^\mp \pi^+ \pi^-$	OCCUR=2
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	$21.4\pi^-p \rightarrow nK_S^0 K_S^0 \pi^0$	OCCUR=3
1459 $\pm$ 5		7 AUGUSTIN	92 DM2	$J/\psi \rightarrow \gamma K\bar{K}\pi$	

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

 $\pi\pi\gamma$ 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=M027M1
NODE=M027M1

NODE=M027M4
NODE=M027M4

NODE=M027M2
NODE=M027M2

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	$8 \pi^- p \rightarrow K^+ K^0 \pi^- n$
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

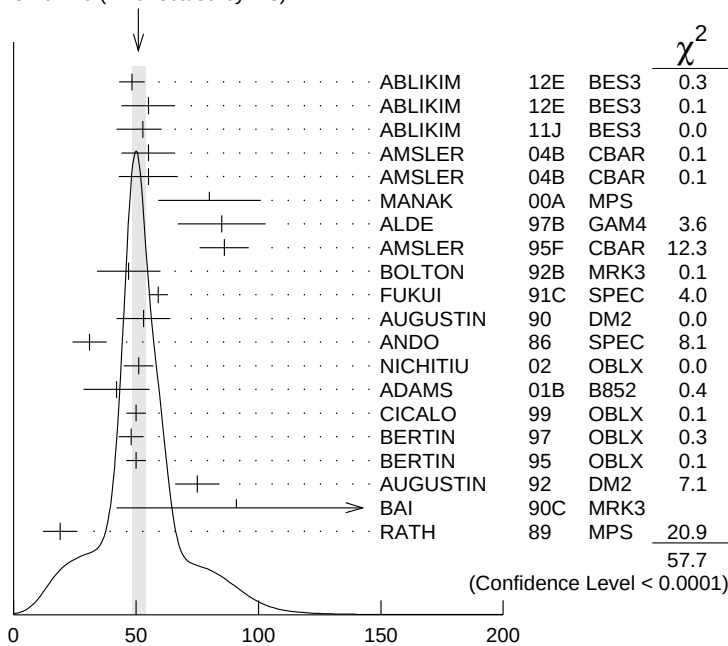
NODE=M027210

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

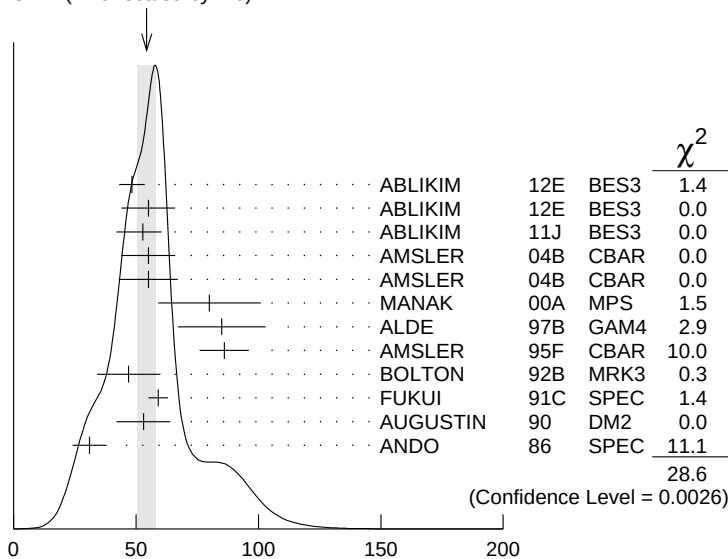
The data in this block is included in the average printed for a previous datablock.

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	$J/\psi \rightarrow \gamma(\pi^+\pi^-\pi^0)$	OCCUR=2
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	$0 \bar{p} p \rightarrow \pi^+\pi^-\pi^+\pi^-\eta$	OCCUR=2
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	$8 \pi^-\pi^+ \rightarrow \eta\pi^+\pi^-n$	

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.

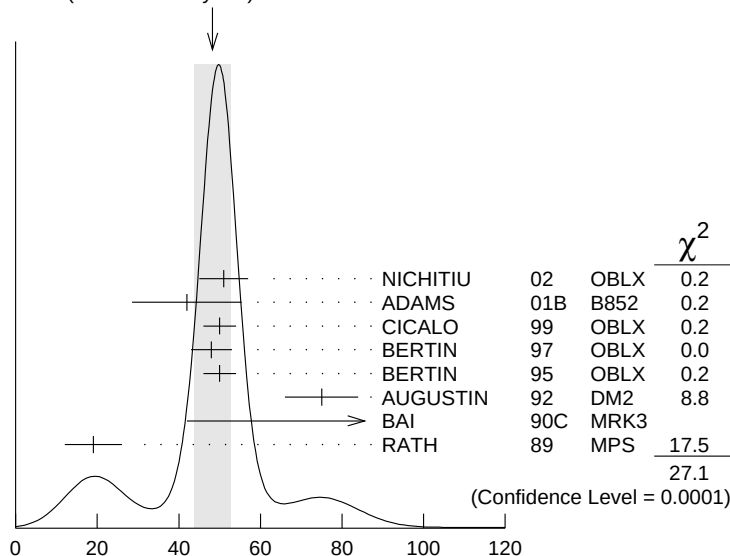
NODE=M027W4
NODE=M027W4

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⁺¹⁵ ₋₃₁₋₃₈		19 BAI	90C MRK3	$J/\psi \rightarrow \gamma K_S^0 K^\pm \pi^\mp$
19 ± 7		19 RATH	89 MPS	21.4 $\pi^- p \rightarrow n K_S^0 K_S^0 \pi^0$

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	$300 \text{ } pp \rightarrow K \bar{K} \pi pp$
1425 ± 2	1520	ARMSTRONG	84	OMEG	$85 \text{ } \pi^+ p, pp \rightarrow (\pi^+, p)(K \bar{K} \pi)p$
~ 1420		BITYUKOV	84	SPEC	$32 \text{ } K^- p \rightarrow K^+ K^- \pi^0 \gamma$

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	$91.2 \text{ } e^+ e^- \rightarrow K_S^0 K^\pm \pi^\mp + X$
61 ± 8	3651	NICHITIU	02 OBLX	
38 ± 9 ± 6	20k	ADAMS	01B B852	$18 \text{ GeV } \pi^- p \rightarrow K^+ K^- \pi^0 n$
58 ± 4		BARBERIS	97C OMEG	$450 \text{ } pp \rightarrow pp K_S^0 K^\pm \pi^\mp$
45 ± 10		BERTIN	97 OBLX	$0.0 \text{ } \bar{p} p \rightarrow K^\pm (K^0) \pi^\mp \pi^+ \pi^-$
90 ± 25		PROKOSHKIN	97B GAM4	$100 \text{ } \pi^- p \rightarrow \eta \pi^0 \pi^0 n$
58 ± 10		⁶ ARMSTRONG	92E OMEG	$85,300 \text{ } \pi^+ p, pp \rightarrow \pi^+ p, pp(K \bar{K} \pi)$
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	$\text{ISR } 31.5 \text{ } pp$
62 ± 14		BROMBERG	80 SPEC	$100 \text{ } \pi^- p \rightarrow K \bar{K} \pi X$
40 ± 15	221	DIONISI	80 HBC	$4 \text{ } \pi^- p \rightarrow K \bar{K} \pi n$
60 ± 20		DAHL	67 HBC	$1.6\text{--}4.2 \text{ } \pi^- p$

• • • 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	$300 \text{ } pp \rightarrow K \bar{K} \pi pp$
62 ± 5	1520	ARMSTRONG	84	OMEG	$85 \text{ } \pi^+ p, pp \rightarrow (\pi^+, p)(K \bar{K} \pi)p$
~ 50		BITYUKOV	84	SPEC	$32 \text{ } K^- p \rightarrow K^+ K^- \pi^0 \gamma$

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)
$\Gamma_1 \quad K \bar{K} \pi$	dominant
$\Gamma_2 \quad K \bar{K}^*(892) + \text{c.c.}$	dominant
$\Gamma_3 \quad \eta \pi \pi$	possibly seen
$\Gamma_4 \quad a_0(980) \pi$	

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.)	REFID=51698
ABDALLAH	03H	PL B569 129	J. Abdallah <i>et al.</i>	(DELPHI Collab.)	REFID=49548
NICHITIU	02	PL B545 261	F. Nichitiu <i>et al.</i>	(OBELIX Collab.)	REFID=48848
ADAMS	01B	PL B516 264	G.S. Adams <i>et al.</i>	(BNL E852 Collab.)	REFID=49649
SOSA	99	PRL 83 913	M. Sosa <i>et al.</i>		REFID=46937
BARBERIS	98C	PL B440 225	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=46346
BARBERIS	97C	PL B413 225	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=45759
BERTIN	97	PL B400 226	A. Bertin <i>et al.</i>	(OBELIX Collab.)	REFID=45417
PROKOSHKIN	97B	SPD 42 298	Yu.D. Prokoshkin, S.A. Sadovsky		REFID=45549
Translated from DANS 354 751.					
ARMSTRONG	92C	ZPHY C54 371	T.A. Armstrong <i>et al.</i>	(ATHU, BARI, BIRM+)	REFID=42097
ARMSTRONG	92E	ZPHY C56 29	T.A. Armstrong <i>et al.</i>	(ATHU, BARI, BIRM+) JPC	REFID=43173
AUGUSTIN	92	PR D46 1951	J.E. Augustin, G. Cosme	(DM2 Collab.)	REFID=41584
ARMSTRONG	91B	ZPHY C52 389	T.A. Armstrong <i>et al.</i>	(ATHU, BARI, BIRM+)	REFID=41862
BAI	90C	PRL 65 2507	Z. Bai <i>et al.</i>	(Mark III Collab.)	REFID=41578
ARMSTRONG	89	PL B221 216	T.A. Armstrong <i>et al.</i>	(CERN, CDEF, BIRM+) JPC	REFID=40729
ARMSTRONG	89G	ZPHY C43 55	T.A. Armstrong <i>et al.</i>	(CERN, BIRM, BARI+)	REFID=40930
BEHREND	89	ZPHY C42 367	H.J. Behrend <i>et al.</i>	(CELLO Collab.)	REFID=40732
HILL	89	ZPHY C42 355	P. Hill <i>et al.</i>	(JADE Collab.) JP	REFID=40741
KOPKE	89	PRPL 174 67	L. Kopke <i>et al.</i>	(CERN)	REFID=41863
AIHARA	88B	PL B209 107	H. Aihara <i>et al.</i>	(TPC-2 γ Collab.)	REFID=40572
BECKER	87	PRL 59 186	J.J. Becker <i>et al.</i>	(Mark III Collab.) JP	REFID=40015
GIDAL	87	PRL 59 2012	G. Gidal <i>et al.</i>	(LBL, SLAC, HARV)	REFID=40223
GIDAL	87B	PRL 59 2016	G. Gidal <i>et al.</i>	(LBL, SLAC, HARV)	REFID=40224
AIHARA	86C	PRL 57 2500	H. Aihara <i>et al.</i>	(TPC-2 γ Collab.) JP	REFID=21326
ANDO	86	PRL 57 1296	A. Ando <i>et al.</i>	(KEK, KYOT, NIRS, SAGA+)	REFID=20891
ARMSTRONG	84	PL 146B 273	T.A. Armstrong <i>et al.</i>	(ATHU, BARI, BIRM+) JP	REFID=20929
BITYUKOV	84	SJNP 39 735	S. Bitjukov <i>et al.</i>	(SERP)	REFID=45856
Translated from YAF 39 1165.					
CHAUVAT	84	PL 148B 382	P. Chauvat <i>et al.</i>	(CERN, CLER, UCLA+)	REFID=20932
JENNI	83	PR D27 1031	P. Jenni <i>et al.</i>	(SLAC, LBL)	REFID=20304
BROMBERG	80	PR D22 1513	C.M. Bromberg <i>et al.</i>	(CIT, FNAL, ILLC+)	REFID=20922
DIONISI	80	NP B169 1	C. Dionisi <i>et al.</i>	(CERN, MADR, CDEF+) IJP	REFID=20924
CORDEN	78	NP B144 253	M.J. Corden <i>et al.</i>	(BIRM, RHEL, TELA+)	REFID=20452
DEFOIX	72	NP B44 125	C. Defoix <i>et al.</i>	(CDEF, CERN)	REFID=20435
DAHL	67	PR 163 1377	O.I. Dahl <i>et al.</i>	(LRL) IJP	REFID=20321
Also		PRL 14 1074	D.H. Miller <i>et al.</i>	(LRL, UCB)	REFID=21291

$\omega(1420)$

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

NODE=M125

 $\omega(1420)$ MASS

NODE=M125M

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT

NODE=M125M

(1400–1450) OUR ESTIMATE

→ UNCHECKED ←

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

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	¹ ACHASOV	03D	RVUE	0.44–2.00 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
1450± 10		² HENNER	02	RVUE	1.2–2.0 $e^+e^- \rightarrow \rho\pi, \omega\pi\pi$
1373± 70	177	³ 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}		⁴ ACHASOV	98H	RVUE	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
~ 1400		⁵ ACHASOV	98H	RVUE	$e^+e^- \rightarrow \omega\pi^+\pi^-$
~ 1460		⁶ ACHASOV	98H	RVUE	$e^+e^- \rightarrow K^+K^-$
1440± 70		⁷ CLEGG	94	RVUE	
1419± 31	315	⁸ ANTONELLI	92	DM2	1.34–2.4 $e^+e^- \rightarrow \rho\pi$

OCCUR=2

OCCUR=3

¹ From the combined fit of ANTONELLI 92, ACHASOV 01E, ACHASOV 02E, and ACHASOV 03D data on the $\pi^+\pi^-\pi^0$ and ANTONELLI 92 on the $\omega\pi^+\pi^-$ final states. Supersedes ACHASOV 99E and ACHASOV 02E.

NODE=M125M;LINKAGE=VH

² Using results of CORDIER 81 and preliminary data of DOLINSKY 91 and ANTONELLI 92.

NODE=M125M;LINKAGE=AB

³ Using the data of AKHMETSHIN 00D and ANTONELLI 92. The $\rho\pi$ dominance for the energy dependence of the $\omega(1420)$ and $\omega(1650)$ width assumed.

NODE=M125M;LINKAGE=KL

⁴ Using data from BARKOV 87, DOLINSKY 91, and ANTONELLI 92.

NODE=M125M;LINKAGE=L1

⁵ Using the data from ANTONELLI 92.

NODE=M125M;LINKAGE=L2

⁶ Using the data from IVANOV 81 and BISELLO 88B.

NODE=M125M;LINKAGE=L3

⁷ From a fit to two Breit-Wigner functions and using the data of DOLINSKY 91 and ANTONELLI 92.

NODE=M125M;LINKAGE=AD

⁸ From a fit to two Breit-Wigner functions interfering between them and with the ω, ϕ tails with fixed (+, –, +) phases.

NODE=M125M;LINKAGE=B

 $\omega(1420)$ WIDTH

NODE=M125W

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT

NODE=M125W

(180–250) OUR ESTIMATE

→ UNCHECKED ←

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

130± 50± 100		AUBERT	07AU	BABR	10.6 $e^+e^- \rightarrow \omega\pi^+\pi^-\gamma$
450± 70± 70		AUBERT,B	04N	BABR	10.6 $e^+e^- \rightarrow \pi^+\pi^-\pi^0\gamma$
870 ⁺⁵⁰⁰ _{–300} ± 450	1.2M	⁹ ACHASOV	03D	RVUE	0.44–2.00 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
199± 15		¹⁰ HENNER	02	RVUE	1.2–2.0 $e^+e^- \rightarrow \rho\pi, \omega\pi\pi$
188± 45	177	¹¹ AKHMETSHIN	00D	CMD2	1.2–1.38 $e^+e^- \rightarrow \omega\pi^+\pi^-$
360 ⁺¹⁰⁰ _{–60}	5095	ANISOVICH	00H	SPEC	0.0 $\rho\bar{p} \rightarrow \omega\pi^0\pi^0\pi^0$
240± 70		¹² CLEGG	94	RVUE	
174± 59	315	¹³ ANTONELLI	92	DM2	1.34–2.4 $e^+e^- \rightarrow \rho\pi$

NODE=M125W;LINKAGE=VH

⁹ From the combined fit of ANTONELLI 92, ACHASOV 01E, ACHASOV 02E, and ACHASOV 03D data on the $\pi^+\pi^-\pi^0$ and ANTONELLI 92 on the $\omega\pi^+\pi^-$ final states. Supersedes ACHASOV 99E and ACHASOV 02E.

NODE=M125W;LINKAGE=AB

¹⁰ Using results of CORDIER 81 and preliminary data of DOLINSKY 91 and ANTONELLI 92.

NODE=M125W;LINKAGE=KL

¹¹ Using the data of AKHMETSHIN 00D and ANTONELLI 92. The $\rho\pi$ dominance for the energy dependence of the $\omega(1420)$ and $\omega(1650)$ width assumed.

NODE=M125W;LINKAGE=AD

¹² From a fit to two Breit-Wigner functions and using the data of DOLINSKY 91 and ANTONELLI 92.

NODE=M125W;LINKAGE=B

¹³ From a fit to two Breit-Wigner functions interfering between them and with the ω, ϕ tails with fixed (+, –, +) phases.

$\omega(1420)$ DECAY MODES

NODE=M125215;NODE=M125

Mode	Fraction (Γ_i/Γ)
Γ_1 $\rho\pi$	dominant
Γ_2 $\omega\pi\pi$	seen
Γ_3 $b_1(1235)\pi$	seen
Γ_4 e^+e^-	seen
Γ_5 $\pi^0\gamma$	

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

 $\omega(1420) \Gamma(i)\Gamma(e^+e^-)/\Gamma^2(\text{total})$

NODE=M125230

$$\Gamma(\rho\pi)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_1/\Gamma \times \Gamma_4/\Gamma$$

NODE=M125G3
 NODE=M125G3

VALUE (units 10^{-6})	EVTs	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.82 ± 0.05 ± 0.06		AUBERT,B	04N BABR	10.6 $e^+e^- \rightarrow \pi^+\pi^-\pi^0\gamma$
0.65 ± 0.13 ± 0.21	1.2M 14,15	ACHASOV	03D RVUE	0.44–2.00 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
0.625 ± 0.160	16,17	CLEGG	94 RVUE	
0.466 ± 0.178	18,19	ANTONELLI	92 DM2	1.34–2.4 $e^+e^- \rightarrow \rho\pi$

¹⁴ Calculated by us from the cross section at the peak.¹⁵ From the combined fit of ANTONELLI 92, ACHASOV 01E, ACHASOV 02E, and ACHASOV 03D data on the $\pi^+\pi^-\pi^0$ and ANTONELLI 92 on the $\omega\pi^+\pi^-$ final states. Supersedes ACHASOV 99E and ACHASOV 02E.¹⁶ From a fit to two Breit-Wigner functions and using the data of DOLINSKY 91 and ANTONELLI 92.¹⁷ From the partial and leptonic width given by the authors.¹⁸ From a fit to two Breit-Wigner functions interfering between them and with the ω,ϕ tails with fixed (+,−,+) phases.¹⁹ From the product of the leptonic width and partial branching ratio given by the authors.

NODE=M125G;LINKAGE=AW
 NODE=M125G;LINKAGE=VH

NODE=M125G;LINKAGE=AD

NODE=M125G;LINKAGE=SE
 NODE=M125G;LINKAGE=A

NODE=M125G;LINKAGE=ES

$$\Gamma(\omega\pi\pi)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_2/\Gamma \times \Gamma_4/\Gamma$$

NODE=M125G4
 NODE=M125G4

VALUE (units 10^{-8})	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
19.7 ± 5.7	AUBERT	07AU BABR	10.6 $e^+e^- \rightarrow \omega\pi^+\pi^-\gamma$
1.9 ± 1.9	²⁰ AKHMETSHIN 00D	CMD2	1.2–2.4 $e^+e^- \rightarrow \omega\pi^+\pi^-$

²⁰ Using the data of AKHMETSHIN 00D and ANTONELLI 92. The $\rho\pi$ dominance for the energy dependence of the $\omega(1420)$ and $\omega(1650)$ width assumed.

NODE=M125G;LINKAGE=KL

$$\Gamma(\pi^0\gamma)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_5/\Gamma \times \Gamma_4/\Gamma$$

NODE=M125G5
 NODE=M125G5

VALUE (units 10^{-8})	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
2.03 $^{+0.70}_{-0.75}$	²¹ AKHMETSHIN 05	CMD2	0.60–1.38 $e^+e^- \rightarrow \pi^0\gamma$

²¹ Using 1420 MeV and 220 MeV for the $\omega(1420)$ mass and width.

NODE=M125G5;LINKAGE=AK

 $\omega(1420)$ BRANCHING RATIOS

NODE=M125225

$$\Gamma(\omega\pi\pi)/\Gamma_{\text{total}} \quad \Gamma_2/\Gamma$$

NODE=M125R2
 NODE=M125R2

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.301 ± 0.029 possibly seen	²² HENNER 02	RVUE	1.2–2.0 $e^+e^- \rightarrow \rho\pi, \omega\pi\pi$
	AKHMETSHIN 00D	CMD2	$e^+e^- \rightarrow \omega\pi^+\pi^-$

$$\Gamma(\omega\pi\pi)/\Gamma(b_1(1235)\pi) \quad \Gamma_2/\Gamma_3$$

NODE=M125R1
 NODE=M125R1

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.60 ± 0.16	5095	ANISOVICH	00H SPEC	0.0 $\rho\bar{p} \rightarrow \omega\pi^0\pi^0\pi^0$

$$\Gamma(\rho\pi)/\Gamma_{\text{total}} \quad \Gamma_1/\Gamma$$

NODE=M125R3
 NODE=M125R3

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.699 ± 0.029	²² HENNER 02	RVUE	1.2–2.0 $e^+e^- \rightarrow \rho\pi, \omega\pi\pi$

$\Gamma(e^+e^-)/\Gamma_{\text{total}}$ Γ_4/Γ

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

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

~ 6.6 1.2M ^{23,24} ACHASOV 03D RVUE 0.44–2.00 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$

23 ±1 ²² HENNER 02 RVUE 1.2–2.0 $e^+e^- \rightarrow \rho\pi, \omega\pi\pi$

²² Assuming that the $\omega(1420)$ decays into $\rho\pi$ and $\omega\pi\pi$ only.

²³ Calculated by us from the cross section at the peak.

²⁴ Assuming that the $\omega(1420)$ decays into $\rho\pi$ only.

NODE=M125R4
NODE=M125R4

NODE=M125R;LINKAGE=AC
NODE=M125R;LINKAGE=AW
NODE=M125R;LINKAGE=GS

 $\omega(1420)$ REFERENCES

AUBERT	07AU	PR D76 092005	B. Aubert <i>et al.</i>	(BABAR Collab.)
AKHMETSHIN	05	PL B605 26	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)
AUBERT,B	04N	PR D70 072004	B. Aubert <i>et al.</i>	(BABAR Collab.)
ACHASOV	03D	PR D68 052006	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)
ACHASOV	02E	PR D66 032001	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)
HENNER	02	EPJ C26 3	V.K. Henner <i>et al.</i>	
ACHASOV	01E	PR D63 072002	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)
AKHMETSHIN	00D	PL B489 125	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)
ANISOVICH	00H	PL B485 341	A.V. Anisovich <i>et al.</i>	
ACHASOV	99E	PL B462 365	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)
ACHASOV	98H	PR D57 4334	N.N. Achasov, A.A. Kozhevnikov	
CLEGG	94	ZPHY C62 455	A.B. Clegg, A. Donnachie	(LANC, MCHS)
ANTONELLI	92	ZPHY C56 15	A. Antonelli <i>et al.</i>	(DM2 Collab.)
DOLINSKY	91	PRPL 202 99	S.I. Dolinsky <i>et al.</i>	(NOVO)
BISELLO	88B	ZPHY C39 13	D. Bisello <i>et al.</i>	(PADO, CLER, FRAS+)
BARKOV	87	JETPL 46 164	L.M. Barkov <i>et al.</i>	(NOVO)
		Translated from ZETFP 46 132.		
CORDIER	81	PL 106B 155	A. Cordier <i>et al.</i>	(ORSAY)
IVANOV	81	PL 107B 297	P.M. Ivanov <i>et al.</i>	(NOVO)

NODE=M125

REFID=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

NODE=M066

 $f_2(1430)$

$$I^G(J^{PC}) = 0^+(2^{++})$$

OMITTED FROM SUMMARY TABLE

This entry lists nearby peaks observed in the D wave of the $K\bar{K}$ and $\pi^+\pi^-$ systems. Needs confirmation.

NODE=M066

 $f_2(1430)$ MASS

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

NODE=M066M1
→ UNCHECKED ←

OCCUR=2

NODE=M066M;LINKAGE=AC
NODE=M066M;LINKAGE=C

 $f_2(1430)$ WIDTH

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

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

VLADIMIRSK... 01	PAN 64 1895 Translated from YAF 64 1979.	V.V. Vladimirovsky <i>et al.</i>
AUGUSTIN 87	ZPHY C36 369	J.E. Augustin <i>et al.</i> (LALO, CLER, FRAS+)
AKESSON 86	NP B264 154	T. Akesson <i>et al.</i> (Axial Field Spec. Collab.)
DAUM 84	ZPHY C23 339	C. Daum <i>et al.</i> (AMST, CERN, CRAC, MPIM+) JP
WETZEL 76	NP B115 208	W. Wetzell <i>et al.</i> (ETH, CERN, LOIC)
BEUSCH 67	PL 25B 357	W. Beusch <i>et al.</i> (ETH, CERN)

NODE=M066

REFID=48571

REFID=40268

REFID=21123

REFID=21372

REFID=20362

REFID=20320

NODE=M149

 $a_0(1450)$

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

See minireview on scalar mesons under $f_0(500)$.

NODE=M149

 $a_0(1450)$ MASS

NODE=M149M

NODE=M149M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1474 ±19 OUR AVERAGE				
1480 ±30		ABELE 98	CBAR	0.0 $\bar{p}p \rightarrow K^0 K^\pm \pi^\mp$
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 $\bar{p}p$, πN
1316.8 ⁺ _{-1.0} 0.7 ⁺ _{-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 ⁺ ₋₁₅ 40	35280	² BAKER 03	SPEC	$\bar{p}p \rightarrow \omega \pi^+ \pi^- \pi^0$
1303 ±16		⁶ BARGIOTTI 03	OBLX	$\bar{p}p$
1296 ±10		⁷ AMSLER 02	CBAR	0.9 $\bar{p}p \rightarrow \pi^0 \pi^0 \eta$
1565 ±30		⁷ ANISOVICH 98B	RVUE	Compilation
1290 ±10		⁸ BERTIN 98B	OBLX	0.0 $\bar{p}p \rightarrow K^\pm K_S^0 \pi^\mp$
1450 ±40		AMSLER 94D	CBAR	0.0 $\bar{p}p \rightarrow \pi^0 \pi^0 \eta$
1410 ±25		ETKIN 82C	MPS	23 $\pi^- p \rightarrow n 2K_S^0$
~ 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, ABLE 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

NODE=M149W

NODE=M149W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
265 ±13 OUR AVERAGE				
265 ±15		ABELE 98	CBAR	0.0 $\bar{p}p \rightarrow K^0 K^\pm \pi^\mp$
265 ±30		¹⁰ AMSLER 95D	CBAR	0.0 $\bar{p}p \rightarrow \pi^0 \pi^0 \pi^0$, $\pi^0 \eta \eta$, $\pi^0 \pi^0 \eta$

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

230 ± 36		11 ANISOVICH	09 RVUE	0.0 $\bar{p}p, \pi N$
$65.0^{+2.1+99.1}_{-5.4-32.6}$		12 UEHARA	09A BELL	$\gamma\gamma \rightarrow \pi^0 \eta$
196 ± 10 ± 10		13 BUGG	08A RVUE	$\bar{p}p$
267 ± 11	80k	14 UMAN	06 E835	$5.2 \bar{p}p \rightarrow \eta\eta\pi^0$
110 ± 14	35280	11 BAKER	03 SPEC	$\bar{p}p \rightarrow \omega\pi^+\pi^-\pi^0$
92 ± 16		15 BARGIOTTI	03 OBLX	$\bar{p}p$
81 ± 21		16 AMSLER	02 CBAR	$0.9 \bar{p}p \rightarrow \pi^0\pi^0\eta$
292 ± 40		16 ANISOVICH	98B RVUE	Compilation
80 ± 5		17 BERTIN	98B OBLX	$0.0 \bar{p}p \rightarrow K^\pm K_S^0 \pi^\mp$
270 ± 40		AMSLER	94D CBAR	$0.0 \bar{p}p \rightarrow \pi^0\pi^0\eta$
230 ± 30		ETKIN	82C MPS	$23 \pi^- p \rightarrow n 2K_S^0$
~ 250		MARTIN	78 SPEC	$10 K^\pm p \rightarrow K_S^0 \pi p$
79 ± 10		18 CASON	76	

¹⁰ Coupled-channel analysis of AMSLER 95B, AMSLER 95C, and AMSLER 94D.

¹¹ From the pole position.

¹² May be a different state.

¹³ Using data from AMSLER 94D, ABELE 98, and BAKER 03. Supersedes BUGG 94.

¹⁴ Statistical error only.

¹⁵ Coupled channel analysis of $\pi^+\pi^-\pi^0$, $K^+K^-\pi^0$, and $K^\pm K_S^0 \pi^\mp$.

¹⁶ T-matrix pole.

¹⁷ Not confirmed by BUGG 08A.

¹⁸ Isospin 0 not excluded.

NODE=M149W;LINKAGE=AB
 NODE=M149W;LINKAGE=PP
 NODE=M149W;LINKAGE=UE
 NODE=M149W;LINKAGE=BU
 NODE=M149W;LINKAGE=ST
 NODE=M149W;LINKAGE=BG
 NODE=M149W;LINKAGE=AN
 NODE=M149W;LINKAGE=BE
 NODE=M149W;LINKAGE=CC

$a_0(1450)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \pi\eta$	seen
$\Gamma_2 \quad \pi\eta'(958)$	seen
$\Gamma_3 \quad K\bar{K}$	seen
$\Gamma_4 \quad \omega\pi\pi$	seen
$\Gamma_5 \quad a_0(980)\pi\pi$	seen
$\Gamma_6 \quad \gamma\gamma$	seen

NODE=M149215;NODE=M149

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

$a_0(1450) \Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

$\Gamma(\pi\eta) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$	$\Gamma_1\Gamma_6/\Gamma$
VALUE (eV)	DOCUMENT ID TECN COMMENT

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

$432 \pm 6^{+1073}_{-256}$	19 UEHARA	09A BELL	$\gamma\gamma \rightarrow \pi^0 \eta$

¹⁹ May be a different state.

NODE=M149225

NODE=M149G01
 NODE=M149G01

NODE=M149G01;LINKAGE=UE

$a_0(1450)$ BRANCHING RATIOS

$\Gamma(\pi\eta'(958))/\Gamma(\pi\eta)$	Γ_2/Γ_1
VALUE	DOCUMENT ID TECN COMMENT
0.35±0.16	²⁰ ABELE 98 CBAR $0.0 \bar{p}p \rightarrow K_L^0 K^\pm \pi^\mp$

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

0.43±0.19	ABELE 97C CBAR $0.0 \bar{p}p \rightarrow \pi^0\pi^0\eta'$

²⁰ Using $\pi^0\eta$ from AMSLER 94D.

NODE=M149R1;LINKAGE=A

$\Gamma(K\bar{K})/\Gamma(\pi\eta)$	Γ_3/Γ_1
VALUE	DOCUMENT ID TECN COMMENT
0.88±0.23	²¹ ABELE 98 CBAR $0.0 \bar{p}p \rightarrow K_L^0 K^\pm \pi^\mp$

²¹ Using $\pi^0\eta$ from AMSLER 94D.

NODE=M149R2
 NODE=M149R2

NODE=M149R2;LINKAGE=A

$\Gamma(\omega\pi\pi)/\Gamma(\pi\eta)$	Γ_4/Γ_1
VALUE	EVTS DOCUMENT ID TECN COMMENT

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

10.7±2.3	35280	²² BAKER 03 SPEC	$\bar{p}p \rightarrow \omega\pi^+\pi^-\pi^0$

²² Using results on $\bar{p}p \rightarrow a_0(1450)^0\pi^0$, $a_0(1450) \rightarrow \eta\pi^0$ from ABELE 96C and assuming the $\omega\rho$ mechanism for the $\omega\pi\pi$ state.

NODE=M149R3
 NODE=M149R3

NODE=M149R;LINKAGE=PP

$\Gamma(a_0(980)\pi\pi)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE

DOCUMENT ID

TECN

COMMENT

seen

BUGG

08A

RVUE

 $\bar{p}p$ NODE=M149R01
NODE=M149R01 $\Gamma(a_0(980)\pi\pi)/\Gamma(\pi\eta)$ Γ_5/Γ_1

VALUE

DOCUMENT ID

TECN

CHG

COMMENT

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

 ≤ 4.3

ANISOVICH

01

RVUE

0

 $\bar{p}p \rightarrow \eta 2\pi^+ 2\pi^-$ NODE=M149R02
NODE=M149R02 $\Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE

DOCUMENT ID

TECN

COMMENT

seen

23 UEHARA

09A

BELL

 $\gamma\gamma \rightarrow \pi^0\eta$ NODE=M149R03
NODE=M149R03

23 May be a different state.

NODE=M149R03;LINKAGE=UE

 $a_0(1450)$ REFERENCES

ANISOVICH	09	IJMP A24 2481	V.V. Anisovich, A.V. Sarantsev	
UEHARA	09A	PR D80 032001	S. Uehara <i>et al.</i>	(BELLE Collab.)
BUGG	08A	PR D78 074023	D.V. Bugg	(LOQM)
UMAN	06	PR D73 052009	I. Uman <i>et al.</i>	(FNAL E835)
BAKER	03	PL B563 140	C.A. Baker <i>et al.</i>	
BARGIOTTI	03	EPJ C26 371	M. Bargiotti <i>et al.</i>	(OBELIX Collab.)
AMSLER	02	EPJ C23 29	C. Amsler <i>et al.</i>	
ANISOVICH	01	NP A690 567	A.V. Anisovich <i>et al.</i>	
ABELE	98	PR D57 3860	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
ANISOVICH	98B	SPU 41 419	V.V. Anisovich <i>et al.</i>	
		Translated from UFN 168 481.		
BERTIN	98B	PL B434 180	A. Bertin <i>et al.</i>	(OBELIX Collab.)
ABELE	97C	PL B404 179	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
ABELE	96C	NP A609 562	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
AMSLER	95B	PL B342 433	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
AMSLER	95C	PL B353 571	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
AMSLER	95D	PL B355 425	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
AMSLER	94D	PL B333 277	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.) IGJPC
BUGG	94	PR D50 4412	D.V. Bugg <i>et al.</i>	(LOQM)
ETKIN	82C	PR D25 2446	A. Etkin <i>et al.</i>	(BNL, CUNY, TUFTS, VAND)
MARTIN	78	NP B134 392	A.D. Martin <i>et al.</i>	(DURH, GEVA)
CASON	76	PRL 36 1485	N.M. Cason <i>et al.</i>	(NDAM, ANL)

NODE=M149

REFID=52719
REFID=53002
REFID=52578
REFID=51063
REFID=49414
REFID=49217
REFID=48580
REFID=48308
REFID=45863
REFID=46331REFID=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

VALUE (MeV)

DOCUMENT ID

 1465 ± 25 OUR ESTIMATE This is only an educated guess; the error given is larger than the error on the average of the published values.

NODE=M105205

NODE=M105M0

→ 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. • • •

 1491 ± 19

7815

¹ ACHASOV 13 SND $1.05-2.00 e^+e^- \rightarrow \pi^0\pi^0\gamma$ $1582 \pm 17 \pm 25$

2382

² AKHMETSHIN 03B CMD2 $e^+e^- \rightarrow \pi^0\pi^0\gamma$ $1349 \pm 25^{+10}_{-5}$

341

³ ALEXANDER 01B CLE2 $B \rightarrow D^{(*)}\omega\pi^-$ 1523 ± 10 ⁴ EDWARDS 00A CLE2 $\tau^- \rightarrow \omega\pi^- \nu_\tau$ 1463 ± 25 ⁵ CLEGG 94 RVUE

1250

⁶ ASTON 80C OMEG $20-70 \gamma p \rightarrow \omega\pi^0 p$ 1290 ± 40 ⁶ BARBER 80C SPEC $3-5 \gamma p \rightarrow \omega\pi^0 p$ NODE=M105M3
NODE=M105M3

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 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.

³ Using Breit-Wigner parameterization of the $\rho(1450)$ and assuming the $\omega\pi^-$ mass dependence for the total width.

⁴ Mass-independent width parameterization. $\rho(1700)$ mass and width fixed at 1700 MeV and 235 MeV respectively.

⁵ Using data from BISELLO 91B, DOLINSKY 86 and ALBRECHT 87L.

⁶ 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 $pp \rightarrow pp2(\pi^+\pi^-)$

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 $\pm$ 20 $^{+20}_{-30}$ 63.5k	¹ ABRAMOWICZ12	ZEUS	$ep \rightarrow e\pi^+\pi^-p$
1493 $\pm$ 15	² LEES	12G	BABR $e^+e^- \rightarrow \pi^+\pi^-\gamma$
1446 $\pm$ 7 $\pm$ 28 5.4M	^{3,4} FUJIKAWA	08	BELL $\tau^- \rightarrow \pi^-\pi^0\nu_\tau$
1328 $\pm$ 15	⁵ SCHAEEL	05C	ALEP $\tau^- \rightarrow \pi^-\pi^0\nu_\tau$
1406 $\pm$ 15 87k	^{3,6} ANDERSON	00A	CLE2 $\tau^- \rightarrow \pi^-\pi^0\nu_\tau$
$\sim$ 1368	⁷ ABELE	99C	CBAR 0.0 $\bar{p}d \rightarrow \pi^+\pi^-\pi^-p$
1348 $\pm$ 33	BERTIN	98	OBLX 0.05–0.405 $\bar{n}p \rightarrow 2\pi^+\pi^-$
1411 $\pm$ 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 $\pm$ 40	⁶ BERTIN	97C	OBLX 0.0 $\bar{p}p \rightarrow \pi^+\pi^-\pi^0$
1282 $\pm$ 37	BERTIN	97D	OBLX 0.05 $\bar{p}p \rightarrow 2\pi^+2\pi^-$
1424 $\pm$ 25	BISELLO	89	DM2 $e^+e^- \rightarrow \pi^+\pi^-$
1265.5 $\pm$ 75.3	DUBNICKA	89	RVUE $e^+e^- \rightarrow \pi^+\pi^-$
1292 $\pm$ 17	⁹ KURDADZE	83	OLYA 0.64–1.4 $e^+e^- \rightarrow \pi^+\pi^-$

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 $\pm$ 20 and 300 $\pm$ 10 MeV respectively.

$K\bar{K}$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

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

1422.8 $\pm$ 6.5	27k	¹ ABELE	99D	CBAR $\pm$	0.0 $\bar{p}p \rightarrow K^+K^-\pi^0$

¹ 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 $e^+e^- \rightarrow K\bar{K}^*(892)\gamma$

NODE=M105M3;LINKAGE=AC

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=AN

NODE=M105M8

NODE=M105M8

$\rho(1450)$ WIDTH

VALUE (MeV)

DOCUMENT ID

400±60 OUR ESTIMATE This is only an educated guess; the error given is larger than the error on the average of the published values.

NODE=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. • • •

429± 42±10	2382	¹ AKHMETSHIN 03B	CMD2	$e^+e^- \rightarrow \pi^0\pi^0\gamma$
547± 86 ⁺⁴⁶ ₋₄₅	341	² ALEXANDER 01B	CLE2	$B \rightarrow D^{(*)}\omega\pi^-$
400± 35		³ EDWARDS 00A	CLE2	$\tau^- \rightarrow \omega\pi^- \nu_\tau$
311± 62		⁴ CLEGG 94	RVUE	
300		⁵ ASTON 80C	OMEG	$20-70 \gamma p \rightarrow \omega\pi^0 p$
320±100		⁵ BARBER 80C	SPEC	$3-5 \gamma p \rightarrow \omega\pi^0 p$

¹ 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.

² Using Breit-Wigner parameterization of the $\rho(1450)$ and assuming the $\omega\pi^-$ mass dependence for the total width.

³ Mass-independent width parameterization. $\rho(1700)$ mass and width fixed at 1700 MeV and 235 MeV respectively.

⁴ Using data from BISELLO 91B, DOLINSKY 86 and ALBRECHT 87L.

⁵ Not separated from $b_1(1235)$, not pure $J^P = 1^-$ effect.

NODE=M105W3

NODE=M105W3

NODE=M105W3;LINKAGE=HK

NODE=M105W3;LINKAGE=3Z

NODE=M105W;LINKAGE=E1

NODE=M105W3;LINKAGE=B

NODE=M105W3;LINKAGE=A

 4π MODE

VALUE (MeV)

DOCUMENT ID

TECN

COMMENT

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

325±100	ABELE	01B	CBAR	$0.0 \bar{p}n \rightarrow 2\pi^- 2\pi^0 \pi^+$

NODE=M105W66

NODE=M105W66

 $\pi\pi$ MODE

VALUE (MeV)

EVTS

DOCUMENT ID

TECN

COMMENT

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

460±30 ⁺⁴⁰ ₋₄₅	63.5k	¹ ABRAMOWICZ12	ZEUS	$ep \rightarrow e\pi^+\pi^-\rho$
427±31		² LEES	12G	BABR $e^+e^- \rightarrow \pi^+\pi^-\gamma$
434±16±60	5.4M	^{3,4} FUJIKAWA	08	BELL $\tau^- \rightarrow \pi^-\pi^0\nu_\tau$
468±41		⁵ SCHAEEL	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 $0.64-1.4 e^+e^- \rightarrow \pi^+\pi^-$

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.

NODE=M105W5

NODE=M105W5

NODE=M105W5;LINKAGE=AB

NODE=M105W5;LINKAGE=LE

NODE=M105W;LINKAGE=1K

NODE=M105W5;LINKAGE=FU

NODE=M105W5;LINKAGE=SC

$\rho(1700)$ 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.

⁸T-matrix pole.

⁹Using 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

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

146.5 ± 10.5	27k	¹ ABELE	99D	CBAR	± 0.0 $\bar{p}p \rightarrow K^+ K^- \pi^0$

¹ 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. • • •

418 ± 25 ± 4	AUBERT	08S	BABR	10.6 $e^+ e^- \rightarrow K\bar{K}^*(892)\gamma$

$\rho(1450)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \pi\pi$	seen
$\Gamma_2 \quad 4\pi$	seen
$\Gamma_3 \quad \omega\pi$	
$\Gamma_4 \quad a_1(1260)\pi$	
$\Gamma_5 \quad h_1(1170)\pi$	
$\Gamma_6 \quad \pi(1300)\pi$	
$\Gamma_7 \quad \rho\rho$	
$\Gamma_8 \quad \rho(\pi\pi)S\text{-wave}$	
$\Gamma_9 \quad e^+e^-$	seen
$\Gamma_{10} \quad \eta\rho$	possibly seen
$\Gamma_{11} \quad a_2(1320)\pi$	not seen
$\Gamma_{12} \quad K\bar{K}$	not seen
$\Gamma_{13} \quad K\bar{K}^*(892) + \text{c.c.}$	possibly seen
$\Gamma_{14} \quad \eta\gamma$	possibly seen
$\Gamma_{15} \quad f_0(500)\gamma$	not seen
$\Gamma_{16} \quad f_0(980)\gamma$	not seen
$\Gamma_{17} \quad f_0(1370)\gamma$	not seen
$\Gamma_{18} \quad f_2(1270)\gamma$	not seen

$\rho(1450) \Gamma(i)\Gamma(e^+e^-)/\Gamma(\text{total})$

$\Gamma(\pi\pi) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$	DOCUMENT ID	TECN	COMMENT	$\Gamma_1\Gamma_9/\Gamma$

VALUE (keV)	DOCUMENT ID	TECN	COMMENT

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

0.12	¹ DIEKMAN	88	RVUE	$e^+e^- \rightarrow \pi^+\pi^-$

0.027 ^{+0.015} _{-0.010}	² KURDADZE	83	OLYA	0.64–1.4 $e^+e^- \rightarrow \pi^+\pi^-$

$\Gamma(\eta\rho) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$	DOCUMENT ID	TECN	COMMENT	$\Gamma_{10}\Gamma_9/\Gamma$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT

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

74 ± 20	³ AKHMETSHIN	00D	CMD2	$e^+e^- \rightarrow \eta\pi^+\pi^-$

91 ± 19	ANTONELLI	88	DM2	$e^+e^- \rightarrow \eta\pi^+\pi^-$

$\Gamma(\eta\gamma) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$	DOCUMENT ID	TECN	COMMENT	$\Gamma_{14}\Gamma_9/\Gamma$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT

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

<16.4	⁴ AKHMETSHIN	05	CMD2	0.60–1.38 $e^+e^- \rightarrow \eta\gamma$

2.2 ± 0.5 ± 0.3	⁵ AKHMETSHIN	01B	CMD2	$e^+e^- \rightarrow \eta\gamma$

NODE=M105W5;LINKAGE=A
 NODE=M105W5;LINKAGE=C5
 NODE=M105W5;LINKAGE=QQ
 NODE=M105W5;LINKAGE=KD

NODE=M105W7
 NODE=M105W7

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;OUR EVAL;→ UNCHECKED ←
 DESIG=8;OUR EST;→ UNCHECKED ←
 DESIG=7;OUR EVAL;→ UNCHECKED ←
 DESIG=15;OUR EST;→ UNCHECKED ←
 DESIG=9;OUR EST;→ UNCHECKED ←
 DESIG=16;OUR EST;→ UNCHECKED ←
 DESIG=17;OUR EST;→ UNCHECKED ←
 DESIG=18;OUR EST;→ UNCHECKED ←
 DESIG=19;OUR EST;→ UNCHECKED ←

NODE=M105220

NODE=M105G3
 NODE=M105G3

NODE=M105G4
 NODE=M105G4

NODE=M105G6
 NODE=M105G6

$$\Gamma(K\bar{K}^*(892)+c.c.) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$$

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

VALUE (eV)	DOCUMENT ID	TECN	COMMENT

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

127±15±6	AUBERT	08S	BABR	10.6 e ⁺ e ⁻ → K ⁻ $\bar{K}^*(892)\gamma$

¹ Using total width = 235 MeV.

² Using for $\rho(1700)$ mass and width 1600 ± 20 and 300 ± 10 MeV respectively.

³ Using the data of ANTONELLI 88, DOLINSKY 91, and AKHMETSHIN 00D. The energy-independent width of the $\rho(1450)$ and $\rho(1700)$ mesons assumed.

⁴ From 2 γ decay mode of η using 1465 MeV and 310 MeV for the $\rho(1450)$ mass and width. Recalculated by us.

⁵ Using the data of AKHMETSHIN 01B on e⁺e⁻ → $\eta\gamma$, AKHMETSHIN 00D and ANTONELLI 88 on e⁺e⁻ → $\eta\pi^+\pi^-$. Recalculated by us using width of 226 MeV.

NODE=M105G8
NODE=M105G8

NODE=M105G3;LINKAGE=B
NODE=M105G3;LINKAGE=KD
NODE=M105G4;LINKAGE=KL

NODE=M105G6;LINKAGE=AK

NODE=M105G;LINKAGE=SW

$$\rho(1450) \Gamma(i)/\Gamma(\text{total}) \times \Gamma(e^+e^-)/\Gamma(\text{total})$$

NODE=M105230

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

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

VALUE (units 10 ⁻⁶)	EVTS	DOCUMENT ID	TECN	COMMENT

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

5.3±0.4	7815	¹ ACHASOV	13	SND	1.05–2.00 e ⁺ e ⁻ → $\pi^0\pi^0\gamma$

NODE=M105R05
NODE=M105R05

$$\Gamma(f_0(500)\gamma)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$$

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

VALUE (units 10 ⁻⁹)	CL%	DOCUMENT ID	TECN	COMMENT

<4.0	90	ACHASOV	11	SND	e ⁺ e ⁻ → $\pi^0\pi^0\gamma$

NODE=M105R01
NODE=M105R01

$$\Gamma(f_0(980)\gamma)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$$

$$\Gamma_{16}/\Gamma \times \Gamma_9/\Gamma$$

VALUE (units 10 ⁻⁹)	CL%	DOCUMENT ID	TECN	COMMENT

<2.6	90	ACHASOV	11	SND	e ⁺ e ⁻ → $\pi^0\pi^0\gamma$

NODE=M105R02
NODE=M105R02

$$\Gamma(f_0(1370)\gamma)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$$

$$\Gamma_{17}/\Gamma \times \Gamma_9/\Gamma$$

VALUE (units 10 ⁻⁹)	CL%	DOCUMENT ID	TECN	COMMENT

<3.5	90	ACHASOV	11	SND	e ⁺ e ⁻ → $\pi^0\pi^0\gamma$

NODE=M105R03
NODE=M105R03

$$\Gamma(f_2(1270)\gamma)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$$

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

VALUE (units 10 ⁻⁹)	CL%	DOCUMENT ID	TECN	COMMENT

<0.8	90	² ACHASOV	11	SND	e ⁺ e ⁻ → $\pi^0\pi^0\gamma$

NODE=M105R04
NODE=M105R04

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 Using Breit-Wigner parametrization of the $\rho(1450)$ with mass and width of 1465 MeV and 400 MeV, respectively.

NODE=M105R05;LINKAGE=AC

NODE=M105R01;LINKAGE=AC

$\rho(1450)$ BRANCHING RATIOS

NODE=M105225

$$\Gamma(\pi\pi)/\Gamma(4\pi)$$

$$\Gamma_1/\Gamma_2$$

VALUE	DOCUMENT ID	TECN	COMMENT

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

0.37±0.10	^{1,2} ABELE	01B	CBAR	0.0 $\bar{p}n \rightarrow 5\pi$

NODE=M105R15
NODE=M105R15

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

$$\Gamma_3/\Gamma$$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

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

seen	1.6k	ACHASOV	12	SND	e ⁺ e ⁻ → $\pi^0\pi^0\gamma$
~ 0.21		CLEGG	94	RVUE	

NODE=M105R5
NODE=M105R5

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

$$\Gamma_1/\Gamma_3$$

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

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

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

$$\Gamma_4/\Gamma_2$$

NODE=M105R10
NODE=M105R10

$$\Gamma(h_1(1170)\pi)/\Gamma(4\pi)$$

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.08±0.04	¹ ABELE	01B	CBAR 0.0 $\bar{p}n \rightarrow 5\pi$

$$\Gamma_5/\Gamma_2$$

NODE=M105R11
NODE=M105R11

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

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.37±0.13	¹ ABELE	01B	CBAR 0.0 $\bar{p}n \rightarrow 5\pi$

$$\Gamma_6/\Gamma_2$$

NODE=M105R12
NODE=M105R12

$$\Gamma(\rho\rho)/\Gamma(4\pi)$$

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

$$\Gamma_7/\Gamma_2$$

NODE=M105R13
NODE=M105R13

$$\Gamma(\rho(\pi\pi)_{S\text{-wave}})/\Gamma(4\pi)$$

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

$$\Gamma_8/\Gamma_2$$

NODE=M105R14
NODE=M105R14

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

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
<0.04	DONNACHIE	87B	RVUE

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

NODE=M105R2
NODE=M105R2

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

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
~ 0.24	³ DONNACHIE	91	RVUE
>2	FUKUI	91	SPEC 8.95 $\pi^- p \rightarrow \omega\pi^0 n$

$$\Gamma_{10}/\Gamma_3$$

NODE=M105R4
NODE=M105R4

$$\Gamma(a_2(1320)\pi)/\Gamma_{\text{total}}$$

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
not seen	AMELIN	00	VES 37 $\pi^- p \rightarrow \eta\pi^+\pi^- n$

$$\Gamma_{11}/\Gamma$$

NODE=M105R9
NODE=M105R9

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

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
<0.08	³ DONNACHIE	91	RVUE

$$\Gamma_{12}/\Gamma_3$$

NODE=M105R8
NODE=M105R8

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

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
possibly seen	COAN	04	CLEO $\tau^- \rightarrow K^- \pi^- K^+ \nu_\tau$

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

NODE=M105R16
NODE=M105R16

¹ $\omega\pi$ not included.

² Using ABELE 97.

³ Using data from BISELLO 91B, DOLINSKY 86 and ALBRECHT 87L.

NODE=M105R;LINKAGE=BL
NODE=M105R;LINKAGE=LK
NODE=M105R;LINKAGE=A

$\rho(1450)$ REFERENCES

NODE=M105

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
LEES	12G	Translated from ZETFP 94 796.	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=54299
ACHASOV	11	PR D86 032013	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=16721
AUBERT	08S	JETP 113 75	Translated from ZETF 140 87.		
FUJIKAWA	08	PR D77 092002	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52242
AKHMETSHIN	05	PR D78 072006	M. Fujikawa <i>et al.</i>	(BELLE Collab.)	REFID=52536
ALOISIO	05	PL B605 26	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=50330
SCHAEEL	05C	PL B606 12	A. Aloisio <i>et al.</i>	(KLOE Collab.)	REFID=51112
AKHMETSHIN	04	PR B578 285	S. Schaeel <i>et al.</i>	(ALEPH Collab.)	REFID=50845
COAN	04	PL B489 125	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=49609
AKHMETSHIN	03B	PRL 92 232001	T.E. Coan <i>et al.</i>	(CLEO Collab.)	REFID=49945
ABELE	01B	PL B562 173	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=49406
AKHMETSHIN	01B	EPJ C21 261	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)	REFID=48356
ALEXANDER	01B	PR B509 217	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=48167
AKHMETSHIN	00D	PR D64 092001	J.P. Alexander <i>et al.</i>	(CLEO Collab.)	REFID=48391
AMELIN	00	NP A668 83	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=47935
ANDERSON	00A	NP A668 83	D. Amelin <i>et al.</i>	(VES Collab.)	REFID=47432
EDWARDS	00A	PR D61 112002	S. Anderson <i>et al.</i>	(CLEO Collab.)	REFID=47468
ABELE	99C	PR D61 072003	K.W. Edwards <i>et al.</i>	(CLEO Collab.)	REFID=47465
ABELE	99D	PL B450 275	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)	REFID=46916
BERTIN	98	PL B468 178	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)	REFID=47401
ABELE	97	PR D57 55	A. Bertin <i>et al.</i>	(OBELIX Collab.)	REFID=45782
ACHASOV	97	PL B391 191	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)	REFID=45415
BARATE	97M	PR D55 2663	N.N. Achasov <i>et al.</i>	(NOVM)	REFID=45382
BERTIN	97C	ZPHY C76 15	R. Barate <i>et al.</i>	(ALEPH Collab.)	REFID=45622
BERTIN	97D	PL B408 476	A. Bertin <i>et al.</i>	(OBELIX Collab.)	REFID=45701
CLEGG	94	PL B414 220	A. Bertin <i>et al.</i>	(OBELIX Collab.)	REFID=45763
BISELLO	91B	ZPHY C62 455	A.B. Clegg, A. Donnachie	(LANC, MCHS)	REFID=44081
DOLINSKY	91	NPBPS B21 111	D. Bisello	(DM2 Collab.)	REFID=41752
DONNACHIE	91	PRPL 202 99	S.I. Dolinsky <i>et al.</i>	(NOVO)	REFID=41369
FUKUI	91	ZPHY C51 689	A. Donnachie, A.B. Clegg	(MCHS, LANC)	REFID=41632
KUHN	90	PL B257 241	S. Fukui <i>et al.</i>	(SUGI, NAGO, KEK, KYOT+)	REFID=41581
ARMSTRONG	89E	ZPHY C48 445	J.H. Kuhn <i>et al.</i>	(MPIM)	REFID=45862
BISELLO	89	PL B228 536	T.A. Armstrong, M. Benayoun	(ATHU, BARI, BIRM+)	REFID=41011
DUBNICKA	89	PL B220 321	D. Bisello <i>et al.</i>	(DM2 Collab.)	REFID=40740
ANTONELLI	88	JP G15 1349	S. Dubnicka <i>et al.</i>	(JINR, SLOV)	REFID=44082
CLEGG	88	PL B212 133	A. Antonelli <i>et al.</i>	(DM2 Collab.)	REFID=40583
DIEKMAN	88	ZPHY C40 313	A.B. Clegg, A. Donnachie	(MCHS, LANC)	REFID=40922
FUKUI	88	PRPL 159 99	B. Diekmann	(BONN)	REFID=40272
ALBRECHT	87L	PL B202 441	S. Fukui <i>et al.</i>	(SUGI, NAGO, KEK, KYOT+)	REFID=40273
DONNACHIE	87B	PL B185 223	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=40418
DOLINSKY	86	ZPHY C34 257	A. Donnachie, A.B. Clegg	(MCHS, LANC)	REFID=40920
BARKOV	85	PL B174 453	S.I. Dolinsky <i>et al.</i>	(NOVO)	REFID=20246
KURDADZE	83	NP B256 365	L.M. Barkov <i>et al.</i>	(NOVO)	REFID=20134
ASTON	80C	JETPL 37 733	L.M. Kurdadze <i>et al.</i>	(NOVO)	REFID=20133
BARBER	80C	Translated from ZETFP 37 613.	D. Aston	(BONN, CERN, EPOL, GLAS, LANC+)	REFID=20652
GOUNARIS	68	PL 92B 211	D.P. Barber <i>et al.</i>	(DARE, LANC, SHEF)	REFID=20653
		ZPHY C4 169	G.J. Gounaris, J.J. Sakurai		REFID=48054
		PRL 21 244			

$\eta(1475)$

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

See also the $\eta(1405)$.

NODE=M175

NODE=M175

NODE=M175205

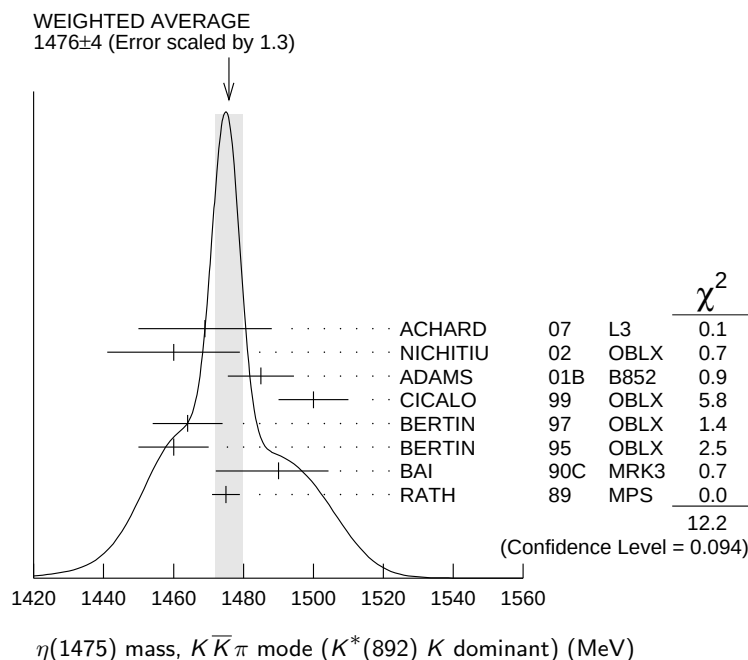
NODE=M175M5
NODE=M175M5 **$\eta(1475)$ MASS** **$K\bar{K}\pi$ MODE ($K^*(892)$ K dominant)**

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1476 ± 4 OUR AVERAGE		Error includes scale factor of 1.3. See the ideogram below.		
1469 ± 14 ± 13	74	ACHARD	07 L3	183-209 $e^+e^- \rightarrow K_S^0 K^\pm \pi^\mp$
1460 ± 19	3651	NICHITIU	02 OBLX	
1485 ± 8 ± 5	20k	ADAMS	01B B852	18 GeV $\pi^- p \rightarrow K^+ K^- \pi^0 n$
1500 ± 10		CICALO	99 OBLX	0 $\bar{p} p \rightarrow K^\pm K_S^0 \pi^\mp \pi^+ \pi^-$
1464 ± 10		BERTIN	97 OBLX	0 $\bar{p} p \rightarrow K^\pm (K^0) \pi^\mp \pi^+ \pi^-$
1460 ± 10		BERTIN	95 OBLX	0 $\bar{p} p \rightarrow K\bar{K}\pi\pi\pi$
1490 $^{+14}_{-8} \pm 3_{-16}$	1100	BAI	90C MRK3	$J/\psi \rightarrow \gamma K_S^0 K^\pm \pi^\mp$
1475 ± 4		RATH	89 MPS	21.4 $\pi^- p \rightarrow n K_S^0 K_S^0 \pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1421 ± 14		AUGUSTIN	92 DM2	$J/\psi \rightarrow \gamma K\bar{K}\pi$

OCCUR=2

OCCUR=2

OCCUR=2

 **$\eta(1475)$ WIDTH**

NODE=M175210

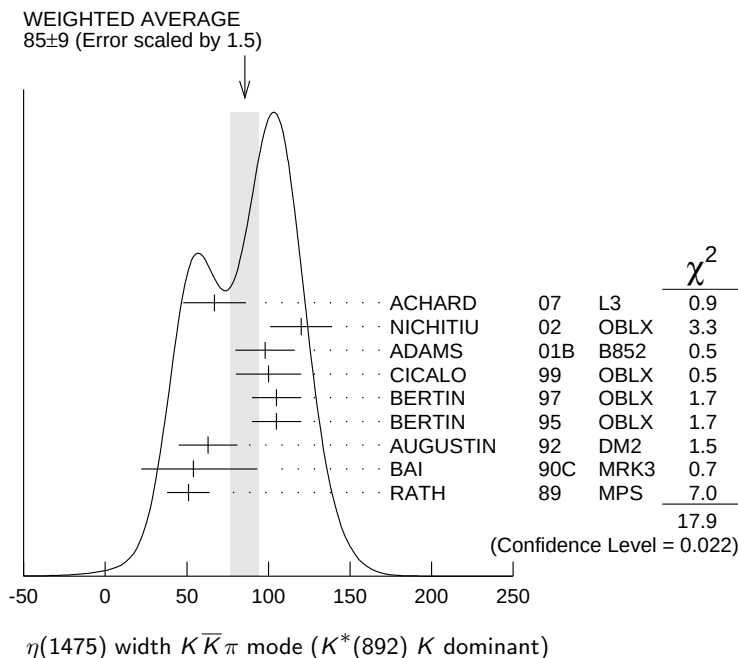
 $K\bar{K}\pi$ MODE ($K^*(892)$ K dominant)NODE=M175W5
NODE=M175W5

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
85 ± 9 OUR AVERAGE		Error includes scale factor of 1.5. See the ideogram below.		
67 ± 18 ± 7	74	ACHARD	07 L3	183-209 $e^+e^- \rightarrow K_S^0 K^\pm \pi^\mp$
120 ± 19	3651	NICHITIU	02 OBLX	
98 ± 18 ± 3	20k	ADAMS	01B B852	18 GeV $\pi^- p \rightarrow K^+ K^- \pi^0 n$
100 ± 20		CICALO	99 OBLX	0 $\bar{p} p \rightarrow K^\pm K_S^0 \pi^\mp \pi^+ \pi^-$
105 ± 15		BERTIN	97 OBLX	0.0 $\bar{p} p \rightarrow K^\pm (K^0) \pi^\mp \pi^+ \pi^-$
105 ± 15		BERTIN	95 OBLX	0 $\bar{p} p \rightarrow K\bar{K}\pi\pi\pi$
63 ± 18		AUGUSTIN	92 DM2	$J/\psi \rightarrow \gamma K\bar{K}\pi$
54 $^{+37}_{-21} \pm 13_{-24}$		BAI	90C MRK3	$J/\psi \rightarrow \gamma K_S^0 K^\pm \pi^\mp$
51 ± 13		RATH	89 MPS	21.4 $\pi^- p \rightarrow n K_S^0 K_S^0 \pi^0$

OCCUR=2

OCCUR=2

OCCUR=2



$\eta(1475)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $K \bar{K} \pi$	dominant
Γ_2 $K \bar{K}^*(892) + \text{c.c.}$	seen
Γ_3 $a_0(980) \pi$	seen
Γ_4 $\gamma \gamma$	seen

NODE=M175215;NODE=M175

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

$\eta(1475) \Gamma(i) \Gamma(\gamma \gamma) / \Gamma(\text{total})$

$\Gamma(K \bar{K} \pi) \times \Gamma(\gamma \gamma) / \Gamma_{\text{total}}$	$\Gamma_1 \Gamma_4 / \Gamma$
VALUE (keV)	CL% EVTS DOCUMENT ID TECN COMMENT
0.23±0.05±0.05	74 ¹ ACHARD 07 L3 183-209 $e^+ e^- \rightarrow e^+ e^- K_S^0 K^\pm \pi^\mp$

NODE=M175220

NODE=M175G2
 NODE=M175G2

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

< 0.089 90 ^{2,3} AHOHE 05 CLE2 10.6 $e^+ e^- \rightarrow e^+ e^- K_S^0 K^\pm \pi^\mp$

¹ Supersedes ACCIARRI 01G. Compatible with $K^* K$ decay. Using $B(K_S^0 \rightarrow \pi^+ \pi^-) = 0.6895$.

² Using $\eta(1475)$ mass of 1481 MeV and width of 48 MeV. The upper limit increases to 0.140 keV if the world average value, 87 MeV, of the width is used.

³ Assuming three-body phase-space decay to $K_S^0 K^\pm \pi^\mp$.

NODE=M175G2;LINKAGE=CH

NODE=M175G2;LINKAGE=AH

NODE=M175G2;LINKAGE=B3

$\eta(1475)$ BRANCHING RATIOS

$\Gamma(K \bar{K}^*(892) + \text{c.c.}) / \Gamma(K \bar{K} \pi)$	Γ_2 / Γ_1
VALUE DOCUMENT ID TECN COMMENT	
0.50±0.10 ⁴ BAILLON 67 HBC 0.0 $\bar{p} p \rightarrow K \bar{K} \pi \pi \pi$	

NODE=M175225

NODE=M175R1
 NODE=M175R1

$\Gamma(K \bar{K}^*(892) + \text{c.c.}) / [\Gamma(K \bar{K}^*(892) + \text{c.c.}) + \Gamma(a_0(980) \pi)]$	$\Gamma_2 / (\Gamma_2 + \Gamma_3)$
VALUE CL% DOCUMENT ID TECN COMMENT	
< 0.25 90 EDWARDS 82E CBAL $J/\psi \rightarrow K^+ K^- \pi^0 \gamma$	

NODE=M175R6
 NODE=M175R6

⁴ Data could also refer to $\eta(1405)$.

NODE=M175R;LINKAGE=BL

$\eta(1475)$ REFERENCES

ACHARD	07	JHEP 0703 018	P. Achard <i>et al.</i>	(L3 Collab.)
AHOHE	05	PR D71 072001	R. Ahohe <i>et al.</i>	(CLEO Collab.)
NICHITIU	02	PL B545 261	F. Nichitiu <i>et al.</i>	(OBELIX Collab.)
ACCIARRI	01G	PL B501 1	M. Acciarri <i>et al.</i>	(L3 Collab.)
ADAMS	01B	PL B516 264	G.S. Adams <i>et al.</i>	(BNL E852 Collab.)
CICALO	99	PL B462 453	C. Cicalo <i>et al.</i>	(OBELIX Collab.)
BERTIN	97	PL B400 226	A. Bertin <i>et al.</i>	(OBELIX Collab.)
BERTIN	95	PL B361 187	A. Bertin <i>et al.</i>	(OBELIX Collab.)
AUGUSTIN	92	PR D46 1951	J.E. Augustin, G. Cosme	(DM2 Collab.)
BAI	90C	PRL 65 2507	Z. Bai <i>et al.</i>	(Mark III Collab.)
RATH	89	PR D40 693	M.G. Rath <i>et al.</i>	(NDAM, BRAN, BNL, CUNY+)
EDWARDS	82E	PRL 49 259	C. Edwards <i>et al.</i>	(CIT, HARV, PRIN+)
BAILLON	67	NC 50A 393	P.H. Baillon <i>et al.</i>	(CERN, CDEF, IRAD)

NODE=M175

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REFID=47394
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REFID=41584
REFID=41578
REFID=40924
REFID=21314
REFID=20407

 $f_0(1500)$

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

See also the mini-reviews on scalar mesons under $f_0(500)$ (see the index for the page number) and on non- $q\bar{q}$ candidates in PDG 06, Journal of Physics (generic for all A,B,E,G) **G33** 1 (2006).

NODE=M152

NODE=M152

 $f_0(1500)$ MASS

NODE=M152M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1505 ± 6 OUR AVERAGE		Error includes scale factor of 1.3. See the ideogram below.		
1466 ± 6 ± 20		ABLIKIM	06V BES2	$e^+e^- \rightarrow J/\psi \rightarrow \gamma\pi^+\pi^-$
1515 ± 12		1 BARBERIS	00A	450 $pp \rightarrow p_f\eta\eta p_s$
1511 ± 9		1,2 BARBERIS	00C	450 $pp \rightarrow p_f4\pi p_s$
1510 ± 8		1 BARBERIS	00E	450 $pp \rightarrow p_f\eta\eta p_s$
1522 ± 25		BERTIN	98 OBLX	0.05–0.405 $\bar{n}p \rightarrow \pi^+\pi^+\pi^-$
1449 ± 20		1 BERTIN	97C OBLX	0.0 $\bar{p}p \rightarrow \pi^+\pi^-\pi^0$
1515 ± 20		ABELE	96B CBAR	0.0 $\bar{p}p \rightarrow \pi^0 K_L^0 K_L^0$
1500 ± 15		3 AMSLER	95B CBAR	0.0 $\bar{p}p \rightarrow 3\pi^0$
1505 ± 15		4 AMSLER	95C CBAR	0.0 $\bar{p}p \rightarrow \eta\eta\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1486 ± 10		1 ANISOVICH	09 RVUE	0.0 $\bar{p}p, \pi N$
1470 ± 60	568	5 KLEMP	08 E791	$D_s^+ \rightarrow \pi^-\pi^+\pi^+$
1470 $\begin{smallmatrix} + \\ - \end{smallmatrix}$ $\begin{smallmatrix} 6 \\ 7 \end{smallmatrix}$ $\begin{smallmatrix} + \\ - \end{smallmatrix}$ $\begin{smallmatrix} 72 \\ 255 \end{smallmatrix}$		6 UEHARA	08A BELL	10.6 $e^+e^- \rightarrow e^+e^-\pi^0\pi^0$
1495 ± 4		AMSLER	06 CBAR	0.9 $\bar{p}p \rightarrow K^+K^-\pi^0$
1539 ± 20	9.9k	AUBERT	06O BABR	$B^+ \rightarrow K^+K^+K^-$
1473 ± 5	80k	7,8 UMAN	06 E835	5.2 $\bar{p}p \rightarrow \eta\eta\pi^0$
1478 ± 6		VLADIMIRSK...	06 SPEC	40 $\pi^-p \rightarrow K_S^0 K_S^0 n$
1493 ± 7		7 BINON	05 GAMS	33 $\pi^-p \rightarrow \eta\eta n$
1524 ± 14	1400	9 GARMASH	05 BELL	$B^+ \rightarrow K^+K^+K^-$
1489 $\begin{smallmatrix} + \\ - \end{smallmatrix}$ $\begin{smallmatrix} 8 \\ 4 \end{smallmatrix}$		10 ANISOVICH	03 RVUE	
1490 ± 30		7 ABELE	01 CBAR	0.0 $\bar{p}d \rightarrow \pi^-4\pi^0 p$
1497 ± 10		7 BARBERIS	99 OMEG	450 $pp \rightarrow p_s p_f K^+K^-$
1502 ± 10		7 BARBERIS	99B OMEG	450 $pp \rightarrow p_s p_f \pi^+\pi^-$
1502 ± 12 ± 10		11 BARBERIS	99D OMEG	450 $pp \rightarrow K^+K^-, \pi^+\pi^-$
1530 ± 45		7 BELLAZZINI	99 GAM4	450 $pp \rightarrow pp\pi^0\pi^0$
1505 ± 18		7 FRENCH	99	300 $pp \rightarrow p_f(K^+K^-)p_s$
1447 ± 27		12 KAMINSKI	99 RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}, \sigma\sigma$
1580 ± 80		7 ALDE	98 GAM4	100 $\pi^-p \rightarrow \pi^0\pi^0 n$
1499 ± 8		1 ANISOVICH	98B RVUE	Compilation
~ 1520		REYES	98 SPEC	800 $pp \rightarrow p_s p_f K_S^0 K_S^0$
1510 ± 20		1 BARBERIS	97B OMEG	450 $pp \rightarrow pp2(\pi^+\pi^-)$
~ 1475		FRABETTI	97D E687	$D_s^\pm \rightarrow \pi^\mp \pi^\pm \pi^\pm$
~ 1505		ABELE	96 CBAR	0.0 $\bar{p}p \rightarrow 5\pi^0$
1500 ± 8		1 ABELE	96C RVUE	Compilation
1460 ± 20	120	7 AMELIN	96B VES	37 $\pi^-A \rightarrow \eta\eta\pi^- A$
1500 ± 8		BUGG	96 RVUE	
1500 ± 10		13 AMSLER	95D CBAR	0.0 $\bar{p}p \rightarrow \pi^0\pi^0\pi^0, \pi^0\eta\eta, \pi^0\pi^0\eta$
1445 ± 5		14 ANTINORI	95 OMEG	300,450 $pp \rightarrow pp2(\pi^+\pi^-)$

NODE=M152M

OCCUR=2

1497±30		⁷ ANTINORI	95	OMEG	300,450	$pp \rightarrow pp\pi^+\pi^-$
~ 1505		BUGG	95	MRK3	$J/\psi \rightarrow \gamma\pi^+\pi^-\pi^+\pi^-$	
1446± 5		⁷ ABATZIS	94	OMEG	450	$pp \rightarrow pp2(\pi^+\pi^-)$
1545±25		⁷ AMSLER	94E	CBAR	0.0	$\bar{p}p \rightarrow \pi^0\eta\eta'$
1520±25		^{1,15} ANISOVICH	94	CBAR	0.0	$\bar{p}p \rightarrow 3\pi^0, \pi^0\eta\eta$
1505±20		^{1,16} BUGG	94	RVUE	$\bar{p}p \rightarrow 3\pi^0, \eta\eta\pi^0, \eta\pi^0\pi^0$	
1560±25		⁷ AMSLER	92	CBAR	0.0	$\bar{p}p \rightarrow \pi^0\eta\eta$
1550±45± 30		⁷ BELADIDZE	92C	VES	36	$\pi^-\text{Be} \rightarrow \pi^-\eta'\eta\text{Be}$
1449± 4		⁷ ARMSTRONG	89E	OMEG	300	$pp \rightarrow pp2(\pi^+\pi^-)$
1610±20		⁷ ALDE	88	GAM4	300	$\pi^-N \rightarrow \pi^-N2\eta$
~ 1525		ASTON	88D	LASS	11	$K^-p \rightarrow K_S^0K_S^0\Lambda$
1570±20	600	⁷ ALDE	87	GAM4	100	$\pi^-p \rightarrow 4\pi^0n$
1575±45		¹⁷ ALDE	86D	GAM4	100	$\pi^-p \rightarrow 2\eta n$
1568±33		⁷ BINON	84C	GAM2	38	$\pi^-p \rightarrow \eta\eta'n$
1592±25		⁷ BINON	83	GAM2	38	$\pi^-p \rightarrow 2\eta n$
1525± 5		⁷ GRAY	83	DBC	0.0	$\bar{p}N \rightarrow 3\pi$

OCCUR=2

¹ T-matrix pole.² Average between $\pi^+\pi^-2\pi^0$ and $2(\pi^+\pi^-)$.³ T-matrix pole, supersedes ANISOVICH 94.⁴ T-matrix pole, supersedes ANISOVICH 94 and AMSLER 92.⁵ Reanalysis of AITALA 01A data. This state could also be $f_0(1370)$.⁶ Breit-Wigner mass. May also be the $f_0(1370)$.⁷ Breit-Wigner mass.⁸ Statistical error only.⁹ Breit-Wigner, solution 1, PWA ambiguous.

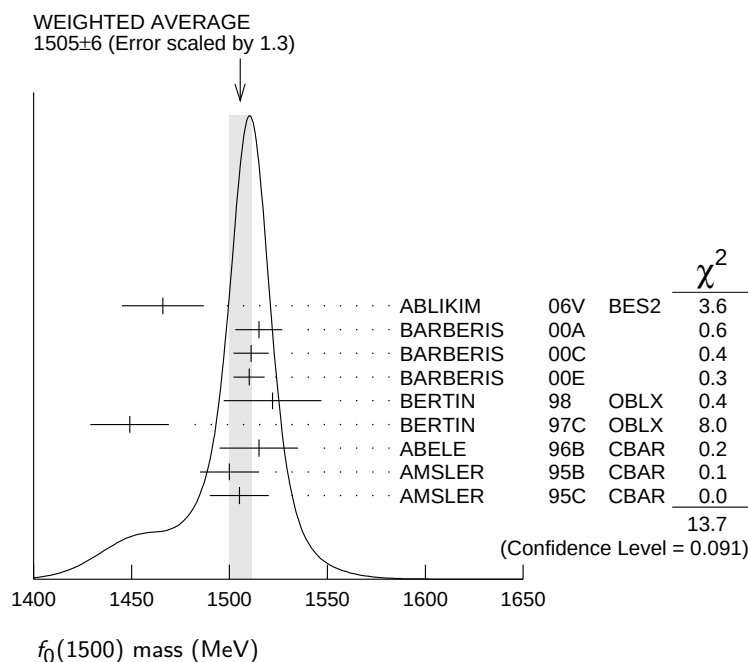
¹⁰ K-matrix pole from combined analysis of $\pi^- p \rightarrow \pi^0\pi^0 n$, $\pi^- p \rightarrow K\bar{K}n$, $\pi^+\pi^- \rightarrow \pi^+\pi^-$, $\bar{p}p \rightarrow \pi^0\pi^0\pi^0$, $\pi^0\eta\eta$, $\pi^0\pi^0\eta$, $\pi^+\pi^-\pi^0$, $K^+K^-\pi^0$, $K_S^0 K_S^0\pi^0$, $K^+K_S^0\pi^-$ at rest, $\bar{p}n \rightarrow \pi^-\pi^-\pi^+$, $K_S^0 K^-\pi^0$, $K_S^0 K_S^0\pi^-$ at rest.

¹¹ Supersedes BARBERIS 99 and BARBERIS 99B.¹² T-matrix pole on sheet $--+$.¹³ T-matrix pole. Coupled-channel analysis of AMSLER 95B, AMSLER 95C, and AMSLER 94D.¹⁴ Supersedes ABATZIS 94, ARMSTRONG 89E. Breit-Wigner mass.¹⁵ From a simultaneous analysis of the annihilations $\bar{p}p \rightarrow 3\pi^0, \pi^0\eta\eta$.¹⁶ Reanalysis of ANISOVICH 94 data.¹⁷ From central value and spread of two solutions. Breit-Wigner mass.

NODE=M152M;LINKAGE=PP
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 NODE=M152M;LINKAGE=UE
 NODE=M152M;LINKAGE=E
 NODE=M152M;LINKAGE=ST
 NODE=M152M;LINKAGE=GA
 NODE=M152M;LINKAGE=KM

NODE=M152M;LINKAGE=BD
 NODE=M152M;LINKAGE=TK
 NODE=M152M;LINKAGE=AB

NODE=M152M;LINKAGE=B
 NODE=M152M;LINKAGE=A
 NODE=M152M;LINKAGE=C1
 NODE=M152M;LINKAGE=AZ

 **$f_0(1500)$ WIDTH**

NODE=M152W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
109± 7 OUR AVERAGE				
108 ⁺ ₋₁₁ ± 25		ABLIKIM	06V BES2	$e^+e^- \rightarrow J/\psi \rightarrow \gamma\pi^+\pi^-$
110± 24		18 BARBERIS	00A	450 $pp \rightarrow p_f\eta\eta p_s$
102± 18		18,19 BARBERIS	00C	450 $pp \rightarrow p_f4\pi p_s$
110± 16		18 BARBERIS	00E	450 $pp \rightarrow p_f\eta\eta p_s$
108± 33		BERTIN	98 OBLX	0.05–0.405 $\bar{n}p \rightarrow \pi^+\pi^+\pi^-$
114± 30		18 BERTIN	97C OBLX	0.0 $\bar{p}p \rightarrow \pi^+\pi^-\pi^0$
105± 15		ABELE	96B CBAR	0.0 $\bar{p}p \rightarrow \pi^0 K_L^0 K_L^0$
120± 25		20 AMSLER	95B CBAR	0.0 $\bar{p}p \rightarrow 3\pi^0$
120± 30		21 AMSLER	95C CBAR	0.0 $\bar{p}p \rightarrow \eta\eta\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
114± 10		18 ANISOVICH	09 RVUE	0.0 $\bar{p}p, \pi N$
90 ⁺ ₋₁ ²⁺⁵⁰ ₋₂₂		22 UEHARA	08A BELL	10.6 $e^+e^- \rightarrow e^+e^-\pi^0\pi^0$
121± 8		AMSLER	06 CBAR	0.9 $\bar{p}p \rightarrow K^+K^-\pi^0$
257± 33	9.9k	AUBERT	06O BABR	$B^+ \rightarrow K^+K^+K^-$
108± 9	80k	23,24 UMAN	06 E835	5.2 $\bar{p}p \rightarrow \eta\eta\pi^0$
119± 10		VLADIMIRSK..	06 SPEC	40 $\pi^-p \rightarrow K_S^0 K_S^0 n$
90± 15		23 BINON	05 GAMS	33 $\pi^-p \rightarrow \eta\eta n$
136± 23	1400	25 GARMASH	05 BELL	$B^+ \rightarrow K^+K^+K^-$
102± 10		26 ANISOVICH	03 RVUE	
140± 40		23 ABELE	01 CBAR	0.0 $\bar{p}d \rightarrow \pi^-4\pi^0 p$
104± 25		23 BARBERIS	99 OMEG	450 $pp \rightarrow p_s p_f K^+K^-$
131± 15		23 BARBERIS	99B OMEG	450 $pp \rightarrow p_s p_f \pi^+\pi^-$
98± 18±16		27 BARBERIS	99D OMEG	450 $pp \rightarrow K^+K^-, \pi^+\pi^-$
160± 50		23 BELLAZZINI	99 GAM4	450 $pp \rightarrow pp\pi^0\pi^0$
100± 33		23 FRENCH	99	300 $pp \rightarrow p_f(K^+K^-)p_s$
108± 46		28 KAMINSKI	99 RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}, \sigma\sigma$
280±100		23 ALDE	98 GAM4	100 $\pi^-p \rightarrow \pi^0\pi^0 n$
130± 20		18 ANISOVICH	98B RVUE	Compilation
120± 35		18 BARBERIS	97B OMEG	450 $pp \rightarrow pp2(\pi^+\pi^-)$
~ 100		FRABETTI	97D E687	$D_s^\pm \rightarrow \pi^\mp \pi^\pm \pi^\pm$
~ 169		ABELE	96 CBAR	0.0 $\bar{p}p \rightarrow 5\pi^0$
100± 30	120	23 AMELIN	96B VES	37 $\pi^-A \rightarrow \eta\eta\pi^-A$
132± 15		BUGG	96 RVUE	
154± 30		29 AMSLER	95D CBAR	0.0 $\bar{p}p \rightarrow \pi^0\pi^0\pi^0, \pi^0\eta\eta, \pi^0\pi^0\eta$
65± 10		30 ANTINORI	95 OMEG	300,450 $pp \rightarrow pp2(\pi^+\pi^-)$
199± 30		23 ANTINORI	95 OMEG	300,450 $pp \rightarrow pp\pi^+\pi^-$
56± 12		23 ABATZIS	94 OMEG	450 $pp \rightarrow pp2(\pi^+\pi^-)$
100± 40		23 AMSLER	94E CBAR	0.0 $\bar{p}p \rightarrow \pi^0\eta\eta'$
148 ⁺ ₋₂₅		18,31 ANISOVICH	94 CBAR	0.0 $\bar{p}p \rightarrow 3\pi^0, \pi^0\eta\eta$
150± 20		18,32 BUGG	94 RVUE	$\bar{p}p \rightarrow 3\pi^0, \eta\eta\pi^0, \eta\pi^0\pi^0$
245± 50		23 AMSLER	92 CBAR	0.0 $\bar{p}p \rightarrow \pi^0\eta\eta$
153± 67±50		23 BELADIDZE	92C VES	36 $\pi^-Be \rightarrow \pi^-\eta'\eta Be$
78± 18		23 ARMSTRONG	89E OMEG	300 $pp \rightarrow pp2(\pi^+\pi^-)$
170± 40		23 ALDE	88 GAM4	300 $\pi^-N \rightarrow \pi^-N2\eta$
150± 20	600	23 ALDE	87 GAM4	100 $\pi^-p \rightarrow 4\pi^0 n$
265± 65		33 ALDE	86D GAM4	100 $\pi^-p \rightarrow 2\eta n$
260± 60		23 BINON	84C GAM2	38 $\pi^-p \rightarrow \eta\eta' n$
210± 40		23 BINON	83 GAM2	38 $\pi^-p \rightarrow 2\eta n$
101± 13		23 GRAY	83 DBC	0.0 $\bar{p}N \rightarrow 3\pi$

NODE=M152W

OCCUR=2

OCCUR=2

NODE=M152W;LINKAGE=PP
 NODE=M152W;LINKAGE=PC
 NODE=M152W;LINKAGE=D
 NODE=M152W;LINKAGE=D1
 NODE=M152W;LINKAGE=UE
 NODE=M152W;LINKAGE=E
 NODE=M152W;LINKAGE=ST
 NODE=M152W;LINKAGE=GA
 NODE=M152W;LINKAGE=KM

18 T-matrix pole.

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

20 T-matrix pole, supersedes ANISOVICH 94.

21 T-matrix pole, supersedes ANISOVICH 94 and AMSLER 92.

22 Breit-Wigner width. May also be the $f_0(1370)$.

23 Breit-Wigner width.

24 Statistical error only.

25 Breit-Wigner, solution 1, PWA ambiguous.

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

- 27 Supersedes BARBERIS 99 and BARBERIS 99B.
 28 T-matrix pole on sheet $-\ - +$.
 29 T-matrix pole. Coupled-channel analysis of AMSLER 95B, AMSLER 95C, and AMSLER 94D.
 30 Supersedes ABATZIS 94, ARMSTRONG 89E. Breit-Wigner mass.
 31 From a simultaneous analysis of the annihilations $\bar{p}p \rightarrow 3\pi^0, \pi^0\eta\eta$.
 32 Reanalysis of ANISOVICH 94 data.
 33 From central value and spread of two solutions. Breit-Wigner mass.

NODE=M152W;LINKAGE=BD
 NODE=M152W;LINKAGE=TK
 NODE=M152W;LINKAGE=AB

 NODE=M152W;LINKAGE=B
 NODE=M152W;LINKAGE=A
 NODE=M152W;LINKAGE=C1
 NODE=M152W;LINKAGE=AZ

$f_0(1500)$ DECAY MODES

	Mode	Fraction (Γ_i/Γ)	Scale factor
Γ_1	$\pi\pi$	$(34.9 \pm 2.3) \%$	1.2
Γ_2	$\pi^+\pi^-$	seen	
Γ_3	$2\pi^0$	seen	
Γ_4	4π	$(49.5 \pm 3.3) \%$	1.2
Γ_5	$4\pi^0$	seen	
Γ_6	$2\pi^+2\pi^-$	seen	
Γ_7	$2(\pi\pi)_{S\text{-wave}}$	seen	
Γ_8	$\rho\rho$	seen	
Γ_9	$\pi(1300)\pi$	seen	
Γ_{10}	$a_1(1260)\pi$	seen	
Γ_{11}	$\eta\eta$	$(5.1 \pm 0.9) \%$	1.4
Γ_{12}	$\eta\eta'(958)$	$(1.9 \pm 0.8) \%$	1.7
Γ_{13}	$K\bar{K}$	$(8.6 \pm 1.0) \%$	1.1
Γ_{14}	$\gamma\gamma$	not seen	

NODE=M152215;NODE=M152

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 DESIG=9
 DESIG=3;OUR EST;→ UNCHECKED ←
 DESIG=7
 DESIG=5;OUR EST;→ UNCHECKED ←
 DESIG=6;OUR EST;→ UNCHECKED ←
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 DESIG=14;OUR EST;→ UNCHECKED ←
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 DESIG=10;OUR EST;→ UNCHECKED ←

CONSTRAINED FIT INFORMATION

An overall fit to 6 branching ratios uses 10 measurements and one constraint to determine 5 parameters. The overall fit has a $\chi^2 = 11.4$ for 6 degrees of freedom.

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

x_4	−83			
x_{11}	11	−52		
x_{12}	−5	−31	29	
x_{13}	39	−67	33	6
	x_1	x_4	x_{11}	x_{12}

$f_0(1500) \Gamma(i) \Gamma(\gamma\gamma) / \Gamma(\text{total})$

$\Gamma(\pi\pi) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$					$\Gamma_1 \Gamma_{14} / \Gamma$
VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$33^{+12}_{-6} + 1809_{21}$		34 UEHARA	08A BELL	$10.6 e^+ e^- \rightarrow e^+ e^- \pi^0 \pi^0$	
not seen		ACCIARRI	01H L3	$\gamma\gamma \rightarrow K_S^0 K_S^0, E_{\text{cm}}^{\text{ee}} = 91, 183\text{--}209 \text{ GeV}$	
<460	95	BARATE	00E ALEP	$\gamma\gamma \rightarrow \pi^+ \pi^-$	
34 May also be the $f_0(1370)$. Multiplied by us by 3 to obtain the $\pi\pi$ value.					

NODE=M152217

NODE=M152G1
 NODE=M152G1

NODE=M152G1;LINKAGE=UE

$f_0(1500)$ BRANCHING RATIOS

$\Gamma(\pi\pi) / \Gamma_{\text{total}}$				Γ_1 / Γ
VALUE	DOCUMENT ID	TECN		
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.454 ± 0.104	BUGG	96	RVUE	

NODE=M152220

NODE=M152R8
 NODE=M152R8

$\Gamma(\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	BERTIN	98	OBLX 0.05–0.405 $\bar{n}p \rightarrow \pi^+\pi^+\pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
possibly seen	FRABETTI	97D E687	$D_s^\pm \rightarrow \pi^\mp \pi^\pm \pi^\pm$

NODE=M152R10
 NODE=M152R10

 $\Gamma(4\pi)/\Gamma(\pi\pi)$ Γ_4/Γ_1

VALUE	DOCUMENT ID	TECN	COMMENT
1.42±0.18 OUR FIT			Error includes scale factor of 1.2.
1.42±0.18 OUR AVERAGE			Error includes scale factor of 1.2.
1.37±0.16	BARBERIS	00D	450 $pp \rightarrow p_f 4\pi p_s$
2.1 ±0.6	35 AMSLER	98	RVUE
• • • We do not use the following data for averages, fits, limits, etc. • • •			
2.1 ±0.2	36 ANISOVICH	02D	SPEC Combined fit
3.4 ±0.8	35 ABELE	96	CBAR 0.0 $\bar{p}p \rightarrow 5\pi^0$

NODE=M152R6
 NODE=M152R6

 $\Gamma(2(\pi\pi)_{S\text{-wave}})/\Gamma(\pi\pi)$ Γ_7/Γ_1

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.42±0.26	37 ABELE	01	CBAR 0.0 $\bar{p}d \rightarrow \pi^- 4\pi^0 p$

NODE=M152R14
 NODE=M152R14

 $\Gamma(2(\pi\pi)_{S\text{-wave}})/\Gamma(4\pi)$ Γ_7/Γ_4

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.26±0.07	ABELE	01B	CBAR 0.0 $\bar{p}d \rightarrow 5\pi p$

NODE=M152R15
 NODE=M152R15

 $\Gamma(\rho\rho)/\Gamma(4\pi)$ Γ_8/Γ_4

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.13±0.08	ABELE	01B	CBAR 0.0 $\bar{p}d \rightarrow 5\pi p$

NODE=M152R16
 NODE=M152R16

 $\Gamma(\rho\rho)/\Gamma(2(\pi\pi)_{S\text{-wave}})$ Γ_8/Γ_7

VALUE	DOCUMENT ID	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •		
3.3±0.5	BARBERIS	00C 450 $pp \rightarrow p_f \pi^+ \pi^- 2\pi^0 p_s$
2.6±0.4	BARBERIS	00C 450 $pp \rightarrow p_f 2(\pi^+ \pi^-) p_s$

NODE=M152R11
 NODE=M152R11

OCCUR=2

 $\Gamma(\pi(1300)\pi)/\Gamma(4\pi)$ Γ_9/Γ_4

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.50±0.25	ABELE	01B	CBAR 0.0 $\bar{p}d \rightarrow 5\pi p$

NODE=M152R17
 NODE=M152R17

 $\Gamma(a_1(1260)\pi)/\Gamma(4\pi)$ Γ_{10}/Γ_4

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.12±0.05	ABELE	01B	CBAR 0.0 $\bar{p}d \rightarrow 5\pi p$

NODE=M152R18
 NODE=M152R18

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

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
large	ALDE	88	GAM4 300 $\pi^- N \rightarrow \eta\eta\pi^- N$
large	BINON	83	GAM2 38 $\pi^- p \rightarrow 2\eta n$

NODE=M152R1
 NODE=M152R1

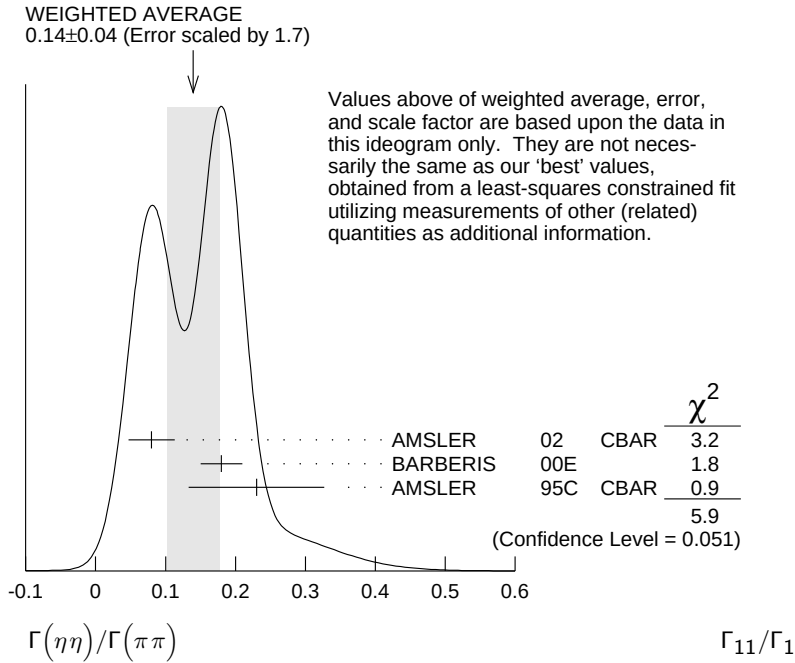
 $\Gamma(\eta\eta)/\Gamma(\pi\pi)$ Γ_{11}/Γ_1

VALUE	DOCUMENT ID	TECN	COMMENT
0.145±0.027 OUR FIT			Error includes scale factor of 1.5.
0.14 ±0.04 OUR AVERAGE			Error includes scale factor of 1.7. See the ideogram below.
0.080±0.033	AMSLER	02	CBAR 0.9 $\bar{p}p \rightarrow \pi^0 \eta\eta, \pi^0 \pi^0 \pi^0$
0.18 ±0.03	BARBERIS	00E	450 $pp \rightarrow p_f \eta\eta p_s$
0.230±0.097	38 AMSLER	95C	CBAR 0.0 $\bar{p}p \rightarrow \eta\eta\pi^0$

NODE=M152R13
 NODE=M152R13

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

0.11 ±0.03	³⁶ ANISOVICH	02D	SPEC	Combined fit
0.078±0.013	³⁹ ABELE	96C	RVUE	Compilation
0.157±0.060	⁴⁰ AMSLER	95D	CBAR	0.0 $\bar{p}p \rightarrow \pi^0 \pi^0 \pi^0, \pi^0 \eta \eta, \pi^0 \pi^0 \eta$



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

Γ_5/Γ_{11}

VALUE DOCUMENT ID TECN COMMENT

NODE=M152R5
NODE=M152R5

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

0.8±0.3	ALDE	87	GAM4	100 $\pi^- p \rightarrow 4\pi^0 n$

$\Gamma(\eta\eta'(958))/\Gamma(\pi\pi)$

Γ_{12}/Γ_1

VALUE DOCUMENT ID TECN COMMENT

NODE=M152R12
NODE=M152R12

0.055±0.024 OUR FIT Error includes scale factor of 1.8.

0.095±0.026 BARBERIS 00A 450 $pp \rightarrow p_f \eta \eta p_s$

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

0.005±0.003	³⁶ ANISOVICH	02D	SPEC	Combined fit

$\Gamma(\eta\eta'(958))/\Gamma(\eta\eta)$

Γ_{12}/Γ_{11}

VALUE DOCUMENT ID TECN COMMENT

NODE=M152R2
NODE=M152R2

0.38±0.16 OUR FIT Error includes scale factor of 1.9.

0.29±0.10 ⁴¹ AMSLER 95C CBAR 0.0 $\bar{p}p \rightarrow \eta \eta \pi^0$

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

0.05±0.03	³⁶ ANISOVICH	02D	SPEC	Combined fit
0.84±0.23	ABELE	96C	RVUE	Compilation
2.7 ±0.8	BINON	84C	GAM2	38 $\pi^- p \rightarrow \eta \eta' n$

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

Γ_{13}/Γ

VALUE DOCUMENT ID TECN

NODE=M152R9
NODE=M152R9

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

0.044±0.021	BUGG	96	RVUE	

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

Γ_{13}/Γ_1

VALUE DOCUMENT ID TECN COMMENT

NODE=M152R7
NODE=M152R7

0.246±0.026 OUR FIT

0.241±0.028 OUR AVERAGE

0.25 ±0.03	⁴² BARGIOTTI	03	OBLX	$\bar{p}p$
0.19 ±0.07	⁴³ ABELE	98	CBAR	0.0 $\bar{p}p \rightarrow K_L^0 K^\pm \pi^\mp$

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

0.16 ±0.05	³⁶ ANISOVICH	02D	SPEC	Combined fit
0.33 ±0.03 ±0.07	BARBERIS	99D	OMEG	450 $pp \rightarrow K^+ K^-, \pi^+ \pi^-$
0.20 ±0.08	⁴⁴ ABELE	96B	CBAR	0.0 $\bar{p}p \rightarrow \pi^0 K_L^0 K_L^0$

$\Gamma(K\bar{K})/\Gamma(\eta\eta)$ Γ_{13}/Γ_{11}

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
1.69±0.33 OUR FIT	Error includes scale factor of 1.4.			
1.85±0.41		BARBERIS 00E	450 $p\bar{p} \rightarrow p_f \eta \eta p_S$	
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
1.5 ±0.6		36 ANISOVICH 02D	SPEC	Combined fit
<0.4	90	45 PROKOSHKIN 91	GAM4	300 $\pi^- p \rightarrow \pi^- p \eta \eta$
<0.6		46 BINON 83	GAM2	38 $\pi^- p \rightarrow 2\eta n$
35 Excluding $\rho\rho$ contribution to 4π .				
36 From a combined K-matrix analysis of Crystal Barrel (0. $p\bar{p} \rightarrow \pi^0 \pi^0 \pi^0$, $\pi^0 \eta \eta$, $\pi^0 \pi^0 \eta$), GAMS ($\pi p \rightarrow \pi^0 \pi^0 n$, $\eta \eta n$, $\eta \eta' n$), and BNL ($\pi p \rightarrow K\bar{K} n$) data.				
37 From the combined data of ABELE 96 and ABELE 96C.				
38 Using AMSLER 95B ($3\pi^0$).				
39 2π width determined to be 60 ± 12 MeV.				
40 Coupled-channel analysis of AMSLER 95B, AMSLER 95C, and AMSLER 94D.				
41 Using AMSLER 94E ($\eta \eta' \pi^0$).				
42 Coupled channel analysis of $\pi^+ \pi^- \pi^0$, $K^+ K^- \pi^0$, and $K^\pm K_S^0 \pi^\mp$.				
43 Using $\pi^0 \pi^0$ from AMSLER 95B.				
44 Using AMSLER 95B ($3\pi^0$), AMSLER 94C ($2\pi^0 \eta$) and SU(3).				
45 Combining results of GAM4 with those of WA76 on $K\bar{K}$ central production.				
46 Using ETKIN 82B and COHEN 80.				

NODE=M152R4
 NODE=M152R4

NODE=M152R6;LINKAGE=C
 NODE=M152R;LINKAGE=CH

NODE=M152R;LINKAGE=KZ
 NODE=M152R3;LINKAGE=A
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 NODE=M152R2;LINKAGE=A
 NODE=M152R;LINKAGE=BG
 NODE=M152R7;LINKAGE=A
 NODE=M152R7;LINKAGE=D
 NODE=M152R4;LINKAGE=BZ
 NODE=M152R4;LINKAGE=A

 $f_0(1500)$ REFERENCES

ANISOVICH 09	IJMP A24 2481	V.V. Anisovich, A.V. Sarantsev	
KLEMPOT 08	EPJ C55 39	E. Klempt, M. Matveev, A.V. Sarantsev	(BONN+)
UEHARA 08A	PR D78 052004	S. Uehara <i>et al.</i>	(BELLE Collab.)
ABLIKIM 06V	PL B642 441	M. Ablikim <i>et al.</i>	(BES Collab.)
AMSLER 06	PL B639 165	C. Amsler <i>et al.</i>	(CBAR Collab.)
AUBERT 06O	PR D74 032003	B. Aubert <i>et al.</i>	(BABAR Collab.)
PDG 06	JP G33 1	W.-M. Yao <i>et al.</i>	(PDG Collab.)
UMAN 06	PR D73 052009	I. Uman <i>et al.</i>	(FNAL E835)
VLADIMIRSK... 06	PAN 69 493	V.V. Vladimirovsky <i>et al.</i>	(ITEP, Moscow)
Translated from YAF 69 515			
BINON 05	PAN 68 960	F. Binon <i>et al.</i>	
Translated from YAF 68 998			
GARMASH 05	PR D71 092003	A. Garmash <i>et al.</i>	(BELLE Collab.)
ANISOVICH 03	EPJ A16 229	V.V. Anisovich <i>et al.</i>	
BARGIOTTI 03	EPJ C26 371	M. Bargiotti <i>et al.</i>	(OBELIX Collab.)
AMSLER 02	EPJ C23 29	C. Amsler <i>et al.</i>	
ANISOVICH 02D	PAN 65 1545	V.V. Anisovich <i>et al.</i>	
Translated from YAF 65 1583			
ABELE 01	EPJ C19 667	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
ABELE 01B	EPJ C21 261	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
ACCARI 01H	PL B501 173	M. Acciarri <i>et al.</i>	(L3 Collab.)
AITALA 01A	PRL 86 765	E.M. Aitala <i>et al.</i>	(FNAL E791 Collab.)
BARATE 00E	PL B472 189	R. Barate <i>et al.</i>	(ALEPH Collab.)
BARBERIS 00A	PL B471 429	D. Barberis <i>et al.</i>	(WA 102 Collab.)
BARBERIS 00C	PL B471 440	D. Barberis <i>et al.</i>	(WA 102 Collab.)
BARBERIS 00D	PL B474 423	D. Barberis <i>et al.</i>	(WA 102 Collab.)
BARBERIS 00E	PL B479 59	D. Barberis <i>et al.</i>	(WA 102 Collab.)
BARBERIS 99	PL B453 305	D. Barberis <i>et al.</i>	(Omega Expt.)
BARBERIS 99B	PL B453 316	D. Barberis <i>et al.</i>	(Omega Expt.)
BARBERIS 99D	PL B462 462	D. Barberis <i>et al.</i>	(Omega Expt.)
BELLAZZINI 99	PL B467 296	R. Bellazzini <i>et al.</i>	
FRENCH 99	PL B460 213	B. French <i>et al.</i>	(WA76 Collab.)
KAMINSKI 99	EPJ C9 141	R. Kaminski, L. Lesniak, B. Loiseau	(CRAC, PARIN)
ABELE 98	PR D57 3860	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
ALDE 98	EPJ A3 361	D. Alde <i>et al.</i>	(GAM4 Collab.)
Also	PAN 62 405	D. Alde <i>et al.</i>	(GAMS Collab.)
Translated from YAF 62 446			
AMSLER 98	RMP 70 1293	C. Amsler	
ANISOVICH 98B	SPU 41 419	V.V. Anisovich <i>et al.</i>	
Translated from UFN 168 481			
BERTIN 98	PR D57 55	A. Bertin <i>et al.</i>	(OBELIX Collab.)
REYES 98	PRL 81 4079	M.A. Reyes <i>et al.</i>	
BARBERIS 97B	PL B413 217	D. Barberis <i>et al.</i>	(WA 102 Collab.)
BERTIN 97C	PL B408 476	A. Bertin <i>et al.</i>	(OBELIX Collab.)
FRABETTI 97D	PL B407 79	P.L. Frabetti <i>et al.</i>	(FNAL E687 Collab.)
ABELE 96	PL B380 453	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
ABELE 96B	PL B385 425	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
ABELE 96C	NP A609 562	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
AMELIN 96B	PAN 59 976	D.V. Amelin <i>et al.</i>	(SERP, TBIL)
Translated from YAF 59 1021			
BUGG 96	NP B471 59	D.V. Bugg, A.V. Sarantsev, B.S. Zou	(LOQM, PNPI)
AMSLER 95B	PL B342 433	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
AMSLER 95C	PL B353 571	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
AMSLER 95D	PL B355 425	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
ANTINORI 95	PL B353 589	F. Antinori <i>et al.</i>	(ATHU, BARI, BIRM+)
BUGG 95	PL B353 378	D.V. Bugg <i>et al.</i>	(LOQM, PNPI, WASH)
ABATZIS 94	PL B324 509	S. Abatzis <i>et al.</i>	(ATHU, BARI, BIRM+)
AMSLER 94C	PL B327 425	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
AMSLER 94D	PL B333 277	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
AMSLER 94E	PL B340 259	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
ANISOVICH 94	PL B323 233	V.V. Anisovich <i>et al.</i>	(Crystal Barrel Collab.)
BUGG 94	PR D50 4412	D.V. Bugg <i>et al.</i>	(LOQM)
AMSLER 92	PL B291 347	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
BELADIDZE 92C	SJNP 55 1535	G.M. Beladidze, S.I. Bitukov, G.V. Borisov	(SERP+)
Translated from YAF 55 2748			
PROKOSHKIN 91	SPD 36 155	V.D. Prokoshkin	(GAM2, GAM4 Collab.)
Translated from DANS 316 900			
ARMSTRONG 89E	PL B228 536	T.A. Armstrong, M. Benayoun	(ATHU, BARI, BIRM+)
ALDE 88	PL B201 160	D.M. Alde <i>et al.</i>	(SERP, BELG, LANL, LAPP+)
ASTON 88D	NP B301 525	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)
ALDE 87	PL B198 286	D.M. Alde <i>et al.</i>	(LANL, BRUX, SERP, LAPP)
ALDE 86D	NP B269 485	D.M. Alde <i>et al.</i>	(BELG, LAPP, SERP, CERN+)
BINON 84C	NC 80A 363	F.G. Binon <i>et al.</i>	(BELG, LAPP, SERP+)
BINON 83	NC 78A 313	F.G. Binon <i>et al.</i>	(BELG, LAPP, SERP+)
Also	SJNP 38 561	F.G. Binon <i>et al.</i>	(BELG, LAPP, SERP+)
Translated from YAF 38 934			
GRAY 83	PR D27 307	L. Gray <i>et al.</i>	(SYRA)
ETKIN 82B	PR D25 1786	A. Etkin <i>et al.</i>	(BNL, CUNY, TUFTS, VAND)
COHEN 80	PR D22 2595	D. Cohen <i>et al.</i>	(ANL)

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$f_1(1510)$

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

OMITTED FROM SUMMARY TABLE
See the minireview under $\eta(1405)$.

NODE=M084

NODE=M084

NODE=M084M

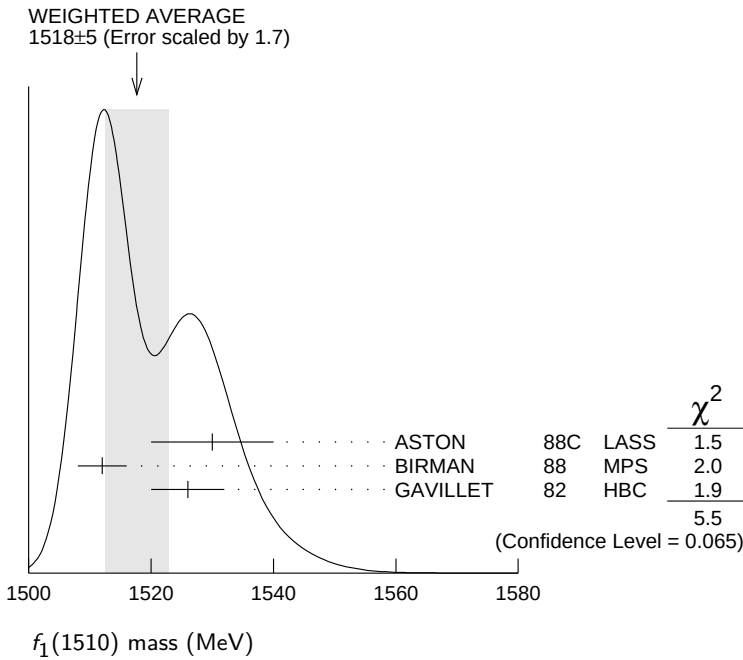
NODE=M084M

NODE=M084M;LINKAGE=A

NODE=M084M;LINKAGE=C

$f_1(1510)$ 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.				



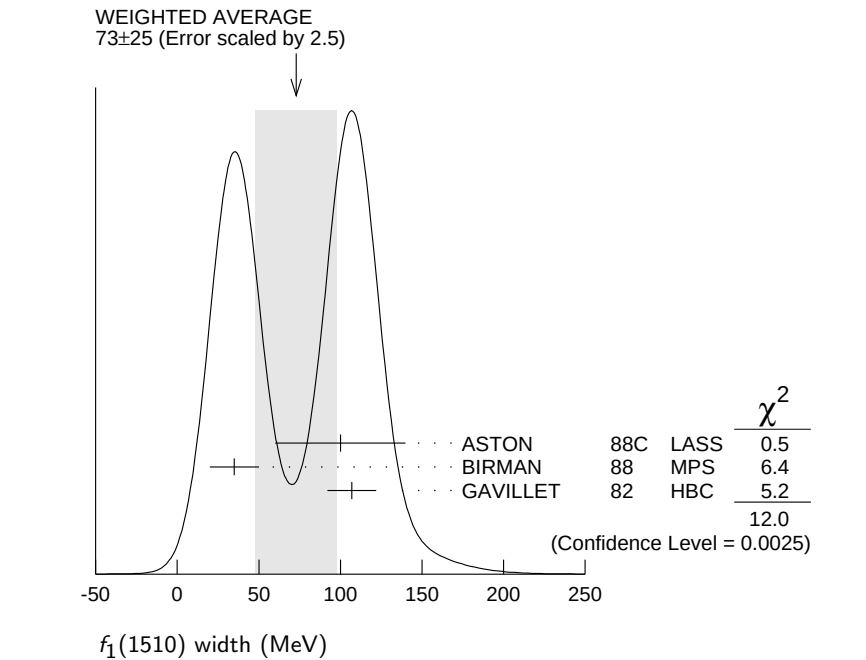
$f_1(1510)$ WIDTH

NODE=M084W

NODE=M084W

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
73±25 OUR AVERAGE		Error includes scale factor of 2.5. See the ideogram below.		
100±40		ASTON	88C LASS	11 $K^-p \rightarrow K_S^0 K^\pm \pi^\mp \Lambda$
35±15	600	³ BIRMAN	88 MPS	8 $\pi^-p \rightarrow K^+ \bar{K}^0 \pi^- n$
107±15	271	GAVILLET	82 HBC	4.2 $K^-p \rightarrow \Lambda K K \pi$
³ From partial wave analysis of $K^+ \bar{K}^0 \pi^-$ state.				

NODE=M084W;LINKAGE=A



$f_1(1510)$ DECAY MODES

NODE=M084215;NODE=M084

Mode	Fraction (Γ_i/Γ)
Γ_1 $K \bar{K}^*(892) + \text{c.c.}$	seen
Γ_2 $\pi^+ \pi^- \eta'$	seen

DESIG=1;OUR EST;→ UNCHECKED ←
DESIG=2

$f_1(1510)$ BRANCHING RATIOS

NODE=M084225

$\Gamma(\pi^+ \pi^- \eta')/\Gamma_{\text{total}}$					Γ_2/Γ
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
seen	230	ABLIKIM	11C BES3	$J/\psi \rightarrow \gamma \pi^+ \pi^- \eta'$	

NODE=M084R01
NODE=M084R01

$f_1(1510)$ REFERENCES

NODE=M084

ABLIKIM	11C	PRL 106 072002	M. Ablikim <i>et al.</i>	(BES III Collab.)
BAUER	93B	PR D48 3976	D.A. Bauer <i>et al.</i>	(SLAC)
AIHARA	88C	PR D38 1	H. Aihara <i>et al.</i>	(TPC-2 γ Collab.)
ASTON	88C	PL B201 573	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS) JP
BIRMAN	88	PRL 61 1557	A. Birman <i>et al.</i>	(BNL, FSU, IND, MASD) JP
GAVILLET	82	ZPHY C16 119	P. Gavillet <i>et al.</i>	(CERN, CDEF, PADO+)

REFID=53684
REFID=43678
REFID=40564
REFID=40282
REFID=40568
REFID=20877

$f'_2(1525)$

$$I^G(J^{PC}) = 0^+(2^{++})$$

NODE=M013

$f'_2(1525)$ MASS

NODE=M013205

VALUE (MeV)

DOCUMENT ID

1525±5 OUR ESTIMATE This is only an educated guess; the error given is larger than the error on the average of the published values.

NODE=M013MX

→ UNCHECKED ←

PRODUCED BY PION BEAM

VALUE (MeV)

EVTS

DOCUMENT ID

TECN

COMMENT

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

1521±13		TIKHOMIROV	03	SPEC	40.0 $\pi^- C \rightarrow K_S^0 K_S^0 K_L^0 X$
1547 ⁺¹⁰ ₋₂		¹ LONGACRE	86	MPS	22 $\pi^- p \rightarrow K_S^0 K_S^0 n$
1496 ⁺⁹ ₋₈		² CHABAUD	81	ASPK	6 $\pi^- p \rightarrow K^+ K^- n$
1497 ⁺⁸ ₋₉		CHABAUD	81	ASPK	18.4 $\pi^- p \rightarrow K^+ K^- n$
1492±29		GORLICH	80	ASPK	17 $\pi^- p$ polarized $\rightarrow K^+ K^- n$
1502±25		³ CORDEN	79	OMEG	12-15 $\pi^- p \rightarrow \pi^+ \pi^- n$
1480	14	CRENNELL	66	HBC	6.0 $\pi^- p \rightarrow K_S^0 K_S^0 n$

NODE=M013M1
NODE=M013M1

OCCUR=2

PRODUCED BY $K^\pm$ BEAM

VALUE (MeV)

EVTS

DOCUMENT ID

TECN

COMMENT

1523.6± 1.1 OUR AVERAGE Includes data from the datablock that follows this one. Error includes scale factor of 1.1. [1523.4 ± 1.3 MeV OUR 2013 AVERAGE Scale factor = 1.1]

NODE=M013M2
NODE=M013M2

NEW

1526.8± 4.3		ASTON	88D	LASS	11 $K^- p \rightarrow K_S^0 K_S^0 \Lambda$
1504 ±12		BOLONKIN	86	SPEC	40 $K^- p \rightarrow K_S^0 K_S^0 Y$
1529 ± 3		ARMSTRONG	83B	OMEG	18.5 $K^- p \rightarrow K^- K^+ \Lambda$
1521 ± 6	650	AGUILAR-...	81B	HBC	4.2 $K^- p \rightarrow \Lambda K^+ K^-$
1521 ± 3	572	ALHARRAN	81	HBC	8.25 $K^- p \rightarrow \Lambda K \bar{K}$
1522 ± 6	123	BARREIRO	77	HBC	4.15 $K^- p \rightarrow \Lambda K_S^0 K_S^0$
1528 ± 7	166	EVANGELIS...	77	OMEG	10 $K^- p \rightarrow K^+ K^- (\Lambda, \Sigma)$
1527 ± 3	120	BRANDENB...	76C	ASPK	13 $K^- p \rightarrow K^+ K^- (\Lambda, \Sigma)$
1519 ± 7	100	AGUILAR-...	72B	HBC	3.9,4.6 $K^- p \rightarrow K \bar{K} (\Lambda, \Sigma)$

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

1514 ± 8	61	BINON	07	GAMS	32.5 $K^- p \rightarrow \eta \eta (\Lambda / \Sigma^0)$
1513 ±10		⁴ BARKOV	99	SPEC	40 $K^- p \rightarrow K_S^0 K_S^0 y$

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

1522.4^{+1.7}_{-1.4} OUR AVERAGE

[1520.7 ± 2.0 MeV OUR 2013 AVERAGE]

NEW

1522.2± 2.8 ^{+5.3} _{-2.0}		AAIJ	13AN	LHCB	$\bar{B}_s^0 \rightarrow J/\psi K^+ K^-$
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	⁵ ACCIARRI	01H	L3	91, 183-209 $e^+ e^- \rightarrow e^+ e^- K_S^0 K_S^0$
1535 ± 5 ± 4		ABREU	96C	DLPH	$Z^0 \rightarrow K^+ K^- + X$
1516 ± 5 ⁺⁹ ₋₁₅		BAI	96C	BES	$J/\psi \rightarrow \gamma K^+ K^-$
1531.6±10.0		AUGUSTIN	88	DM2	$J/\psi \rightarrow \gamma K^+ K^-$
1515 ± 5		⁶ FALVARD	88	DM2	$J/\psi \rightarrow \phi K^+ K^-$
1525 ±10 ±10		BALTRUSAIT..87	MRK3		$J/\psi \rightarrow \gamma K^+ K^-$

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

1523 ± 5	870	⁷ SCHEGELSKY	06A	RVUE	$\gamma \gamma \rightarrow K_S^0 K_S^0$
1496 ± 2		⁸ FALVARD	88	DM2	$J/\psi \rightarrow \phi K^+ K^-$

OCCUR=2

PRODUCED IN $\bar{p}p$ ANNIHILATION

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
1530 ± 12	⁹ ANISOVICH	09	RVUE 0.0 $\bar{p}p, \pi N$
1513 ± 4	AMSLER	06	CBAR 0.9 $\bar{p}p \rightarrow K^+ K^- \pi^0$
1508 ± 9	¹⁰ AMSLER	02	CBAR 0.9 $\bar{p}p \rightarrow \pi^0 \eta \eta, \pi^0 \pi^0 \pi^0$

NODE=M013M9
NODE=M013M9

CENTRAL PRODUCTION

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
1515$\pm$15	BARBERIS	99	OMEG 450 $pp \rightarrow p_s p_f K^+ K^-$

NODE=M013M4
NODE=M013M4

PRODUCED IN $e p$ COLLISIONS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1512$\pm$3$^{+1.4}_{-0.5}$		¹¹ CHEKANOV	08	ZEUS $ep \rightarrow K_S^0 K_S^0 X$
1537^{+9}_{-8}	84	¹² CHEKANOV	04	ZEUS $ep \rightarrow K_S^0 K_S^0 X$

NODE=M013M10
NODE=M013M10

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

- ¹ From a partial-wave analysis of data using a K-matrix formalism with 5 poles.
- ² CHABAUD 81 is a reanalysis of PAWLICKI 77 data.
- ³ From an amplitude analysis where the $f_2'(1525)$ width and elasticity are in complete disagreement with the values obtained from $K\bar{K}$ channel, making the solution dubious.
- ⁴ Systematic errors not estimated.
- ⁵ Supersedes ACCIARRI 95J.
- ⁶ From an analysis ignoring interference with $f_0(1710)$.
- ⁷ From analysis of L3 data at 91 and 183–209 GeV.
- ⁸ From an analysis including interference with $f_0(1710)$.
- ⁹ 4-poles, 5-channel K matrix fit.
- ¹⁰ T-matrix pole.
- ¹¹ In the SU(3) based model with a specific interference pattern of the $f_2(1270)$, $a_2^0(1320)$, and $f_2'(1525)$ mesons incoherently added to the $f_0(1710)$ and non-resonant background.
- ¹² Systematic errors not estimated.

NODE=M013M;LINKAGE=L
NODE=M013M;LINKAGE=D
NODE=M013M;LINKAGE=N

NODE=M013M2;LINKAGE=SK
NODE=M013M;LINKAGE=HA
NODE=M013M;LINKAGE=F1
NODE=M013M3;LINKAGE=SC
NODE=M013M;LINKAGE=F2
NODE=M013M9;LINKAGE=AN
NODE=M013M;LINKAGE=TT
NODE=M013M10;LINKAGE=HE

NODE=M013M10;LINKAGE=CH

 $f_2'(1525)$ WIDTH

VALUE (MeV)	DOCUMENT ID	COMMENT
73$^{+6}_{-5}$ OUR FIT		
76$\pm$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}	¹³ LONGACRE	86	MPS 22 $\pi^- p \rightarrow K_S^0 K_S^0 n$
69^{+22}_{-16}	¹⁴ CHABAUD	81	ASPK 6 $\pi^- p \rightarrow K^+ K^- n$
137^{+23}_{-21}	CHABAUD	81	ASPK 18.4 $\pi^- p \rightarrow K^+ K^- n$
150^{+83}_{-50}	GORLICH	80	ASPK 17 $\pi^- p$ polarized $\rightarrow K^+ K^- n$
165 ± 42	¹⁵ CORDEN	79	OMEG 12–15 $\pi^- p \rightarrow \pi^+ \pi^- n$
92^{+39}_{-22}	¹⁶ POLYCHRO...	79	STRC 7 $\pi^- p \rightarrow n K_S^0 K_S^0$

NODE=M013W1
NODE=M013W1

OCCUR=2

PRODUCED BY $K^\pm$ BEAM

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
81.5$^{+2.2}_{-1.9}$ OUR AVERAGE		Includes data from the datablock that follows this one. [80.2 $\pm$ 2.6 MeV OUR 2013 AVERAGE]		
90 $\pm$ 12		ASTON	88D	LASS 11 $K^- p \rightarrow K_S^0 K_S^0 \Lambda$
73 $\pm$ 18		BOLONKIN	86	SPEC 40 $K^- p \rightarrow K_S^0 K_S^0 Y$
83 $\pm$ 15		ARMSTRONG	83B	OMEG 18.5 $K^- p \rightarrow K^- K^+ \Lambda$
85 $\pm$ 16	650	AGUILAR-...	81B	HBC 4.2 $K^- p \rightarrow \Lambda K^+ K^-$
80 $^{+14}_{-11}$	572	ALHARRAN	81	HBC 8.25 $K^- p \rightarrow \Lambda K \bar{K}$
72 $\pm$ 25	166	EVANGELIS...	77	OMEG 10 $K^- p \rightarrow K^+ K^- (\Lambda, \Sigma)$
69 $\pm$ 22	100	AGUILAR-...	72B	HBC 3.9,4.6 $K^- p \rightarrow K \bar{K} (\Lambda, \Sigma)$

NODE=M013W2
NODE=M013W2

NEW

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

92	$+^{25}_{-16}$	61	BINON	07	GAMS	32.5	$K^- p \rightarrow \eta \eta (\Lambda / \Sigma^0)$
75	± 20	17	BARKOV	99	SPEC	40	$K^- p \rightarrow K_S^0 K_S^0 \gamma$
62	$+^{19}_{-14}$	123	BARREIRO	77	HBC	4.15	$K^- p \rightarrow \Lambda K_S^0 K_S^0$
61	± 8	120	BRANDENB...	76C	ASPK	13	$K^- p \rightarrow K^+ K^- (\Lambda, \Sigma)$

PRODUCED IN e^+e^- ANNIHILATION AND PARTICLE DECAYS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

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

NODE=M013W3
NODE=M013W3

81.5 $^{+2.4}_{-2.0}$ OUR AVERAGE

[79.9 $\pm$ 3.3 MeV OUR 2013 AVERAGE Scale factor = 1.1]

84	± 6	$+^{10}_{-5}$		AAIJ	13AN	LHCB	$\bar{B}_S^0 \rightarrow J/\psi K^+ K^-$	
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	18	ACCIARRI	01H L3	$91, 183\text{--}209 e^+ e^- \rightarrow e^+ e^- K_S^0 K_S^0$	
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			19	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. • • •

104	± 10	870	20	SCHEGELSKY	06A	RVUE	$\gamma\gamma \rightarrow K_S^0 K_S^0$
100	± 3		21	FALVARD	88	DM2	$J/\psi \rightarrow \phi K^+ K^-$

NEW

OCCUR=2

PRODUCED IN $\bar{p}p$ ANNIHILATION

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

79 ± 8 22 AMSLER 02 CBAR 0.9 $\bar{p}p \rightarrow \pi^0 \eta \eta, \pi^0 \pi^0 \pi^0$

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

128 ± 20	23	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

70 ± 25 BARBERIS 99 OMEG 450 $pp \rightarrow p_S p_f K^+ K^-$

NODE=M013W4
NODE=M013W4

PRODUCED IN $e p$ COLLISIONS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

83 ± 9 $+^{5}_{-4}$ 24 CHEKANOV 08 ZEUS $e p \rightarrow K_S^0 K_S^0 X$

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

50 $+^{34}_{-22}$	84	25	CHEKANOV	04	ZEUS	$e p \rightarrow K_S^0 K_S^0 X$

13 From a partial-wave analysis of data using a K-matrix formalism with 5 poles.

14 CHABAUD 81 is a reanalysis of PAWLICKI 77 data.

15 From an amplitude analysis where the $f_2'(1525)$ width and elasticity are in complete disagreement with the values obtained from $K \bar{K}$ channel, making the solution dubious.

16 From a fit to the D with $f_2(1270)$ - $f_2'(1525)$ interference. Mass fixed at 1516 MeV.

17 Systematic errors not estimated.

18 Supersedes ACCIARRI 95j.

19 From an analysis ignoring interference with $f_0(1710)$.

20 From analysis of L3 data at 91 and 183-209 GeV.

21 From an analysis including interference with $f_0(1710)$.

22 T-matrix pole.

23 4-poles, 5-channel K matrix fit.

24 In the SU(3) based model with a specific interference pattern of the $f_2(1270)$, $a_2^0(1320)$, and $f_2'(1525)$ mesons incoherently added to the $f_0(1710)$ and non-resonant background.

25 Systematic errors not estimated.

NODE=M013W;LINKAGE=L
NODE=M013W;LINKAGE=D
NODE=M013W;LINKAGE=N

NODE=M013W;LINKAGE=M
NODE=M013W2;LINKAGE=SK
NODE=M013W;LINKAGE=HA
NODE=M013W;LINKAGE=F1
NODE=M013W3;LINKAGE=SC
NODE=M013W;LINKAGE=F2
NODE=M013W;LINKAGE=TT
NODE=M013W9;LINKAGE=AN
NODE=M013W10;LINKAGE=HE

NODE=M013W10;LINKAGE=CH

$f_2'(1525)$ DECAY MODES

NODE=M013215;NODE=M013

Mode	Fraction (Γ_i/Γ)
Γ_1 $K\bar{K}$	$(88.7 \pm 2.2) \%$
Γ_2 $\eta\eta$	$(10.4 \pm 2.2) \%$
Γ_3 $\pi\pi$	$(8.2 \pm 1.5) \times 10^{-3}$
Γ_4 $K\bar{K}^*(892) + \text{c.c.}$	
Γ_5 $\pi K\bar{K}$	
Γ_6 $\pi\pi\eta$	
Γ_7 $\pi^+\pi^+\pi^-\pi^-$	
Γ_8 $\gamma\gamma$	$(1.10 \pm 0.14) \times 10^{-6}$

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 $\langle \delta p_i \delta p_j \rangle / (\delta p_i \delta p_j)$, 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)
Γ_1 $K\bar{K}$	$65 \begin{smallmatrix} +5 \\ -4 \end{smallmatrix}$
Γ_2 $\eta\eta$	7.6 ± 1.8
Γ_3 $\pi\pi$	0.60 ± 0.12
Γ_8 $\gamma\gamma$	$(8.1 \pm 0.9) \times 10^{-5}$

DESIG=2
DESIG=4
DESIG=1
DESIG=8

 $f_2'(1525)$ PARTIAL WIDTHS

NODE=M013220

$\Gamma(K\bar{K})$				Γ_1
VALUE (MeV)	DOCUMENT ID	TECN	COMMENT	

 $65 \begin{smallmatrix} +5 \\ -4 \end{smallmatrix}$ OUR FIT **$63 \begin{smallmatrix} +6 \\ -5 \end{smallmatrix}$** ²⁶ LONGACRE 86 MPS $22 \pi^- p \rightarrow K_S^0 K_S^0 n$

$\Gamma(\eta\eta)$					Γ_2
VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT	

 7.6 ± 1.8 OUR FIT

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

5.0 ± 0.8 870 ²⁷ SCHEGELSKY 06A RVUE $\gamma\gamma \rightarrow K_S^0 K_S^0$

$24 \begin{smallmatrix} +3 \\ -1 \end{smallmatrix}$ ²⁶ LONGACRE 86 MPS $22 \pi^- p \rightarrow K_S^0 K_S^0 n$

$\Gamma(\pi\pi)$					Γ_3
VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT	

 0.60 ± 0.12 OUR FIT **$1.4 \begin{smallmatrix} +1.0 \\ -0.5 \end{smallmatrix}$** ²⁶ LONGACRE 86 MPS $22 \pi^- p \rightarrow K_S^0 K_S^0 n$

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

 $0.2 \begin{smallmatrix} +1.0 \\ -0.2 \end{smallmatrix}$ 870 ²⁷ SCHEGELSKY 06A RVUE $\gamma\gamma \rightarrow K_S^0 K_S^0$ NODE=M013W6
NODE=M013W6NODE=M013W7
NODE=M013W7NODE=M013W5
NODE=M013W5

$\Gamma(\gamma\gamma)$ 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 ²⁷ SCHEGELSKY 06A RVUE $\gamma\gamma \rightarrow K_S^0 K_S^0$ ²⁶ From a partial-wave analysis of data using a K-matrix formalism with 5 poles.²⁷ From analysis of L3 data at 91 and 183–209 GeV, using $\Gamma(f_2'(1525) \rightarrow K\bar{K}) = 68$ MeV and SU(3) relations.NODE=M013W8
NODE=M013W8NODE=M013PW;LINKAGE=L
NODE=M013W8;LINKAGE=SC $f_2'(1525) \Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

NODE=M013223

 $\Gamma(K\bar{K}) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_1\Gamma_8/\Gamma$

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT

0.072 ±0.007 OUR FIT**0.072 ±0.007 OUR AVERAGE**0.048 ^{+0.067}_{-0.008} ^{+0.108}_{-0.012} UEHARA 13 BELL $\gamma\gamma \rightarrow K_S^0 K_S^0$ 0.0564±0.0048±0.0116 ABE 04 BELL $10.6 e^+ e^- \rightarrow e^+ e^- K^+ K^-$ 0.076 ±0.006 ±0.011 331 ²⁸ ACCIARRI 01H L3 $e^+ e^- \rightarrow e^+ e^- K_S^0 K_S^0$ 0.067 ±0.008 ±0.015 ²⁹ ALBRECHT 90G ARG $e^+ e^- \rightarrow e^+ e^- K^+ K^-$ 0.11 ^{+0.03}_{-0.02} ±0.02 BEHREND 89C CELL $e^+ e^- \rightarrow e^+ e^- K_S^0 K_S^0$ 0.10 ^{+0.04}_{-0.03} ^{+0.03}_{-0.02} BERGER 88 PLUT $e^+ e^- \rightarrow e^+ e^- K_S^0 K_S^0$ 0.12 ±0.07 ±0.04 ²⁹ AIHARA 86B TPC $e^+ e^- \rightarrow e^+ e^- K^+ K^-$ 0.11 ±0.02 ±0.04 ²⁹ ALTHOFF 83 TASS $e^+ e^- \rightarrow e^+ e^- K\bar{K}$

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

0.0314±0.0050±0.0077 ³⁰ ALBRECHT 90G ARG $e^+ e^- \rightarrow e^+ e^- K^+ K^-$ ²⁸ Supersedes ACCIARRI 95J. From analysis of L3 data at 91 and 183–209 GeV,²⁹ Using an incoherent background.³⁰ Using a coherent background.NODE=M013G1
NODE=M013G1

OCCUR=2

NODE=M013G;LINKAGE=HA
NODE=M013G1;LINKAGE=A
NODE=M013G1;LINKAGE=B $f_2'(1525) \text{ BRANCHING RATIOS}$

NODE=M013225

 $\Gamma(\eta\eta)/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE	DOCUMENT ID	TECN	COMMENT

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

seen UEHARA 10A BELL $10.6 e^+ e^- \rightarrow e^+ e^- \eta\eta$ 0.10±0.03 ³¹ PROKOSHKIN 91 GAM4 $300 \pi^- p \rightarrow \pi^- p \eta\eta$ ³¹ Combining results of GAM4 with those of WA76 on $K\bar{K}$ central production and results of CBAL, MRK3 and DM2 on $J/\psi \rightarrow \gamma\eta\eta$.NODE=M013R8
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 ³² BINON 07 GAMS $32.5 K^- p \rightarrow \eta\eta(\Lambda/\Sigma^0)$ 0.11 ±0.04 ³³ PROKOSHKIN 91 GAM4 $300 \pi^- p \rightarrow \pi^- p \eta\eta$

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

< 0.14 90 BARBERIS 00E $450 p p \rightarrow p_f \eta\eta p_s$ < 0.50 BARNES 67 HBC $4.6, 5.0 K^- p$ ³² Using the compilation of the cross sections for $f_2'(1525)$ production in $K^- p$ collisions from ASTON 88D.³³ Combining results of GAM4 with those of WA76 on $K\bar{K}$ central production and results of CBAL, MRK3 and DM2 on $J/\psi \rightarrow \gamma\eta\eta$.NODE=M013R3
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} ³⁴ GORLICH 80 ASPK $17, 18 \pi^- p$ 0.0075±0.0025 ^{34,35} MARTIN 79 RVUENODE=M013R1
NODE=M013R1

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

<0.06	95	AGUILAR-...	81B	HBC	$4.2 K^- p \rightarrow \Lambda K^+ K^-$
0.19 ± 0.03		CORDEN	79	OMEG	$12-15 \pi^- p \rightarrow \pi^+ \pi^- n$
<0.045	95	BARREIRO	77	HBC	$4.15 K^- p \rightarrow \Lambda K_S^0 K_S^0$
0.012 ± 0.004		34 PAWLICKI	77	SPEC	$6 \pi N \rightarrow K^+ K^- N$
<0.063	90	BRANDENB...	76C	ASPK	$13 K^- p \rightarrow K^+ K^- (\Lambda, \Sigma)$
<0.0086		34 BEUSCH	75B	OSPK	$8.9 \pi^- p \rightarrow K^0 \bar{K}^0 n$

34 Assuming that the $f_2'(1525)$ is produced by an one-pion exchange production mechanism.

35 MARTIN 79 uses the PAWLICKI 77 data with different input value of the $f_2'(1525) \rightarrow K \bar{K}$ branching ratio.

NODE=M013R1;LINKAGE=C

NODE=M013R1;LINKAGE=D

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

Γ_3/Γ_1

VALUE	DOCUMENT ID	TECN	COMMENT
0.0092 $\pm$ 0.0018 OUR FIT			
0.075 $\pm$ 0.035	AUGUSTIN	87	DM2 $J/\psi \rightarrow \gamma \pi^+ \pi^-$

NODE=M013R7

NODE=M013R7

$[\Gamma(K\bar{K}^*(892)+c.c.) + \Gamma(\pi K\bar{K})]/\Gamma(K\bar{K})$

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

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

NODE=M013R5

NODE=M013R5

• • • 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	

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

Γ_6/Γ_1

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

NODE=M013R4

NODE=M013R4

• • • 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	

$\Gamma(\pi^+ \pi^+ \pi^- \pi^-)/\Gamma(K\bar{K})$

Γ_7/Γ_1

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

NODE=M013R6

NODE=M013R6

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

<0.32	95	AGUILAR-...	72B	HBC	$3.9, 4.6 K^- p$

$f_2'(1525)$ REFERENCES

NODE=M013

AAIJ	13AN	PR D87 072004	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=55137
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	PL B639 165	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	EPJ C23 29	C. Amsler <i>et al.</i>		REFID=48580
ACCIARRI	01H	PL B501 173	M. Acciarri <i>et al.</i>	(L3 Collab.)	REFID=48321
BARBERIS	00E	PL B479 59	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=47961
BARBERIS	99	PL B453 305	D. Barberis <i>et al.</i>	(Omega Expt.)	REFID=46921
BARKOV	99	JETPL 70 248	B.P. Barkov <i>et al.</i>		REFID=47379
ABREU	96C	PL B379 309	P. Abreu <i>et al.</i>	(DELPHI Collab.)	REFID=44671
BAI	96C	PRL 77 3959	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=45169
ACCIARRI	95J	PL B363 118	M. Acciarri <i>et al.</i>	(L3 Collab.)	REFID=44615
PROKOSHKIN	91	SPD 36 155	Y.D. Prokoshkin	(GAM2, GAM4 Collab.)	REFID=41719
ALBRECHT	90G	ZPHY C48 183	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=41374
PDG	90	PL B239 1	J.J. Hernandez <i>et al.</i>	(IFIC, BOST, CIT+)	REFID=40744
BEHREND	89C	ZPHY C43 91	H.J. Behrend <i>et al.</i>	(CELLO Collab.)	REFID=40915
ASTON	88D	NP B301 525	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)	REFID=40330
AUGUSTIN	88	PRL 60 2238	J.E. Augustin <i>et al.</i>	(DM2 Collab.)	REFID=40574
BERGER	88	ZPHY C37 329	C. Berger <i>et al.</i>	(PLUTO Collab.)	REFID=40566
FALVARD	88	PR D38 2706	A. Falvard <i>et al.</i>	(CLER, FRAS, LALO+)	REFID=40576
AUGUSTIN	87	ZPHY C36 369	J.E. Augustin <i>et al.</i>	(LALO, CLER, FRAS+)	REFID=40268
BALTRUSAITIS	87	PR D35 2077	R.M. Baltrusaitis <i>et al.</i>	(Mark III Collab.)	REFID=40010
AIHARA	86B	PRL 57 404	H. Aihara <i>et al.</i>	(TPC-2 γ Collab.)	REFID=20764
BOLONKIN	86	SJNP 43 776	B.V. Bolonkin <i>et al.</i>	(ITEP) JP	REFID=44646
Translated from YAF 43 1211.					

LONGACRE	86	PL B177 223	R.S. Longacre <i>et al.</i>	(BNL, BRAN, CUNY+)
ALTHOFF	83	PL 121B 216	M. Althoff <i>et al.</i>	(TASSO Collab.)
ARMSTRONG	83B	NP B224 193	T.A. Armstrong <i>et al.</i>	(BARI, BIRM, CERN+)
AGUILAR-...	81B	ZPHY C8 313	M. Aguilar-Benitez <i>et al.</i>	(CERN, CDEF+)
ALHARRAN	81	NP B191 26	S. Al-Harran <i>et al.</i>	(BIRM, CERN, GLAS+)
CHABAUD	81	APP B12 575	V. Chabaud <i>et al.</i>	(CERN, CRAC, MPIM)
COSTA...	80	NP B175 402	G. Costa de Beauregard <i>et al.</i>	(BARI, BONN+)
GORLICH	80	NP B174 16	L. Gorlich <i>et al.</i>	(CRAC, MPIM, CERN+)
CORDEN	79	NP B157 250	M.J. Corden <i>et al.</i>	(BIRM, RHEL, TELA+) JP
MARTIN	79	NP B158 520	A.D. Martin, E.N. Ozmurtlu	(DURH)
POLYCHRO...	79	PR D19 1317	V.A. Polychronakos <i>et al.</i>	(NDAM, ANL)
BARREIRO	77	NP B121 237	F. Barreiro <i>et al.</i>	(CERN, AMST, NIJ+)
EVANGELIS...	77	NP B127 384	C. Evangelista <i>et al.</i>	(BARI, BONN, CERN+)
PAWLICKI	77	PR D15 3196	A.J. Pawlicki <i>et al.</i>	(ANL) IJP
BRANDENB...	76C	NP B104 413	G.W. Brandenburg <i>et al.</i>	(SLAC)
BEUSCH	75B	PL 60B 101	W. Beusch <i>et al.</i>	(CERN, ETH)
AGUILAR-...	72B	PR D6 29	M. Aguilar-Benitez <i>et al.</i>	(BNL)
AMMAR	67	PRL 19 1071	R. Ammar <i>et al.</i>	(NWES, ANL) JP
BARNES	67	PRL 19 964	V.E. Barnes <i>et al.</i>	(BNL, SYRA) IJPC
CRENNELL	66	PRL 16 1025	D.J. Crennell <i>et al.</i>	(BNL) I

REFID=20768
REFID=21408
REFID=20558
REFID=21104
REFID=21403
REFID=20742
REFID=20737
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REFID=20374
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REFID=21392
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REFID=20225
REFID=21390
REFID=20205
REFID=21382
REFID=21383
REFID=20317

NODE=M123

$f_2(1565)$

$$I^G(J^{PC}) = 0^+(2^{++})$$

OMITTED FROM SUMMARY TABLE

Seen mostly in antinucleon-nucleon annihilation. Needs confirmation in other channels.

NODE=M123

$f_2(1565)$ MASS

NODE=M123M

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	$0.0 \bar{p} N \rightarrow 3\pi^- 2\pi^+$

NODE=M123M

OCCUR=2

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.

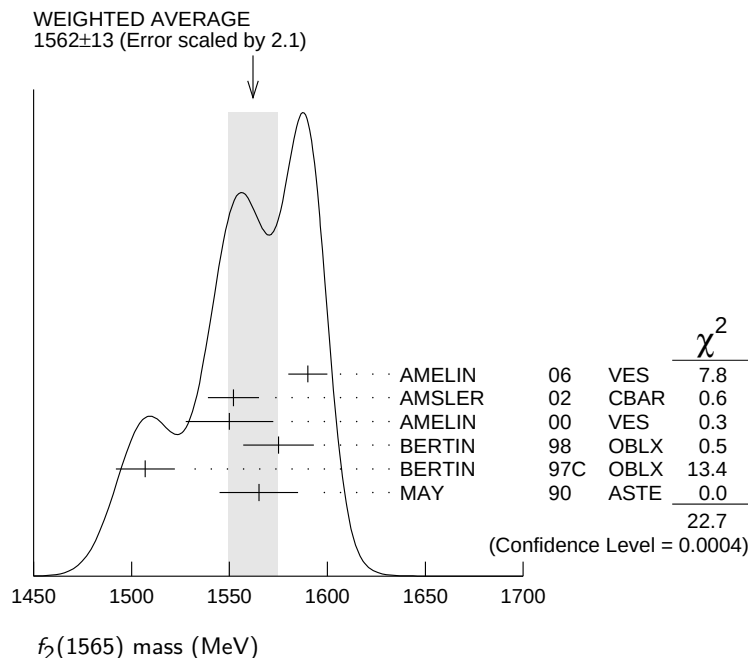
⁷ J^P not determined, could be partly $f_0(1500)$.

⁸ J^P not determined.

⁹ Superseded by AMSLER 95B.

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

NODE=M123W

NODE=M123W

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 ⁺ 80 - 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 $\bar{p} N \rightarrow 3\pi^- 2\pi^+$

OCCUR=2

- 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 ρp 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;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

NODE=M123215;NODE=M123

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \pi\pi$	seen
$\Gamma_2 \quad \pi^+\pi^-$	seen
$\Gamma_3 \quad \pi^0\pi^0$	seen
$\Gamma_4 \quad \rho^0\rho^0$	seen
$\Gamma_5 \quad 2\pi^+2\pi^-$	seen
$\Gamma_6 \quad \eta\eta$	seen
$\Gamma_7 \quad a_2(1320)\pi$	
$\Gamma_8 \quad \omega\omega$	seen
$\Gamma_9 \quad K\bar{K}$	
$\Gamma_{10} \quad \gamma\gamma$	

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

NODE=M123225

$\Gamma(\eta\eta)$	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 $\gamma\gamma \rightarrow K_S^0 K_S^0$	
$\Gamma(\gamma\gamma)$	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=M123W3
 NODE=M123W3

NODE=M123W1
 NODE=M123W1

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 $0 \bar{p}p \rightarrow \omega\omega\pi^0$	
$\Gamma(\pi^+\pi^-)/\Gamma_{\text{total}}$	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.	
$\Gamma(\pi^0\pi^0)/\Gamma_{\text{total}}$	Γ_3/Γ
VALUE DOCUMENT ID TECN COMMENT seen AMSLER 95B CBAR $0.0 \bar{p}p \rightarrow 3\pi^0$	
$\Gamma(\pi^+\pi^-)/\Gamma(\rho^0\rho^0)$	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 $\bar{p}N \rightarrow 3\pi^-2\pi^+$	
$\Gamma(\eta\eta)/\Gamma(\pi^0\pi^0)$	Γ_6/Γ_3
VALUE DOCUMENT ID TECN COMMENT • • • We do not use the following data for averages, fits, limits, etc. • • • $0.024 \pm 0.005 \pm 0.012$ 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=M123R5
 NODE=M123R5

NODE=M123R1
 NODE=M123R1

NODE=M123R1;LINKAGE=A

NODE=M123R3
 NODE=M123R3

NODE=M123R2
 NODE=M123R2

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

ANISOVICH	09	IJMP A24 2481	V.V. Anisovich, A.V. Sarantsev	
AMELIN	06	PAN 69 690	D.V. Amelin <i>et al.</i>	(VES Collab.)
Translated from YAF 69 715.				
SCHEGELSKY	06A	EPJ A27 207	V.A. Schegelsky <i>et al.</i>	
AMSLER	02	EPJ C23 29	C. Amsler <i>et al.</i>	
AMELIN	00	NP A668 83	D. Amelin <i>et al.</i>	(VES Collab.)
BAKER	99B	PL B467 147	C.A. Baker <i>et al.</i>	
BERTIN	98	PR D57 55	A. Bertin <i>et al.</i>	(OBELIX Collab.)
BERTIN	97C	PL B408 476	A. Bertin <i>et al.</i>	(OBELIX Collab.)
ABELE	96C	NP A609 562	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
AMSLER	95B	PL B342 433	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
AMSLER	95C	PL B353 571	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
AMSLER	95D	PL B355 425	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
BALOSHIN	95	PAN 58 46	O.N. Baloshin <i>et al.</i>	(ITEP)
Translated from YAF 58 50.				
AMSLER	94D	PL B333 277	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
ANISOVICH	94	PL B323 233	V.V. Anisovich <i>et al.</i>	(Crystal Barrel Collab.)
ANISOVICH	94B	PR D50 1972	V.V. Anisovich <i>et al.</i>	(LOQM)
ADAMO	93	NP A558 13C	A. Adamo <i>et al.</i>	(OBELIX Collab.)
ARMSTRONG	93C	PL B307 394	T.A. Armstrong <i>et al.</i>	(FNAL, FERR, GENO+)
ARMSTRONG	93D	PL B307 399	T.A. Armstrong <i>et al.</i>	(FNAL, FERR, GENO+)
WEIDENAUER	93	ZPHY C59 387	P. Weidenauer <i>et al.</i>	(ASTERIX Collab.)
ADAMO	92	PL B287 368	A. Adamo <i>et al.</i>	(OBELIX Collab.)
BELADIDZE	92B	ZPHY C54 367	G.M. Beladidze <i>et al.</i>	(VES Collab.)
AKER	91	PL B260 249	E. Aker <i>et al.</i>	(Crystal Barrel Collab.)
MAY	90	ZPHY C46 203	B. May <i>et al.</i>	(ASTERIX Collab.)
MAY	89	PL B225 450	B. May <i>et al.</i>	(ASTERIX Collab.) IJP
BRIDGES	86B	PRL 56 215	D.L. Bridges <i>et al.</i>	(SYRA, CASE)
BRIDGES	86C	PRL 57 1534	D.L. Bridges <i>et al.</i>	(SYRA)

NODE=M123

REFID=52719
 REFID=51574

REFID=51185
 REFID=48580
 REFID=47432
 REFID=47398
 REFID=45782
 REFID=45701
 REFID=45076
 REFID=44377
 REFID=44440
 REFID=44441
 REFID=44621

REFID=44093
 REFID=43659
 REFID=44071
 REFID=43657
 REFID=43587
 REFID=43596
 REFID=43585
 REFID=42177
 REFID=42172
 REFID=41587
 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

 $\rho(1570)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$1570 \pm 36 \pm 62$	54	¹ AUBERT	08S	BABR $10.6 e^+ e^- \rightarrow \phi \pi^0 \gamma$
1480 ± 40		² BITYUKOV	87	SPEC $32.5 \pi^- p \rightarrow \phi \pi^0 n$

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

¹ From the fit with two resonances.

² Systematic errors not estimated.

NODE=M188M

NODE=M188M

NODE=M188M;LINKAGE=AU
 NODE=M188M;LINKAGE=BI

 $\rho(1570)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$144 \pm 75 \pm 43$	54	³ AUBERT	08S	BABR $10.6 e^+ e^- \rightarrow \phi \pi^0 \gamma$
130 ± 60		⁴ BITYUKOV	87	SPEC $32.5 \pi^- p \rightarrow \phi \pi^0 n$

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

³ From the fit with two resonances.

⁴ Systematic errors not estimated.

NODE=M188W

NODE=M188W

NODE=M188W;LINKAGE=AU
 NODE=M188W;LINKAGE=BI

 $\rho(1570)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $e^+ e^-$	
Γ_2 $\phi \pi$	not seen
Γ_3 $\omega \pi$	

NODE=M188215;NODE=M188

DESIG=1

DESIG=2

DESIG=3

$\rho(1570) \Gamma(i)\Gamma(e^+ e^-)/\Gamma(\text{total})$								
$\Gamma(\phi\pi) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}}$			$\Gamma_2\Gamma_1/\Gamma$					
VALUE (eV)	CL%	EVTs	DOCUMENT ID	TECN	COMMENT			
3.5±0.9±0.3		54	⁵ AUBERT	08S BABR	$10.6 e^+ e^- \rightarrow \phi \pi^0 \gamma$			
• • • We do not use the following data for averages, fits, limits, etc. • • •								
<70	90		⁶ AULCHENKO	87B ND	$e^+ e^- \rightarrow K_S^0 K_L^0 \pi^0$			
⁵ From the fit with two resonances.								
⁶ Using mass and width of BITYUKOV 87.								

NODE=M188225

NODE=M188G01
NODE=M188G01

NODE=M188G01;LINKAGE=AU
NODE=M188G01;LINKAGE=AL

$\rho(1570) \text{ BRANCHING RATIOS}$					Γ_2/Γ
$\Gamma(\phi\pi)/\Gamma_{\text{total}}$			DOCUMENT ID	TECN	COMMENT
VALUE					
not seen			ABELE	97H CBAR	$\bar{p}p \rightarrow K_L^0 K_S^0 \pi^0 \pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.01			⁷ DONNACHIE	91 RVUE	
⁷ Using data from BISELLO 91B, DOLINSKY 86, and ALBRECHT 87L.					

NODE=M188220

NODE=M188R01
NODE=M188R01

NODE=M188R01;LINKAGE=DO

$\Gamma(\phi\pi)/\Gamma(\omega\pi)$					Γ_2/Γ_3
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
>0.5	95	BITYUKOV	87 SPEC	$32.5 \pi^- p \rightarrow \phi \pi^0 n$	

NODE=M188R02
NODE=M188R02

$\rho(1570) \text{ REFERENCES}$				
AUBERT	08S	PR D77 092002	B. Aubert <i>et al.</i>	(BABAR Collab.)
ABELE	97H	PL B415 280	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
BISELLO	91B	NPBPS B21 111	D. Bisello	(DM2 Collab.)
DONNACHIE	91	ZPHY C51 689	A. Donnachie, A.B. Clegg	(MCHS, LANC)
ALBRECHT	87L	PL B185 223	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
AULCHENKO	87B	JETPL 45 145	V.M. Aulchenko <i>et al.</i>	(NOVO)
		Translated from ZETFP 45 118.		
BITYUKOV	87	PL B188 383	S.I. Bityukov <i>et al.</i>	(SERP)
DOLINSKY	86	PL B174 453	S.I. Dolinsky <i>et al.</i>	(NOVO)

NODE=M188

REFID=52242
REFID=45765
REFID=41752
REFID=41632
REFID=40418
REFID=41373

REFID=40011
REFID=20246

NODE=M166

$h_1(1595)$

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

OMITTED FROM SUMMARY TABLE
Seen in a partial-wave analysis of the $\omega\eta$ system produced in the reaction $\pi^- p \rightarrow \omega\eta n$ at 18 GeV/c.

NODE=M166

$h_1(1595) \text{ MASS}$				
VALUE (MeV)	DOCUMENT ID	TECN	COMMENT	
$1594 \pm 15^{+10}_{-60}$	EUGENIO	01 SPEC	$18 \pi^- p \rightarrow \omega\eta n$	

NODE=M166M

NODE=M166M

$h_1(1595) \text{ WIDTH}$				
VALUE (MeV)	DOCUMENT ID	TECN	COMMENT	
$384 \pm 60^{+70}_{-100}$	EUGENIO	01 SPEC	$18 \pi^- p \rightarrow \omega\eta n$	

NODE=M166W

NODE=M166W

$h_1(1595) \text{ DECAY MODES}$		
Mode	Fraction (Γ_i/Γ)	
$\Gamma_1 \quad \omega\eta$	seen	

NODE=M166215;NODE=M166

DESIG=1;OUR EST;→ UNCHECKED ←

$h_1(1595) \text{ REFERENCES}$			
EUGENIO	01	PL B497 190	P. Eugenio <i>et al.</i>

NODE=M166

REFID=48010

NODE=M164

$\pi_1(1600)$

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

$\pi_1(1600)$ MASS

NODE=M164M

NODE=M164M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1662⁺⁸₋₉ OUR AVERAGE				
1660 $\pm$ 10 ⁺⁰ ₋₆₄	420k	ALEKSEEV	10	COMP 190 $\pi^- Pb \rightarrow \pi^- \pi^- \pi^+ Pb'$
1664 $\pm$ 8 $\pm$ 10	145k	¹ LU	05	B852 18 $\pi^- p \rightarrow \omega \pi^- \pi^0 p$
1709 $\pm$ 24 $\pm$ 41	69k	² KUHN	04	B852 18 $\pi^- p \rightarrow \eta \pi^+ \pi^- \pi^- p$
1597 $\pm$ 10 ⁺⁴⁵ ₋₁₀		² IVANOV	01	B852 18 $\pi^- p \rightarrow \eta' \pi^- p$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1593 $\pm$ 8 ⁺²⁹ ₋₄₇	2,3	ADAMS	98B	B852 18.3 $\pi^- p \rightarrow \pi^+ \pi^- \pi^- p$

¹ May be a different state: natural and unnatural parity exchanges.
² Natural parity exchange.
³ Superseded by DZIERBA 06 excluding this state in a more refined PWA analysis, with 2.6 M events of $\pi^- p \rightarrow \pi^- \pi^- \pi^+ p$ and 3 M events of $\pi^- p \rightarrow \pi^- \pi^0 \pi^0 p$ of E852 data.

NODE=M164M;LINKAGE=LU
NODE=M164M;LINKAGE=A
NODE=M164M;LINKAGE=DZ

$\pi_1(1600)$ WIDTH

NODE=M164W

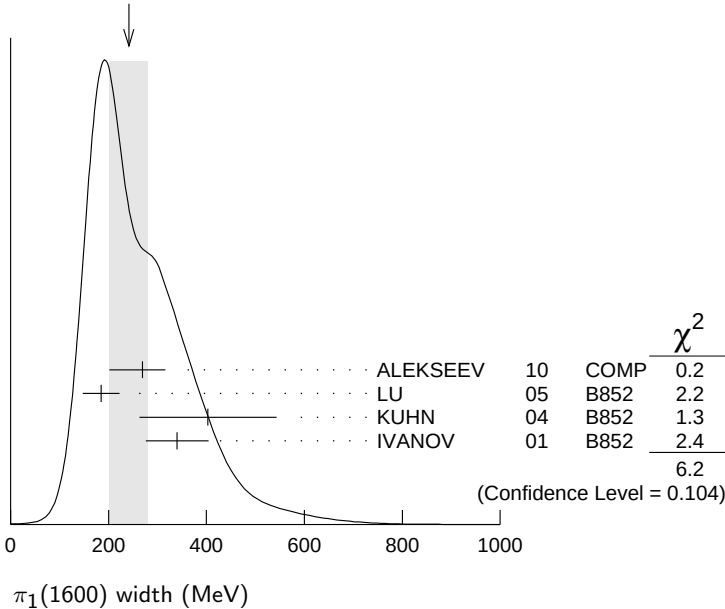
NODE=M164W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
241$\pm$40 OUR AVERAGE Error includes scale factor of 1.4. See the ideogram below.				
269 $\pm$ 21 ⁺⁴² ₋₆₄	420k	ALEKSEEV	10	COMP 190 $\pi^- Pb \rightarrow \pi^- \pi^- \pi^+ Pb'$
185 $\pm$ 25 $\pm$ 28	145k	⁴ LU	05	B852 18 $\pi^- p \rightarrow \omega \pi^- \pi^0 p$
403 $\pm$ 80 $\pm$ 115	69k	⁵ KUHN	04	B852 18 $\pi^- p \rightarrow \eta \pi^+ \pi^- \pi^- p$
340 $\pm$ 40 $\pm$ 50		⁵ IVANOV	01	B852 18 $\pi^- p \rightarrow \eta' \pi^- p$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
168 $\pm$ 20 ⁺¹⁵⁰ ₋₁₂	5,6	ADAMS	98B	B852 18.3 $\pi^- p \rightarrow \pi^+ \pi^- \pi^- p$

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 $\pm$ 40 (Error scaled by 1.4)



$\pi_1(1600)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \pi\pi\pi$	not seen
$\Gamma_2 \quad \rho^0\pi^-$	not seen
$\Gamma_3 \quad f_2(1270)\pi^-$	not seen
$\Gamma_4 \quad b_1(1235)\pi$	seen
$\Gamma_5 \quad \eta'(958)\pi^-$	seen
$\Gamma_6 \quad f_1(1285)\pi$	seen

NODE=M164215;NODE=M164

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

 $\pi_1(1600)$ BRANCHING RATIOS
 $\Gamma(\rho^0\pi^-)/\Gamma_{\text{total}}$ 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=M164220

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 $\pi^-p \rightarrow \pi^-\pi^0\pi^0p$ 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 $\pi^-p \rightarrow \pi^-\pi^0\pi^0p$ 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 $18\pi^-p \rightarrow \omega\pi^-\pi^0p$

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 $18\pi^-p \rightarrow \eta'\pi^-\pi$

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 $18\pi^-p \rightarrow \eta\pi^+\pi^-\pi^-p$

NODE=M164R5
 NODE=M164R5

¹⁰ Using $\eta'(958)\pi$ data from IVANOV 01.

NODE=M164R;LINKAGE=KU

 $\pi_1(1600)$ REFERENCES

ALEKSEEV	10	PRL 104 241803	M.G. Alekseev <i>et al.</i>	(COMPASS Collab.)
NOZAR	09	PRL 102 102002	M. Nozar <i>et al.</i>	(CLAS Collab.)
DZIERBA	06	PR D73 072001	A.R. Dzierba <i>et al.</i>	(BNL E852 Collab.)
LU	05	PRL 94 032002	M. Lu <i>et al.</i>	(BNL E852 Collab.)
KUHN	04	PL B595 109	J. Kuhn <i>et al.</i>	(BNL E852 Collab.)
BAKER	03	PL B563 140	C.A. Baker <i>et al.</i>	
CHUNG	02	PR D65 072001	S.U. Chung <i>et al.</i>	(BNL E852 Collab.)
IVANOV	01	PRL 86 3977	E.I. Ivanov <i>et al.</i>	(BNL E852 Collab.)
ADAMS	98B	PRL 81 5760	G.S. Adams <i>et al.</i>	(BNL E852 Collab.)

NODE=M164

REFID=53356
 REFID=52758
 REFID=51077
 REFID=50459
 REFID=49773
 REFID=49414
 REFID=48837
 REFID=48317
 REFID=46610

$a_1(1640)$

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

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

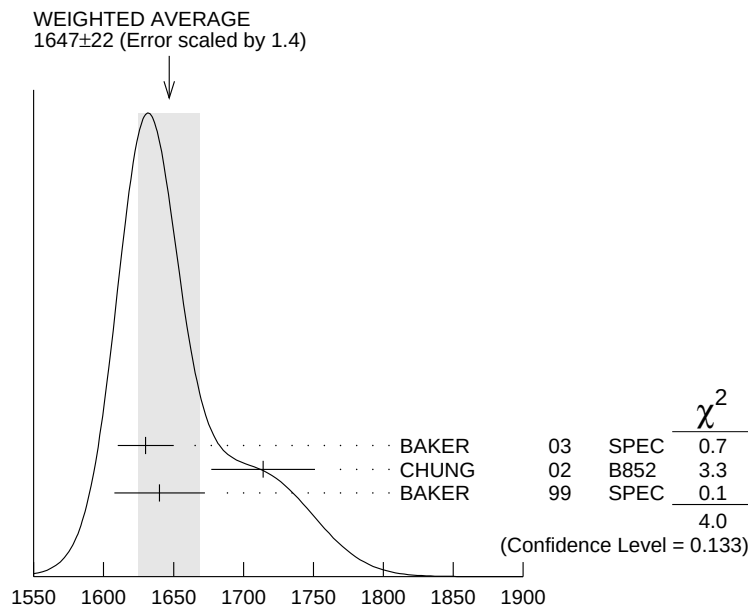
NODE=M161

 $a_1(1640)$ 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	$\bar{p}p \rightarrow \omega\pi^+\pi^-\pi^0$
$1714 \pm 9 \pm 36$		CHUNG	02 B852	$18.3\pi^-\bar{p} \rightarrow \pi^+\pi^-\pi^-p$
$1640 \pm 12 \pm 30$		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	$\bar{p}p \rightarrow \omega\pi^+\pi^-\pi^0$
$308 \pm 37 \pm 62$		CHUNG	02 B852	$18.3\pi^-\bar{p} \rightarrow \pi^+\pi^-\pi^-p$
$300 \pm 22 \pm 40$		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)
$\Gamma_1 \pi\pi\pi$	seen
$\Gamma_2 f_2(1270)\pi$	seen
$\Gamma_3 \sigma\pi$	seen
$\Gamma_4 \rho\pi S\text{-wave}$	seen
$\Gamma_5 \rho\pi D\text{-wave}$	seen
$\Gamma_6 \omega\pi\pi$	seen
$\Gamma_7 f_1(1285)\pi$	seen
$\Gamma_8 a_1(1260)\eta$	not seen

DESIG=3;OUR EST;→ UNCHECKED ←
 DESIG=1;OUR EST;→ UNCHECKED ←
 DESIG=2;OUR EST;→ UNCHECKED ←
 DESIG=7;OUR EST;→ UNCHECKED ←
 DESIG=4;OUR EST;→ UNCHECKED ←
 DESIG=5;OUR EST;→ UNCHECKED ←
 DESIG=6;OUR EST;→ UNCHECKED ←
 DESIG=8

$a_1(1640)$ BRANCHING RATIOS

NODE=M161220

 $\Gamma(f_2(1270)\pi)/\Gamma(\sigma\pi)$ **Γ_2/Γ_3**

VALUE	DOCUMENT ID	TECN	COMMENT

 NODE=M161R1
 NODE=M161R1

• • • 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

 NODE=M161R2
 NODE=M161R2

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

seen	CHUNG	02	B852	18.3 $\pi^- p \rightarrow \pi^+ \pi^- \pi^- p$
seen	AMELIN	95B	VES	36 $\pi^- A \rightarrow \pi^+ \pi^- \pi^- A$

 $\Gamma(\omega\pi\pi)/\Gamma_{\text{total}}$ **Γ_6/Γ**

VALUE	EVS	DOCUMENT ID	TECN	COMMENT

 NODE=M161R3
 NODE=M161R3

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

seen	35280	³ BAKER	03	SPEC $\bar{p}p \rightarrow \omega\pi^+\pi^-\pi^0$

 $\Gamma(f_1(1285)\pi)/\Gamma_{\text{total}}$ **Γ_7/Γ**

VALUE	DOCUMENT ID	TECN	COMMENT

 NODE=M161R4
 NODE=M161R4

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

not seen	KUHN	04	B852	18 $\pi^- p \rightarrow \eta\pi^+\pi^-\pi^- p$
seen	LEE	94	MPS2	18 $\pi^- p \rightarrow K^+ \bar{K}^0 \pi^- \pi^- p$

 $\Gamma(a_1(1260)\eta)/\Gamma_{\text{total}}$ **Γ_8/Γ**

VALUE	DOCUMENT ID	TECN	COMMENT

 NODE=M161R5
 NODE=M161R5

not seen	KUHN	04	B852	18 $\pi^- p \rightarrow \eta\pi^+\pi^-\pi^- p$

³ Assuming the $\omega\rho$ mechanism for the $\omega\pi\pi$ state.

NODE=M161R;LINKAGE=KB

 $a_1(1640)$ REFERENCES

NODE=M161

KUHN	04	PL B595 109	J. Kuhn <i>et al.</i>	(BNL E852 Collab.)
BAKER	03	PL B563 140	C.A. Baker <i>et al.</i>	
CHUNG	02	PR D65 072001	S.U. Chung <i>et al.</i>	(BNL E852 Collab.)
ASNER	00	PR D61 012002	D.M. Asner <i>et al.</i>	(CLEO Collab.)
BAKER	99	PL B449 114	C.A. Baker <i>et al.</i>	
ABREU	98G	PL B426 411	P. Abreu <i>et al.</i>	(DELPHI Collab.)
AMELIN	95B	PL B356 595	D.V. Amelin <i>et al.</i>	(SERP, TBIL)
LEE	94	PL B323 227	J.H. Lee <i>et al.</i>	(BNL, IND, KYUN, MASD+)
BOWLER	88	PL B209 99	M.G. Bowler	(OXF)
BELLINI	85	SJNP 41 781	D. Bellini <i>et al.</i>	
Translated from YAF 41 1223.				

 REFID=49773
 REFID=49414
 REFID=48837
 REFID=47339
 REFID=46888
 REFID=45909
 REFID=44433
 REFID=44092
 REFID=40578
 REFID=47490

$f_2(1640)$

$$J^{PC} = 0^+(2^+ +)$$

NODE=M117

OMITTED FROM SUMMARY TABLE

 $f_2(1640)$ MASS

NODE=M117M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
1639 ± 6 OUR AVERAGE	Error includes scale factor of 1.2.		
1620 ± 16	BUGG	95	MRK3 $J/\psi \rightarrow \gamma \pi^+ \pi^- \pi^+ \pi^-$
1647 ± 7	ADAMO	92	OBLX $\bar{n} p \rightarrow 3\pi^+ 2\pi^-$
1635 ± 7	ALDE	90	GAM2 $38 \pi^- p \rightarrow \omega \omega n$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
1640 ± 5	AMSLER	06	CBAR $0.9 \bar{p} p \rightarrow K^+ K^- \pi^0$
1659 ± 6	VLADIMIRSK...	06	SPEC $40 \pi^- p \rightarrow K_S^0 K_S^0 n$
1643 ± 7	¹ ALDE	89B	GAM2 $38 \pi^- p \rightarrow \omega \omega n$
¹ Superseded by ALDE 90.			

NODE=M117M

NODE=M117M;LINKAGE=BB

 $f_2(1640)$ WIDTH

NODE=M117W

VALUE (MeV)	CL%	DOCUMENT ID	TECN	COMMENT
99⁺⁶⁰₋₄₀ OUR AVERAGE	Error includes scale factor of 2.9.			
140 ⁺⁶⁰ ₋₂₀		BUGG	95	MRK3 $J/\psi \rightarrow \gamma \pi^+ \pi^- \pi^+ \pi^-$
58 ± 20		ADAMO	92	OBLX $\bar{n} p \rightarrow 3\pi^+ 2\pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
44 ± 9		AMSLER	06	CBAR $0.9 \bar{p} p \rightarrow K^+ K^- \pi^0$
152 ± 18		VLADIMIRSK...	06	SPEC $40 \pi^- p \rightarrow K_S^0 K_S^0 n$
< 70	90	ALDE	90	GAM2 $38 \pi^- p \rightarrow \omega \omega n$

NODE=M117W

 $f_2(1640)$ DECAY MODES

NODE=M117215;NODE=M117

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \omega \omega$	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

$\Gamma(K\bar{K})/\Gamma_{\text{total}}$	DOCUMENT ID	TECN	COMMENT	Γ_3/Γ
seen	AMSLER	06	CBAR $0.9 \bar{p} p \rightarrow K^+ K^- \pi^0$	

NODE=M117R2
 NODE=M117R2

 $f_2(1640)$ REFERENCES

NODE=M117

AMSLER	06	PL B639 165	C. Amsler <i>et al.</i>	(CBAR Collab.)
VLADIMIRSK...	06	PAN 69 493	V.V. Vladimirovsky <i>et al.</i>	(ITEP, Moscow)
		Translated from YAF 69 515.		
BUGG	95	PL B353 378	D.V. Bugg <i>et al.</i>	(LOQM, PNPI, WASH) JP
ADAMO	92	PL B287 368	A. Adamo <i>et al.</i>	(OBELIX Collab.)
ALDE	90	PL B241 600	D.M. Alde <i>et al.</i>	(SERP, BELG, LANL, LAPP+)
ALDE	89B	PL B216 451	D.M. Alde <i>et al.</i>	(SERP, BELG, LANL, LAPP+) IGJPC

REFID=51136
 REFID=51191
 REFID=44438
 REFID=42177
 REFID=40935
 REFID=40735

$\eta_2(1645)$

$$I^G(J^{PC}) = 0^+(2^-+)$$

NODE=M154

 $\eta_2(1645)$ MASS

NODE=M154M

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
1617± 5 OUR AVERAGE				
1613± 8	BARBERIS	00B		450 $pp \rightarrow p_f \eta \pi^+ \pi^- p_s$
1617± 8	BARBERIS	00C		450 $pp \rightarrow p_f 4\pi p_s$
1620±20	BARBERIS	97B	OMEG	450 $pp \rightarrow pp2(\pi^+ \pi^-)$
1645±14±15	ADOMEIT	96	CBAR 0	1.94 $\bar{p}p \rightarrow \eta 3\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1645± 6±20	ANISOVICH	00E	SPEC	0.9–1.94 $\bar{p}p \rightarrow \eta 3\pi^0$

NODE=M154M

 $\eta_2(1645)$ WIDTH

NODE=M154W

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
181±11 OUR AVERAGE				
185±17	BARBERIS	00B		450 $pp \rightarrow p_f \eta \pi^+ \pi^- p_s$
177±18	BARBERIS	00C		450 $pp \rightarrow p_f 4\pi p_s$
180±25	BARBERIS	97B	OMEG	450 $pp \rightarrow pp2(\pi^+ \pi^-)$
180 ⁺⁴⁰ ₋₂₁ ±25	ADOMEIT	96	CBAR 0	1.94 $\bar{p}p \rightarrow \eta 3\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
200±25	ANISOVICH	00E	SPEC	0.9–1.94 $\bar{p}p \rightarrow \eta 3\pi^0$

NODE=M154W

 $\eta_2(1645)$ DECAY MODES

NODE=M154215;NODE=M154

Mode	Fraction (Γ_i/Γ)
Γ_1 $a_2(1320)\pi$	seen
Γ_2 $K\bar{K}\pi$	seen
Γ_3 $K^*\bar{K}$	seen
Γ_4 $\eta\pi^+\pi^-$	seen
Γ_5 $a_0(980)\pi$	seen
Γ_6 $f_2(1270)\eta$	not seen

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

 $\eta_2(1645)$ BRANCHING RATIOS

NODE=M154220

$$\Gamma(K\bar{K}\pi)/\Gamma(a_2(1320)\pi) \quad \Gamma_2/\Gamma_1$$

VALUE	DOCUMENT ID	TECN	COMMENT
0.07±0.03	¹ BARBERIS	97C	OMEG 450 $pp \rightarrow ppK\bar{K}\pi$

¹ Using $2(\pi^+ \pi^-)$ data from BARBERIS 97B.

NODE=M154R1
 NODE=M154R1

NODE=M154R1;LINKAGE=A

$$\Gamma(a_2(1320)\pi)/\Gamma(a_0(980)\pi) \quad \Gamma_1/\Gamma_5$$

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 $pp \rightarrow p_f \eta \pi^+ \pi^- p_s$

² Reanalysis of ADOMEIT 96 and ANISOVICH 00E.

NODE=M154R3
 NODE=M154R3

NODE=M154R3;LINKAGE=AN

$$\Gamma(f_2(1270)\eta)/\Gamma_{\text{total}} \quad \Gamma_6/\Gamma$$

VALUE	DOCUMENT ID	COMMENT
not seen	BARBERIS	00B 450 $pp \rightarrow p_f \eta \pi^+ \pi^- p_s$

NODE=M154R4
 NODE=M154R4

 $\eta_2(1645)$ REFERENCES

NODE=M154

ANISOVICH	11	EPJ C71 1511	A.V. Anisovich <i>et al.</i>	(LOQM, RAL, PNPI)
ANISOVICH	00E	PL B477 19	A.V. Anisovich <i>et al.</i>	
BARBERIS	00B	PL B471 435	D. Barberis <i>et al.</i>	(WA 102 Collab.)
BARBERIS	00C	PL B471 440	D. Barberis <i>et al.</i>	(WA 102 Collab.)
BARBERIS	97B	PL B413 217	D. Barberis <i>et al.</i>	(WA 102 Collab.)
BARBERIS	97C	PL B413 225	D. Barberis <i>et al.</i>	(WA 102 Collab.)
ADOMEIT	96	ZPHY C71 227	J. Adomeit <i>et al.</i>	(Crystal Barrel Collab.)

REFID=53631
 REFID=47945
 REFID=47958
 REFID=47959
 REFID=45758
 REFID=45759
 REFID=45202

$\omega(1650)$

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

NODE=M126

 $\omega(1650)$ MASS

NODE=M126M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

1670± 30 OUR ESTIMATE

NODE=M126M

→ UNCHECKED ←

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

1667± 13± 6		AUBERT	07AU BABR	10.6 e ⁺ e ⁻ → ωπ ⁺ π ⁻ γ
1645± 8	13	AUBERT	06D BABR	10.6 e ⁺ e ⁻ → ωηγ
1660± 10± 2		AUBERT,B	04N BABR	10.6 e ⁺ e ⁻ → π ⁺ π ⁻ π ⁰ γ
1770± 50±60	1.2M	¹ ACHASOV	03D RVUE	0.44-2.00 e ⁺ e ⁻ → π ⁺ π ⁻ π ⁰
1619± 5		² HENNER	02 RVUE	1.2-2.0 e ⁺ e ⁻ → ρπ,
1700± 20		EUGENIO	01 SPEC	18 π ⁻ p → ωηπ
1705± 26	612	³ AKHMETSHIN	00D CMD2	e ⁺ e ⁻ → ωπ ⁺ π ⁻
1820 ⁺¹⁹⁰ ₋₁₅₀		⁴ ACHASOV	98H RVUE	e ⁺ e ⁻ → π ⁺ π ⁻ π ⁰
1840 ⁺¹⁰⁰ ₋₇₀		⁵ ACHASOV	98H RVUE	e ⁺ e ⁻ → ωπ ⁺ π ⁻
1780 ⁺¹⁷⁰ ₋₃₀₀		⁶ ACHASOV	98H RVUE	e ⁺ e ⁻ → K ⁺ K ⁻
~ 2100		⁷ ACHASOV	98H RVUE	e ⁺ e ⁻ → K _S ⁰ K [±] π [∓]
1606± 9		⁸ CLEGG	94 RVUE	
1662± 13	750	⁹ ANTONELLI	92 DM2	1.34-2.4e ⁺ e ⁻ → ρπ,
1670± 20		ATKINSON	83B OMEG	20-70 γp → 3πX
1657± 13		CORDIER	81 DM1	e ⁺ e ⁻ → ω2π
1679± 34	21	ESPOSITO	80 FRAM	e ⁺ e ⁻ → 3π
1652± 17		COSME	79 OSPK	e ⁺ e ⁻ → 3π

OCCUR=2

OCCUR=2

OCCUR=3

OCCUR=4

OCCUR=5

OCCUR=4

¹ From the combined fit of ANTONELLI 92, ACHASOV 01E, ACHASOV 02E, and ACHASOV 03D data on the π⁺π⁻π⁰ and ANTONELLI 92 on the ωπ⁺π⁻ final states. Supersedes ACHASOV 99E and ACHASOV 02E.

² Using results of CORDIER 81 and preliminary data of DOLINSKY 91 and ANTONELLI 92.

³ Using the data of AKHMETSHIN 00D and ANTONELLI 92. The ρπ dominance for the energy dependence of the ω(1420) and ω(1650) width assumed.

⁴ Using data from BARKOV 87, DOLINSKY 91, and ANTONELLI 92.

⁵ Using the data from ANTONELLI 92.

⁶ Using the data from IVANOV 81 and BISELLO 88B.

⁷ Using the data from BISELLO 91C.

⁸ From a fit to two Breit-Wigner functions and using the data of DOLINSKY 91 and ANTONELLI 92.

⁹ From the combined fit of the ρπ and ωππ final states.

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. • • •

222± 25± 20		AUBERT	07AU BABR	10.6 e ⁺ e ⁻ → ωπ ⁺ π ⁻ γ
114± 14	13	AUBERT	06D BABR	10.6 e ⁺ e ⁻ → ωηγ
230± 30± 20		AUBERT,B	04N BABR	10.6 e ⁺ e ⁻ → π ⁺ π ⁻ π ⁰ γ
490 ⁺²⁰⁰ ₋₁₅₀ ±130	1.2M	¹⁰ ACHASOV	03D RVUE	0.44-2.00 e ⁺ e ⁻ → π ⁺ π ⁻ π ⁰
250± 14		¹¹ HENNER	02 RVUE	1.2-2.0 e ⁺ e ⁻ → ρπ, ωππ
250± 50		EUGENIO	01 SPEC	18 π ⁻ p → ωηπ
370± 25	612	¹² AKHMETSHIN	00D CMD2	e ⁺ e ⁻ → ωπ ⁺ π ⁻
113± 20		¹³ CLEGG	94 RVUE	
280± 24	750	¹⁴ ANTONELLI	92 DM2	1.34-2.4e ⁺ e ⁻ → ρπ, ωππ
160± 20		ATKINSON	83B OMEG	20-70 γp → 3πX
136± 46		CORDIER	81 DM1	e ⁺ e ⁻ → ω2π
99± 49	21	ESPOSITO	80 FRAM	e ⁺ e ⁻ → 3π
42± 17		COSME	79 OSPK	e ⁺ e ⁻ → 3π

OCCUR=2

OCCUR=5

OCCUR=4

- ¹⁰ From the combined fit of ANTONELLI 92, ACHASOV 01E, ACHASOV 02E, and ACHASOV 03D data on the $\pi^+\pi^-\pi^0$ and ANTONELLI 92 on the $\omega\pi^+\pi^-$ final states. Supersedes ACHASOV 99E and ACHASOV 02E.
- ¹¹ Using results of CORDIER 81 and preliminary data of DOLINSKY 91 and ANTONELLI 92.
- ¹² Using the data of AKHMETSHIN 00D and ANTONELLI 92. The $\rho\pi$ dominance for the energy dependence of the $\omega(1420)$ and $\omega(1650)$ width assumed.
- ¹³ From a fit to two Breit-Wigner functions and using the data of DOLINSKY 91 and ANTONELLI 92.
- ¹⁴ From the combined fit of the $\rho\pi$ and $\omega\pi\pi$ final states.

$\omega(1650)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $\rho\pi$	seen
Γ_2 $\omega\pi\pi$	seen
Γ_3 $\omega\eta$	seen
Γ_4 e^+e^-	seen

$\omega(1650) \Gamma(i)\Gamma(e^+e^-)/\Gamma^2(\text{total})$

$$\Gamma(\rho\pi)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_1/\Gamma \times \Gamma_4/\Gamma$$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1.3 ± 0.1 ± 0.1		AUBERT,B	04N BABR	10.6 $e^+e^- \rightarrow \pi^+\pi^-\pi^0\gamma$
1.2 $+0.4$ -0.1 ± 0.8 1.2M	15,16	ACHASOV	03D RVUE	0.44–2.00 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
0.921 ± 0.230	17,18	CLEGG	94 RVUE	
0.479 ± 0.050	750 19,20	ANTONELLI	92 DM2	1.34–2.4 $e^+e^- \rightarrow \rho\pi, \omega\pi\pi$

$$\Gamma(\omega\pi\pi)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_2/\Gamma \times \Gamma_4/\Gamma$$

VALUE (units 10^{-7})	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
7.0 ± 0.5		AUBERT	07AU BABR	10.6 $e^+e^- \rightarrow \omega\pi^+\pi^-\gamma$
4.1 ± 0.9 ± 1.3 1.2M	15,16	ACHASOV	03D RVUE	0.44–2.00 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
5.40 ± 0.95	21	AKHMETSHIN 00D	CMD2	1.2–1.38 $e^+e^- \rightarrow \omega\pi^+\pi^-$
3.18 ± 0.80	17,18	CLEGG	94 RVUE	
6.07 ± 0.61	750 19,20	ANTONELLI	92 DM2	1.34–2.4 $e^+e^- \rightarrow \rho\pi, \omega\pi\pi$

$$\Gamma(\omega\eta)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_3/\Gamma \times \Gamma_4/\Gamma$$

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.57 ± 0.06		13	AUBERT	06D BABR	10.6 $e^+e^- \rightarrow \omega\eta\gamma$
<6	90	22	AKHMETSHIN 03B	CMD2	$e^+e^- \rightarrow \eta\pi^0\gamma$

- ¹⁵ Calculated by us from the cross section at the peak.
- ¹⁶ From the combined fit of ANTONELLI 92, ACHASOV 01E, ACHASOV 02E, and ACHASOV 03D data on the $\pi^+\pi^-\pi^0$ and ANTONELLI 92 on the $\omega\pi^+\pi^-$ final states. Supersedes ACHASOV 99E and ACHASOV 02E.
- ¹⁷ From a fit to two Breit-Wigner functions and using the data of DOLINSKY 91 and ANTONELLI 92.
- ¹⁸ From the partial and leptonic width given by the authors.
- ¹⁹ From the combined fit of the $\rho\pi$ and $\omega\pi\pi$ final states.
- ²⁰ From the product of the leptonic width and partial branching ratio given by the authors.
- ²¹ Using the data of AKHMETSHIN 00D and ANTONELLI 92. The $\rho\pi$ dominance for the energy dependence of the $\omega(1420)$ and $\omega(1650)$ width assumed.
- ²² $\omega(1650)$ mass and width fixed at 1700 MeV and 250 MeV, respectively.

$\omega(1650)$ BRANCHING RATIOS

$$\Gamma(\omega\pi\pi)/\Gamma_{\text{total}} \quad \Gamma_2/\Gamma$$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
~ 0.35	1.2M	23	ACHASOV	03D RVUE 0.44–2.00 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
0.620 ± 0.014		24	HENNER	02 RVUE 1.2–2.0 $e^+e^- \rightarrow \rho\pi, \omega\pi\pi$

NODE=M126W;LINKAGE=VH

NODE=M126W;LINKAGE=AB

NODE=M126W;LINKAGE=KI

NODE=M126W;LINKAGE=AD

NODE=M126W;LINKAGE=AE

NODE=M126215;NODE=M126

DESIG=1;OUR EST;→ UNCHECKED ←

DESIG=2;OUR EST;→ UNCHECKED ←

DESIG=4;OUR EST;→ UNCHECKED ←

DESIG=3;OUR EST;→ UNCHECKED ←

NODE=M126230

NODE=M126G3
NODE=M126G3NODE=M126G4
NODE=M126G4NODE=M126G5
NODE=M126G5NODE=M126G;LINKAGE=AW
NODE=M126G;LINKAGE=VH

NODE=M126G;LINKAGE=AD

NODE=M126G;LINKAGE=SE
NODE=M126G;LINKAGE=AE
NODE=M126G;LINKAGE=ES
NODE=M126G;LINKAGE=KL

NODE=M126G5;LINKAGE=KH

NODE=M126225

NODE=M126R2
NODE=M126R2

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

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
~ 0.65	1.2M	²³ ACHASOV	03D	RVUE $0.44\text{--}2.00\ e^+e^- \rightarrow \pi^+\pi^-\pi^0$
0.380 ± 0.014		²⁴ HENNER	02	RVUE $1.2\text{--}2.0\ e^+e^- \rightarrow \rho\pi, \omega\pi\pi$

NODE=M126R3
 NODE=M126R3

 $\Gamma(e^+e^-)/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE (units 10^{-7})	EVTs	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
~ 18	1.2M	^{24,25} ACHASOV	03D	RVUE $0.44\text{--}2.00\ e^+e^- \rightarrow \pi^+\pi^-\pi^0$
32 ± 1		²⁴ HENNER	02	RVUE $1.2\text{--}2.0\ e^+e^- \rightarrow \rho\pi, \omega\pi\pi$
²³ From the combined fit of ANTONELLI 92, ACHASOV 01E, ACHASOV 02E, and ACHASOV 03D data on the $\pi^+\pi^-\pi^0$ and ANTONELLI 92 on the $\omega\pi^+\pi^-$ final states. Supersedes ACHASOV 99E and ACHASOV 02E.				
²⁴ Assuming that the $\omega(1650)$ decays into $\rho\pi$ and $\omega\pi\pi$ only.				
²⁵ 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

NODE=M126

AUBERT	07AU	PR D76 092005	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT	06D	PR D73 052003	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT,B	04N	PR D70 072004	B. Aubert <i>et al.</i>	(BABAR Collab.)
ACHASOV	03D	PR D68 052006	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)
AKHMETSHIN	03B	PL B562 173	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)
ACHASOV	02E	PR D66 032001	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)
HENNER	02	EPJ C26 3	V.K. Henner <i>et al.</i>	
ACHASOV	01E	PR D63 072002	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)
EUGENIO	01	PL B497 190	P. Eugenio <i>et al.</i>	
AKHMETSHIN	00D	PL B489 125	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)
ACHASOV	99E	PL B462 365	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)
ACHASOV	98H	PR D57 4334	N.N. Achasov, A.A. Kozhevnikov	
CLEGG	94	ZPHY C62 455	A.B. Clegg, A. Donnachie	(LANC, MCHS)
ANTONELLI	92	ZPHY C56 15	A. Antonelli <i>et al.</i>	(DM2 Collab.)
BISELLO	91C	ZPHY C52 227	D. Bisello <i>et al.</i>	(DM2 Collab.)
DOLINSKY	91	PRPL 202 99	S.I. Dolinsky <i>et al.</i>	(NOVO)
BISELLO	88B	ZPHY C39 13	D. Bisello <i>et al.</i>	(PADO, CLER, FRAS+)
BARKOV	87	JETPL 46 164	L.M. Barkov <i>et al.</i>	(NOVO)
ATKINSON	83B	Translated from ZETFP 46 132	M. Atkinson <i>et al.</i>	(BONN, CERN, GLAS+)
CORDIER	81	PL 106B 155	A. Cordier <i>et al.</i>	(ORSAY)
IVANOV	81	PL 107B 297	P.M. Ivanov <i>et al.</i>	(NOVO)
ESPOSITO	80	LNC 28 195	B. Esposito <i>et al.</i>	(FRAS, NAPL, PADO+)
COSME	79	NP B152 215	G. Cosme <i>et al.</i>	(IPN)

REFID=52049
 REFID=51047
 REFID=50184
 REFID=49577
 REFID=49406
 REFID=48815
 REFID=49177
 REFID=48311
 REFID=48010
 REFID=47935
 REFID=47391
 REFID=46323
 REFID=44081
 REFID=43168
 REFID=41867
 REFID=41369
 REFID=40581
 REFID=40280
 REFID=21502
 REFID=21586
 REFID=20553
 REFID=21584
 REFID=21475

$\omega_3(1670)$

$$I^G(J^{PC}) = 0^-(3^{--})$$

NODE=M045

 $\omega_3(1670)$ MASS

NODE=M045M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1667 ± 4 OUR AVERAGE				
1665.3 ± 5.2 ± 4.5	23400	AMELIN	96 VES	$36 \pi^- p \rightarrow \pi^+ \pi^- \pi^0 n$
1685 ± 20	60	BAUBILLIER	79 HBC	8.2 $K^- p$ backward
1673 ± 12	430	^{1,2} BALTAY	78E HBC	$15 \pi^+ p \rightarrow \Delta 3\pi$
1650 ± 12		CORDEN	78B OMEG	$8-12 \pi^- p \rightarrow N 3\pi$
1669 ± 11	600	² WAGNER	75 HBC	$7 \pi^+ p \rightarrow \Delta^{++} 3\pi$
1678 ± 14	500	DIAZ	74 DBC	$6 \pi^+ n \rightarrow p 3\pi^0$
1660 ± 13	200	DIAZ	74 DBC	$6 \pi^+ n \rightarrow p \omega \pi^0 \pi^0$
1679 ± 17	200	MATTHEWS	71D DBC	$7.0 \pi^+ n \rightarrow p 3\pi^0$
1670 ± 20		KENYON	69 DBC	$8 \pi^+ n \rightarrow p 3\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
~ 1700	110	¹ CERRADA	77B HBC	$4.2 K^- p \rightarrow \Lambda 3\pi$
1695 ± 20		BARNES	69B HBC	$4.6 K^- p \rightarrow \omega 2\pi X$
1636 ± 20		ARMENISE	68B DBC	$5.1 \pi^+ n \rightarrow p 3\pi^0$
¹ Phase rotation seen for $J^P = 3^- \rho\pi$ wave.				
² From a fit to $I(J^P) = 0(3^-) \rho\pi$ partial wave.				

NODE=M045M

OCCUR=2

NODE=M045M;LINKAGE=E
NODE=M045M;LINKAGE=P $\omega_3(1670)$ WIDTH

NODE=M045W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
168 ± 10 OUR AVERAGE				
149 ± 19 ± 7	23400	AMELIN	96 VES	$36 \pi^- p \rightarrow \pi^+ \pi^- \pi^0 n$
160 ± 80	60	³ BAUBILLIER	79 HBC	8.2 $K^- p$ backward
173 ± 16	430	^{4,5} BALTAY	78E HBC	$15 \pi^+ p \rightarrow \Delta 3\pi$
253 ± 39		CORDEN	78B OMEG	$8-12 \pi^- p \rightarrow N 3\pi$
173 ± 28	600	^{3,5} WAGNER	75 HBC	$7 \pi^+ p \rightarrow \Delta^{++} 3\pi$
167 ± 40	500	DIAZ	74 DBC	$6 \pi^+ n \rightarrow p 3\pi^0$
122 ± 39	200	DIAZ	74 DBC	$6 \pi^+ n \rightarrow p \omega \pi^0 \pi^0$
155 ± 40	200	³ MATTHEWS	71D DBC	$7.0 \pi^+ n \rightarrow p 3\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
90 ± 20		BARNES	69B HBC	$4.6 K^- p \rightarrow \omega 2\pi$
100 ± 40		KENYON	69 DBC	$8 \pi^+ n \rightarrow p 3\pi^0$
112 ± 60		ARMENISE	68B DBC	$5.1 \pi^+ n \rightarrow p 3\pi^0$
³ Width errors enlarged by us to $4\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.				
⁴ Phase rotation seen for $J^P = 3^- \rho\pi$ wave.				
⁵ From a fit to $I(J^P) = 0(3^-) \rho\pi$ partial wave.				

NODE=M045W

OCCUR=2

NODE=M045W;LINKAGE=S
NODE=M045W;LINKAGE=E
NODE=M045W;LINKAGE=P $\omega_3(1670)$ DECAY MODES

NODE=M045215;NODE=M045

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \rho\pi$	seen
$\Gamma_2 \quad \omega\pi\pi$	seen
$\Gamma_3 \quad b_1(1235)\pi$	possibly seen

DESIG=1;OUR EST;→ UNCHECKED ←
DESIG=2;OUR EST;→ UNCHECKED ←
DESIG=3;OUR EST;→ UNCHECKED ← $\omega_3(1670)$ BRANCHING RATIOS

NODE=M045220

$\Gamma(\omega\pi\pi)/\Gamma(\rho\pi)$					Γ_2/Γ_1
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.71 ± 0.27	100	DIAZ	74 DBC	$6 \pi^+ n \rightarrow p 5\pi^0$	
$\Gamma(b_1(1235)\pi)/\Gamma(\rho\pi)$					Γ_3/Γ_1
VALUE		DOCUMENT ID	TECN	COMMENT	
possibly seen		DIAZ	74 DBC	$6 \pi^+ n \rightarrow p 5\pi^0$	

NODE=M045R3
NODE=M045R3NODE=M045R4
NODE=M045R4

$\Gamma(b_1(1235)\pi)/\Gamma(\omega\pi\pi)$ Γ_3/Γ_2

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

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

>0.75	68	BAUBILLIER	79	HBC	8.2 $K^- p$ backward

NODE=M045R5
NODE=M045R5

 $\omega_3(1670)$ REFERENCES

AMELIN	96	ZPHY C70 71	D.V. Amelin <i>et al.</i>	(SERP, TBIL)
BAUBILLIER	79	PL 89B 131	M. Baubillier <i>et al.</i>	(BIRM, CERN, GLAS+)
BALTAY	78E	PRL 40 87	C. Baltay, C.V. Cautis, M. Kalelkar	(COLU) JP
CORDEN	78B	NP B138 235	M.J. Corden <i>et al.</i>	(BIRM, RHEL, TELA+)
CERRADA	77B	NP B126 241	M. Cerrada <i>et al.</i>	(AMST, CERN, NIJM+) JP
WAGNER	75	PL 58B 201	F. Wagner, M. Tabak, D.M. Chew	(LBL) JP
DIAZ	74	PRL 32 260	J. Diaz <i>et al.</i>	(CASE, CMU)
MATTHEWS	71D	PR D3 2561	J.A.J. Matthews <i>et al.</i>	(TNTD, WISC)
BARNES	69B	PRL 23 142	V.E. Barnes <i>et al.</i>	(BNL)
KENYON	69	PRL 23 146	I.R. Kenyon <i>et al.</i>	(BNL, UCND, ORNL)
ARMENISE	68B	PL 26B 336	N. Armenise <i>et al.</i>	(BARI, BGNA, FIRZ+)

NODE=M045

REFID=44649
REFID=21522
REFID=21520
REFID=21269
REFID=20537
REFID=20843
REFID=21248
REFID=21515
REFID=21512
REFID=20800
REFID=20783

NODE=M034

 $\pi_2(1670)$

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

 $\pi_2(1670)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

1672.2 ± 3.0 OUR AVERAGE Error includes scale factor of 1.4. See the ideogram below.

1658 ± 3	$^{+24}_{-8}$	420k	ALEKSEEV	10	COMP	190 $\pi^- Pb \rightarrow \pi^- \pi^- \pi^+ Pb'$
1749 ± 10	± 100	145k	LU	05	B852	18 $\pi^- p \rightarrow \omega \pi^- \pi^0 p$
1676 ± 3	± 8		¹ CHUNG	02	B852	18.3 $\pi^- p \rightarrow \pi^+ \pi^- \pi^- p$
1685 ± 10	± 30		² BARBERIS	01		450 $pp \rightarrow p_f 3\pi^0 p_s$
1687 ± 9	± 15		AMELIN	99	VES	37 $\pi^- A \rightarrow \omega \pi^- \pi^0 A^*$
1669 ± 4			BARBERIS	98B		450 $pp \rightarrow p_f \rho \pi p_s$
1670 ± 4			BARBERIS	98B		450 $pp \rightarrow p_f f_2(1270) \pi p_s$
1730 ± 20			³ AMELIN	95B	VES	36 $\pi^- A \rightarrow \pi^+ \pi^- \pi^- A$
1690 ± 14			⁴ BERDNIKOV	94	VES	37 $\pi^- A \rightarrow K^+ K^- \pi^- A$
1710 ± 20	700		ANTIPOV	87	SIGM	50 $\pi^- Cu \rightarrow \mu^+ \mu^- \pi^- Cu$
1676 ± 6			⁴ EVANGELIS...	81	OMEG	12 $\pi^- p \rightarrow 3\pi p$
1657 ± 14			^{4,5} DAUM	80D	SPEC	63-94 $\pi p \rightarrow 3\pi X$
1662 ± 10	2000		⁴ BALTAY	77	HBC	15 $\pi^+ p \rightarrow p 3\pi$

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

1742 ± 31	± 49		ANTREASYAN	90	CBAL	$e^+ e^- \rightarrow e^+ e^- \pi^0 \pi^0 \pi^0$
1624 ± 21			¹ BELLINI	85	SPEC	40 $\pi^- A \rightarrow \pi^- \pi^+ \pi^- A$
1622 ± 35			⁶ BELLINI	85	SPEC	40 $\pi^- A \rightarrow \pi^- \pi^+ \pi^- A$
1693 ± 28			⁷ BELLINI	85	SPEC	40 $\pi^- A \rightarrow \pi^- \pi^+ \pi^- A$
1710 ± 20			⁸ DAUM	81B	SPEC	63,94 $\pi^- p$
1660 ± 10			⁴ ASCOLI	73	HBC	5-25 $\pi^- p \rightarrow p \pi_2$

¹ From $f_2(1270)\pi$ decay.

² From a fit to the invariant mass distribution.

³ From a fit to $J^{PC} = 2^-+ f_2(1270)\pi, f_0(1370)\pi$ waves.

⁴ From a fit to $J^P = 2^- S$ -wave $f_2(1270)\pi$ partial wave.

⁵ Clear phase rotation seen in $2^- S, 2^- P, 2^- D$ waves. We quote central value and spread of single-resonance fits to three channels.

⁶ From $\rho\pi$ decay.

⁷ From $\sigma\pi$ decay.

⁸ From a two-resonance fit to four $2^- 0^+$ waves. This should not be averaged with all the single resonance fits.

NODE=M034M

NODE=M034M

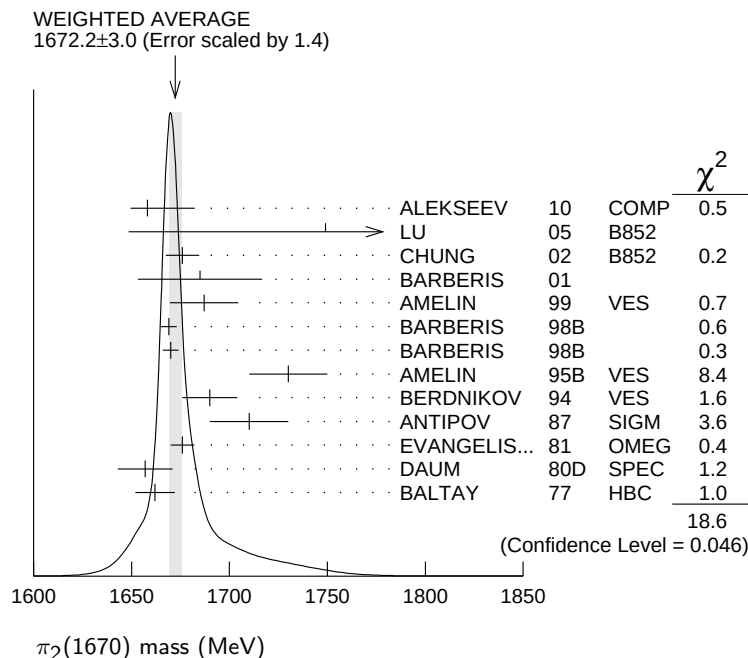
OCCUR=2

OCCUR=2

OCCUR=3

NODE=M034M;LINKAGE=F2
NODE=M034M;LINKAGE=BR
NODE=M034M;LINKAGE=AX
NODE=M034M;LINKAGE=P
NODE=M034M;LINKAGE=D

NODE=M034M;LINKAGE=R2
NODE=M034M;LINKAGE=S2
NODE=M034M;LINKAGE=L



$\pi_2(1670)$ WIDTH

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 $\pi^- p \rightarrow p \pi_2$

NODE=M034W

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	$(95.8 \pm 1.4) \%$		DESIG=20
Γ_2	$\pi^+ \pi^- \pi^0$			DESIG=22
Γ_3	$\pi^0 \pi^0 \pi^0$			DESIG=23
Γ_4	$f_2(1270)\pi$	$(56.3 \pm 3.2) \%$		DESIG=8
Γ_5	$\rho\pi$	$(31 \pm 4) \%$		DESIG=2
Γ_6	$\sigma\pi$	$(10.9 \pm 3.4) \%$		DESIG=13
Γ_7	$(\pi\pi)_{S\text{-wave}}$	$(8.7 \pm 3.4) \%$		DESIG=11
Γ_8	$K\bar{K}^*(892) + \text{c.c.}$	$(4.2 \pm 1.4) \%$		DESIG=5
Γ_9	$\omega\rho$	$(2.7 \pm 1.1) \%$		DESIG=14
Γ_{10}	$\gamma\gamma$	$< 2.8 \times 10^{-7}$	90%	DESIG=12
Γ_{11}	$\eta\pi$			DESIG=3
Γ_{12}	$\pi^\pm 2\pi^+ 2\pi^-$			DESIG=4
Γ_{13}	$\rho(1450)\pi$	$< 3.6 \times 10^{-3}$	97.7%	DESIG=15
Γ_{14}	$b_1(1235)\pi$	$< 1.9 \times 10^{-3}$	97.7%	DESIG=16
Γ_{15}	$\eta 3\pi$			DESIG=24
Γ_{16}	$f_1(1285)\pi$	possibly seen		DESIG=25
Γ_{17}	$a_2(1320)\pi$	not seen		DESIG=26

CONSTRAINED FIT INFORMATION

An overall fit to 4 branching ratios uses 6 measurements and one constraint to determine 4 parameters. The overall fit has a $\chi^2 = 1.9$ for 3 degrees of freedom.

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

x_5	-53		
x_7	-29	-59	
x_8	-8	-21	-9
	x_4	x_5	x_7

 $\pi_2(1670)$ PARTIAL WIDTHS

NODE=M034217

$\Gamma(\gamma\gamma)$					Γ_{10}
VALUE (keV)	CL%	DOCUMENT ID	TECN	CHG	COMMENT
<0.072	90	17 ACCIARRI	97T L3		$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^- \pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.19	90	17 ALBRECHT	97B ARG		$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^- \pi^0$
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 $\pm 0.3 \pm 0.12$		18 BEHREND	90C CELL 0		$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^- \pi^0$
1.3 $\pm 0.3 \pm 0.2$		19 BEHREND	90C CELL 0		$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^- \pi^0$

OCCUR=2

17 Decaying into $f_2(1270)\pi$ and $\rho\pi$.

18 Constructive interference between $f_2(1270)\pi, \rho\pi$ and background.

19 Incoherent Ansatz.

NODE=M034W1;LINKAGE=QQ

NODE=M034W1;LINKAGE=C

NODE=M034W1;LINKAGE=G

 $\pi_2(1670)$ $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

NODE=M034230

$\Gamma(\pi^+ \pi^- \pi^0) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$					$\Gamma_2 \Gamma_{10}/\Gamma$
VALUE (keV)	CL%	DOCUMENT ID	TECN	COMMENT	
<0.1	95	20 SCHEGELSKY 06	RVUE	$\gamma\gamma \rightarrow \pi^+ \pi^- \pi^0$	

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

NODE=M034G01

NODE=M034G01

NODE=M034G01;LINKAGE=SC

$\pi_2(1670)$ BRANCHING RATIOS

NODE=M034220

 $\Gamma(3\pi)/\Gamma_{\text{total}}$ $\Gamma_1/\Gamma = (\Gamma_4 + \Gamma_5 + \Gamma_7)/\Gamma$ NODE=M034R20
NODE=M034R20

VALUE

DOCUMENT ID

0.958±0.014 OUR FIT $\Gamma(\pi^0\pi^0\pi^0)/\Gamma(\pi^+\pi^-\pi^0)$ Γ_3/Γ_2 NODE=M034R21
NODE=M034R21

VALUE

DOCUMENT ID

COMMENT

0.29±0.03±0.05

21

BARBERIS

01

450 $p p \rightarrow p_f 3\pi^0 p_s$ $\Gamma(\rho\pi)/0.565\Gamma(f_2(1270)\pi)$ $\Gamma_5/0.565\Gamma_4$

NODE=M034R16

(With $f_2(1270) \rightarrow \pi^+\pi^-$.)NODE=M034R16
NODE=M034R16

VALUE

DOCUMENT ID

TECN

COMMENT

0.97±0.09 OUR AVERAGE

Error includes scale factor of 1.9.

0.76±0.07±0.10

CHUNG

02

B852

18.3 $\pi^- p \rightarrow \pi^+\pi^-\pi^- p$

1.01±0.05

BARBERIS

98B

450 $p p \rightarrow p_f \pi^+\pi^-\pi^0 p_s$ $\Gamma(\sigma\pi)/\Gamma(f_2(1270)\pi)$ Γ_6/Γ_4 NODE=M034R15
NODE=M034R15

VALUE

DOCUMENT ID

TECN

COMMENT

0.19±0.06 OUR AVERAGE

0.17±0.02±0.07

CHUNG

02

B852

18.3 $\pi^- p \rightarrow \pi^+\pi^-\pi^- p$

0.24±0.10

22,23

BAKER

99

SPEC

1.94 $\bar{p} p \rightarrow 4\pi^0$ $\frac{1}{2}\Gamma(\rho\pi)/\Gamma(\pi^\pm\pi^+\pi^-)$ $\frac{1}{2}\Gamma_5/(0.565\Gamma_4 + \frac{1}{2}\Gamma_5 + 0.624\Gamma_7)$ NODE=M034R2
NODE=M034R2

VALUE

DOCUMENT ID

TECN

CHG

COMMENT

0.29±0.04 OUR FIT**0.29±0.05**

24

DAUM

81B

SPEC

63,94 $\pi^- p$

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

<0.3

BARTSCH

68

HBC

+

8 $\pi^+ p \rightarrow 3\pi p$ $0.565\Gamma(f_2(1270)\pi)/\Gamma(\pi^\pm\pi^+\pi^-)$ $0.565\Gamma_4/(0.565\Gamma_4 + \frac{1}{2}\Gamma_5 + 0.624\Gamma_7)$

NODE=M034R3

(With $f_2(1270) \rightarrow \pi^+\pi^-$.)NODE=M034R3
NODE=M034R3

VALUE

DOCUMENT ID

TECN

CHG

COMMENT

0.604±0.035 OUR FIT**0.60 ±0.05 OUR AVERAGE**

Error includes scale factor of 1.3.

0.61 ±0.04

24

DAUM

81B

SPEC

63,94 $\pi^- p$

0.76 +0.24

-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 $\pi^+ p \rightarrow 3\pi p$ $0.624\Gamma((\pi\pi)_{S\text{-wave}})/\Gamma(\pi^\pm\pi^+\pi^-)$ $0.624\Gamma_7/(0.565\Gamma_4 + \frac{1}{2}\Gamma_5 + 0.624\Gamma_7)$

NODE=M034R11

(With $(\pi\pi)_{S\text{-wave}} \rightarrow \pi^+\pi^-$.)NODE=M034R11
NODE=M034R11

VALUE

DOCUMENT ID

TECN

COMMENT

0.10±0.04 OUR FIT**0.10±0.05**

24

DAUM

81B

SPEC

63,94 $\pi^- p$ $\Gamma(K\bar{K}^*(892)+c.c.)/\Gamma(f_2(1270)\pi)$ Γ_8/Γ_4 NODE=M034R13
NODE=M034R13

VALUE

DOCUMENT ID

TECN

CHG

COMMENT

0.075±0.025 OUR FIT**0.075±0.025**

25

ARMSTRONG

82B

OMEG

-

16 $\pi^- p \rightarrow K^+ K^- \pi^- p$ $\Gamma(\omega\rho)/\Gamma_{\text{total}}$ Γ_9/Γ NODE=M034R17
NODE=M034R17

VALUE

DOCUMENT ID

TECN

COMMENT

0.027±0.004±0.010

26

AMELIN

99

VES

37 $\pi^- A \rightarrow \omega \pi^- \pi^0 A^*$ $\Gamma(\eta\pi)/\Gamma(\pi^\pm\pi^+\pi^-)$ $\Gamma_{11}/(0.565\Gamma_4 + \frac{1}{2}\Gamma_5 + 0.624\Gamma_7)$

NODE=M034R5

(All η decays.)NODE=M034R5
NODE=M034R5

VALUE

DOCUMENT ID

TECN

CHG

COMMENT

<0.09

BALTAY

68

HBC

+

7-8.5 $\pi^+ p$

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

<0.10

CRENNELL

70

HBC

-

6 $\pi^- p \rightarrow f_2 \pi^- N$

$$\Gamma(\pi^{\pm}2\pi^{+}2\pi^{-})/\Gamma(\pi^{\pm}\pi^{+}\pi^{-})$$

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
<0.10	CRENNELL	70	HBC	— $6\pi^{-}p \rightarrow f_2\pi^{-}N$
<0.1	BALTAY	68	HBC	+ $7,8.5\pi^{+}p$

NODE=M034R6
NODE=M034R6;CHECK LIMITS

$$\Gamma(\rho(1450)\pi)/\Gamma_{\text{total}}$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.0036	97.7	AMELIN	99	VES $37\pi^{-}A \rightarrow \omega\pi^{-}\pi^0A^{*}$

NODE=M034R18
NODE=M034R18

$$\Gamma(b_1(1235)\pi)/\Gamma_{\text{total}}$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.0019	97.7	AMELIN	99	VES $37\pi^{-}A \rightarrow \omega\pi^{-}\pi^0A^{*}$

NODE=M034R19
NODE=M034R19

$$\Gamma(f_1(1285)\pi)/\Gamma_{\text{total}}$$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
possibly seen	69k	KUHN	04	B852 $18\pi^{-}p \rightarrow \eta\pi^{+}\pi^{-}\pi^{-}p$

NODE=M034R23
NODE=M034R23

$$\Gamma(a_2(1320)\pi)/\Gamma_{\text{total}}$$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
not seen	69k	KUHN	04	B852 $18\pi^{-}p \rightarrow \eta\pi^{+}\pi^{-}\pi^{-}p$

NODE=M034R24
NODE=M034R24

$$D\text{-wave}/S\text{-wave RATIO FOR } \pi_2(1670) \rightarrow f_2(1270)\pi$$

VALUE	DOCUMENT ID	TECN	COMMENT
-0.18 ± 0.06	22 BAKER	99	SPEC $1.94\bar{p}p \rightarrow 4\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.22 ± 0.10	24 DAUM	81B	SPEC $63,94\pi^{-}p$

NODE=M034R14
NODE=M034R14

$$F\text{-wave}/P\text{-wave RATIO FOR } \pi_2(1670) \rightarrow \rho\pi$$

VALUE	DOCUMENT ID	TECN	COMMENT
$-0.72 \pm 0.07 \pm 0.14$	CHUNG	02	B852 $18.3\pi^{-}p \rightarrow \pi^{+}\pi^{-}\pi^{-}p$

NODE=M034R22
NODE=M034R22

21 Using BARBERIS 98B.

22 Using preliminary CBAR data.

23 With the $\sigma\pi$ in $L=2$ and the $f_2(1270)\pi$ in $L=0$.

24 From a two-resonance fit to four $2^{-}0^{+}$ waves.

25 From a partial-wave analysis of $K^{+}K^{-}\pi^{-}$ system.

26 Normalized to the $B(\pi_2(1670) \rightarrow f_2\pi)$.

NODE=M034R;LINKAGE=RB
NODE=M034R;LINKAGE=BK
NODE=M034R15;LINKAGE=A
NODE=M034R;LINKAGE=L
NODE=M034R13;LINKAGE=M
NODE=M034R;LINKAGE=DM

$\pi_2(1670)$ REFERENCES

ALEKSEEV	10	PRL 104 241803	M.G. Alekseev <i>et al.</i>	(COMPASS Collab.)
SCHEGELSKY	06	EPJ A27 199	V.A. Schegelsky <i>et al.</i>	
LU	05	PRL 94 032002	M. Lu <i>et al.</i>	(BNL E852 Collab.)
KUHN	04	PL B595 109	J. Kuhn <i>et al.</i>	(BNL E852 Collab.)
CHUNG	02	PR D65 072001	S.U. Chung <i>et al.</i>	(BNL E852 Collab.)
BARBERIS	01	PL B507 14	D. Barberis <i>et al.</i>	
AMELIN	99	PAN 62 445	D.V. Amelin <i>et al.</i>	(VES Collab.)
		Translated from YAF 62 487.		
BAKER	99	PL B449 114	C.A. Baker <i>et al.</i>	
BARBERIS	98B	PL B422 399	D. Barberis <i>et al.</i>	(WA 102 Collab.)
ACCIARRI	97T	PL B413 147	M. Acciarri <i>et al.</i>	(L3 Collab.)
ALBRECHT	97B	ZPHY C74 469	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
AMELIN	95B	PL B356 595	D.V. Amelin <i>et al.</i>	(SERP, TBIL)
BERDNIKOV	94	PL B337 219	E.B. Berdnikov <i>et al.</i>	(SERP, TBIL)
ANTREASYAN	90	ZPHY C48 561	D. Antreasyan <i>et al.</i>	(Crystal Ball Collab.)
BEHREND	90C	ZPHY C46 583	H.J. Behrend <i>et al.</i>	(CELLO Collab.)
ANTIPOV	87	EPL 4 403	Y.M. Antipov <i>et al.</i>	(SERP, JINR, INRM+)
BELLINI	85	SJNP 41 781	D. Bellini <i>et al.</i>	
		Translated from YAF 41 1223.		
ARMSTRONG	82B	NP B202 1	T.A. Armstrong, B. Baccari	(AACH3, BARI, BONN+)
DAUM	81B	NP B182 269	C. Daum <i>et al.</i>	(AMST, CERN, CRAC, MPIM+)
EVANGELIS...	81	NP B178 197	C. Evangelista <i>et al.</i>	(BARI, BONN, CERN+)
Also		NP B186 594	C. Evangelista	
DAUM	80D	PL 89B 285	C. Daum <i>et al.</i>	(AMST, CERN, CRAC, MPIM+) JP
BALTAY	77	PRL 39 591	C. Baltay, C.V. Cautis, M. Kalelkar	(COLU) JP
ASCOLI	73	PR D7 669	G. Ascoli	(ILL, TATO, GENO, HAMB, MILA+) JP
CRENNELL	70	PRL 24 781	D.J. Crennell <i>et al.</i>	(BNL)
ARMENISE	69	LNC 2 501	N. Armenise <i>et al.</i>	(BARI, BGNA, FIRZ)
BALTAY	68	PRL 20 887	C. Baltay <i>et al.</i>	(COLU, ROCH, RUTG, YALE) I
BARTSCH	68	NP B7 345	J. Bartsch <i>et al.</i>	(AACH, BERL, CERN) JP

NODE=M034

REFID=53356
REFID=51186
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REFID=21553
REFID=20805
REFID=20689
REFID=21531
REFID=21532

$\phi(1680)$

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

NODE=M067

 $\phi(1680)$ MASS

NODE=M067205

 e^+e^- PRODUCTION

NODE=M067M1

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT

NODE=M067M1

1680±20 OUR ESTIMATE

→ UNCHECKED ←

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

1689±7±10	4.8k	¹ SHEN	09	BELL	10.6 $e^+e^- \rightarrow K^+K^-\pi^+\pi^-\gamma$
1709±20±43		² AUBERT	08s	BABR	10.6 $e^+e^- \rightarrow$ hadrons
1623±20	948	³ AKHMETSHIN	03	CMD2	1.05–1.38 $e^+e^- \rightarrow K_L^0 K_S^0$
~1500		⁴ ACHASOV	98H	RVUE	$e^+e^- \rightarrow \pi^+\pi^-\pi^0, \omega\pi^+\pi^-,$ K^+K^-
~1900		⁵ ACHASOV	98H	RVUE	$e^+e^- \rightarrow K_S^0 K^\pm \pi^\mp$
1700±20		⁶ CLEGG	94	RVUE	$e^+e^- \rightarrow K^+K^-, K_S^0 K\pi$
1657±27	367	⁷ BISELLO	91C	DM2	$e^+e^- \rightarrow K_S^0 K^\pm \pi^\mp$
1655±17		⁷ BISELLO	88B	DM2	$e^+e^- \rightarrow K^+K^-$
1680±10		⁸ BUON	82	DM1	$e^+e^- \rightarrow$ hadrons
1677±12		⁹ MANE	82	DM1	$e^+e^- \rightarrow K_S^0 K\pi$

OCCUR=4

¹ From a fit with two incoherent Breit-Wigners.² From the simultaneous fit to the $K\bar{K}^*(892)+$ c.c. and $\phi\eta$ data from AUBERT 08s using the results of AUBERT 07AK.³ From the combined fit of AKHMETSHIN 03 and MANE 81 also including ρ, ω , and ϕ . Neither isospin nor flavor structure known.⁴ Using data from IVANOV 81, BARKOV 87, BISELLO 88B, DOLINSKY 91, and ANTONELLI 92.⁵ Using the data from BISELLO 91C.⁶ Using BISELLO 88B and MANE 82 data.⁷ From global fit including ρ, ω, ϕ and $\rho(1700)$ assume mass 1570 MeV and width 510 MeV for ρ radial excitation.⁸ From global fit of ρ, ω, ϕ and their radial excitations to channels $\omega\pi^+\pi^-, K^+K^-, K_S^0 K_L^0, K_S^0 K^\pm \pi^\mp$. Assume mass 1570 MeV and width 510 MeV for ρ radial excitations, mass 1570 and width 500 MeV for ω radial excitation.⁹ Fit to one channel only, neglecting interference with $\omega, \rho(1700)$.

NODE=M067M1;LINKAGE=SH

NODE=M067M1;LINKAGE=AU

NODE=M067M;LINKAGE=HK

NODE=M067M1;LINKAGE=L1

NODE=M067M1;LINKAGE=L4

NODE=M067M;LINKAGE=A

NODE=M067M;LINKAGE=E

NODE=M067M;LINKAGE=C

NODE=M067M;LINKAGE=D

PHOTOPRODUCTION

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

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

1753±3	¹⁰ LINK	02K	FOCS	20–160 $\gamma p \rightarrow K^+K^-p$
1726±22	¹⁰ BUSENITZ	89	TPS	$\gamma p \rightarrow K^+K^-X$
1760±20	¹⁰ ATKINSON	85C	OMEG	20–70 $\gamma p \rightarrow K\bar{K}X$
1690±10	¹⁰ ASTON	81F	OMEG	25–70 $\gamma p \rightarrow K^+K^-X$

¹⁰ We list here a state decaying into K^+K^- possibly different from $\phi(1680)$.

NODE=M067M2;LINKAGE=LK

 $p\bar{p}$ ANNIHILATION

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

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

1700±8	¹¹ AMSLER	06	CBAR	0.9 $\bar{p}p \rightarrow K^+K^-\pi^0$

¹¹ Could also be $\rho(1700)$.

NODE=M067M3

NODE=M067M3

NODE=M067M3;LINKAGE=AM

 $\phi(1680)$ WIDTH

NODE=M067210

 e^+e^- PRODUCTION

NODE=M067W1

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT

NODE=M067W1

150±50 OUR ESTIMATE This is only an educated guess; the error given is larger than the error on the average of the published values.

→ UNCHECKED ←

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

211±14±19	4.8k	¹² SHEN	09	BELL	10.6 $e^+e^- \rightarrow K^+K^-\pi^+\pi^-\gamma$
322±77±160		¹³ AUBERT	08s	BABR	10.6 $e^+e^- \rightarrow$ hadrons
139±60	948	¹⁴ AKHMETSHIN	03	CMD2	1.05–1.38 $e^+e^- \rightarrow K_L^0 K_S^0$
300±60		¹⁵ CLEGG	94	RVUE	$e^+e^- \rightarrow K^+K^-, K_S^0 K\pi$
146±55	367	¹⁵ BISELLO	91C	DM2	$e^+e^- \rightarrow K_S^0 K^\pm \pi^\mp$
207±45		¹⁶ BISELLO	88B	DM2	$e^+e^- \rightarrow K^+K^-$
185±22		¹⁷ BUON	82	DM1	$e^+e^- \rightarrow$ hadrons
102±36		¹⁸ MANE	82	DM1	$e^+e^- \rightarrow K_S^0 K\pi$

- ¹² From a fit with two incoherent Breit-Wigners.
¹³ From the simultaneous fit to the $K\bar{K}^*(892) + \text{c.c.}$ and $\phi\eta$ data from AUBERT 08S using the results of AUBERT 07AK.
¹⁴ From the combined fit of AKHMETSHIN 03 and MANE 81 also including ρ , ω , and ϕ . Neither isospin nor flavor structure known.
¹⁵ Using BISELLO 88B and MANE 82 data.
¹⁶ From global fit including ρ , ω , ϕ and $\rho(1700)$.
¹⁷ From global fit of ρ , ω , ϕ and their radial excitations to channels $\omega\pi^+\pi^-$, K^+K^- , $K_S^0K_L^0$, $K_S^0K^\pm\pi^\mp$. Assume mass 1570 MeV and width 510 MeV for ρ radial excitations, mass 1570 and width 500 MeV for ω radial excitation.
¹⁸ Fit to one channel only, neglecting interference with ω , $\rho(1700)$.

NODE=M067W1;LINKAGE=SH
 NODE=M067W1;LINKAGE=AU

NODE=M067W;LINKAGE=HK

NODE=M067W;LINKAGE=A
 NODE=M067W;LINKAGE=E
 NODE=M067W;LINKAGE=C

NODE=M067W;LINKAGE=D

NODE=M067W2
 NODE=M067W2

PHOTOPRODUCTION

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

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

122±63	¹⁹ LINK	02K	FOCS	20–160	$\gamma p \rightarrow K^+ K^- p$
121±47	¹⁹ BUSENITZ	89	TPS		$\gamma p \rightarrow K^+ K^- X$
80±40	¹⁹ ATKINSON	85C	OMEG	20–70	$\gamma p \rightarrow K\bar{K}X$
100±40	¹⁹ ASTON	81F	OMEG	25–70	$\gamma p \rightarrow K^+ K^- X$

¹⁹ We list here a state decaying into K^+K^- possibly different from $\phi(1680)$.

NODE=M067W2;LINKAGE=LK

$p\bar{p}$ ANNIHILATION

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

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

143±24	²⁰ AMSLER	06	CBAR	0.9	$\bar{p}p \rightarrow K^+ K^- \pi^0$

²⁰ Could also be $\rho(1700)$.

NODE=M067W3
 NODE=M067W3

NODE=M067W3;LINKAGE=AM

$\phi(1680)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $K\bar{K}^*(892) + \text{c.c.}$	dominant
Γ_2 $K_S^0 K \pi$	seen
Γ_3 $K\bar{K}$	seen
Γ_4 $K_L^0 K_S^0$	
Γ_5 $e^+ e^-$	seen
Γ_6 $\omega \pi \pi$	not seen
Γ_7 $\phi \pi \pi$	
Γ_8 $K^+ K^- \pi^+ \pi^-$	seen
Γ_9 $\phi \eta$	
Γ_{10} $K^+ K^- \pi^0$	

DESIG=4;OUR EST;→ UNCHECKED ←
 DESIG=5;OUR EST;→ UNCHECKED ←
 DESIG=3;OUR EST;→ UNCHECKED ←
 DESIG=9
 DESIG=6;OUR EST;→ UNCHECKED ←
 DESIG=1;OUR EST;→ UNCHECKED ←
 DESIG=11
 DESIG=12;OUR EVAL;→ UNCHECKED ←
 DESIG=10
 DESIG=2

NODE=M067215;NODE=M067

$\phi(1680) \Gamma(i) \Gamma(e^+ e^-) / \Gamma^2(\text{total})$

This combination of a branching ratio into channel (i) and branching ratio into $e^+ e^-$ is directly measured and obtained from the cross section at the peak. We list only data that have not been used to determine the branching ratio into (i) or $e^+ e^-$.

NODE=M067223

NODE=M067223

$$\Gamma(K_L^0 K_S^0) / \Gamma_{\text{total}} \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_4 / \Gamma \times \Gamma_5 / \Gamma$$

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

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

0.131±0.059	948	²¹ AKHMETSHIN 03	CMD2	1.05–1.38	$e^+ e^- \rightarrow K_L^0 K_S^0$

²¹ From the combined fit of AKHMETSHIN 03 and MANE 81 also including ρ , ω , and ϕ . Neither isospin nor flavor structure known. Recalculated by us.

NODE=M067G5
 NODE=M067G5

NODE=M067G;LINKAGE=GK

$$\Gamma(K\bar{K}^*(892) + \text{c.c.}) / \Gamma_{\text{total}} \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_1 / \Gamma \times \Gamma_5 / \Gamma$$

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

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

1.15±0.16±0.01	²² AUBERT	08S	BABR	10.6	$e^+ e^- \rightarrow K\bar{K}^*(892)\gamma + \text{c.c.}$
3.29±1.57	²³ BISELLO	91C	DM2	1.35–2.40	$e^+ e^- \rightarrow K_S^0 K^\pm \pi^\mp$

²² From the simultaneous fit to the $K\bar{K}^*(892) + \text{c.c.}$ and $\phi\eta$ data from AUBERT 08S using the results of AUBERT 07AK.

²³ Recalculated by us with the published value of $B(K\bar{K}^*(892) + \text{c.c.}) \times \Gamma(e^+ e^-)$.

NODE=M067G6
 NODE=M067G6

NODE=M067G6;LINKAGE=AU

NODE=M067G;LINKAGE=GL

$$\Gamma(\phi\pi\pi)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_7/\Gamma \times \Gamma_5/\Gamma$$

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

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

$1.86 \pm 0.14 \pm 0.21$ 4.8k ²⁴ SHEN 09 BELL $10.6 e^+e^- \rightarrow K^+K^-\pi^+\pi^-\gamma$
²⁴ Multiplied by 3/2 to take into account the $\phi\pi^0\pi^0$ mode. Using $B(\phi \rightarrow K^+K^-) = (49.2 \pm 0.6)\%$.

NODE=M067G01
 NODE=M067G01

NODE=M067G01;LINKAGE=SH

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

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

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

$0.43 \pm 0.10 \pm 0.09$ ²⁵ AUBERT 08S BABR $10.6 e^+e^- \rightarrow \phi\eta\gamma$
²⁵ From the simultaneous fit to the $K\bar{K}^*(892) + \text{c.c.}$ and $\phi\eta$ data from AUBERT 08S using the results of AUBERT 07AK.

NODE=M067G7
 NODE=M067G7

NODE=M067G7;LINKAGE=AU

$\phi(1680)$ BRANCHING RATIOS

NODE=M067225

$$\Gamma(K\bar{K}^*(892) + \text{c.c.})/\Gamma(K_S^0 K\pi) \quad \Gamma_1/\Gamma_2$$

VALUE DOCUMENT ID TECN COMMENT

dominant MANE 82 DM1 $e^+e^- \rightarrow K_S^0 K^\pm \pi^\mp$

NODE=M067R3
 NODE=M067R3

$$\Gamma(K\bar{K})/\Gamma(K\bar{K}^*(892) + \text{c.c.}) \quad \Gamma_3/\Gamma_1$$

VALUE DOCUMENT ID TECN COMMENT

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

0.07 ± 0.01 BUON 82 DM1 e^+e^-

NODE=M067R2
 NODE=M067R2

$$\Gamma(\omega\pi\pi)/\Gamma(K\bar{K}^*(892) + \text{c.c.}) \quad \Gamma_6/\Gamma_1$$

VALUE DOCUMENT ID TECN COMMENT

<0.10 BUON 82 DM1 e^+e^-

NODE=M067R1
 NODE=M067R1

$$\Gamma(\phi\eta)/\Gamma(K\bar{K}^*(892) + \text{c.c.}) \quad \Gamma_9/\Gamma_1$$

VALUE DOCUMENT ID TECN COMMENT

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

≈ 0.37 ²⁶ AUBERT 08S BABR $10.6 e^+e^- \rightarrow \text{hadrons}$

²⁶ From the fit including data from AUBERT 07AK.

NODE=M067R5
 NODE=M067R5

NODE=M067R5;LINKAGE=AU

$\phi(1680)$ REFERENCES

NODE=M067

SHEN	09	PR D80 031101	C.P. Shen <i>et al.</i>	(BELLE Collab.)
AUBERT	08S	PR D77 092002	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT	07AK	PR D76 012008	B. Aubert <i>et al.</i>	(BABAR Collab.)
AMSLER	06	PL B639 165	C. Amsler <i>et al.</i>	(CBAR Collab.)
AKHMETSHIN	03	PL B551 27	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)
Also		PAN 65 1222	E.V. Anashkin, V.M. Aulchenko, R.R. Akhmetshin	
LINK	02K	PL B545 50	J.M. Link <i>et al.</i>	(FNAL FOCUS Collab.)
ACHASOV	98H	PR D57 4334	N.N. Achasov, A.A. Kozhevnikov	
CLEGG	94	ZPHY C62 455	A.B. Clegg, A. Donnachie	(LANC, MCHS)
ANTONELLI	92	ZPHY C56 15	A. Antonelli <i>et al.</i>	(DM2 Collab.)
BISELLO	91C	ZPHY C52 227	D. Bisello <i>et al.</i>	(DM2 Collab.)
DOLINSKY	91	PRPL 202 99	S.I. Dolinsky <i>et al.</i>	(NOVO)
BUSENITZ	89	PR D40 1	J.K. Busenitz <i>et al.</i>	(ILL, FNAL)
BISELLO	88B	ZPHY C39 13	D. Bisello <i>et al.</i>	(PADO, CLER, FRAS+)
BARKOV	87	JETPL 46 164	L.M. Barkov <i>et al.</i>	(NOVO)
ATKINSON	85C	ZPHY C27 233	M. Atkinson <i>et al.</i>	(BONN, CERN, GLAS+)
BUON	82	PL 118B 221	J. Buon <i>et al.</i>	(LALO, MONP)
MANE	82	PL 112B 178	F. Mane <i>et al.</i>	(LALO)
ASTON	81F	PL 104B 231	D. Aston	(BONN, CERN, EPOL, GLAS, LANC+)
IVANOV	81	PL 107B 297	P.M. Ivanov <i>et al.</i>	(NOVO)
MANE	81	PL 99B 261	F. Mane <i>et al.</i>	(ORSAY)

REFID=53000
 REFID=52242
 REFID=51908
 REFID=51136
 REFID=49172
 REFID=48827
 REFID=48845
 REFID=46323
 REFID=44081
 REFID=43168
 REFID=41867
 REFID=41369
 REFID=40927
 REFID=40581
 REFID=40280
 REFID=21596
 REFID=21494
 REFID=21590
 REFID=21585
 REFID=20553
 REFID=21588

$\rho_3(1690)$

$$I^G(J^{PC}) = 1^+(3^{--})$$

NODE=M015

 $\rho_3(1690)$ MASS

NODE=M015205

VALUE (MeV)

DOCUMENT ID

1688.8±2.1 OUR AVERAGE Includes data from the 5 datablocks that follow this one.

NODE=M015M

2 π MODE

VALUE (MeV)

EVTS

DOCUMENT ID

TECN

CHG

COMMENT

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

NODE=M015M1

NODE=M015M1

1686± 4 OUR AVERAGE

1677±14		EVANGELIS...	81	OMEG	—	12 $\pi^- p \rightarrow 2\pi p$
1679±11	476	BALTAY	78B	HBC	0	15 $\pi^+ p \rightarrow$ $\pi^+ \pi^- n$
1678±12	175	¹ ANTIPOV	77	CIBS	0	25 $\pi^- p \rightarrow p 3\pi$
1690± 7	600	¹ ENGLER	74	DBC	0	6 $\pi^+ n \rightarrow$ $\pi^+ \pi^- p$
1693± 8		² GRAYER	74	ASPK	0	17 $\pi^- p \rightarrow$ $\pi^+ \pi^- n$
1678±12		MATTHEWS	71C	DBC	0	7 $\pi^+ N$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
1734±10		³ CORDEN	79	OMEG		12–15 $\pi^- p \rightarrow$ $n 2\pi$
1692±12		^{2,4} ESTABROOKS	75	RVUE		17 $\pi^- p \rightarrow$ $\pi^+ \pi^- n$
1737±23		ARMENISE	70	DBC	0	9 $\pi^+ N$
1650±35	122	BARTSCH	70B	HBC	+	8 $\pi^+ p \rightarrow N 2\pi$
1687±21		STUNTEBECK	70	HDBC	0	8 $\pi^- p, 5.4 \pi^+ d$
1683±13		ARMENISE	68	DBC	0	5.1 $\pi^+ d$
1670±30		GOLDBERG	65	HBC	0	6 $\pi^+ d, 8 \pi^- p$

¹ Mass errors enlarged by us to $\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.² Uses same data as HYAMS 75.³ From a phase shift solution containing a $f'_2(1525)$ width two times larger than the $K\bar{K}$ result.⁴ From phase-shift analysis. Error takes account of spread of different phase-shift solutions.

NODE=M015M1;LINKAGE=E

NODE=M015M1;LINKAGE=G

NODE=M015M1;LINKAGE=M

NODE=M015M1;LINKAGE=I

 $K\bar{K}$ AND $K\bar{K}\pi$ MODES

VALUE (MeV)

EVTS

DOCUMENT ID

TECN

CHG

COMMENT

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

NODE=M015M2

NODE=M015M2

1696± 4 OUR AVERAGE

1699± 5		ALPER	80	CNTR	0	62 $\pi^- p \rightarrow$ $K^+ K^- n$
1698±12	6k	^{5,6} MARTIN	78D	SPEC		10 $\pi p \rightarrow$ $K_S^0 K^- p$
1692± 6		BLUM	75	ASPK	0	18.4 $\pi^- p \rightarrow$ $n K^+ K^-$
1690±16		ADERHOLZ	69	HBC	+	8 $\pi^+ p \rightarrow K\bar{K}\pi$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
1694± 8		⁷ COSTA...	80	OMEG		10 $\pi^- p \rightarrow$ $K^+ K^- n$

⁵ From a fit to $J^P = 3^-$ partial wave.⁶ Systematic error on mass scale subtracted.⁷ They cannot distinguish between $\rho_3(1690)$ and $\omega_3(1670)$.

NODE=M015M2;LINKAGE=P

NODE=M015M2;LINKAGE=S

NODE=M015M2;LINKAGE=L

(4 π) $^\pm$ MODE

VALUE (MeV)

EVTS

DOCUMENT ID

TECN

CHG

COMMENT

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

NODE=M015M3

NODE=M015M3

1686± 5 OUR AVERAGE Error includes scale factor of 1.1.

1694± 6		⁸ EVANGELIS...	81	OMEG	—	12 $\pi^- p \rightarrow p 4\pi$
1665±15	177	BALTAY	78B	HBC	+	15 $\pi^+ p \rightarrow p 4\pi$
1670±10		THOMPSON	74	HBC	+	13 $\pi^+ p$
1687±20		CASON	73	HBC	—	8,18.5 $\pi^- p$
1685±14		⁹ CASON	73	HBC	—	8,18.5 $\pi^- p$
1680±40	144	BARTSCH	70B	HBC	+	8 $\pi^+ p \rightarrow N 4\pi$
1689±20	102	⁹ BARTSCH	70B	HBC	+	8 $\pi^+ p \rightarrow N 2\rho$
1705±21		CASO	70	HBC	—	11.2 $\pi^- p \rightarrow$ $n \rho 2\pi$

OCCUR=2

OCCUR=3

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

1718±10		¹⁰ EVANGELIS...	81	OMEG	—	12 $\pi^- p \rightarrow p4\pi$
1673± 9		¹¹ EVANGELIS...	81	OMEG	—	12 $\pi^- p \rightarrow p4\pi$
1733± 9	66	⁹ KLIGER	74	HBC	—	4.5 $\pi^- p \rightarrow p4\pi$
1630±15		HOLMES	72	HBC	+	10–12 $K^+ p$
1720±15		BALTAY	68	HBC	+	7, 8.5 $\pi^+ p$

OCCUR=2

OCCUR=3

⁸ From $\rho^- \rho^0$ mode, not independent of the other two EVANGELISTA 81 entries.

⁹ From $\rho^\pm \rho^0$ mode.

¹⁰ From $a_2(1320)^- \pi^0$ mode, not independent of the other two EVANGELISTA 81 entries.

¹¹ From $a_2(1320)^0 \pi^-$ mode, not independent of the other two EVANGELISTA 81 entries.

NODE=M015M3;LINKAGE=A

NODE=M015M3;LINKAGE=F

NODE=M015M3;LINKAGE=B

NODE=M015M3;LINKAGE=C

$\omega\pi$ MODE

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT

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

NODE=M015M5

NODE=M015M5

1681± 7 OUR AVERAGE

1670±25		¹² ALDE	95	GAM2		38 $\pi^- p \rightarrow \omega\pi^0 n$
1690±15		EVANGELIS...	81	OMEG	—	12 $\pi^- p \rightarrow \omega\pi p$
1666±14		GESSAROLI	77	HBC		11 $\pi^- p \rightarrow \omega\pi p$
1686± 9		THOMPSON	74	HBC	+	13 $\pi^+ p$

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

1654±24		BARNHAM	70	HBC	+	10 $K^+ p \rightarrow \omega\pi X$

¹² Supersedes ALDE 92C.

NODE=M015M5;LINKAGE=A

$\eta\pi^+\pi^-$ MODE

(For difficulties with MMS experiments, see the $a_2(1320)$ mini-review in the 1973 edition.)

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT

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

NODE=M015M6

NODE=M015M6

NODE=M015M6

1682±12 OUR AVERAGE

1685±10±20		AMELIN	00	VES		37 $\pi^- p \rightarrow \eta\pi^+\pi^- n$
1680±15		FUKUI	88	SPEC	0	8.95 $\pi^- p \rightarrow \eta\pi^+\pi^- n$

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

1700±47		¹³ ANDERSON	69	MMS	—	16 $\pi^- p$ 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

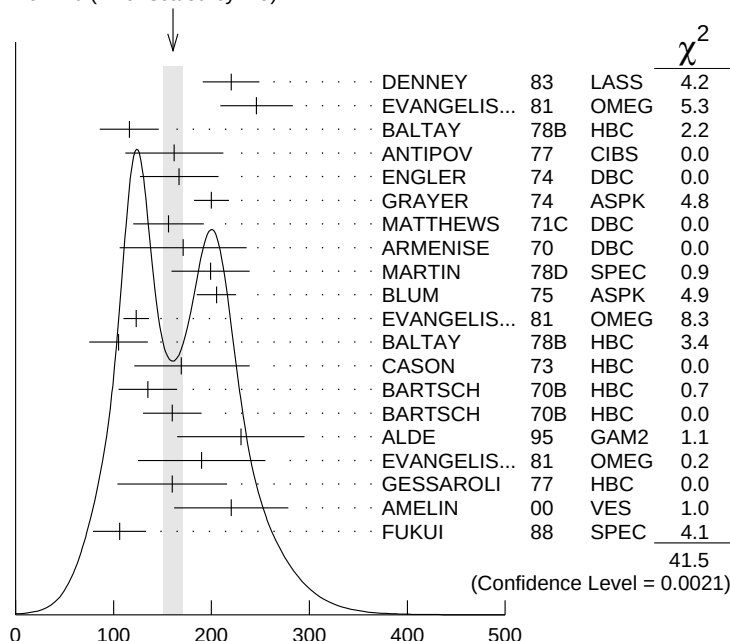
VALUE (MeV)	DOCUMENT ID

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

WEIGHTED AVERAGE
161±10 (Error scaled by 1.5)



$\rho_3(1690)$ width, 2π , $K\bar{K}$, and $K\bar{K}\pi$ modes (MeV)

2 π MODE

VALUE (MeV) EVTS DOCUMENT ID TECN CHG COMMENT

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

NODE=M015W1

NODE=M015W1

186±14 OUR AVERAGE Error includes scale factor of 1.3. See the ideogram below.

220±29		DENNEY	83	LASS		10 $\pi^+ N$
246±37		EVANGELIS...	81	OMEG	—	12 $\pi^- p \rightarrow 2\pi p$
116±30	476	BALTAY	78B	HBC	0	15 $\pi^+ p \rightarrow$ $\pi^+ \pi^- n$
162±50	175	¹⁵ ANTIPOV	77	CIBS	0	25 $\pi^- p \rightarrow p 3\pi$
167±40	600	ENGLER	74	DBC	0	6 $\pi^+ n \rightarrow$ $\pi^+ \pi^- p$
200±18		¹⁶ GRAYER	74	ASPK	0	17 $\pi^- p \rightarrow$ $\pi^+ \pi^- n$
156±36		MATTHEWS	71C	DBC	0	7 $\pi^+ N$
171±65		ARMENISE	70	DBC	0	9 $\pi^+ d$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
322±35		¹⁷ CORDEN	79	OMEG		12–15 $\pi^- p \rightarrow$ $n 2\pi$
240±30		^{16,18} ESTABROOKS	75	RVUE		17 $\pi^- p \rightarrow$ $\pi^+ \pi^- n$
180±30	122	BARTSCH	70B	HBC	+	8 $\pi^+ p \rightarrow N 2\pi$
267 ⁺⁷² –46		STUNTEBECK	70	HDBC	0	8 $\pi^- p, 5.4 \pi^+ d$
188±49		ARMENISE	68	DBC	0	5.1 $\pi^+ d$
180±40		GOLDBERG	65	HBC	0	6 $\pi^+ d, 8 \pi^- p$

¹⁵ Width errors enlarged by us to $4\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.

¹⁶ Uses same data as HYAMS 75 and BECKER 79.

¹⁷ From a phase shift solution containing a $f'_2(1525)$ width two times larger than the $K\bar{K}$ result.

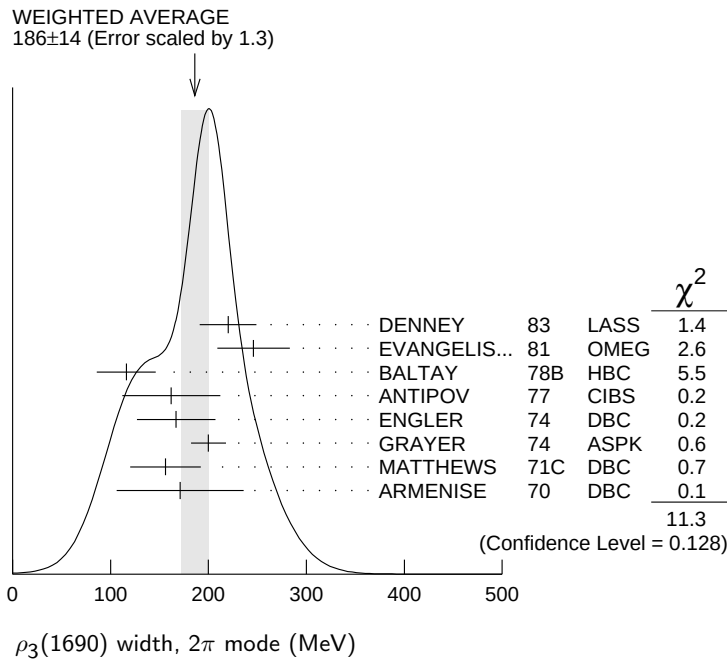
¹⁸ From phase-shift analysis. Error takes account of spread of different phase-shift solutions.

NODE=M015W1;LINKAGE=T

NODE=M015W1;LINKAGE=G

NODE=M015W1;LINKAGE=M

NODE=M015W1;LINKAGE=I



$K\bar{K}$ AND $K\bar{K}\pi$ MODES

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

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

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;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	—	$7-12 \pi^- p \rightarrow \rho\text{MM}$

OCCUR=2

OCCUR=3

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;LINKAGE=R

NODE=M015W6;LINKAGE=N

 $\rho_3(1690)$ DECAY MODES

NODE=M015215;NODE=M015

Mode	Fraction (Γ_i/Γ)	Scale factor
Γ_1 4π	(71.1 ± 1.9) %	
Γ_2 $\pi^\pm\pi^+\pi^-\pi^0$	(67 ± 22) %	
Γ_3 $\omega\pi$	(16 ± 6) %	
Γ_4 $\pi\pi$	(23.6 ± 1.3) %	
Γ_5 $K\bar{K}\pi$	(3.8 ± 1.2) %	
Γ_6 $K\bar{K}$	(1.58 ± 0.26) %	1.2
Γ_7 $\eta\pi^+\pi^-$	seen	
Γ_8 $\rho(770)\eta$	seen	
Γ_9 $\pi\pi\rho$	seen	
Excluding 2ρ and $a_2(1320)\pi$.		
Γ_{10} $a_2(1320)\pi$	seen	
Γ_{11} $\rho\rho$	seen	
Γ_{12} $\phi\pi$		
Γ_{13} $\eta\pi$		
Γ_{14} $\pi^\pm 2\pi^+ 2\pi^- \pi^0$		

DESIG=2

DESIG=11

DESIG=7

DESIG=1

DESIG=3

DESIG=4

DESIG=13

DESIG=14;OUR EST;→ UNCHECKED ←

DESIG=5;OUR EST;→ UNCHECKED ←

DESIG=6;OUR EST;→ UNCHECKED ←

DESIG=8;OUR EST;→ UNCHECKED ←

DESIG=9

DESIG=10

DESIG=12

CONSTRAINED FIT INFORMATION

An overall fit to 5 branching ratios uses 10 measurements and one constraint to determine 4 parameters. The overall fit has a $\chi^2 = 14.7$ for 7 degrees of freedom.

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

x_4	-77		
x_5	-74	17	
x_6	-15	2	0
	x_1	x_4	x_5

$\rho_3(1690)$ BRANCHING RATIOS

NODE=M015220

$\Gamma(\pi\pi)/\Gamma_{\text{total}}$					Γ_4/Γ
VALUE	DOCUMENT ID	TECN	CHG	COMMENT	
0.236$\pm$0.013 OUR FIT					
0.243$\pm$0.013 OUR AVERAGE					
0.259 ^{+0.018} _{-0.019}	BECKER	79	ASPK	0	17 $\pi^- p$ polarized
0.23 $\pm$ 0.02	CORDEN	79	OMEG		12-15 $\pi^- p \rightarrow n^2\pi$
0.22 $\pm$ 0.04	²⁸ MATTHEWS	71C	HDBC	0	7 $\pi^+ n \rightarrow \pi^- p$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.245 $\pm$ 0.006	²⁹ ESTABROOKS	75	RVUE		17 $\pi^- p \rightarrow \pi^+ \pi^- n$

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$\pm$0.11	CASON	73	HBC	-	8,18.5 $\pi^- p$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.2	HOLMES	72	HBC	+	10-12 $K^+ p$
<0.12	BALLAM	71B	HBC	-	16 $\pi^- p$

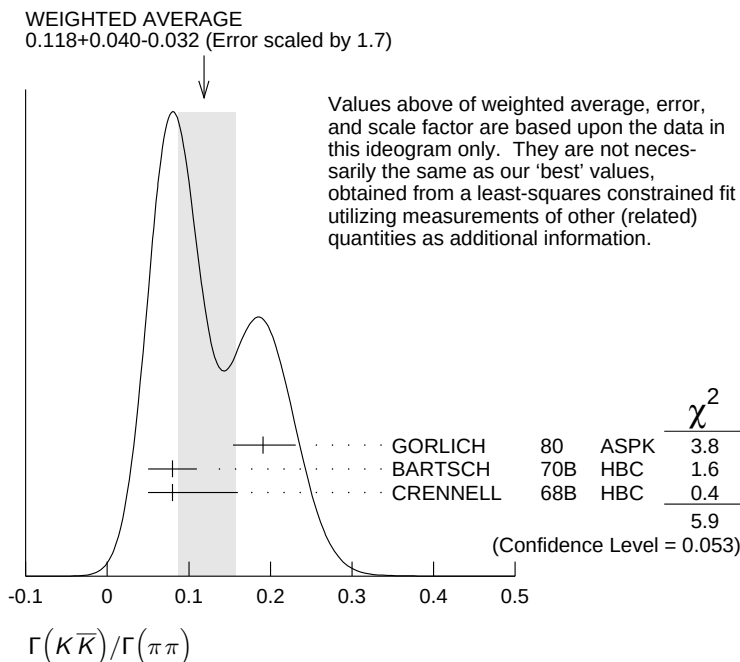
NODE=M015R2
NODE=M015R2

$\Gamma(\pi\pi)/\Gamma(4\pi)$					Γ_4/Γ_1
VALUE	DOCUMENT ID	TECN	CHG	COMMENT	
0.332$\pm$0.026 OUR FIT	Error includes scale factor of 1.1.				
0.30 $\pm$ 0.10	BALTAY	78B	HBC	0	15 $\pi^+ p \rightarrow p 4\pi$

NODE=M015R3
NODE=M015R3

$\Gamma(K\bar{K})/\Gamma(\pi\pi)$					Γ_6/Γ_4
VALUE	DOCUMENT ID	TECN	CHG	COMMENT	
0.067$\pm$0.011 OUR FIT	Error includes scale factor of 1.2.				
0.118^{+0.040}_{-0.032} OUR AVERAGE	Error includes scale factor of 1.7. See the ideogram below.				
0.191 ^{+0.040} _{-0.037}	GORLICH	80	ASPK	0	17,18 $\pi^- p$ polarized
0.08 $\pm$ 0.03	BARTSCH	70B	HBC	+	8 $\pi^+ p$
0.08 ^{+0.08} _{-0.03}	CRENNELL	68B	HBC		6.0 $\pi^- p$

NODE=M015R4
NODE=M015R4

 $\Gamma(K\bar{K}\pi)/\Gamma(\pi\pi)$ Γ_5/Γ_4

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
0.16±0.05 OUR FIT				
0.16±0.05	³⁰ BARTSCH	70B	HBC	+ 8 $\pi^+ p$

NODE=M015R5
NODE=M015R5

³⁰ Increased by us to correspond to $B(\rho_3(1690) \rightarrow \pi\pi)=0.24$.

NODE=M015R5;LINKAGE=A

$$[\Gamma(\pi\pi\rho) + \Gamma(a_2(1320)\pi) + \Gamma(\rho\rho)]/\Gamma(\pi^\pm\pi^+\pi^-\pi^0) \quad (\Gamma_9+\Gamma_{10}+\Gamma_{11})/\Gamma_2$$

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
0.94±0.09 OUR AVERAGE				
0.96±0.21	BALTAY	78B	HBC	+ 15 $\pi^+ p \rightarrow p4\pi$
0.88±0.15	BALLAM	71B	HBC	- 16 $\pi^- p$
1 ±0.15	BARTSCH	70B	HBC	+ 8 $\pi^+ p$
consistent with 1	CASO	68	HBC	- 11 $\pi^- p$

NODE=M015R6
NODE=M015R6

 $\Gamma(\rho\rho)/\Gamma(\pi^\pm\pi^+\pi^-\pi^0)$ Γ_{11}/Γ_2

VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
0.12±0.11		BALTAY	78B	HBC	+ 15 $\pi^+ p \rightarrow p4\pi$
0.56	66	KLIGER	74	HBC	- 4.5 $\pi^- p \rightarrow p4\pi$
0.13±0.09		³¹ THOMPSON	74	HBC	+ 13 $\pi^+ p$
0.7 ±0.15		BARTSCH	70B	HBC	+ 8 $\pi^+ p$

NODE=M015R7
NODE=M015R7

³¹ $\rho\rho$ and $a_2(1320)\pi$ modes are indistinguishable.

NODE=M015R7;LINKAGE=T

$$\Gamma(\rho\rho)/[\Gamma(\pi\pi\rho) + \Gamma(a_2(1320)\pi) + \Gamma(\rho\rho)] \quad \Gamma_{11}/(\Gamma_9+\Gamma_{10}+\Gamma_{11})$$

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
0.48±0.16	CASO	68	HBC	- 11 $\pi^- p$

NODE=M015R8
NODE=M015R8

 $\Gamma(a_2(1320)\pi)/\Gamma(\pi^\pm\pi^+\pi^-\pi^0)$ Γ_{10}/Γ_2

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
0.66±0.08	BALTAY	78B	HBC	+ 15 $\pi^+ p \rightarrow p4\pi$
0.36±0.14	³² THOMPSON	74	HBC	+ 13 $\pi^+ p$
not seen	CASON	73	HBC	- 8,18.5 $\pi^- p$
0.6 ±0.15	BARTSCH	70B	HBC	+ 8 $\pi^+ p$
0.6	BALTAY	68	HBC	+ 7,8.5 $\pi^+ p$

NODE=M015R9
NODE=M015R9

³² $\rho\rho$ and $a_2(1320)\pi$ modes are indistinguishable.

NODE=M015R9;LINKAGE=T

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

$$\Gamma_3/\Gamma_2$$

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 de Beauregard <i>et al.</i>	(BARI, BONN+)
GORLICH	80	NP B174 16	L. Gorlich <i>et al.</i>	(CRAC, MPIM, CERN+)
BECKER	79	NP B151 46	H. Becker <i>et al.</i>	(MPIM, CERN, ZEEM, CRAC)
CORDEN	79	NP B157 250	M.J. Corden <i>et al.</i>	(BIRM, RHEL, TELA+) JP
BALTAY	78B	PR D17 62	C. Baltay <i>et al.</i>	(COLU, BING)
MARTIN	78B	NP B140 158	A.D. Martin <i>et al.</i>	(DURH, GEVA)
MARTIN	78D	PL 74B 417	A.D. Martin <i>et al.</i>	(DURH, GEVA)
ANTIPOV	77	NP B119 45	Y.M. Antipov <i>et al.</i>	(SERP, GEVA)
GESSAROLI	77	NP B126 382	R. Gessaroli <i>et al.</i>	(BGNA, FIRZ, GENO+)
BLUM	75	PL 57B 403	W. Blum <i>et al.</i>	(CERN, MPIM) JP
ESTABROOKS	75	NP B95 322	P.G. Estabrooks, A.D. Martin	(DURH)
HYAMS	75	NP B100 205	B.D. Hyams <i>et al.</i>	(CERN, MPIM)
ENGLER	74	PR D10 2070	A. Engler <i>et al.</i>	(CMU, CASE)

REFID=47432
REFID=44371
REFID=41859
REFID=40273
REFID=20754
REFID=20462
REFID=21665
REFID=20737
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REFID=21265
REFID=21273
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+)

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REFID=21617
REFID=20402
REFID=21601

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±20 OUR ESTIMATE

NODE=M065M0

NODE=M065M0

→ UNCHECKED ←

 $\eta\rho^0$ MODE

VALUE (MeV)

DOCUMENT ID

TECN

COMMENT

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

NODE=M065M6

NODE=M065M6

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

1740±20	ANTONELLI	88	DM2	$e^+e^- \rightarrow \eta\pi^+\pi^-$
1701±15	¹ FUKUI	88	SPEC	$8.95 \pi^- p \rightarrow \eta\pi^+\pi^- n$

¹ Assuming $\rho^+ f_0(1370)$ decay mode interferes with $a_1(1260)^+ \pi$ background. From a two Breit-Wigner fit.

NODE=M065M;LINKAGE=B

 $\pi\pi$ MODE

VALUE (MeV)

EVTS

DOCUMENT ID

TECN

COMMENT

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

NODE=M065M1

NODE=M065M1

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

1780 ±20 ⁺¹⁵ ₋₂₀	63.5k	² ABRAMOWICZ12	ZEUS	$ep \rightarrow e\pi^+\pi^- p$
1861 ±17		³ LEES	12G	$BABR \ e^+e^- \rightarrow \pi^+\pi^-\gamma$
1728 ±17 ±89	5.4M	^{4,5} FUJIKAWA	08	$BELL \ \tau^- \rightarrow \pi^-\pi^0\nu_\tau$
1780 ⁺³⁷ ₋₂₉		⁶ ABELE	97	$CBAR \ \bar{p}n \rightarrow \pi^-\pi^0\pi^0$
1719 ±15		⁶ BERTIN	97C	$OBLX \ 0.0 \ \bar{p}p \rightarrow \pi^+\pi^-\pi^0$
1730 ±30		CLEGG	94	$RVUE \ e^+e^- \rightarrow \pi^+\pi^-$
1768 ±21		BISELLO	89	$DM2 \ e^+e^- \rightarrow \pi^+\pi^-$
1745.7±91.9		DUBNICKA	89	$RVUE \ e^+e^- \rightarrow \pi^+\pi^-$
1546 ±26		GESHKEN...	89	$RVUE$
1650		⁷ ERKAL	85	$RVUE \ 20-70 \ \gamma p \rightarrow \gamma\pi$
1550 ±70		ABE	84B	$HYBR \ 20 \ \gamma p \rightarrow \pi^+\pi^- p$
1590 ±20		⁸ ASTON	80	$OMEG \ 20-70 \ \gamma p \rightarrow p2\pi$
1600 ±10		⁹ ATIYA	79B	$SPEC \ 50 \ \gamma C \rightarrow C2\pi$
1598 ⁺²⁴ ₋₂₂		BECKER	79	$ASPK \ 17 \ \pi^- p \text{ polarized}$
1659 ±25		⁷ LANG	79	$RVUE$
1575		⁷ MARTIN	78C	$RVUE \ 17 \ \pi^- p \rightarrow \pi^+\pi^- n$
1610 ±30		⁷ FROGGATT	77	$RVUE \ 17 \ \pi^- p \rightarrow \pi^+\pi^- n$
1590 ±20		¹⁰ HYAMS	73	$ASPK \ 17 \ \pi^- p \rightarrow \pi^+\pi^- n$

- ² Using the KUHN 90 parametrization of the pion form factor, neglecting $\rho-\omega$ interference.
³ Using the GOUNARIS 68 parametrization of the pion form factor leaving the masses and widths of the $\rho(1450)$, $\rho(1700)$, and $\rho(2150)$ resonances as free parameters of the fit.
⁴ $|F_\pi(0)|^2$ fixed to 1.
⁵ From the GOUNARIS 68 parametrization of the pion form factor.
⁶ T-matrix pole.
⁷ From phase shift analysis of HYAMS 73 data.
⁸ Simple relativistic Breit-Wigner fit with constant width.
⁹ An additional 40 MeV uncertainty in both the mass and width is present due to the choice of the background shape.
¹⁰ Included in BECKER 79 analysis.

$\pi\omega$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
1708 ± 41	7815	¹¹ ACHASOV	13 SND	1.05–2.00 $e^+e^- \rightarrow \pi^0\pi^0\gamma$
1550 to 1620		¹² ACHASOV	00i SND	$e^+e^- \rightarrow \pi^0\pi^0\gamma$
1580 to 1710		¹³ ACHASOV	00i SND	$e^+e^- \rightarrow \pi^0\pi^0\gamma$
1710 ± 90		ACHASOV	97 RVUE	$e^+e^- \rightarrow \omega\pi^0$

- ¹¹ 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.
¹² 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.
¹³ Taking into account the $\rho(1700)$ contribution only. Using the data of ACHASOV 00i on $e^+e^- \rightarrow \omega\pi^0$ and of EDWARDS 00A on $\tau^- \rightarrow \omega\pi^-\nu_\tau$.

$K\bar{K}$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
1740.8 ± 22.2	27k	¹⁴ ABELE	99D CBAR	±	0.0 $\bar{p}p \rightarrow K^+K^-\pi^0$
1582 ± 36	1600	CLELAND	82B SPEC	±	50 $\pi p \rightarrow K_S^0 K^\pm p$

- ¹⁴ 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 ⁺ ₂₄		ACHASOV	97 RVUE	$e^+e^- \rightarrow 2(\pi^+\pi^-)$
1570 ± 20		¹⁵ CORDIER	82 DM1	$e^+e^- \rightarrow 2(\pi^+\pi^-)$
1520 ± 30		¹⁶ ASTON	81E OMEG	20–70 $\gamma p \rightarrow p4\pi$
1654 ± 25		¹⁷ DIBIANCA	81 DBC	$\pi^+d \rightarrow pp2(\pi^+\pi^-)$
1666 ± 39		¹⁵ BACCI	80 FRAG	$e^+e^- \rightarrow 2(\pi^+\pi^-)$
1780	34	KILLIAN	80 SPEC	11 $e^-p \rightarrow 2(\pi^+\pi^-)$
1500		¹⁸ ATIYA	79B SPEC	50 $\gamma C \rightarrow C4\pi^\pm$
1570 ± 60	65	¹⁹ ALEXANDER	75 HBC	7.5 $\gamma p \rightarrow p4\pi$
1550 ± 60		¹⁶ 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 $\gamma p \rightarrow p4\pi$

- ¹⁵ Simple relativistic Breit-Wigner fit with model dependent width.
¹⁶ Simple relativistic Breit-Wigner fit with constant width.
¹⁷ One peak fit result.
¹⁸ Parameters roughly estimated, not from a fit.
¹⁹ 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

$3(\pi^+\pi^-)$ 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	²⁰ FRABETTI	04 E687	$\gamma p \rightarrow 3\pi^+3\pi^-p$
1783 ± 15	CLEGG	90 RVUE	$e^+e^- \rightarrow 3(\pi^+\pi^-)2(\pi^+\pi^-\pi^0)$
²⁰ From a fit with two resonances with the JACOB 72 continuum.			

NODE=M065M1;LINKAGE=AB
 NODE=M065M1;LINKAGE=LE

NODE=M065M1;LINKAGE=FU
 NODE=M065M1;LINKAGE=GO
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 NODE=M065M;LINKAGE=P
 NODE=M065M;LINKAGE=M
 NODE=M065M;LINKAGE=R

NODE=M065M;LINKAGE=H

NODE=M065M8
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OCCUR=2

NODE=M065M8;LINKAGE=AC

NODE=M065M;LINKAGE=I1

NODE=M065M;LINKAGE=I2

NODE=M065M2
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NODE=M065M2;LINKAGE=AN

NODE=M065M4
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OCCUR=2

NODE=M065M;LINKAGE=A
 NODE=M065M4;LINKAGE=M
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 NODE=M065M;LINKAGE=C
 NODE=M065M;LINKAGE=D

NODE=M065M5
 NODE=M065M5

NODE=M065M7
 NODE=M065M7

NODE=M065M;LINKAGE=PI

$\rho(1700)$ WIDTH **$\eta\rho^0$ AND $\pi^+\pi^-$ MODES**

VALUE (MeV)

DOCUMENT ID

250 $\pm$ 100 OUR ESTIMATE

NODE=M065210

NODE=M065W0
NODE=M065W0

→ UNCHECKED ←

 $\eta\rho^0$ MODE

VALUE (MeV)

DOCUMENT ID

TECN

COMMENT

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

NODE=M065W6
NODE=M065W6

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

150 $\pm$ 30	ANTONELLI	88	DM2	$e^+e^- \rightarrow \eta\pi^+\pi^-$
282 $\pm$ 44	²¹ FUKUI	88	SPEC	8.95 $\pi^-p \rightarrow \eta\pi^+\pi^-n$

²¹ Assuming $\rho^+ f_0(1370)$ decay mode interferes with $a_1(1260)^+\pi$ background. From a two Breit-Wigner fit.

NODE=M065W;LINKAGE=B

 $\pi\pi$ MODE

VALUE (MeV)

EVTS

DOCUMENT ID

TECN

COMMENT

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

NODE=M065W1
NODE=M065W1

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

310 $\pm$ 30	$^{+25}_{-35}$	63.5k	²² ABRAMOWICZ12	ZEUS	$ep \rightarrow e\pi^+\pi^-p$
316 $\pm$ 26			²³ LEES	12G BABR	$e^+e^- \rightarrow \pi^+\pi^-\gamma$
164 $\pm$ 21	$^{+89}_{-26}$	5.4M	^{24,25} FUJIKAWA	08 BELL	$\tau^- \rightarrow \pi^-\pi^0\nu_\tau$
275 $\pm$ 45			²⁶ ABELE	97 CBAR	$\bar{p}n \rightarrow \pi^-\pi^0\pi^0$
310 $\pm$ 40			²⁶ BERTIN	97C OBLX	0.0 $\bar{p}p \rightarrow \pi^+\pi^-\pi^0$
400 $\pm$ 100			CLEGG	94 RVUE	$e^+e^- \rightarrow \pi^+\pi^-$
224 $\pm$ 22			BISELLO	89 DM2	$e^+e^- \rightarrow \pi^+\pi^-$
242.5 $\pm$ 163.0			DUBNICKA	89 RVUE	$e^+e^- \rightarrow \pi^+\pi^-$
620 $\pm$ 60			GESHKEN...	89 RVUE	
<315			²⁷ ERKAL	85 RVUE	20-70 $\gamma p \rightarrow \gamma\pi$
280 $^{+30}_{-80}$			ABE	84B HYBR	20 $\gamma p \rightarrow \pi^+\pi^-p$
230 $\pm$ 80			²⁸ ASTON	80 OMEG	20-70 $\gamma p \rightarrow p2\pi$
283 $\pm$ 14			²⁹ ATIYA	79B SPEC	50 $\gamma C \rightarrow C2\pi$
175 $^{+98}_{-53}$			BECKER	79 ASPK	17 π^-p polarized
232 $\pm$ 34			²⁷ LANG	79 RVUE	
340			²⁷ MARTIN	78C RVUE	17 $\pi^-p \rightarrow \pi^+\pi^-n$
300 $\pm$ 100			²⁷ FROGGATT	77 RVUE	17 $\pi^-p \rightarrow \pi^+\pi^-n$
180 $\pm$ 50			³⁰ HYAMS	73 ASPK	17 $\pi^-p \rightarrow \pi^+\pi^-n$

²² Using the KUHN 90 parametrization of the pion form factor, neglecting $\rho-\omega$ interference.²³ 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.²⁴ $|F_\pi(0)|^2$ fixed to 1.²⁵ From the GOUNARIS 68 parametrization of the pion form factor.²⁶ T-matrix pole.²⁷ From phase shift analysis of HYAMS 73 data.²⁸ Simple relativistic Breit-Wigner fit with constant width.²⁹ An additional 40 MeV uncertainty in both the mass and width is present due to the choice of the background shape.³⁰ Included in BECKER 79 analysis.NODE=M065W1;LINKAGE=AB
NODE=M065W1;LINKAGE=LENODE=M065W1;LINKAGE=FU
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NODE=M065W;LINKAGE=R

NODE=M065W;LINKAGE=H

 $K\bar{K}$ MODE

VALUE (MeV)

EVTS

DOCUMENT ID

TECN

CHG

COMMENT

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

187.2 $\pm$ 26.7	27k	³¹ ABELE	99D	CBAR	$\pm$ 0.0 $\bar{p}p \rightarrow K^+K^-\pi^0$
265 $\pm$ 120	1600	CLELAND	82B	SPEC	$\pm$ 50 $\pi p \rightarrow K_S^0 K^\pm p$

³¹ 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		32 CORDIER	82 DM1	$e^+e^- \rightarrow 2(\pi^+\pi^-)$
400 ± 50		33 ASTON	81E OMEG	20–70 $\gamma p \rightarrow p4\pi$
400 ± 146		34 DIBIANCA	81 DBC	$\pi^+d \rightarrow pp2(\pi^+\pi^-)$
700 ± 160		32 BACCI	80 FRAG	$e^+e^- \rightarrow 2(\pi^+\pi^-)$
100	34	KILLIAN	80 SPEC	11 $e^-p \rightarrow 2(\pi^+\pi^-)$
600		35 ATIYA	79B SPEC	50 $\gamma C \rightarrow C4\pi^\pm$
340 ± 160	65	36 ALEXANDER	75 HBC	7.5 $\gamma p \rightarrow p4\pi$
360 ± 100		33 CONVERSI	74 OSPK	$e^+e^- \rightarrow 2(\pi^+\pi^-)$
400 ± 120	160	37 SCHACHT	74 STRC	5.5–9 $\gamma p \rightarrow p4\pi$
850 ± 200	340	37 SCHACHT	74 STRC	9–18 $\gamma p \rightarrow p4\pi$
650 ± 100	400	BINGHAM	72B HBC	9.3 $\gamma p \rightarrow p4\pi$

32 Simple relativistic Breit-Wigner fit with model-dependent width.

33 Simple relativistic Breit-Wigner fit with constant width.

34 One peak fit result.

35 Parameters roughly estimated, not from a fit.

36 Skew mass distribution compensated by Ross-Stodolsky factor.

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

 $\pi^+\pi^-\pi^0\pi^0$ MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
300 ± 50	ATKINSON	85B OMEG	20–70 γp

 $\omega\pi^0$ MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
350 to 580	38 ACHASOV	00I SND	$e^+e^- \rightarrow \pi^0\pi^0\gamma$
490 to 1040	39 ACHASOV	00I SND	$e^+e^- \rightarrow \pi^0\pi^0\gamma$

38 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.

39 Taking into account the $\rho(1700)$ contribution only. Using the data of ACHASOV 00I on $e^+e^- \rightarrow \omega\pi^0$ and of EDWARDS 00A on $\tau^- \rightarrow \omega\pi^- \nu_\tau$.

3($\pi^+\pi^-\pi^0$) AND 2($\pi^+\pi^-\pi^0$) MODES

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
315 ± 100	40 FRABETTI	04 E687	$\gamma p \rightarrow 3\pi^+3\pi^-p$
285 ± 20	CLEGG	90 RVUE	$e^+e^- \rightarrow 3(\pi^+\pi^-)2(\pi^+\pi^-\pi^0)$

40 From a fit with two resonances with the JACOB 72 continuum.

 $\rho(1700)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 4π	
Γ_2 $2(\pi^+\pi^-)$	large
Γ_3 $\rho\pi\pi$	dominant
Γ_4 $\rho^0\pi^+\pi^-$	large
Γ_5 $\rho^0\pi^0\pi^0$	
Γ_6 $\rho^\pm\pi^\mp\pi^0$	large
Γ_7 $a_1(1260)\pi$	seen
Γ_8 $h_1(1170)\pi$	seen
Γ_9 $\pi(1300)\pi$	seen
Γ_{10} $\rho\rho$	seen
Γ_{11} $\pi^+\pi^-$	seen
Γ_{12} $\pi\pi$	seen
Γ_{13} $K\bar{K}^*(892) + \text{c.c.}$	seen
Γ_{14} $\eta\rho$	seen
Γ_{15} $a_2(1320)\pi$	not seen
Γ_{16} $K\bar{K}$	seen
Γ_{17} e^+e^-	seen
Γ_{18} $\pi^0\omega$	seen

NODE=M065W4
NODE=M065W4

OCCUR=2

NODE=M065W;LINKAGE=A
NODE=M065W4;LINKAGE=M
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NODE=M065W5
NODE=M065W5

NODE=M065W9
NODE=M065W9

OCCUR=2

NODE=M065W;LINKAGE=I1

NODE=M065W;LINKAGE=I2

NODE=M065W7
NODE=M065W7

NODE=M065W;LINKAGE=PI

NODE=M065215;NODE=M065

DESIG=20

DESIG=2;OUR EST;→ UNCHECKED ←

DESIG=12;OUR EST;→ UNCHECKED ←

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DESIG=7

DESIG=9;OUR EST;→ UNCHECKED ←

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DESIG=13;OUR EST;→ UNCHECKED ←

DESIG=10;OUR EST;→ UNCHECKED ←

DESIG=11;OUR EST;→ UNCHECKED ←

DESIG=14;OUR EST;→ UNCHECKED ←

DESIG=5;OUR EST;→ UNCHECKED ←

DESIG=8;OUR EST;→ UNCHECKED ←

DESIG=6;OUR EST;→ UNCHECKED ←

$$\rho(1700) \Gamma(i) \Gamma(e^+ e^-) / \Gamma(\text{total})$$

This combination of a partial width with the partial width into $e^+ e^-$ and with the total width is obtained from the cross-section into channel_i in $e^+ e^-$ annihilation.

NODE=M065225

NODE=M065225

$$\Gamma(2(\pi^+ \pi^-)) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_2 \Gamma_{17} / \Gamma$$

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
2.6 ± 0.2	DELCOURT	81B	DM1 $e^+ e^- \rightarrow 2(\pi^+ \pi^-)$
2.83 ± 0.42	BACCI	80	FRAG $e^+ e^- \rightarrow 2(\pi^+ \pi^-)$

NODE=M065G2
NODE=M065G2
$$\Gamma(\pi^+ \pi^-) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{11} \Gamma_{17} / \Gamma$$

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.13	⁴¹ DIEKMAN	88	RVUE $e^+ e^- \rightarrow \pi^+ \pi^-$
0.029 ^{+0.016} _{-0.012}	KURDADZE	83	OLYA 0.64–1.4 $e^+ e^- \rightarrow \pi^+ \pi^-$

NODE=M065G4
NODE=M065G4

⁴¹ Using total width = 220 MeV.

NODE=M065G4;LINKAGE=B

$$\Gamma(K \bar{K}^*(892) + \text{c.c.}) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{13} \Gamma_{17} / \Gamma$$

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.305 ± 0.071	⁴² BIZOT	80	DM1 $e^+ e^-$

NODE=M065G10
NODE=M065G10

⁴² Model dependent.

NODE=M065G;LINKAGE=M

$$\Gamma(\eta \rho) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{14} \Gamma_{17} / \Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
7 ± 3	ANTONELLI	88	DM2 $e^+ e^- \rightarrow \eta \pi^+ \pi^-$

NODE=M065G11
NODE=M065G11
$$\Gamma(K \bar{K}) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{16} \Gamma_{17} / \Gamma$$

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.035 ± 0.029	⁴³ BIZOT	80	DM1 $e^+ e^-$

NODE=M065G5
NODE=M065G5

⁴³ Model dependent.

NODE=M065G5;LINKAGE=M

$$\Gamma(\rho \pi \pi) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_3 \Gamma_{17} / \Gamma$$

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
3.510 ± 0.090	⁴⁴ BIZOT	80	DM1 $e^+ e^-$

NODE=M065G12
NODE=M065G12

⁴⁴ Model dependent.

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. • • •				
1.7 ± 0.4	7815	⁴⁵ ACHASOV	13	SND 1.05–2.00 $e^+ e^- \rightarrow \pi^0 \pi^0 \gamma$

NODE=M065R01
NODE=M065R01

⁴⁵ 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;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	⁴⁶ ABELE	01B	CBAR 0.0 $\bar{p} n \rightarrow 5\pi$

NODE=M065R19
NODE=M065R19

⁴⁶ $\omega \pi$ not included.

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		47 BINGHAM	72B	HBC	$9.3 \gamma p \rightarrow p4\pi$

47 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	48 ABELE	01B	CBAR	$0.0 \bar{p}n \rightarrow 5\pi$

48 $\omega\pi$ 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	49 ABELE	01B	CBAR	$0.0 \bar{p}n \rightarrow 5\pi$

49 $\omega\pi$ 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	50 ABELE	01B	CBAR	$0.0 \bar{p}n \rightarrow 5\pi$

50 $\omega\pi$ 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	51 ABELE	01B	CBAR	$0.0 \bar{p}n \rightarrow 5\pi$

51 $\omega\pi$ 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
$0.15 \text{ to } 0.30$	52 MARTIN	78C	RVUE	$17 \pi^- p \rightarrow \pi^+\pi^-n$
<0.20	53 COSTA...	77B	RVUE	$e^+e^- \rightarrow 2\pi, 4\pi$
0.30 ± 0.05	52 FROGGATT	77	RVUE	$17 \pi^- p \rightarrow \pi^+\pi^-n$
<0.15	54 EISENBERG	73	HBC	$5 \pi^+ p \rightarrow \Delta^{++} 2\pi$
0.25 ± 0.05	55 HYAMS	73	ASPK	$17 \pi^- p \rightarrow \pi^+\pi^-n$

52 From phase shift analysis of HYAMS 73 data.

53 Estimate using unitarity, time reversal invariance, Breit-Wigner.

54 Estimated using one-pion-exchange model.

55 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	56 DAVIER	73	STRC	$6-18 \gamma p \rightarrow p4\pi$
<0.2	57 BINGHAM	72B	HBC	$9.3 \gamma p \rightarrow p2\pi$

56 Upper limit is estimate.

57 2σ upper limit.

NODE=M065R3
NODE=M065R3

NODE=M065R3;LINKAGE=E
NODE=M065R3;LINKAGE=S

$\Gamma(\pi\pi)/\Gamma(4\pi)$ Γ_{12}/Γ_1

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.16 ± 0.04	58,59 ABELE	01B	CBAR $0.0 \bar{p} n \rightarrow 5\pi$
58 Using ABELE 97.			
59 $\omega\pi$ not included.			

NODE=M065R20
 NODE=M065R20

NODE=M065R;LINKAGE=LK
 NODE=M065R20;LINKAGE=BL

 $\Gamma(K\bar{K}^*(892)+c.c.)/\Gamma_{\text{total}}$ Γ_{13}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
possibly seen	COAN	04	CLEO $\tau^- \rightarrow K^- \pi^- K^+ \nu_\tau$

NODE=M065R21
 NODE=M065R21

 $\Gamma(K\bar{K}^*(892)+c.c.)/\Gamma(2(\pi^+\pi^-))$ Γ_{13}/Γ_2

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.15 ± 0.03	60 DELCOURT	81B	DM1 $e^+e^- \rightarrow \bar{K}K\pi$
60 Assuming $\rho(1700)$ and ω radial excitations to be degenerate in mass.			

NODE=M065R9
 NODE=M065R9

NODE=M065R9;LINKAGE=D

 $\Gamma(\eta\rho)/\Gamma_{\text{total}}$ Γ_{14}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
possibly seen		AKHMETSHIN 00D	CMD2	$e^+e^- \rightarrow \eta\pi^+\pi^-$
<0.04		DONNACHIE 87B	RVUE	
<0.02	58	ATKINSON 86B	OMEG	20-70 γp

NODE=M065R12
 NODE=M065R12

 $\Gamma(\eta\rho)/\Gamma(2(\pi^+\pi^-))$ Γ_{14}/Γ_2

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.123 ± 0.027	DELCOURT	82	DM1 $e^+e^- \rightarrow \pi^+\pi^- \text{MM}$
~ 0.1	ASTON	80	OMEG 20-70 γp

NODE=M065R8
 NODE=M065R8

 $\Gamma(\pi^+\pi^- \text{ neutrals})/\Gamma(2(\pi^+\pi^-))$ $(\Gamma_5+\Gamma_6+0.714\Gamma_{14})/\Gamma_2$

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
2.6 ± 0.4	61 BALLAM	74	HBC 9.3 γp
61 Upper limit. Background not subtracted.			

NODE=M065R7
 NODE=M065R7

NODE=M065R7;LINKAGE=U

 $\Gamma(a_2(1320)\pi)/\Gamma_{\text{total}}$ Γ_{15}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
not seen	AMELIN	00	VES $37 \pi^- p \rightarrow \eta\pi^+\pi^- n$

NODE=M065R14
 NODE=M065R14

 $\Gamma(K\bar{K})/\Gamma(2(\pi^+\pi^-))$ Γ_{16}/Γ_2

VALUE	CL%	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.015 ± 0.010		62 DELCOURT	81B	DM1	$e^+e^- \rightarrow \bar{K}K$
<0.04	95	BINGHAM	72B	HBC	0 9.3 γp
62 Assuming $\rho(1700)$ and ω radial excitations to be degenerate in mass.					

NODE=M065R4
 NODE=M065R4

NODE=M065R4;LINKAGE=D

 $\Gamma(K\bar{K})/\Gamma(K\bar{K}^*(892)+c.c.)$ Γ_{16}/Γ_{13}

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.052 ± 0.026	BUON	82	DM1 $e^+e^- \rightarrow \text{hadrons}$

NODE=M065R10
 NODE=M065R10

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

VALUE	EVS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
seen	1.6k	ACHASOV	12	SND $e^+e^- \rightarrow \pi^0\pi^0\gamma$
not seen	2382	AKHMETSHIN 03B	CMD2	$e^+e^- \rightarrow \pi^0\pi^0\gamma$
seen		ACHASOV	97	RVUE $e^+e^- \rightarrow \omega\pi^0$

NODE=M065R13
 NODE=M065R13

$\rho(1700)$ REFERENCES

NODE=M065

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	$\gamma\gamma \rightarrow K_S^0K_S^0, E_{\text{cm}}^{\text{ee}} = 91, 183\text{--}209 \text{ GeV}$
~ 1775		⁵ GRYGOREV	99	SPEC	40 $\pi^-p \rightarrow K_S^0K_S^0n$
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

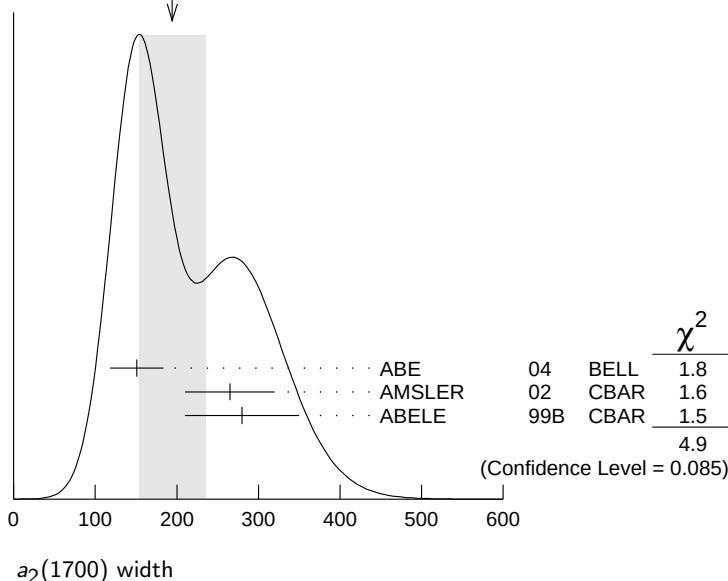
NODE=M162W

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	$\gamma\gamma \rightarrow K_S^0K_S^0, E_{\text{cm}}^{\text{ee}} = 91, 183\text{--}209 \text{ GeV}$
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

WEIGHTED AVERAGE
194±40 (Error scaled by 1.6)



$a_2(1700)$ 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±0.04±0.02		ACCIARRI	97T L3	$\gamma\gamma \rightarrow \pi^+\pi^-\pi^0$	
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
0.37 ^{+0.12} _{-0.08} ±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
1722⁺⁶₋₅	OUR AVERAGE Error includes scale factor of 1.6. See the ideogram below.			
[1720 ± 6 MeV OUR 2013 AVERAGE Scale factor = 1.6]				
1750 ⁺⁶ ₋₇	⁺²⁹ ₋₁₈	UEHARA	13 BELL	$\gamma\gamma \rightarrow K_S^0 K_S^0$
1701 ± 5	⁺⁹ ₋₂	4k 1 CHEKANOV	08 ZEUS	$ep \rightarrow K_S^0 K_S^0 X$
1765 ⁺⁴ ₋₃	±13	ABLIKIM	06v BES2	$e^+e^- \rightarrow J/\psi \rightarrow \gamma\pi^+\pi^-$
1760 ±15	⁺¹⁵ ₋₁₀	2 ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma\pi^+\pi^- K^+ K^-$
1738 ±30		ABLIKIM	04E BES2	$J/\psi \rightarrow \omega K^+ K^-$
1740 ± 4	⁺¹⁰ ₋₂₅	3 BAI	03G BES	$J/\psi \rightarrow \gamma K \bar{K}$
1740 ⁺³⁰ ₋₂₅		3 BAI	00A BES	$J/\psi \rightarrow \gamma(\pi^+\pi^-\pi^+\pi^-)$
1698 ±18		4 BARBERIS	00E	450 $pp \rightarrow p_f \eta \eta p_s$
1710 ±12	±11	5 BARBERIS	99D OMEG	450 $pp \rightarrow K^+ K^-, \pi^+ \pi^-$
1710 ±25		6 FRENCH	99	300 $pp \rightarrow p_f(K^+ K^-) p_s$
1707 ±10		7 AUGUSTIN	88 DM2	$J/\psi \rightarrow \gamma K^+ K^-, K_S^0 K_S^0$
1698 ±15		7 AUGUSTIN	87 DM2	$J/\psi \rightarrow \gamma\pi^+\pi^-$
1720 ±10	±10	8 BALTRUSAIT..	87 MRK3	$J/\psi \rightarrow \gamma K^+ K^-$
1742 ±15		7 WILLIAMS	84 MPSF	200 $\pi^- N \rightarrow 2K_S^0 X$
1670 ±50		BLOOM	83 CBAL	$J/\psi \rightarrow \gamma 2\eta$

NODE=M068M

NODE=M068M

NEW

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

1750±13		AMSLER	06	CBAR	1.64 $\bar{p}p \rightarrow K^+ K^- \pi^0$
1747± 5	80k	9,10 UMAN	06	E835	5.2 $\bar{p}p \rightarrow \eta\eta\pi^0$
1776±15		VLADIMIRSK...	06	SPEC	40 $\pi^- p \rightarrow K_S^0 K_S^0 n$
1790 ⁺⁴⁰ ₋₃₀		2 ABLIKIM	05	BES2	$J/\psi \rightarrow \phi\pi^+\pi^-$
1670±20		9 BINON	05	GAMS	33 $\pi^- p \rightarrow \eta\eta n$
1726± 7	74	10 CHEKANOV	04	ZEUS	$e p \rightarrow K_S^0 K_S^0 X$
1732±15		11 ANISOVICH	03	RVUE	
1682±16		TIKHOMIROV	03	SPEC	40.0 $\pi^- C \rightarrow K_S^0 K_S^0 K_L^0 X$
1670±26	3651	3,12 NICHITIU	02	OBLX	
1770±12		13,14 ANISOVICH	99B	SPEC	0.6–1.2 $p\bar{p} \rightarrow \eta\eta\pi^0$
1730±15		3 BARBERIS	99	OMEG	450 $pp \rightarrow p_S p_f K^+ K^-$
1750±20		3 BARBERIS	99B	OMEG	450 $pp \rightarrow p_S p_f \pi^+ \pi^-$
1750±30		15 ANISOVICH	98B	RVUE	Compilation
1720±39		BAI	98H	BES	$J/\psi \rightarrow \gamma\pi^0\pi^0$
1775± 1.5	57	16 BARKOV	98		$\pi^- p \rightarrow K_S^0 K_S^0 n$
1690±11		17 ABREU	96C	DLPH	$Z^0 \rightarrow K^+ K^- + X$
1696± 5	⁺⁹ ₋₃₄	8 BAI	96C	BES	$J/\psi \rightarrow \gamma K^+ K^-$
1781± 8	⁺¹⁰ ₋₃₁	3 BAI	96C	BES	$J/\psi \rightarrow \gamma K^+ K^-$
1768±14		BALOSHIN	95	SPEC	40 $\pi^- C \rightarrow K_S^0 K_S^0 X$
1750±15		18 BUGG	95	MRK3	$J/\psi \rightarrow \gamma\pi^+\pi^-\pi^+\pi^-$
1620±16		8 BUGG	95	MRK3	$J/\psi \rightarrow \gamma\pi^+\pi^-\pi^+\pi^-$
1748±10		7 ARMSTRONG	93C	E760	$\bar{p}p \rightarrow \pi^0\eta\eta \rightarrow 6\gamma$
~ 1750		BREAKSTONE	93	SFM	$pp \rightarrow pp\pi^+\pi^-\pi^+\pi^-$
1744±15		19 ALDE	92D	GAM2	38 $\pi^- p \rightarrow \eta\eta n$
1713±10		20 ARMSTRONG	89D	OMEG	300 $pp \rightarrow ppK^+K^-$
1706±10		20 ARMSTRONG	89D	OMEG	300 $pp \rightarrow ppK_S^0 K_S^0$
1700±15		8 BOLONKIN	88	SPEC	40 $\pi^- p \rightarrow K_S^0 K_S^0 n$
1720±60		3 BOLONKIN	88	SPEC	40 $\pi^- p \rightarrow K_S^0 K_S^0 n$
1638±10		21 FALVARD	88	DM2	$J/\psi \rightarrow \phi K^+ K^-, K_S^0 K_S^0$
1690± 4		22 FALVARD	88	DM2	$J/\psi \rightarrow \phi K^+ K^-, K_S^0 K_S^0$
1755± 8		23 ALDE	86C	GAM2	38 $\pi^- p \rightarrow n2\eta$
1730 ⁺² ₋₁₀		24 LONGACRE	86	RVUE	22 $\pi^- p \rightarrow n2K_S^0$
1650±50		BURKE	82	MRK2	$J/\psi \rightarrow \gamma2\rho$
1640±50	25,26	EDWARDS	82D	CBAL	$J/\psi \rightarrow \gamma2\eta$
1730±10 ±20	27	ETKIN	82C	MPS	23 $\pi^- p \rightarrow n2K_S^0$

OCCUR=2

OCCUR=2

OCCUR=2

OCCUR=2

OCCUR=2

¹ In the SU(3) based model with a specific interference pattern of the $f_2(1270)$, $a_2^0(1320)$, and $f_2'(1525)$ mesons incoherently added to the $f_0(1710)$ and non-resonant background.

² This state may be different from $f_0(1710)$, see CLOSE 05.

³ $J^P = 0^+$.

⁴ T-matrix pole.

⁵ Supersedes BARBERIS 99 and BARBERIS 99B.

⁶ $J^P = 0^+$, supersedes by ARMSTRONG 89D.

⁷ No J^{PC} determination.

⁸ $J^P = 2^+$.

⁹ Breit-Wigner mass.

¹⁰ Systematic errors not estimated.

¹¹ K-matrix pole, assuming $J^P = 0^+$, from combined analysis of $\pi^- p \rightarrow \pi^0\pi^0 n$, $\pi^- p \rightarrow K\bar{K}n$, $\pi^+\pi^- \rightarrow \pi^+\pi^-$, $\bar{p}p \rightarrow \pi^0\pi^0\pi^0$, $\pi^0\eta\eta$, $\pi^0\pi^0\eta$, $\pi^+\pi^-\pi^0$, $K^+K^-\pi^0$, $K_S^0 K_S^0 \pi^0$, $K^+K_S^0 \pi^-$ at rest, $\bar{p}n \rightarrow \pi^-\pi^-\pi^+$, $K_S^0 K^- \pi^0$, $K_S^0 K_S^0 \pi^-$ at rest.

¹² Decaying to $f_0(1370)\pi\pi$.

¹³ $J^P = 0^+$.

¹⁴ Not seen by AMSLER 02.

¹⁵ T-matrix pole, assuming $J^P = 0^+$

¹⁶ No J^{PC} determination.

¹⁷ No J^{PC} determination, width not determined.

¹⁸ From a fit to the 0^+ partial wave.

¹⁹ ALDE 92D combines all the GAMS-2000 data.

²⁰ $J^P = 2^+$, superseded by FRENCH 99.

²¹ From an analysis ignoring interference with $f_2'(1525)$.

²² From an analysis including interference with $f_2'(1525)$.

²³ Superseded by ALDE 92D.

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=BW

NODE=M068M;LINKAGE=CH

NODE=M068M;LINKAGE=KM

NODE=M068M;LINKAGE=NC

NODE=M068M;LINKAGE=AV

NODE=M068M;LINKAGE=NS

NODE=M068M;LINKAGE=AN

NODE=M068M;LINKAGE=4A

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

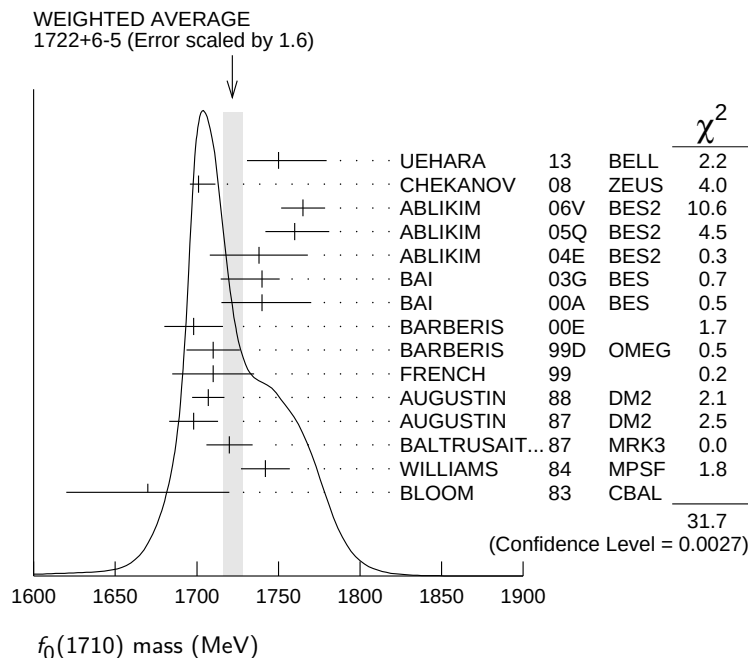
- ²⁴ Uses MRK3 data. From a partial-wave analysis of data using a K-matrix formalism with 5 poles, but assuming spin 2. Fit with constrained inelasticity.
²⁵ $J^P = 2^+$ preferred.
²⁶ From fit neglecting nearby $f_2'(1525)$. Replaced by BLOOM 83.
²⁷ Superseded by LONGACRE 86.

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
135 ± 7 OUR AVERAGE Error includes scale factor of 1.1. [135 ± 8 MeV OUR 2013 AVERAGE Scale factor = 1.1]

139	+11 -12	+96 -50		UEHARA	13	BELL	$\gamma\gamma \rightarrow K_S^0 K_S^0$
100	±24	+7 -22	4k	28	CHEKANOV	08	ZEUS $e p \rightarrow K_S^0 K_S^0 X$
145	±8	±69			ABLIKIM	06V	BES2 $e^+ e^- \rightarrow J/\psi \rightarrow \gamma \pi^+ \pi^-$
125	±25	+10 -15		29	ABLIKIM	05Q	BES2 $\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$
125	±20				ABLIKIM	04E	BES2 $J/\psi \rightarrow \omega K^+ K^-$
166	+5 -8	+15 -10		30	BAI	03G	BES $J/\psi \rightarrow \gamma K \bar{K}$
120	+50 -40			30	BAI	00A	BES $J/\psi \rightarrow \gamma(\pi^+ \pi^- \pi^+ \pi^-)$
120	±26			31	BARBERIS	00E	450 $p p \rightarrow p_f \eta \eta p_s$
126	±16	±18		32	BARBERIS	99D	OMEG 450 $p p \rightarrow K^+ K^-, \pi^+ \pi^-$
105	±34			33	FRENCH	99	300 $p p \rightarrow p_f(K^+ K^-) p_s$
166.4 ± 33.2				34	AUGUSTIN	88	DM2 $J/\psi \rightarrow \gamma K^+ K^-, K_S^0 K_S^0$
136 ± 28				34	AUGUSTIN	87	DM2 $J/\psi \rightarrow \gamma \pi^+ \pi^-$
130 ± 20				35	BALTRUSAIT...	87	MRK3 $J/\psi \rightarrow \gamma K^+ K^-$
57 ± 38				36	WILLIAMS	84	MPSF 200 $\pi^- N \rightarrow 2 K_S^0 X$
160 ± 80					BLOOM	83	CBAL $J/\psi \rightarrow \gamma 2\eta$

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

148	+40 -30			AMSLER	06	CBAR	1.64 $\bar{p} p \rightarrow K^+ K^- \pi^0$
188 ± 13			80k	29,37	UMAN	06	E835 5.2 $\bar{p} p \rightarrow \eta \eta \pi^0$
250 ± 30					VLADIMIRSK...	06	SPEC 40 $\pi^- p \rightarrow K_S^0 K_S^0 n$
270	+60 -30			38	ABLIKIM	05	BES2 $J/\psi \rightarrow \phi \pi^+ \pi^-$
260 ± 50				29	BINON	05	GAMS 33 $\pi^- p \rightarrow \eta \eta n$
38	+20 -14		74	37	CHEKANOV	04	ZEUS $e p \rightarrow K_S^0 K_S^0 X$
144 ± 30			39,40		ANISOVICH	03	RVUE

320	± 50 -20	40,41	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	30,42 NICHITIU	02	OBLX		
220	± 40	43,44	ANISOVICH	99B	SPEC	$0.6-1.2 p\bar{p} \rightarrow \eta\eta\pi^0$	
100	± 25	30	BARBERIS	99	OMEG	$450 p\bar{p} \rightarrow p_s p_f K^+ K^-$	
160	± 30	30	BARBERIS	99B	OMEG	$450 p\bar{p} \rightarrow p_s p_f \pi^+ \pi^-$	
250	± 140	45	ANISOVICH	98B	RVUE	Compilation	
30	± 7	57	46 BARKOV	98		$\pi^- p \rightarrow K_S^0 K_S^0 n$	
103	± 18 $+30$ -11	35	BAI	96C	BES	$J/\psi \rightarrow \gamma K^+ K^-$	
85	± 24 $+22$ -19	30	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	47	BUGG	95	MRK3	$J/\psi \rightarrow \gamma \pi^+ \pi^- \pi^+ \pi^-$	
160	$+60$ -20	35	BUGG	95	MRK3	$J/\psi \rightarrow \gamma \pi^+ \pi^- \pi^+ \pi^-$	OCCUR=2
264	± 25	34	ARMSTRONG	93C	E760	$\bar{p}p \rightarrow \pi^0 \eta \eta \rightarrow 6\gamma$	
200	to 300		BREAKSTONE	93	SFM	$p\bar{p} \rightarrow p\bar{p} \pi^+ \pi^- \pi^+ \pi^-$	
< 80	90% CL	48	ALDE	92D	GAM2	$38 \pi^- p \rightarrow \eta \eta N^*$	
181	± 30	49	ARMSTRONG	89D	OMEG	$300 p\bar{p} \rightarrow p\bar{p} K^+ K^-$	
104	± 30	49	ARMSTRONG	89D	OMEG	$300 p\bar{p} \rightarrow p\bar{p} K_S^0 K_S^0$	OCCUR=2
30	± 20	35	BOLONKIN	88	SPEC	$40 \pi^- p \rightarrow K_S^0 K_S^0 n$	
350	± 150	30	BOLONKIN	88	SPEC	$40 \pi^- p \rightarrow K_S^0 K_S^0 n$	OCCUR=2
148	± 17	50	FALVARD	88	DM2	$J/\psi \rightarrow \phi K^+ K^-, K_S^0 K_S^0$	
184	± 6	51	FALVARD	88	DM2	$J/\psi \rightarrow \phi K^+ K^-, K_S^0 K_S^0$	OCCUR=2
122	$+74$ -15	52	LONGACRE	86	RVUE	$22 \pi^- p \rightarrow n 2 K_S^0$	
200	± 100		BURKE	82	MRK2	$J/\psi \rightarrow \gamma 2\rho$	
220	$+100$ -70	53,54	EDWARDS	82D	CBAL	$J/\psi \rightarrow \gamma 2\eta$	
200	$+156$ -9	55	ETKIN	82B	MPS	$23 \pi^- p \rightarrow n 2 K_S^0$	

²⁸ 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.

²⁹ Breit-Wigner width.

³⁰ $J^P = 0^+$.

³¹ T-matrix pole.

³² Supersedes BARBERIS 99 and BARBERIS 99B.

³³ $J^P = 0^+$, supersedes by ARMSTRONG 89D.

³⁴ No J^{PC} determination.

³⁵ $J^P = 2^+$.

³⁶ No J^{PC} determination.

³⁷ Systematic errors not estimated.

³⁸ This state may be different from $f_0(1710)$, see CLOSE 05.

³⁹ (Solution I)

⁴⁰ K-matrix pole, assuming $J^P = 0^+$, from combined analysis of $\pi^- p \rightarrow \pi^0 \pi^0 n$, $\pi^- p \rightarrow K \bar{K} n$, $\pi^+ \pi^- \rightarrow \pi^+ \pi^-$, $\bar{p}p \rightarrow \pi^0 \pi^0 \pi^0$, $\pi^0 \eta \eta$, $\pi^0 \pi^0 \eta$, $\pi^+ \pi^- \pi^0$, $K^+ K^- \pi^0$, $K_S^0 K_S^0 \pi^0$, $K^+ K_S^0 \pi^-$ at rest, $\bar{p}n \rightarrow \pi^- \pi^- \pi^+$, $K_S^0 K^- \pi^0$, $K_S^0 K_S^0 \pi^-$ at rest.

⁴¹ (Solution I)

⁴² Decaying to $f_0(1370)\pi\pi$.

⁴³ $J^P = 0^+$.

⁴⁴ Not seen by AMSLER 02.

⁴⁵ T-matrix pole, assuming $J^P = 0^+$

⁴⁶ No J^{PC} determination.

⁴⁷ From a fit to the 0^+ partial wave.

⁴⁸ ALDE 92D combines all the GAMS-2000 data.

⁴⁹ $J^P = 2^+$, (0^+ excluded).

⁵⁰ From an analysis ignoring interference with $f_2'(1525)$.

⁵¹ From an analysis including interference with $f_2'(1525)$.

⁵² Uses MRK3 data. From a partial-wave analysis of data using a K-matrix formalism with 5 poles, but assuming spin 2. Fit with constrained inelasticity.

⁵³ $J^P = 2^+$ preferred.

⁵⁴ From fit neglecting nearby $f_2'(1525)$. Replaced by BLOOM 83.

⁵⁵ From an amplitude analysis of the $K_S^0 K_S^0$ system, superseded by LONGACRE 86.

NODE=M068W;LINKAGE=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
 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

NODE=M068215;NODE=M068

Mode	Fraction (Γ_i/Γ)
Γ_1 $K\bar{K}$	seen
Γ_2 $\eta\eta$	seen
Γ_3 $\pi\pi$	seen
Γ_4 $\gamma\gamma$	
Γ_5 $\omega\omega$	seen

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

 $f_0(1710) \Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

NODE=M068220

$\Gamma(K\bar{K}) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$	$\Gamma_1\Gamma_4/\Gamma$
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=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	⁵⁶ BEHREND	89C	CELL	$\gamma\gamma \rightarrow K_S^0 K_S^0$
<280	95	⁵⁶ ALTHOFF	85B	TASS	$\gamma\gamma \rightarrow K\bar{K}\pi$

⁵⁶ 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	57 BARATE 00E ALEP $\gamma\gamma \rightarrow \pi^+ \pi^-$

NODE=M068G3
 NODE=M068G3

⁵⁷ Assuming spin 0.

NODE=M068G;LINKAGE=Z

 $f_0(1710)$ BRANCHING RATIOS

NODE=M068225

$\Gamma(K\bar{K})/\Gamma_{\text{total}}$	Γ_1/Γ
VALUE DOCUMENT ID TECN COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •	
0.36 ± 0.12	ALBALADEJO 08 RVUE
$0.38^{+0.09}_{-0.19}$	^{58,59} LONGACRE 86 MPS $22 \pi^- p \rightarrow n 2 K_S^0$

NODE=M068R2
 NODE=M068R2

$\Gamma(\eta\eta)/\Gamma_{\text{total}}$	Γ_2/Γ
VALUE DOCUMENT ID TECN	
• • • We do not use the following data for averages, fits, limits, etc. • • •	
0.22 ± 0.12	ALBALADEJO 08 RVUE
$0.18^{+0.03}_{-0.13}$	^{58,59} LONGACRE 86 RVUE

NODE=M068R1
 NODE=M068R1

$\Gamma(\pi\pi)/\Gamma_{\text{total}}$	Γ_3/Γ
VALUE DOCUMENT ID TECN COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •	
not seen	AMSLER 02 CBAR $0.9 \bar{p} p \rightarrow \pi^0 \eta \eta, \pi^0 \pi^0 \pi^0$
$0.039^{+0.002}_{-0.024}$	^{58,59} LONGACRE 86 RVUE

NODE=M068R5
 NODE=M068R5

$\Gamma(\pi\pi)/\Gamma(K\bar{K})$	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	⁶⁰ ABLIKIM 04E BES2 $J/\psi \rightarrow \omega K^+ K^-$
$5.8^{+9.1}_{-5.5}$	⁶¹ 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 $pp \rightarrow pp\pi\pi, ppK\bar{K}$

NODE=M068R6
 NODE=M068R6

$\Gamma(\eta\eta)/\Gamma(K\bar{K})$ Γ_2/Γ_1

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
0.48±0.15		BARBERIS	00E	450 $p\bar{p} \rightarrow p_f \eta \eta p_s$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.46 ^{+0.70} _{-0.38}		⁶¹ ANISOVICH	02D SPEC	Combined fit
<0.02	90	⁶² PROKOSHKIN	91 GA24	300 $\pi^- p \rightarrow \pi^- p \eta \eta$

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

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
seen	180	ABLIKIM	06H BES	$J/\psi \rightarrow \gamma \omega \omega$
⁵⁸ From a partial-wave analysis of data using a K-matrix formalism with 5 poles, but assuming spin 2.				
⁵⁹ Fit with constrained inelasticity.				
⁶⁰ Using data from ABLIKIM 04A.				
⁶¹ From a combined K-matrix analysis of Crystal Barrel (0. $p\bar{p} \rightarrow \pi^0 \pi^0 \pi^0$, $\pi^0 \eta \eta$, $\pi^0 \pi^0 \eta$), GAMS ($\pi p \rightarrow \pi^0 \pi^0 n$, $\eta \eta n$, $\eta \eta' n$), and BNL ($\pi p \rightarrow K \bar{K} n$) data.				
⁶² Combining results of GAM4 with those of ARMSTRONG 89D.				

NODE=M068R7
 NODE=M068R7

NODE=M068R3
 NODE=M068R3

NODE=M068R;LINKAGE=L

NODE=M068R;LINKAGE=M
 NODE=M068R;LINKAGE=AB
 NODE=M068R;LINKAGE=CH

NODE=M068R;LINKAGE=A

 $\phi_0(1710)$ REFERENCES

NODE=M068

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. Vladimirovsky <i>et al.</i>	(ITEP, Moscow)	REFID=51191
Translated from YAF 69 515.					
ABLIKIM	05	PL B607 243	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50450
ABLIKIM	05Q	PR D72 092002	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50958
BINON	05	PAN 68 960	F. Binon <i>et al.</i>		REFID=50780
Translated from YAF 68 998.					
CLOSE	05	PR D71 094022	F.E. Close, Q. Zhao		REFID=50788
ABLIKIM	04A	PL B598 149	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=49740
ABLIKIM	04E	PL B603 138	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50174
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.					
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
BALTRUSAIT...	87	PR D35 2077	R.M. Baltrusaitis <i>et al.</i>	(Mark III Collab.)	REFID=40010
ALDE	86C	PL B182 105	D.M. Alde <i>et al.</i>	(SERP, BELG, LANL, LAPP)	REFID=21694
LONGACRE	86	PL B177 223	R.S. Longacre <i>et al.</i>	(BNL, BRAN, CUNY+)	REFID=20768
ALTHOFF	85B	ZPHY C29 189	M. Althoff <i>et al.</i>	(TASSO Collab.)	REFID=21349
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

$\eta(1760)$

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

NODE=M114

OMITTED FROM SUMMARY TABLE

Seen by DM2 in the $\rho\rho$ system (BISELLO 89B). Structure in this region has been reported before in the same system (BALTRUSAITIS 86B) and in the $\omega\omega$ system (BALTRUSAITIS 85C, BISELLO 87).

NODE=M114

 $\eta(1760)$ MASS

NODE=M114M

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
1751±15 OUR AVERAGE				
[1756 ± 9 MeV OUR 2013 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.				

NODE=M114M

NEW

OCCUR=2

NODE=M114M;LINKAGE=ZA
 NODE=M114M;LINKAGE=MA
 NODE=M114M;LINKAGE=ZH
 NODE=M114M;LINKAGE=A

 $\eta(1760)$ WIDTH

NODE=M114W

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
240±30 OUR AVERAGE				
[96 ± 70 MeV OUR 2013 AVERAGE Scale factor = 5.1]				
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=M114W

NEW

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=M114

Mode	Fraction (Γ_i/Γ)
Γ_1 4π	
Γ_2 $2\pi^+2\pi^-$	seen
Γ_3 $\pi^+\pi^-2\pi^0$	seen
Γ_4 $\rho^0\rho^0$	seen
Γ_5 $\rho^+\rho^-$	seen
Γ_6 $2(\pi^+\pi^-\pi^0)$	
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

$\Gamma(\eta'\pi^+\pi^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$					$\Gamma_8\Gamma_9/\Gamma$
<u>VALUE (eV)</u>	<u>EVTs</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
$28.2^{+7.9}_{-7.5} \pm 3.7$	465	⁹ ZHANG	12A BELL	$e^+e^- \rightarrow e^+e^-\eta'\pi^+\pi^-$	
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
$3.0^{+2.0}_{-1.2} \pm 0.8$	52	¹⁰ ZHANG	12A BELL	$e^+e^- \rightarrow e^+e^-\eta'\pi^+\pi^-$	
$18^{+13}_{-10} \pm 5$	315	¹¹ ZHANG	12A BELL	$e^+e^- \rightarrow e^+e^-\eta'\pi^+\pi^-$	

NODE=M114G01

NODE=M114G01

OCCUR=2

OCCUR=3

⁹ From a single-resonance fit.¹⁰ From a two-resonance fit. For constructive interference with the $X(1835)$.¹¹ From a two-resonance fit. For destructive interference with the $X(1835)$. **$\eta(1760)$ BRANCHING RATIOS** **$\Gamma(2\pi^+2\pi^-)/\Gamma_{\text{total}}$**

VALUE	DOCUMENT ID	TECN	COMMENT
seen	BISELLO	89B DM2	$J/\psi \rightarrow \gamma 2\pi^+ 2\pi^-$

 Γ_2/Γ

NODE=M114210

NODE=M114R01
NODE=M114R01 **$\Gamma(\pi^+\pi^-2\pi^0)/\Gamma_{\text{total}}$**

VALUE	DOCUMENT ID	TECN	COMMENT
seen	BISELLO	89B DM2	$J/\psi \rightarrow \gamma \pi^+ \pi^- 2\pi^0$

 Γ_3/Γ NODE=M114R02
NODE=M114R02 **$\Gamma(\rho^0\rho^0)/\Gamma_{\text{total}}$**

VALUE	DOCUMENT ID	TECN	COMMENT
seen	BISELLO	89B DM2	$J/\psi \rightarrow \gamma \rho^0 \rho^0$
seen	BALTRUSAIT...86	MRK3	$J/\psi \rightarrow \gamma \rho^0 \rho^0$

 Γ_4/Γ NODE=M114R03
NODE=M114R03 **$\Gamma(\rho^+\rho^-)/\Gamma_{\text{total}}$**

VALUE	DOCUMENT ID	TECN	COMMENT
seen	BISELLO	89B DM2	$J/\psi \rightarrow \gamma \rho^+ \rho^-$
seen	BALTRUSAIT...86	MRK3	$J/\psi \rightarrow \gamma \rho^+ \rho^-$

 Γ_5/Γ NODE=M114R04
NODE=M114R04 **$\Gamma(\omega\omega)/\Gamma_{\text{total}}$**

VALUE	DOCUMENT ID	TECN	COMMENT
seen	BISELLO	87 DM2	$J/\psi \rightarrow \omega\omega$
seen	BALTRUSAIT...85C	MRK3	$J/\psi \rightarrow \gamma\omega\omega$

 Γ_7/Γ NODE=M114R06
NODE=M114R06 **$\eta(1760)$ REFERENCES**

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

NODE=M114

REFID=54763
REFID=51125
REFID=40575
REFID=40012
REFID=22009
REFID=22100
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 (generic for all A,B,E,G) **G33** 1 (2006).

NODE=M075

NODE=M075

 $\pi(1800)$ MASS

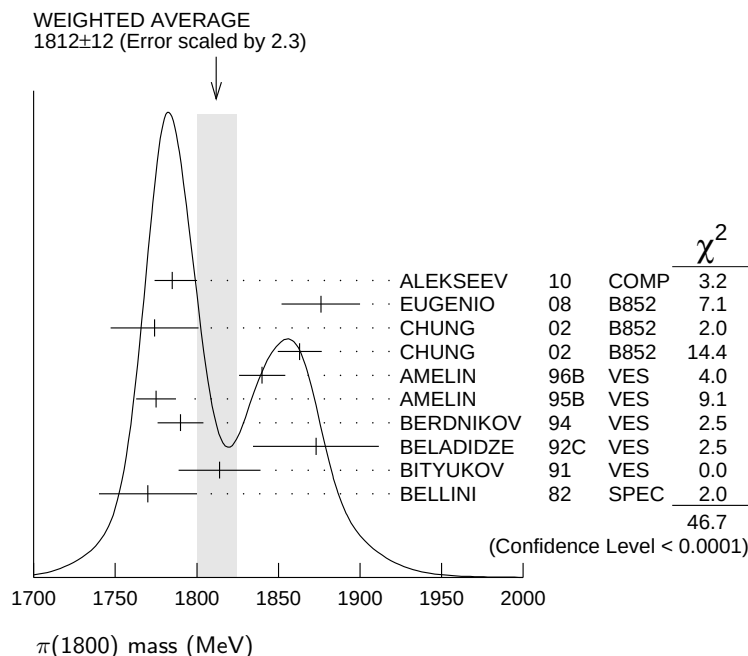
VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
1812±12 OUR AVERAGE		Error includes scale factor of 2.3. See the ideogram below.			
1785± 9 ⁺¹² ₋₆	420k	ALEKSEEV	10	COMP	190 $\pi^- Pb \rightarrow \pi^- \pi^- \pi^+ Pb'$
1876±18±16	4k	¹ EUGENIO	08	B852	18 $\pi^- p \rightarrow \eta \eta \pi^- p$
1774±18±20		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 $\pi^- A \rightarrow \omega \pi^- \pi^0 A^*$

NODE=M075M

NODE=M075M

OCCUR=2

- 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.



NODE=M075M;LINKAGE=SP
 NODE=M075M;LINKAGE=C1
 NODE=M075M;LINKAGE=C2
 NODE=M075M;LINKAGE=AX
 NODE=M075M;LINKAGE=A

$\pi(1800)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
208 ± 12 OUR AVERAGE					
$208 \pm 22^{+21}_{-37}$	420k	ALEKSEEV	10	COMP	$190 \pi^- Pb \rightarrow \pi^- \pi^- \pi^+ Pb'$
$221 \pm 26 \pm 38$	4k	⁶ EUGENIO	08	B852	$18 \pi^- p \rightarrow \eta \eta \pi^- p$
$223 \pm 48 \pm 50$		⁷ CHUNG	02	B852	$18.3 \pi^- p \rightarrow \pi^+ \pi^- \pi^- p$
$191 \pm 21 \pm 20$		⁸ CHUNG	02	B852	$18.3 \pi^- p \rightarrow \pi^+ \pi^- \pi^- p$
$210 \pm 30 \pm 30$	1200	AMELIN	96B	VES	$37 \pi^- A \rightarrow \eta \eta \pi^- A$
$190 \pm 15 \pm 15$		⁹ AMELIN	95B	VES	$36 \pi^- A \rightarrow \pi^+ \pi^- \pi^- A$
210 ± 70		¹⁰ BERDNIKOV	94	VES	$37 \pi^- A \rightarrow K^+ K^- \pi^- A$
$225 \pm 35 \pm 20$		BELADIDZE	92C	VES	$36 \pi^- Be \rightarrow \pi^- \eta' \eta Be$
$205 \pm 18 \pm 32$	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. ● ● ●					
$259 \pm 19 \pm 6$		AMELIN	99	VES	$37 \pi^- A \rightarrow \omega \pi^- \pi^0 A^*$

NODE=M075W

NODE=M075W

OCCUR=2

- 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

$\pi(1800)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \pi^+ \pi^- \pi^-$	seen
$\Gamma_2 f_0(500)\pi^-$	seen
$\Gamma_3 f_0(980)\pi^-$	seen
$\Gamma_4 f_0(1370)\pi^-$	seen
$\Gamma_5 f_0(1500)\pi^-$	not seen
$\Gamma_6 \rho \pi^-$	not seen
$\Gamma_7 \eta \eta \pi^-$	seen

NODE=M075215;NODE=M075

DESIG=10;OUR EST;→ UNCHECKED ←
 DESIG=11;OUR EST;→ UNCHECKED ←
 DESIG=3;OUR EST;→ UNCHECKED ←
 DESIG=1
 DESIG=12
 DESIG=2
 DESIG=7;OUR EST;→ UNCHECKED ←

Γ_8	$a_0(980)\eta$	seen
Γ_9	$a_2(1320)\eta$	not seen
Γ_{10}	$f_2(1270)\pi$	not seen
Γ_{11}	$f_0(1370)\pi^-$	not seen
Γ_{12}	$f_0(1500)\pi^-$	seen
Γ_{13}	$\eta\eta'(958)\pi^-$	seen
Γ_{14}	$K_0^*(1430)K^-$	seen
Γ_{15}	$K^*(892)K^-$	not seen

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

NODE=M075220

$\Gamma(f_0(980)\pi^-)/\Gamma(f_0(500)\pi^-)$					Γ_3/Γ_2
VALUE	DOCUMENT ID	TECN	CHG	COMMENT	
0.44±0.08±0.38	¹¹ CHUNG	02	B852	$18.3 \pi^- p \rightarrow \pi^+ \pi^- \pi^- p$	

NODE=M075R11
NODE=M075R11

$\Gamma(f_0(980)\pi^-)/\Gamma(f_0(1370)\pi^-)$					Γ_3/Γ_4
VALUE	DOCUMENT ID	TECN	CHG	COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
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	CHG	COMMENT	
not seen	CHUNG	02	B852	$18.3 \pi^- p \rightarrow \pi^+ \pi^- \pi^- p$	

NODE=M075R12
NODE=M075R12

$\Gamma(\rho\pi^-)/\Gamma_{\text{total}}$					Γ_6/Γ
VALUE	DOCUMENT ID	TECN	CHG	COMMENT	
not seen	BELLINI	82	SPEC	—	$40 \pi^- A \rightarrow 3\pi A$

NODE=M075R2
NODE=M075R2

$\Gamma(\rho\pi^-)/\Gamma(f_0(980)\pi^-)$					Γ_6/Γ_3
VALUE	CL%	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.25		CHUNG	02	B852	$18.3 \pi^- p \rightarrow \pi^+ \pi^- \pi^- p$
<0.14	90	AMELIN	95B	VES	—
					$36 \pi^- A \rightarrow \pi^+ \pi^- \pi^- A$

NODE=M075R6
NODE=M075R6

$\Gamma(\eta\eta\pi^-)/\Gamma(\pi^+\pi^-\pi^-)$					Γ_7/Γ_1
VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.5 ± 0.1	1200	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	CHG	COMMENT	
not seen	EUGENIO	08	B852	$18 \pi^- p \rightarrow \eta\eta\pi^- p$	

NODE=M075R13
NODE=M075R13

$\Gamma(f_2(1270)\pi)/\Gamma_{\text{total}}$					Γ_{10}/Γ
VALUE	DOCUMENT ID	TECN	CHG	COMMENT	
not seen	EUGENIO	08	B852	$18 \pi^- p \rightarrow \eta\eta\pi^- p$	

NODE=M075R14
NODE=M075R14

$\Gamma(f_0(1370)\pi^-)/\Gamma_{\text{total}}$					Γ_{11}/Γ
VALUE	DOCUMENT ID	TECN	CHG	COMMENT	
not seen	EUGENIO	08	B852	$18 \pi^- p \rightarrow \eta\eta\pi^- p$	

NODE=M075R15
NODE=M075R15

$\Gamma(f_0(1500)\pi^-)/\Gamma(a_0(980)\eta)$					Γ_{12}/Γ_8
VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.48 ± 0.17	4k	^{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

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. Bityukov, G.V. Borisov	(SERP+)
		Translated from YAF 55 2748.		
BITYUKOV	91	PL B268 137	S.I. Bityukov <i>et al.</i>	(SERP, TBIL)
BELLINI	82	PRL 48 1697	G. Bellini <i>et al.</i>	(MILA, BGNA, JINR)

NODE=M075

REFID=53356
REFID=52160
REFID=51004
REFID=48837
REFID=48318
REFID=46910

REFID=44725

REFID=44433
REFID=44073
REFID=43175

REFID=41749
REFID=21134

NODE=M038

 $f_2(1810)$

$$I^G(J^{PC}) = 0^+(2^{++})$$

OMITTED FROM SUMMARY TABLE

Needs confirmation.

NODE=M038

 $f_2(1810)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

1815 ± 12 OUR AVERAGE Error includes scale factor of 1.4. See the ideogram below.

1737 ± 9	9^{+198}_{-65}	¹ UEHARA	10A	BELL $10.6 e^+ e^- \rightarrow e^+ e^- \eta \eta$
1800 ± 30	40	ALDE	88D	GAM4 $300 \pi^- p \rightarrow \pi^- p 4\pi^0$
1806 ± 10	1600	ALDE	87	GAM4 $100 \pi^- p \rightarrow 4\pi^0 n$
1870 ± 40		² ALDE	86D	GAM4 $100 \pi^- p \rightarrow \eta \eta n$
1857^{+35}_{-24}		³ COSTA...	80	OMEG $10 \pi^- p \rightarrow K^+ K^- n$

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

1858^{+18}_{-71}		⁴ LONGACRE	86	RVUE Compilation

1799 ± 15		⁵ CASON	82	STRC $8 \pi^+ p \rightarrow \Delta^{++} \pi^0 \pi^0$

¹ Breit-Wigner mass.

² Seen in only one solution.

³ Error increased by spread of two solutions. Included in LONGACRE 86 global analysis.

⁴ From a partial-wave analysis of data using a K-matrix formalism with 5 poles. Includes compilation of several other experiments.

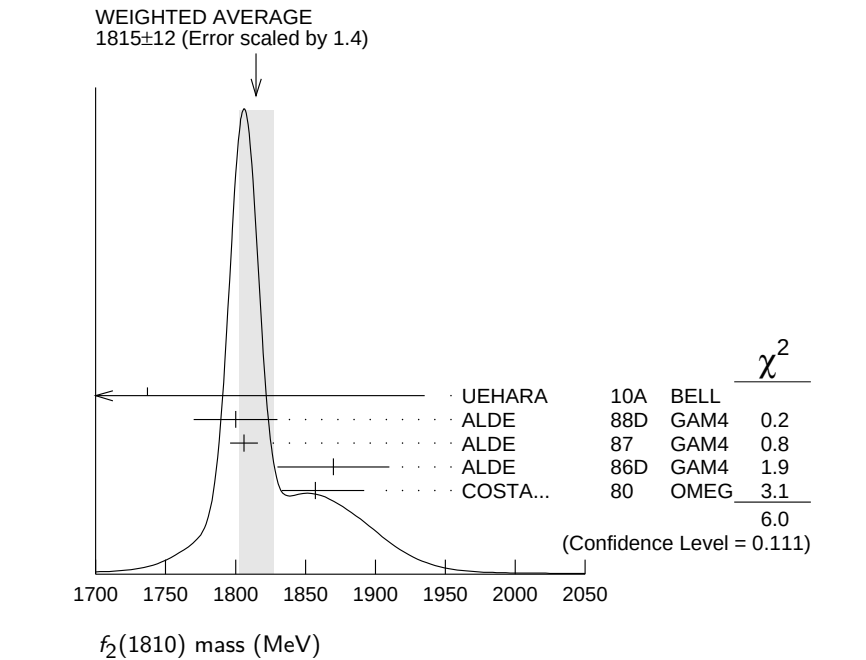
⁵ From an amplitude analysis of the reaction $\pi^+ \pi^- \rightarrow 2\pi^0$. The resonance in the $2\pi^0$ final state is not confirmed by PROKOSHKIN 97.

NODE=M038M

NODE=M038M

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.		
228 ⁺ ₋₂₀ 21+234 153		⁶ UEHARA	10A BELL	10.6 $e^+e^- \rightarrow e^+e^-\eta\eta$
160 ± 30	40	ALDE	88D GAM4	300 $\pi^-p \rightarrow \pi^-p4\pi^0$
190 ± 20	1600	ALDE	87 GAM4	100 $\pi^-p \rightarrow 4\pi^0n$
250 ± 30		⁷ ALDE	86D GAM4	100 $\pi^-p \rightarrow \eta\eta n$
185 ⁺ ₋₁₃₉ 102 139		⁸ COSTA...	80 OMEG	10 $\pi^-p \rightarrow K^+K^-n$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
388 ⁺ ₋₂₁ 15 21		⁹ LONGACRE	86 RVUE	Compilation
280 ⁺ ₋₃₅ 42 35		¹⁰ CASON	82 STRC	8 $\pi^+p \rightarrow \Delta^{++}\pi^0\pi^0$

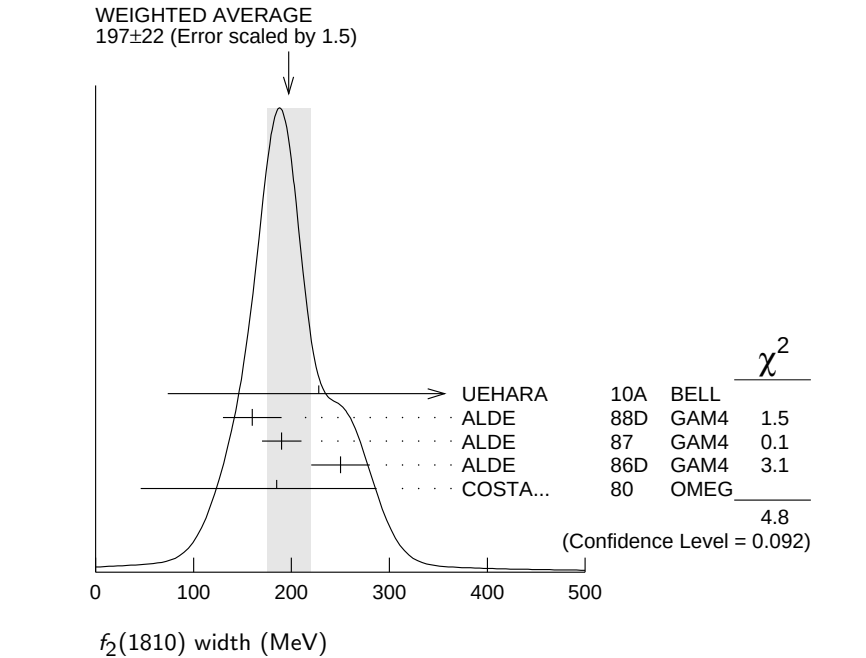
⁶ Breit-Wigner width.
⁷ Seen in only one solution.
⁸ Error increased by spread of two solutions. Included in LONGACRE 86 global analysis.
⁹ From a partial-wave analysis of data using a K-matrix formalism with 5 poles. Includes compilation of several other experiments.
¹⁰ From an amplitude analysis of the reaction $\pi^+\pi^- \rightarrow 2\pi^0$. The resonance in the $2\pi^0$ final state is not confirmed by PROKOSHKIN 97.

NODE=M038W

NODE=M038W

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

Mode		Fraction (Γ_i/Γ)
Γ_1	$\pi\pi$	
Γ_2	$\eta\eta$	
Γ_3	$4\pi^0$	seen
Γ_4	K^+K^-	
Γ_5	$\gamma\gamma$	seen

NODE=M038215;NODE=M038

DESIG=2
DESIG=3
DESIG=4;OUR EST;→ UNCHECKED ←
DESIG=1
DESIG=5;OUR EST;→ UNCHECKED ←

$f_2(1810)$ $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

$\Gamma(\eta\eta) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$					$\Gamma_2\Gamma_5/\Gamma$
VALUE (eV)	DOCUMENT ID	TECN	COMMENT		
$5.2^{+0.9+37.3}_{-0.8-4.5}$	¹¹ UEHARA	10A BELL	10.6 $e^+e^- \rightarrow e^+e^-\eta\eta$		

NODE=M038225

NODE=M038G01
NODE=M038G01

¹¹ Including interference with the $f'_2(1525)$ (parameters fixed to the values from the 2008 edition of this review, PDG 08) and $f_2(1270)$. May also be the $f_0(1500)$.

NODE=M038G01;LINKAGE=UE

$f_2(1810)$ BRANCHING RATIOS

$\Gamma(\pi\pi)/\Gamma_{\text{total}}$					Γ_1/Γ
VALUE	DOCUMENT ID	TECN	COMMENT		
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
not seen	AMSLER 02	CBAR	$0.9 \bar{p}p \rightarrow \pi^0\eta\eta, \pi^0\pi^0\pi^0$		
not seen	PROKOSHKIN 97	GAM2	$38 \pi^-p \rightarrow \pi^0\pi^0n$		
$0.21^{+0.02}_{-0.03}$	¹² LONGACRE 86	RVUE	Compilation		
0.44 ± 0.03	¹³ CASON 82	STRC	$8 \pi^+p \rightarrow \Delta^{++}\pi^0\pi^0$		

NODE=M038220

NODE=M038R2
NODE=M038R2

¹² From a partial-wave analysis of data using a K-matrix formalism with 5 poles. Includes compilation of several other experiments.
¹³ Included in LONGACRE 86 global analysis.

NODE=M038R2;LINKAGE=L

NODE=M038R;LINKAGE=C

$\Gamma(\eta\eta)/\Gamma_{\text{total}}$					Γ_2/Γ
VALUE	DOCUMENT ID	TECN	COMMENT		
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
$0.008^{+0.028}_{-0.003}$	¹⁴ LONGACRE 86	RVUE	Compilation		

NODE=M038R3
NODE=M038R3

¹⁴ From a partial-wave analysis of data using a K-matrix formalism with 5 poles. Includes compilation of several other experiments.

NODE=M038R3;LINKAGE=L

$\Gamma(\pi\pi)/\Gamma(4\pi^0)$

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
<0.75	ALDE	87	GAM4 100 $\pi^- p \rightarrow 4\pi^0 n$

 Γ_1/Γ_3

NODE=M038R4
 NODE=M038R4

 $\Gamma(4\pi^0)/\Gamma(\eta\eta)$

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.8 ± 0.3	ALDE	87	GAM4 100 $\pi^- p \rightarrow 4\pi^0 n$

 Γ_3/Γ_2

NODE=M038R5
 NODE=M038R5

 $\Gamma(K^+K^-)/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$0.003^{+0.019}_{-0.002}$	¹⁵ LONGACRE	86	RVUE Compilation
seen	COSTA...	80	OMEG 10 $\pi^- p \rightarrow K^+ K^- n$

 Γ_4/Γ

NODE=M038R1
 NODE=M038R1

¹⁵ From a partial-wave analysis of data using a K-matrix formalism with 5 poles. Includes compilation of several other experiments.

NODE=M038R1;LINKAGE=L

 $f_2(1810)$ REFERENCES

UEHARA	10A	PR D82 114031	S. Uehara <i>et al.</i>	(BELLE Collab.)
PDG	08	PL B667 1	C. Amsler <i>et al.</i>	(PDG Collab.)
AMSLER	02	EPJ C23 29	C. Amsler <i>et al.</i>	
PROKOSHKIN	97	SPD 42 117	Y.D. Prokoshkin <i>et al.</i>	(SERP)
ALDE	88D	Translated from DANS 353 323.		
		SJNP 47 810	D.M. Alde <i>et al.</i>	(SERP, BELG, LANL, LAPP+)
ALDE	87	Translated from YAF 47 1273.		
		PL B198 286	D.M. Alde <i>et al.</i>	(LANL, BRUX, SERP, LAPP)
ALDE	86D	NP B269 485	D.M. Alde <i>et al.</i>	(BELG, LAPP, SERP, CERN+)
LONGACRE	86	PL B177 223	R.S. Longacre <i>et al.</i>	(BNL, BRAN, CUNY+)
CASON	82	PRL 48 1316	N.M. Cason <i>et al.</i>	(NDAM, ANL)
COSTA...	80	NP B175 402	G. Costa de Beauregard <i>et al.</i>	(BARI, BONN+)

NODE=M038

REFID=53641
 REFID=52166
 REFID=48580
 REFID=45386

REFID=44652

REFID=40221
 REFID=20765
 REFID=20768
 REFID=20746
 REFID=20737

NODE=M085

 $X(1835)$

$$I^G(J^{PC}) = ?^?(? - +)$$

OMITTED FROM SUMMARY TABLE

Could be a superposition of two states, one with small width appearing as threshold enhancement in $p\bar{p}$, the other one with a larger width, decaying into $\pi^+\pi^-\eta'$. For the former ABLIKIM 12D determine $J^{PC} = 0(-+)$.

NODE=M085

 $X(1835)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$1835.7^{+5.0}_{-3.2}$ OUR AVERAGE				
$1836.5 \pm 3.0^{+5.6}_{-2.1}$	4265	¹ ABLIKIM	11C	BES3 $J/\psi \rightarrow \gamma\pi^+\pi^-\eta'$
$1833.7 \pm 6.1 \pm 2.7$	264	ABLIKIM	05R	BES2 $J/\psi \rightarrow \gamma\pi^+\pi^-\eta'$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$1832^{+19}_{-5} \pm 26$		² ABLIKIM	12D	BES3 $J/\psi \rightarrow \gamma p\bar{p}$
$1877.3 \pm 6.3^{+3.4}_{-7.4}$		³ ABLIKIM	11J	BES3 $J/\psi \rightarrow \omega(\eta\pi^+\pi^-)$
$1837^{+10}_{-12} \pm 9$	231	^{4,5} ALEXANDER	10	CLEO $J/\psi \rightarrow \gamma p\bar{p}$
1831 ± 7		^{5,6} ABLIKIM	05R	BES2 $J/\psi \rightarrow \gamma p\bar{p}$
$1859^{+3}_{-10} \pm 5$		⁵ BAI	03F	BES2 $J/\psi \rightarrow \gamma p\bar{p}$

NODE=M085M

NODE=M085M

OCCUR=2

¹ From a fit of the $\pi^+\pi^-\eta'$ mass distribution to a combination of $\gamma f_1(1510)$, $\gamma X(1835)$, and two unconfirmed states $\gamma X(2120)$, and $\gamma X(2370)$, for $M(p\bar{p}) < 2.8$ GeV, and accounting for backgrounds from non- η' events and $J/\psi \rightarrow \pi^0\pi^+\pi^-\eta'$.

NODE=M085M;LINKAGE=AI

² From the fit including final state interaction effects in isospin 0 S-wave according to SIBIRTSEV 05A. Supersedes ABLIKIM 10G.

NODE=M085M;LINKAGE=AK

³ The selected process is $J/\psi \rightarrow \omega a_0(980)\pi$. This state may be due also to $\eta_2(1870)$ or to a combination of $X(1835)$ and $\eta_2(1870)$.

NODE=M085M;LINKAGE=BL

⁴ From a fit of the $p\bar{p}$ mass distribution to a combination of $\gamma X(1835)$, γR with $M(R) = 2100$ MeV and $\Gamma(R) = 160$ MeV, and $\gamma p\bar{p}$ phase space, for $M(p\bar{p}) < 2.85$ GeV.

NODE=M085M;LINKAGE=AE

- ⁵ Evidence for a threshold enhancement in the $p\bar{p}$ mass spectrum was also reported by ABE 02K, AUBERT,B 05L, and WANG 05A in $B^+ \rightarrow p\bar{p}K^+$, WANG 05A in $B^0 \rightarrow p\bar{p}K_S^0$, ABE 02W in $\bar{B}^0 \rightarrow p\bar{p}D^0$, DEL-AMO-SANCHEZ 12 in $B \rightarrow D(D^*)p\bar{p}(\pi)$, and WEI 08 in $B^+ \rightarrow p\bar{p}\pi^+$ decays. Not seen by ATHAR 06 in $\Upsilon(1S) \rightarrow p\bar{p}\gamma$.
- ⁶ From the fit including final state interaction effects in isospin 0 S -wave according to SIBIRTSEV 05A. Systematic errors not estimated.

NODE=M085M;LINKAGE=HF

NODE=M085M;LINKAGE=AB

X(1835) WIDTH

NODE=M085W

NODE=M085W

VALUE (MeV)	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
99 ± 50 OUR AVERAGE	Error includes scale factor of 2.8.				
190 ± 9 ⁺³⁸ ₋₃₆	4265	⁷	ABLIKIM	11C BES3	$J/\psi \rightarrow \gamma\pi^+\pi^-\eta'$
67.7±20.3± 7.7	264		ABLIKIM	05R BES2	$J/\psi \rightarrow \gamma\pi^+\pi^-\eta'$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 76	90	⁸	ABLIKIM	12D BES3	$J/\psi \rightarrow \gamma p\bar{p}$
57 ± 12 ⁺¹⁹ ₋₄		⁹	ABLIKIM	11J BES3	$J/\psi \rightarrow \omega(\eta\pi^+\pi^-)$
0 ⁺⁴⁴ ₋₀	231	^{10,11}	ALEXANDER	10 CLEO	$J/\psi \rightarrow \gamma p\bar{p}$
< 153	90	^{11,12}	ABLIKIM	05R BES2	$J/\psi \rightarrow \gamma p\bar{p}$
< 30		¹¹	BAI	03F BES2	$J/\psi \rightarrow \gamma p\bar{p}$

OCCUR=2

NODE=M085W;LINKAGE=AI

NODE=M085W;LINKAGE=AK

NODE=M085W;LINKAGE=BL

NODE=M085W;LINKAGE=AE

NODE=M085W;LINKAGE=HF

NODE=M085W;LINKAGE=AB

⁷ From a fit of the $\pi^+\pi^-\eta'$ mass distribution to a combination of $\gamma f_1(1510)$, $\gamma X(1835)$, and two unconfirmed states $\gamma X(2120)$, and $\gamma X(2370)$, for $M(p\bar{p}) < 2.8$ GeV, and accounting for backgrounds from non- η' events and $J/\psi \rightarrow \pi^0\pi^+\pi^-\eta'$.

⁸ From the fit including final state interaction effects in isospin 0 S -wave according to SIBIRTSEV 05A. Supersedes ABLIKIM 10G.

⁹ The selected process is $J/\psi \rightarrow \omega a_0(980)\pi$. This state may be due also to $\eta_2(1870)$ or to a combination of $X(1835)$ and $\eta_2(1870)$.

¹⁰ From a fit of the $p\bar{p}$ mass distribution to a combination of $\gamma X(1835)$, γR with $M(R) = 2100$ MeV and $\Gamma(R) = 160$ MeV, and $\gamma p\bar{p}$ phase space, for $M(p\bar{p}) < 2.85$ GeV.

¹¹ Evidence for a threshold enhancement in the $p\bar{p}$ mass spectrum was also reported by ABE 02K, AUBERT,B 05L, and WANG 05A in $B^+ \rightarrow p\bar{p}K^+$, WANG 05A in $B^0 \rightarrow p\bar{p}K_S^0$, ABE 02W in $\bar{B}^0 \rightarrow p\bar{p}D^0$, DEL-AMO-SANCHEZ 12 in $B \rightarrow D(D^*)p\bar{p}(\pi)$, and WEI 08 in $B^+ \rightarrow p\bar{p}\pi^+$ decays. Not seen by ATHAR 06 in $\Upsilon(1S) \rightarrow p\bar{p}\gamma$.

¹² From the fit including final state interaction effects in isospin 0 S -wave according to SIBIRTSEV 05A. Systematic errors not estimated.

X(1835) DECAY MODES

NODE=M085215;NODE=M085

Mode	Fraction (Γ_i/Γ)
Γ_1 $p\bar{p}$	seen
Γ_2 $\eta'\pi^+\pi^-$	seen
Γ_3 $\gamma\gamma$	

DESIG=1;OUR EVAL;→ UNCHECKED ←
DESIG=2;OUR EVAL;→ UNCHECKED ←
DESIG=4

X(1835) $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

NODE=M085225

$\Gamma(\eta'\pi^+\pi^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$					$\Gamma_2\Gamma_3/\Gamma$
VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT	

NODE=M085G01
NODE=M085G01

• • • We do not use the following data for averages, fits, limits, etc. • • •				
<35.6	90	¹³	ZHANG	12A BELL $e^+e^- \rightarrow e^+e^-\eta'\pi^+\pi^-$
<83	90	¹⁴	ZHANG	12A BELL $e^+e^- \rightarrow e^+e^-\eta'\pi^+\pi^-$

OCCUR=2

NODE=M085G01;LINKAGE=ZH

NODE=M085G01;LINKAGE=ZA

¹³ From a two-resonance fit and constructive interference of the $\eta(1760)$ and $X(1835)$, a significance of 2.8σ .

¹⁴ From a two-resonance fit and destructive interference of the $\eta(1760)$ and $X(1835)$, a significance of 2.8σ .

X(1835) BRANCHING RATIOS

NODE=M085220

$\Gamma(p\bar{p})/\Gamma(\eta'\pi^+\pi^-)$				Γ_1/Γ_2
VALUE	DOCUMENT ID	TECN	COMMENT	
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
0.333	ABLIKIM	05R	BES2	$J/\psi \rightarrow \gamma\pi^+\pi^-\eta'$

NODE=M085R01
NODE=M085R01

X(1835) REFERENCES

ABLIKIM	12D	PRL 108 112003	M. Ablikim <i>et al.</i>	(BES III Collab.)
DEL-AMO-SA...	12	PR D85 092017	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)
ZHANG	12A	PR D86 052002	C.C. Zhang <i>et al.</i>	(BELLE Collab.)
ABLIKIM	11C	PRL 106 072002	M. Ablikim <i>et al.</i>	(BES III Collab.)
ABLIKIM	11J	PRL 107 182001	M. Ablikim <i>et al.</i>	(BES III Collab.)
ABLIKIM	10G	CP C34 421	M. Ablikim <i>et al.</i>	(BES III Collab.)
ALEXANDER	10	PR D82 092002	J.P. Alexander <i>et al.</i>	(CLEO Collab.)
WEI	08	PL B659 80	J.-T. Wei <i>et al.</i>	(BELLE Collab.)
ATHAR	06	PR D73 032001	S.B. Athar <i>et al.</i>	(CLEO Collab.)
ABLIKIM	05R	PRL 95 262001	M. Ablikim <i>et al.</i>	(BES Collab.)
AUBERT,B	05L	PR D72 051101	B. Aubert <i>et al.</i>	(BABAR Collab.)
SIBIRTSEV	05A	PR D71 054010	A. Sibirtsev, J. Haidenbauer	
WANG	05A	PL B617 141	M.-Z. Wang <i>et al.</i>	(BELLE Collab.)
BAI	03F	PRL 91 022001	J.Z. Bai <i>et al.</i>	(BES II Collab.)
ABE	02K	PRL 88 181803	K. Abe <i>et al.</i>	(BELLE Collab.)
ABE	02W	PRL 89 151802	K. Abe <i>et al.</i>	(BELLE Collab.)

NODE=M085

REFID=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)

$I^G(J^{PC}) = \text{?}^?(??)$

OMITTED FROM SUMMARY TABLE

NODE=M215

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)
$\Gamma_1 \quad 3(\pi^+ \pi^-)$	seen

DESIG=1

X(1840) BRANCHING RATIOS

NODE=M215225

$\Gamma(3(\pi^+ \pi^-))/\Gamma_{\text{total}}$					Γ_1/Γ
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
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

NODE=M054

$\phi_3(1850)$

$I^G(J^{PC}) = 0^-(3^{--})$

$\phi_3(1850)$ MASS

NODE=M054M

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
1854± 7 OUR AVERAGE				
1855±10		ASTON	88E LASS	11 $K^- p \rightarrow K^- K^+ \Lambda$, $K_S^0 K^\pm \pi^\mp \Lambda$
1870 ⁺³⁰ ₋₂₀	430	ARMSTRONG	82 OMEG	18.5 $K^- p \rightarrow$ $K^- K^+ \Lambda$
1850±10	123	ALHARRAN	81B HBC	8.25 $K^- p \rightarrow K \bar{K} \Lambda$

NODE=M054M

$\phi_3(1850)$ WIDTH

NODE=M054W

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
87⁺²⁸₋₂₃ OUR AVERAGE Error includes scale factor of 1.2.				
64±31		ASTON	88E LASS	11 $K^- p \rightarrow K^- K^+ \Lambda$, $K_S^0 K^\pm \pi^\mp \Lambda$
160 ⁺⁹⁰ ₋₅₀	430	ARMSTRONG	82 OMEG	18.5 $K^- p \rightarrow$ $K^- K^+ \Lambda$
80 ⁺⁴⁰ ₋₃₀	123	ALHARRAN	81B HBC	8.25 $K^- p \rightarrow K \bar{K} \Lambda$

NODE=M054W

$\phi_3(1850)$ DECAY MODES

NODE=M054215;NODE=M054

Mode	Fraction (Γ_i/Γ)
Γ_1 $K \bar{K}$	seen
Γ_2 $K \bar{K}^*(892) + c.c.$	seen

DESIG=1;OUR EST;→ UNCHECKED ←
DESIG=2;OUR EST;→ UNCHECKED ←

$\phi_3(1850)$ BRANCHING RATIOS

NODE=M054220

$\Gamma(K \bar{K}^*(892) + c.c.)/\Gamma(K \bar{K})$				Γ_2/Γ_1
VALUE	DOCUMENT ID	TECN	COMMENT	
0.55^{+0.85}_{-0.45}	ASTON	88E LASS	11 $K^- p \rightarrow K^- K^+ \Lambda$, $K_S^0 K^\pm \pi^\mp \Lambda$	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.8 ±0.4	ALHARRAN	81B HBC	8.25 $K^- p \rightarrow K \bar{K} \pi \Lambda$	

NODE=M054R1
NODE=M054R1

$\phi_3(1850)$ REFERENCES

NODE=M054

ASTON	88E	PL B208 324	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS) IGJPC
ARMSTRONG	82	PL 110B 77	T.A. Armstrong <i>et al.</i>	(BARI, BIRM, CERN+) JP
ALHARRAN	81B	PL 101B 357	S. Al-Harran <i>et al.</i>	(BIRM, CERN, GLAS+)

REFID=40577
REFID=21405
REFID=21702

$\eta_2(1870)$

$$I^G(J^{PC}) = 0^+(2^-+)$$

OMITTED FROM SUMMARY TABLE

Needs confirmation.

NODE=M101

NODE=M101

NODE=M101M

NODE=M101M

 $\eta_2(1870)$ 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	$J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$

 $\eta_2(1870)$ 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 $pp \rightarrow p_f \eta \pi^+ \pi^- p_s$
4.1 ± 2.3	ADOMEIT	96 CBAR	1.94 $\bar{p}p \rightarrow \eta 3\pi^0$

¹ Reanalysis of ADOMEIT 96 and ANISOVICH 00E.

NODE=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 $pp \rightarrow p_f \eta \pi^+ \pi^- p_s$

NODE=M101R4

NODE=M101R4

 $\Gamma(a_0(980)\pi)/\Gamma(f_2(1270)\eta)$ Γ_4/Γ_3

VALUE	DOCUMENT ID	TECN	COMMENT
0.48 ± 0.45	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

 $\pi_2(1880)$

$$I^G(J^{PC}) = 1^-(2^-+)$$

NODE=M185

 $\pi(1880)$ MASS

NODE=M185M

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

 $\pi(1880)$ WIDTH

NODE=M185W

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

 $\pi_2(1880)$ DECAY MODES

NODE=M185215;NODE=M185

Mode	
Γ_1	$\eta\eta\pi^-$
Γ_2	$a_0(980)\eta$
Γ_3	$a_2(1320)\eta$
Γ_4	$f_0(1500)\pi$
Γ_5	$f_1(1285)\pi$
Γ_6	$\omega\pi^-\pi^0$

DESIG=1

DESIG=2

DESIG=3

DESIG=4

DESIG=5

DESIG=6

 $\Gamma(a_2(1320)\eta)/\Gamma(f_1(1285)\pi)$ Γ_3/Γ_5

VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
22.7±7.3	69k	KUHN	04	B852	— 18 $\pi^- p \rightarrow \eta\pi^+\pi^-\pi^- p$

NODE=M185R01
NODE=M185R01

 $\Gamma(f_0(1500)\pi)/\Gamma(a_0(980)\eta)$ Γ_4/Γ_2

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.28 ^{+0.20} _{-0.15}	¹ ANISOVICH	01B	SPEC	0 0.6–1.94 $\bar{p}p \rightarrow \eta\eta\pi^0\pi^0$

NODE=M185R02
NODE=M185R02

¹ Systematic errors not estimated.

NODE=M185R02;LINKAGE=NS

 $\pi_2(1880)$ REFERENCES

NODE=M185

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>	

REFID=52160
REFID=50459
REFID=49773
REFID=48318

$\rho(1900)$

$$J^{PC} = 1^{+}(1^{-}-)$$

OMITTED FROM SUMMARY TABLE

See our mini-review under the $\rho(1700)$. **$\rho(1900)$ 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. **$\rho(1900)$ 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. **$\rho(1900) \Gamma(i) \Gamma(e^+ e^-) / \Gamma^2(\text{total})$**

$\Gamma(\phi\pi) / \Gamma_{\text{total}} \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$	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. **$\rho(1900)$ DECAY MODES**

Mode	Fraction (Γ_i / Γ)
Γ_1 6π	seen
Γ_2 $3\pi^+ 3\pi^-$	seen
Γ_3 $2\pi^+ 2\pi^- 2\pi^0$	
Γ_4 $\phi\pi$	
Γ_5 hadrons	seen
Γ_6 $e^+ e^-$	seen
Γ_7 $\bar{N} N$	not seen

 $\rho(1900)$ BRANCHING RATIOS

$\Gamma(6\pi) / \Gamma_{\text{total}}$	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=M170

NODE=M170

NODE=M170M

NODE=M170M

OCCUR=2

NODE=M170M;LINKAGE=AU

NODE=M170M;LINKAGE=PI

NODE=M170M;LINKAGE=RS

NODE=M170W

NODE=M170W

OCCUR=2

NODE=M170W;LINKAGE=AU

NODE=M170W;LINKAGE=PI

NODE=M170W;LINKAGE=RS

NODE=M170215

NODE=M170B01

NODE=M170B01

NODE=M170B01;LINKAGE=AU

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 ←

NODE=M170230

NODE=M170R1

NODE=M170R1

$\rho(1900)$ 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

 $f_2(1910)$

$$I^G(J^{PC}) = 0^+(2^{++})$$

OMITTED FROM SUMMARY TABLE

We list here three different peaks with close masses and widths seen in the mass distributions of $\omega\omega$, $\eta\eta'$, and K^+K^- final states. ALDE 91B argues that they are of different nature.

NODE=M142

NODE=M142

 $f_2(1910)$ MASS

NODE=M142205

NODE=M142MX

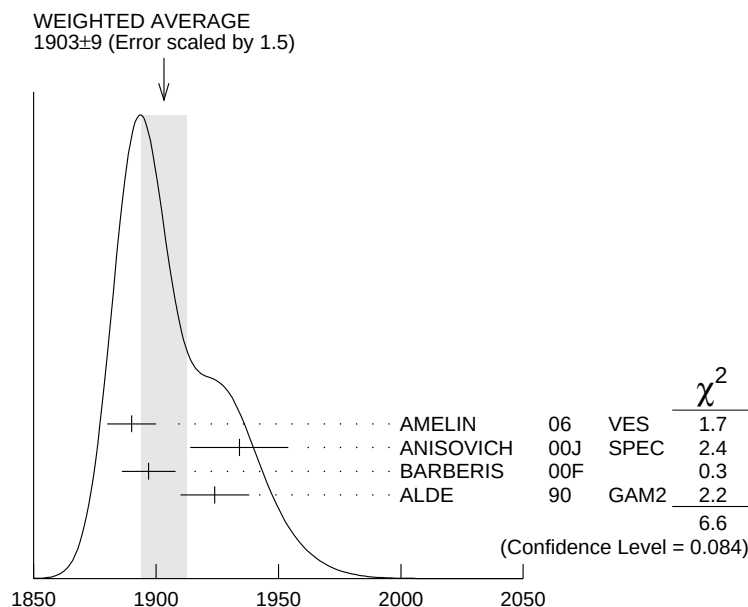
NODE=M142M2
NODE=M142M2

 $f_2(1910)$ $\omega\omega$ MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
1903$\pm$9 OUR AVERAGE	Error includes scale factor of 1.5. See the ideogram below.		
1890 $\pm$ 10	¹ AMELIN	06 VES	36 $\pi^- p \rightarrow \omega\omega n$
1934 $\pm$ 20	ANISOVICH	00J SPEC	
1897 $\pm$ 11	BARBERIS	00F	450 $pp \rightarrow p_f\omega\omega p_s$
1924 $\pm$ 14	ALDE	90 GAM2	38 $\pi^- p \rightarrow \omega\omega n$

¹ Supersedes BELADIDZE 92B.

NODE=M142M2;LINKAGE=AM

 $f_2(1910)$ $\omega\omega$ MODE MASS (MeV) **$f_2(1910)$ $\eta\eta'$ MODE**

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
1934$\pm$16	² BARBERIS	00A	450 $pp \rightarrow p_f\eta\eta' p_s$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
1911 $\pm$ 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
• • • We do not use the following data for averages, fits, limits, etc. • • •			
1941 $\pm$ 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

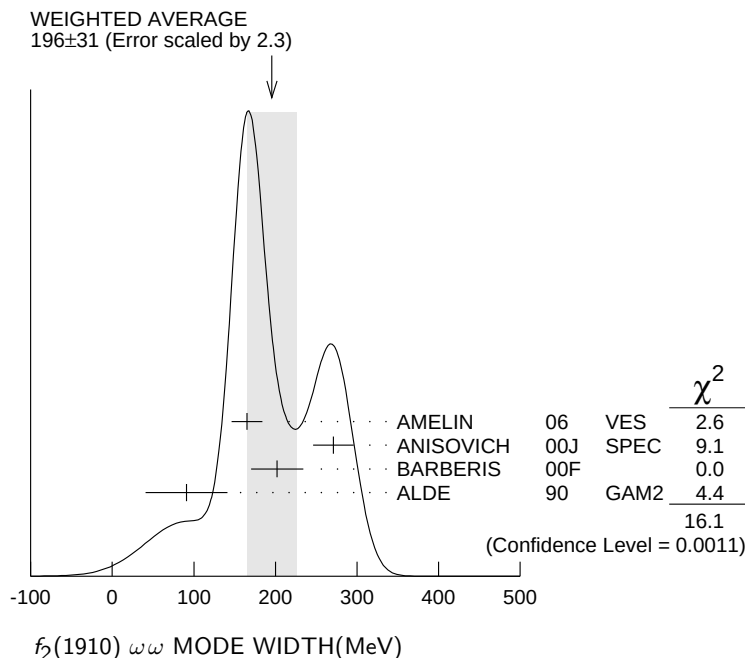
NODE=M142W2
NODE=M142W2 **$f_2(1910)$ $\omega\omega$ MODE**

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
196±31 OUR AVERAGE	Error includes scale factor of 2.3. See the ideogram below.		

165±19	³ AMELIN	06	VES	36 $\pi^- p \rightarrow \omega\omega n$
271±25	ANISOVICH	00J	SPEC	
202±32	BARBERIS	00F		450 $pp \rightarrow p_f \omega\omega p_s$
91±50	ALDE	90	GAM2	38 $\pi^- p \rightarrow \omega\omega n$

³Supersedes BELADIDZE 92B.

NODE=M142W2;LINKAGE=AM

 **$f_2(1910)$ $\eta\eta'$ MODE**

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
141±41	⁴ BARBERIS	00A	450 $pp \rightarrow p_f \eta\eta' p_s$

• • • 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 $\bar{p}p \rightarrow K^+K^-\pi^0$

• • • We do not use the following data for averages, fits, limits, etc. • • •

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 $0.9-1.94 p \bar{p}$

NODE=M142R12
 NODE=M142R12

⁵ Reanalysis of ADOMEIT 96 and ANISOVICH 00E.

NODE=M142R12;LINKAGE=AN

$f_2(1910)$ REFERENCES

NODE=M142

ANISOVICH	11	EPJ C71 1511	A.V. Anisovich <i>et al.</i>	(LOQM, RAL, PNPI)
AMELIN	06	PAN 69 690	D.V. Amelin <i>et al.</i>	(VES Collab.)
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.		

REFID=53631
 REFID=51574

REFID=51136
 REFID=47945
 REFID=47950
 REFID=47957
 REFID=47962
 REFID=45202
 REFID=42172
 REFID=43309
 REFID=41844

REFID=41911
 REFID=40935
 REFID=40727
 REFID=44697

REFID=40734

$f_2(1950)$

$$I^G(J^{PC}) = 0^+(2^{++})$$

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 $f_4(2050)$.

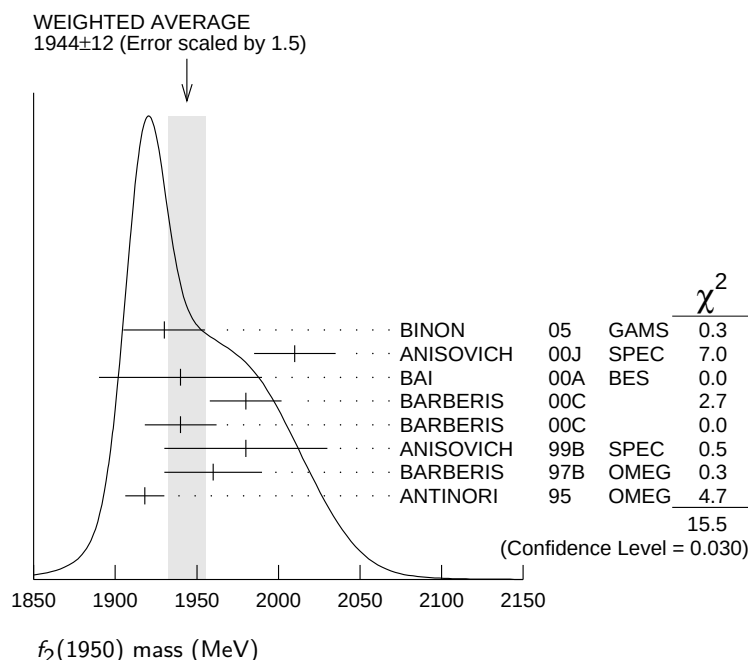
⁵ T-matrix pole.

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=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+) JP
OAKDEN	94	NP A574 731	M.N. Oakden, M.R. Pennington	(DURH)
ASTON	91	NPBPS B21 5	D. Aston <i>et al.</i>	(LASS Collab.)

NODE=M135

REFID=53525
REFID=52761
REFID=50780

REFID=49650
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

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	$22 \pi^- p \rightarrow 2 \phi n$

NODE=M106M

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

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	$22 \pi^- p \rightarrow 2 \phi n$

NODE=M106W

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

$\Gamma(K\bar{K})/\Gamma_{\text{total}}$	DOCUMENT ID	TECN	COMMENT	Γ_2/Γ
VALUE				
seen	VLADIMIRSK...06	SPEC	$40 \pi^- p \rightarrow K_S^0 K_S^0 n$	

NODE=M106R01
NODE=M106R01

 $f_2(2010)$ REFERENCES

NODE=M106

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)

REFID=51191

REFID=40580
REFID=40285
REFID=21871
REFID=21869
REFID=21866
REFID=21867

$f_0(2020)$

$$J^{PC} = 0^{++}$$

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

1996^{+10}_{-9} OUR AVERAGE Error includes scale factor of 1.1.

$1885 \pm 13^{+50}_{-2}$	420k	ALEKSEEV	10	COMP	$190 \pi^- Pb \rightarrow \pi^- \pi^- \pi^+ Pb'$
$1985 \pm 10 \pm 13$	145k	LU	05	B852	$18 \pi^- p \rightarrow \omega \pi^- \pi^0 p$
$1996 \pm 25 \pm 43$		CHUNG	02	B852	$18.3 \pi^- p \rightarrow 3\pi p$
2005^{+25}_{-45}		¹ ANISOVICH	01F	SPEC	$2.0 \bar{p} p \rightarrow 3\pi^0, \pi^0 \eta, \pi^0 \eta'$
$2000 \pm 40^{+60}_{-20}$		IVANOV	01	B852	$18 \pi^- p \rightarrow \eta' \pi^- p$
$1944 \pm 8 \pm 50$		² AMELIN	99	VES	$37 \pi^- A \rightarrow \omega \pi^- \pi^0 A^*$
2010 ± 20		³ DONSKOV	96	GAM2 0	$38 \pi^- p \rightarrow \eta \pi^0 n$
2040 ± 30		⁴ CLELAND	82B	SPEC $\pm$	$50 \pi p \rightarrow K_S^0 K^\pm p$
2030 ± 50		⁵ CORDEN	78C	OMEG 0	$15 \pi^- p \rightarrow 3\pi n$

• • • We do not use the following data for averages, fits, limits, etc. • • •

2004 ± 6	80k	⁶ UMAN	06	E835	$5.2 \bar{p} p \rightarrow \eta \eta \pi^0$
1903 ± 10		⁷ BALDI	78	SPEC $-$	$10 \pi^- p \rightarrow p K_S^0 K^-$

¹ From the combined analysis of ANISOVICH 99C, ANISOVICH 99E, and ANISOVICH 01F.

² May be a different state.

³ From a simultaneous fit to the G_+ and G_0 wave intensities.

⁴ From an amplitude analysis.

⁵ $J^P = 4^+$ is favored, though $J^P = 2^+$ cannot be excluded.

⁶ Statistical error only.

⁷ From a fit to the Y_8^0 moment. Limited by phase space.

NODE=M017M;LINKAGE=AN
 NODE=M017M;LINKAGE=DM
 NODE=M017M;LINKAGE=A
 NODE=M017M;LINKAGE=C
 NODE=M017M;LINKAGE=M
 NODE=M017M;LINKAGE=ST
 NODE=M017M;LINKAGE=Y

 $a_4(2040)$ WIDTH

NODE=M017W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

NODE=M017W

255^{+28}_{-24} OUR AVERAGE Error includes scale factor of 1.3. See the ideogram below.

$294 \pm 25^{+46}_{-19}$	420k	ALEKSEEV	10	COMP	$190 \pi^- Pb \rightarrow \pi^- \pi^- \pi^+ Pb'$
$231 \pm 30 \pm 46$	145k	LU	05	B852	$18 \pi^- p \rightarrow \omega \pi^- \pi^0 p$
$298 \pm 81 \pm 85$		CHUNG	02	B852	$18.3 \pi^- p \rightarrow 3\pi p$
180 ± 30		⁸ ANISOVICH	01F	SPEC	$2.0 \bar{p} p \rightarrow 3\pi^0, \pi^0 \eta, \pi^0 \eta'$
$350 \pm 100^{+70}_{-50}$		IVANOV	01	B852	$18 \pi^- p \rightarrow \eta' \pi^- p$
$324 \pm 26 \pm 75$		⁹ AMELIN	99	VES	$37 \pi^- A \rightarrow \omega \pi^- \pi^0 A^*$
370 ± 80		¹⁰ DONSKOV	96	GAM2 0	$38 \pi^- p \rightarrow \eta \pi^0 n$
380 ± 150		¹¹ CLELAND	82B	SPEC $\pm$	$50 \pi p \rightarrow K_S^0 K^\pm p$
510 ± 200		¹² CORDEN	78C	OMEG 0	$15 \pi^- p \rightarrow 3\pi n$

• • • We do not use the following data for averages, fits, limits, etc. • • •

401 ± 16	80k	¹³ UMAN	06	E835	$5.2 \bar{p} p \rightarrow \eta \eta \pi^0$
166 ± 43		¹⁴ BALDI	78	SPEC $-$	$10 \pi^- p \rightarrow p K_S^0 K^-$

⁸ From the combined analysis of ANISOVICH 99C, ANISOVICH 99E, and ANISOVICH 01F.

⁹ May be a different state.

¹⁰ From a simultaneous fit to the G_+ and G_0 wave intensities.

¹¹ From an amplitude analysis.

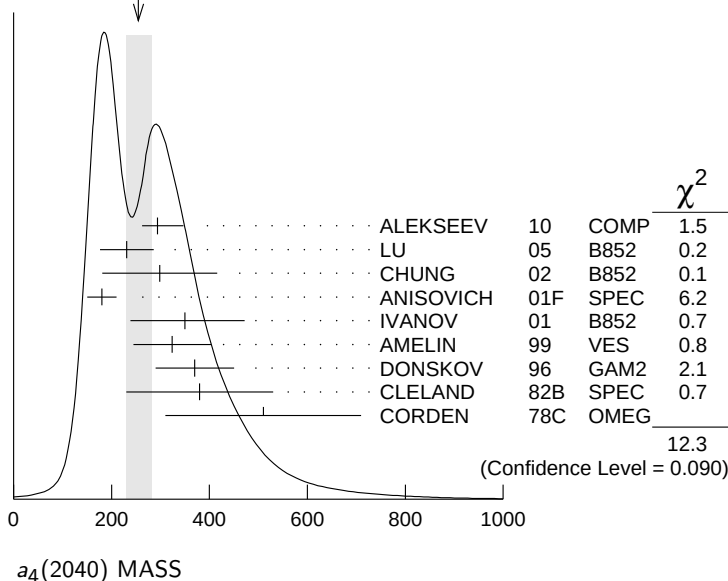
¹² $J^P = 4^+$ is favored, though $J^P = 2^+$ cannot be excluded.

¹³ Statistical error only.

¹⁴ From a fit to the Y_8^0 moment. Limited by phase space.

NODE=M017W;LINKAGE=AN
 NODE=M017W;LINKAGE=DM
 NODE=M017W;LINKAGE=A
 NODE=M017W;LINKAGE=C
 NODE=M017W;LINKAGE=M
 NODE=M017W;LINKAGE=ST
 NODE=M017W;LINKAGE=Y

WEIGHTED AVERAGE
255+28-24 (Error scaled by 1.3)



$a_4(2040)$ DECAY MODES

NODE=M017215;NODE=M017

Mode	Fraction (Γ_i/Γ)
Γ_1 $K\bar{K}$	seen
Γ_2 $\pi^+\pi^-\pi^0$	seen
Γ_3 $\rho\pi$	seen
Γ_4 $f_2(1270)\pi$	seen
Γ_5 $\omega\pi^-\pi^0$	seen
Γ_6 $\omega\rho$	seen
Γ_7 $\eta\pi^0$	seen
Γ_8 $\eta'(958)\pi$	seen

DESIG=1

DESIG=2

DESIG=5;OUR EST;→ UNCHECKED ←

DESIG=6;OUR EST;→ UNCHECKED ←

DESIG=7;OUR EST;→ UNCHECKED ←

DESIG=8

DESIG=3

DESIG=4;OUR EST;→ UNCHECKED ←

$a_4(2040)$ BRANCHING RATIOS

NODE=M017220

$\Gamma(K\bar{K})/\Gamma_{\text{total}}$					Γ_1/Γ
VALUE	DOCUMENT ID	TECN	CHG	COMMENT	
seen	BALDI	78	SPEC	$\pm$ 10 $\pi^- p \rightarrow K_S^0 K^- p$	
$\Gamma(\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$					Γ_2/Γ
VALUE	DOCUMENT ID	TECN	CHG	COMMENT	
seen	CORDEN	78C	OMEG	0 15 $\pi^- p \rightarrow 3\pi n$	
$\Gamma(\rho\pi)/\Gamma(f_2(1270)\pi)$					Γ_3/Γ_4
VALUE	DOCUMENT ID	TECN	COMMENT		
$1.1 \pm 0.2 \pm 0.2$	CHUNG	02	B852	18.3 $\pi^- p \rightarrow 3\pi p$	
$\Gamma(\eta\pi^0)/\Gamma_{\text{total}}$					Γ_7/Γ
VALUE	DOCUMENT ID	TECN	CHG	COMMENT	
seen	DONSKOV	96	GAM2	0 38 $\pi^- p \rightarrow \eta\pi^0 n$	
$\Gamma(\omega\rho)/\Gamma_{\text{total}}$					Γ_6/Γ
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
seen	145k	LU	05	B852 18 $\pi^- p \rightarrow \omega\pi^-\pi^0 p$	

NODE=M017R1
NODE=M017R1

NODE=M017R2
NODE=M017R2

NODE=M017R4
NODE=M017R4

NODE=M017R3
NODE=M017R3

NODE=M017R5
NODE=M017R5

$a_4(2040)$ REFERENCES

ALEKSEEV	10	PRL 104 241803	M.G. Alekseev <i>et al.</i>	(COMPASS Collab.)
UMAN	06	PR D73 052009	I. Uman <i>et al.</i>	(FNAL E835)
LU	05	PRL 94 032002	M. Lu <i>et al.</i>	(BNL E852 Collab.)
CHUNG	02	PR D65 072001	S.U. Chung <i>et al.</i>	(BNL E852 Collab.)
ANISOVICH	01F	PL B517 261	A.V. Anisovich <i>et al.</i>	
IVANOV	01	PRL 86 3977	E.I. Ivanov <i>et al.</i>	(BNL E852 Collab.)
AMELIN	99	PAN 62 445	D.V. Amelin <i>et al.</i>	(VES Collab.)
		Translated from YAF 62 487.		
ANISOVICH	99C	PL B452 173	A.V. Anisovich <i>et al.</i>	
ANISOVICH	99E	PL B452 187	A.V. Anisovich <i>et al.</i>	
DONSKOV	96	PAN 59 982	S.V. Donskov <i>et al.</i>	(GAMS Collab.) IGJPC
		Translated from YAF 59 1027.		
CLELAND	82B	NP B208 228	W.E. Cleland <i>et al.</i>	(DURH, GEVA, LAUS+)
BALDI	78	PL 74B 413	R. Baldi <i>et al.</i>	(GEVA) JP
CORDEN	78C	NP B136 77	M.J. Corden <i>et al.</i>	(BIRM, RHEL, TELA+) JP

NODE=M017

REFID=53356
REFID=51063
REFID=50459
REFID=48837
REFID=48352
REFID=48317
REFID=46910

REFID=46903
REFID=46902
REFID=45207

REFID=21281
REFID=21783
REFID=20859

NODE=M016

 $f_4(2050)$

$$I^G(J^{PC}) = 0^+(4^{++})$$

 $f_4(2050)$ MASS

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
2018±11 OUR AVERAGE		Error includes scale factor of 2.1. See the ideogram below.		
1960±15		AMELIN	06 VES	36 $\pi^- p \rightarrow \omega \omega n$
2005±10		¹ BINON	05 GAMS	33 $\pi^- p \rightarrow \eta \eta n$
1998±15		ALDE	98 GAM4	100 $\pi^- p \rightarrow \pi^0 \pi^0 n$
2060±20		ALDE	90 GAM2	38 $\pi^- p \rightarrow \omega \omega n$
2038±30		AUGUSTIN	87 DM2	$J/\psi \rightarrow \gamma \pi^+ \pi^-$
2086±15		BALTRUSAIT..	87 MRK3	$J/\psi \rightarrow \gamma \pi^+ \pi^-$
2000±60		ALDE	86D GAM4	100 $\pi^- p \rightarrow n 2\eta$
2020±20	40k	² BINON	84B GAM2	38 $\pi^- p \rightarrow n 2\pi^0$
2015±28		³ CASON	82 STRC	8 $\pi^+ p \rightarrow \Delta^{++} \pi^0 \pi^0$
2031 ⁺²⁵ ₋₃₆		ETKIN	82B MPS	23 $\pi^- p \rightarrow n 2K_S^0$
2020±30	700	APEL	75 NICE	40 $\pi^- p \rightarrow n 2\pi^0$
2050±25		BLUM	75 ASPK	18.4 $\pi^- p \rightarrow n K^+ K^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

1966±25	⁴ ANISOVICH	09 RVUE	0.0 $\bar{p} p, \pi N$
1885 ⁺¹⁴⁺²¹⁸ ₋₁₃₋₂₅	⁵ UEHARA	09 BELL	10.6 $e^+ e^- \rightarrow e^+ e^- \pi^0 \pi^0$
2018± 6	ANISOVICH	00J SPEC	2.0 $\bar{p} p \rightarrow \eta \pi^0 \pi^0, \pi^0 \pi^0,$ $\eta \eta, \eta \eta', \pi \pi$
~ 2000	⁶ MARTIN	98 RVUE	$N \bar{N} \rightarrow \pi \pi$
~ 2010	⁷ MARTIN	97 RVUE	$\bar{N} N \rightarrow \pi \pi$
~ 2040	⁸ OAKDEN	94 RVUE	0.36–1.55 $\bar{p} p \rightarrow \pi \pi$
~ 1990	⁹ OAKDEN	94 RVUE	0.36–1.55 $\bar{p} p \rightarrow \pi \pi$
1978± 5	¹⁰ ALPER	80 CNTR	62 $\pi^- p \rightarrow K^+ K^- n$
2040±10	¹⁰ ROZANSKA	80 SPRK	18 $\pi^- p \rightarrow p \bar{p} n$
1935±13	¹⁰ CORDEN	79 OMEG	12–15 $\pi^- p \rightarrow n 2\pi$
1988± 7	EVANGELIS...	79B OMEG	10 $\pi^- p \rightarrow K^+ K^- n$
1922±14	¹¹ ANTIPOV	77 CIBS	25 $\pi^- p \rightarrow p 3\pi$

¹ From the first PWA solution.

² From a partial-wave analysis of the data.

³ From an amplitude analysis of the reaction $\pi^+ \pi^- \rightarrow 2\pi^0$.

⁴ K matrix pole.

⁵ Taking into account the $f_2(1950)$. Helicity-2 production favored.

⁶ Energy-dependent analysis.

⁷ Single energy analysis.

⁸ From solution A of amplitude analysis of data on $\bar{p} p \rightarrow \pi \pi$. See however KLOET 96 who fit $\pi^+ \pi^-$ only and find waves only up to $J = 3$ to be important but not significantly resonant.

⁹ From solution B of amplitude analysis of data on $\bar{p} p \rightarrow \pi \pi$. See however KLOET 96 who fit $\pi^+ \pi^-$ only and find waves only up to $J = 3$ to be important but not significantly resonant.

¹⁰ $I(J^P) = 0(4^+)$ from amplitude analysis assuming one-pion exchange.

¹¹ Width errors enlarged by us to $4\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.

NODE=M016M

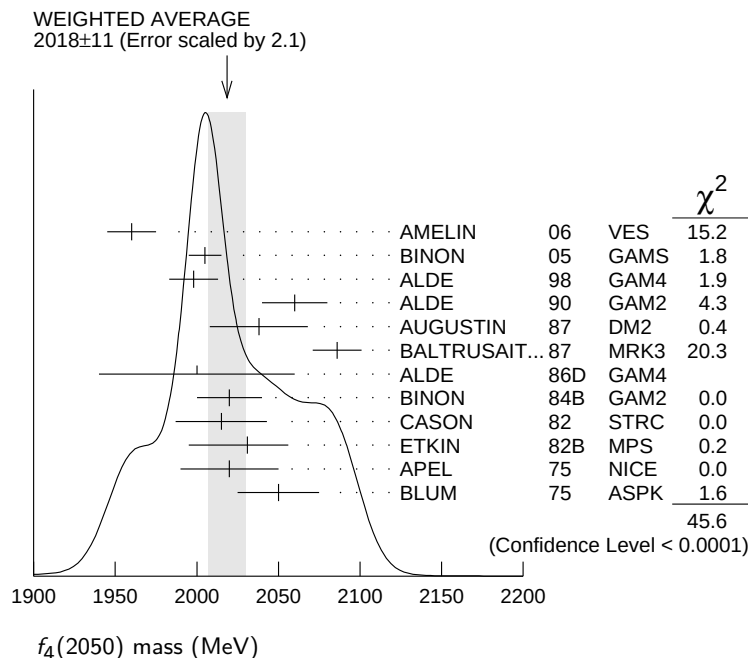
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OCCUR=2

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NODE=M016M;LINKAGE=N
NODE=M016M;LINKAGE=NN
NODE=M016M;LINKAGE=KM
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NODE=M016M;LINKAGE=RB
NODE=M016M;LINKAGE=BR
NODE=M016M;LINKAGE=B

NODE=M016M;LINKAGE=BB

NODE=M016M;LINKAGE=M
NODE=M016M;LINKAGE=T



$f_4(2050)$ WIDTH

NODE=M016W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
237± 18 OUR AVERAGE		Error includes scale factor of 1.9. See the ideogram below.		
290± 20		AMELIN	06	VES 36 $\pi^- p \rightarrow \omega \omega n$
340± 80		¹² BINON	05	GAMS 33 $\pi^- p \rightarrow \eta \eta n$
395± 40		ALDE	98	GAM4 100 $\pi^- p \rightarrow \pi^0 \pi^0 n$
170± 60		ALDE	90	GAM2 38 $\pi^- p \rightarrow \omega \omega n$
304± 60		AUGUSTIN	87	DM2 $J/\psi \rightarrow \gamma \pi^+ \pi^-$
210± 63		BALTRUSAIT..	87	MRK3 $J/\psi \rightarrow \gamma \pi^+ \pi^-$
400±100		ALDE	86D	GAM4 100 $\pi^- p \rightarrow n 2 \eta$
240± 40	40k	¹³ BINON	84B	GAM2 38 $\pi^- p \rightarrow n 2 \pi^0$
190± 14		DENNEY	83	LASS 10 $\pi^+ n / \pi^+ p$
186 ⁺¹⁰³ ₋₅₈		¹⁴ CASON	82	STRC 8 $\pi^+ p \rightarrow \Delta^{++} \pi^0 \pi^0$
305 ⁺³⁶ ₋₁₁₉		ETKIN	82B	MPS 23 $\pi^- p \rightarrow n 2 K_S^0$
180± 60	700	APEL	75	NICE 40 $\pi^- p \rightarrow n 2 \pi^0$
225 ⁺¹²⁰ ₋₇₀		BLUM	75	ASPK 18.4 $\pi^- p \rightarrow n K^+ K^-$

NODE=M016W

• • • We do not use the following data for averages, fits, limits, etc. • • •

260± 40	¹⁵	ANISOVICH	09	RVUE 0.0 $\bar{p} p, \pi N$
453± 20 ⁺³¹ ₋₁₂₉	¹⁶	UEHARA	09	BELL 10.6 $e^+ e^- \rightarrow e^+ e^- \pi^0 \pi^0$
182± 7		ANISOVICH	00J	SPEC 2.0 $\bar{p} p \rightarrow \eta \pi^0 \pi^0, \pi^0 \pi^0,$ $\eta \eta, \eta \eta', \pi \pi$
~ 170	¹⁷	MARTIN	98	RVUE $N \bar{N} \rightarrow \pi \pi$
~ 200	¹⁸	MARTIN	97	RVUE $\bar{N} N \rightarrow \pi \pi$
~ 60	¹⁹	OAKDEN	94	RVUE 0.36-1.55 $\bar{p} p \rightarrow \pi \pi$
~ 80	²⁰	OAKDEN	94	RVUE 0.36-1.55 $\bar{p} p \rightarrow \pi \pi$
243± 16	²¹	ALPER	80	CNTR 62 $\pi^- p \rightarrow K^+ K^- n$
140± 15	²¹	ROZANSKA	80	SPRK 18 $\pi^- p \rightarrow p \bar{p} n$
263± 57	²¹	CORDEN	79	OMEG 12-15 $\pi^- p \rightarrow n 2 \pi$
100± 28		EVANGELIS...	79B	OMEG 10 $\pi^- p \rightarrow K^+ K^- n$
107± 56	²²	ANTIPOV	77	CIBS 25 $\pi^- p \rightarrow p 3 \pi$

OCCUR=2

¹² From the first PWA solution.

¹³ From a partial-wave analysis of the data.

¹⁴ From an amplitude analysis of the reaction $\pi^+ \pi^- \rightarrow 2 \pi^0$.

¹⁵ K matrix pole.

¹⁶ Taking into account the $f_2(1950)$. Helicity-2 production favored.

¹⁷ Energy-dependent analysis.

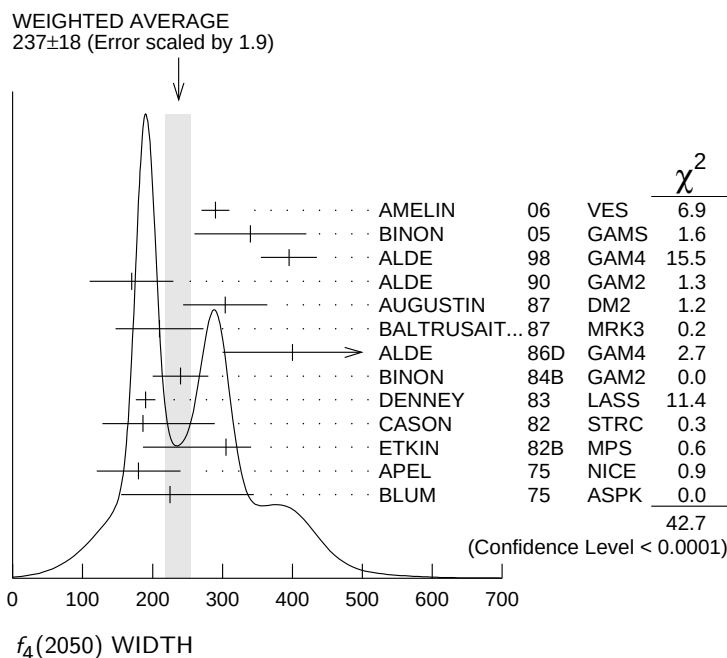
¹⁸ Single energy analysis.

NODE=M016W;LINKAGE=BI
 NODE=M016W;LINKAGE=N
 NODE=M016W;LINKAGE=NN
 NODE=M016W;LINKAGE=KM
 NODE=M016W;LINKAGE=UE
 NODE=M016W;LINKAGE=RB
 NODE=M016W;LINKAGE=BR

- 19 From solution A of amplitude analysis of data on $\bar{p}p \rightarrow \pi\pi$. See however KLOET 96 who fit $\pi^+\pi^-$ only and find waves only up to $J = 3$ to be important but not significantly resonant.
- 20 From solution B of amplitude analysis of data on $\bar{p}p \rightarrow \pi\pi$. See however KLOET 96 who fit $\pi^+\pi^-$ only and find waves only up to $J = 3$ to be important but not significantly resonant.
- 21 $I(J^P) = 0(4^+)$ from amplitude analysis assuming one-pion exchange.
- 22 Width errors enlarged by us to $4\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.

NODE=M016W;LINKAGE=BW

NODE=M016W;LINKAGE=BB

NODE=M016W;LINKAGE=M
NODE=M016W;LINKAGE=T **$f_4(2050)$ DECAY MODES**

NODE=M016215;NODE=M016

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \omega\omega$	seen
$\Gamma_2 \quad \pi\pi$	$(17.0 \pm 1.5) \%$
$\Gamma_3 \quad K\bar{K}$	$(6.8^{+3.4}_{-1.8}) \times 10^{-3}$
$\Gamma_4 \quad \eta\eta$	$(2.1 \pm 0.8) \times 10^{-3}$
$\Gamma_5 \quad 4\pi^0$	$< 1.2 \%$
$\Gamma_6 \quad \gamma\gamma$	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

TECN

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

TECN

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

TECN

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

TECN

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+)	
BALTRUSAIT...	87	PR D35 2077	R.M. Baltrusaitis <i>et al.</i>	(Mark III Collab.)	
ALDE	86D	NP B269 485	D.M. Alde <i>et al.</i>	(BELG, LAPP, SERP, CERN+)	
ALTHOFF	85B	ZPHY C29 189	M. Althoff <i>et al.</i>	(TASSO Collab.)	
BINON	84B	LNC 39 41	F.G. Binon <i>et al.</i>	(SERP, BELG, LAPP)	
BINON	83C	SJNP 38 723	F.G. Binon <i>et al.</i>	(SERP, BRUX+)	
		Translated from YAF 38 1199.			
DENNEY	83	PR D28 2726	D.L. Denney <i>et al.</i>	(IOWA, MICH)	
CASON	82	PRL 48 1316	N.M. Cason <i>et al.</i>	(NDAM, ANL)	
ETKIN	82B	PR D25 1786	A. Etkin <i>et al.</i>	(BNL, CUNY, TUFTS, VAND)	
ALPER	80	PL 94B 422	B. Alper <i>et al.</i>	(AMST, CERN, CRAC, MPIM+)	
ROZANSKA	80	NP B162 505	M. Rozanska <i>et al.</i>	(MPIM, CERN)	
CORDEN	79	NP B157 250	M.J. Corden <i>et al.</i>	(BIRM, RHEL, TELA+)	
EVANGELIS...	79B	NP B154 381	C. Evangelista <i>et al.</i>	(BARI, BONN, CERN+)	
ANTIPOV	77	NP B119 45	Y.M. Antipov <i>et al.</i>	(SERP, GEVA)	
APEL	75	PL 57B 398	W.D. Apel <i>et al.</i>	(KARLK, KARLE, PISA, SERP+)	
BLUM	75	PL 57B 403	W. Blum <i>et al.</i>	(CERN, MPIM)	

REFID=52719

REFID=52761

REFID=51574

REFID=50780

REFID=47432

REFID=47950

REFID=47962

REFID=46605

REFID=46914

REFID=46373

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REFID=40010

REFID=20765

REFID=21349

REFID=21780

REFID=40288

REFID=20754

REFID=20746

REFID=20390

REFID=21665

REFID=21774

REFID=20374

REFID=21967

REFID=20728

REFID=20720

REFID=21651

$\pi_2(2100)$

$$I^G(J^{PC}) = 1^-(2^-+)$$

OMITTED FROM SUMMARY TABLE

Needs confirmation.

NODE=M020

NODE=M020

NODE=M020M

NODE=M020M

NODE=M020M;LINKAGE=AX

NODE=M020M;LINKAGE=L

NODE=M020W

NODE=M020W

NODE=M020W;LINKAGE=AX

NODE=M020W;LINKAGE=L

NODE=M020215;NODE=M020

DESIG=1;OUR EST;→ UNCHECKED ←

DESIG=2;OUR EST;→ UNCHECKED ←

DESIG=3;OUR EST;→ UNCHECKED ←

DESIG=4;OUR EST;→ UNCHECKED ←

NODE=M020220

NODE=M020R1

NODE=M020R1

NODE=M020R2

NODE=M020R2

NODE=M020R3

NODE=M020R3

NODE=M020R4

NODE=M020R4

NODE=M020R;LINKAGE=L

NODE=M020

REFID=44433

REFID=20872

 $\pi_2(2100)$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
2090± 29 OUR AVERAGE			
2090± 30	¹ AMELIN	95B VES	$36 \pi^- A \rightarrow \pi^+ \pi^- \pi^- A$
2100± 150	² DAUM	81B CNTR	$63,94 \pi^- p \rightarrow 3\pi X$
¹ From a fit to $J^{PC} = 2^-+ f_2(1270)\pi, (\pi\pi)_S\pi$ waves.			
² From a two-resonance fit to four 2^-0^+ waves.			

 $\pi_2(2100)$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
625± 50 OUR AVERAGE	Error includes scale factor of 1.2.		
520± 100	³ AMELIN	95B VES	$36 \pi^- A \rightarrow \pi^+ \pi^- \pi^- A$
651± 50	⁴ DAUM	81B CNTR	$63,94 \pi^- p \rightarrow 3\pi X$
³ From a fit to $J^{PC} = 2^-+ f_2(1270)\pi, (\pi\pi)_S\pi$ waves.			
⁴ From a two-resonance fit to four 2^-0^+ waves.			

 $\pi_2(2100)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad 3\pi$	seen
$\Gamma_2 \quad \rho\pi$	seen
$\Gamma_3 \quad f_2(1270)\pi$	seen
$\Gamma_4 \quad (\pi\pi)_S\pi$	seen

 $\pi_2(2100)$ BRANCHING RATIOS

$\Gamma(\rho\pi)/\Gamma(3\pi)$				Γ_2/Γ_1
<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
0.19±0.05	⁵ DAUM	81B	CNTR	63,94 $\pi^- p$
$\Gamma(f_2(1270)\pi)/\Gamma(3\pi)$				Γ_3/Γ_1
<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
0.36±0.09	⁵ DAUM	81B	CNTR	63,94 $\pi^- p$
$\Gamma((\pi\pi)_s\pi)/\Gamma(3\pi)$				Γ_4/Γ_1
<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
0.45±0.07	⁵ DAUM	81B	CNTR	63,94 $\pi^- p$
D-wave/S-wave RATIO FOR $\pi_2(2100) \rightarrow f_2(1270)\pi$				
<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
0.39±0.23	⁵ DAUM	81B	CNTR	63,94 $\pi^- p$
⁵ From a two-resonance fit to four 2^-0^+ waves.				

 $\pi_2(2100)$ REFERENCES

AMELIN	95B	PL B356 595	D.V. Amelin <i>et al.</i>	(SERP, TBIL)
DAUM	81B	NP B182 269	C. Daum <i>et al.</i>	(AMST, CERN, CRAC, MPIM+)

$f_0(2100)$

$$I^G(J^{PC}) = 0^+(0^{++})$$

OMITTED FROM SUMMARY TABLE

Needs confirmation.

NODE=M168

NODE=M168

NODE=M168M

NODE=M168M

 $f_0(2100)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2103± 8 OUR AVERAGE				
2102±13		¹ ANISOVICH	00J SPEC	2.0 $\bar{p}p \rightarrow \eta\pi^0\pi^0, \pi^0\pi^0,$ $\eta\eta, \eta\eta', \pi^+\pi^-$
2090±30		BAI	00A BES	$J/\psi \rightarrow \gamma(\pi^+\pi^-\pi^+\pi^-)$
2105±10		ANISOVICH	99K SPEC	0.6–1.94 $\bar{p}p \rightarrow \eta\eta, \eta\eta'$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2105± 8	80k	² UMAN	06 E835	5.2 $\bar{p}p \rightarrow \eta\eta\pi^0$
~ 2104		BUGG	95	$J/\psi \rightarrow \gamma\pi^+\pi^-\pi^+\pi^-$
~ 2122		HASAN	94 RVUE	$\bar{p}p \rightarrow \pi\pi$

¹ Includes the data of ANISOVICH 00B indicating to exotic decay pattern.² Statistical error only.

NODE=M168M;LINKAGE=AN

NODE=M168M;LINKAGE=ST

 $f_0(2100)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
209± 19 OUR AVERAGE				
211± 29		³ ANISOVICH	00J SPEC	2.0 $\bar{p}p \rightarrow \eta\pi^0\pi^0, \pi^0\pi^0,$ $\eta\eta, \eta\eta', \pi^+\pi^-$
330±100		BAI	00A BES	$J/\psi \rightarrow \gamma(\pi^+\pi^-\pi^+\pi^-)$
200± 25		ANISOVICH	99K SPEC	0.6–1.94 $\bar{p}p \rightarrow \eta\eta, \eta\eta'$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
236± 14	80k	⁴ UMAN	06 E835	5.2 $\bar{p}p \rightarrow \eta\eta\pi^0$
~ 203		BUGG	95	$J/\psi \rightarrow \gamma\pi^+\pi^-\pi^+\pi^-$
~ 273		HASAN	94 RVUE	$\bar{p}p \rightarrow \pi\pi$

³ Includes the data of ANISOVICH 00B indicating to exotic decay pattern.⁴ Statistical error only.

NODE=M168W

NODE=M168W

NODE=M168W;LINKAGE=AN

NODE=M168W;LINKAGE=ST

 $f_0(2100)$ REFERENCES

UMAN	06	PR D73 052009	I. Uman <i>et al.</i>	(FNAL E835)
ANISOVICH	00B	NP A662 319	A.V. Anisovich <i>et al.</i>	
ANISOVICH	00J	PL B491 47	A.V. Anisovich <i>et al.</i>	
BAI	00A	PL B472 207	J.Z. Bai <i>et al.</i>	(BES Collab.)
ANISOVICH	99K	PL B468 309	A.V. Anisovich <i>et al.</i>	
BUGG	95	PL B353 378	D.V. Bugg <i>et al.</i>	(LOQM, PNPI, WASH)
HASAN	94	PL B334 215	A. Hasan, D.V. Bugg	(LOQM)

NODE=M168

 REFID=51063
 REFID=47942
 REFID=47950
 REFID=47426
 REFID=47472
 REFID=44438
 REFID=44103

$f_2(2150)$

$$I^G(J^{PC}) = 0^+(2^{++})$$

OMITTED FROM SUMMARY TABLE

This entry was previously called T_0 .

NODE=M042

NODE=M042

NODE=M042205

NODE=M042M
NODE=M042M

NODE=M042M;LINKAGE=ST

NODE=M042M3
NODE=M042M3NODE=M042M3;LINKAGE=K3
NODE=M042M3;LINKAGE=ANODE=M042M4
NODE=M042M4

NODE=M042M4;LINKAGE=AD

NODE=M042M1
NODE=M042M1

OCCUR=2

NODE=M042M1;LINKAGE=B

NODE=M042M1;LINKAGE=BB
NODE=M042M1;LINKAGE=P
NODE=M042M1;LINKAGE=LNODE=M042M2
NODE=M042M2NODE=M042M2;LINKAGE=I
NODE=M042M2;LINKAGE=E
NODE=M042M2;LINKAGE=M

$f_2(2150)$ MASS

$f_2(2150)$ MASS, COMBINED MODES (MeV)

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2157±12 OUR AVERAGE Includes data from the 2 datablocks that follow this one.				
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2170±6	80k	¹ UMAN	06 E835	5.2 $\bar{p}p \rightarrow \eta\eta\pi^0$
¹ Statistical error only.				
$\eta\eta$ MODE				
VALUE (MeV)	DOCUMENT ID	TECN	COMMENT	
The data in this block is included in the average printed for a previous datablock.				
2157±12 OUR AVERAGE				
2151±16	BARBERIS	00E	450	$pp \rightarrow p_f\eta\eta p_s$
2175±20	PROKOSHKIN	95D	GAM4	300 $\pi^- N \rightarrow \pi^- N 2\eta$, 450 $pp \rightarrow pp 2\eta$
2130±35	SINGOVSKI	94	GAM4	450 $pp \rightarrow pp 2\eta$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2140±30	² ABELE	99B	CBAR	
2104±20	³ ARMSTRONG	93C	E760	$\bar{p}p \rightarrow \pi^0\eta\eta \rightarrow 6\gamma$
² Spin not determined.				
³ No J^{PC} determination.				
$\eta\pi\pi$ MODE				
VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
The data in this block is included in the average printed for a previous datablock.				
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2135±20±45	⁴ ADOMEIT	96	CBAR 0	1.94 $\bar{p}p \rightarrow \eta 3\pi^0$
⁴ ANISOVICH 00E recommends to withdraw ADOMEIT 96 that assumed a single $J^P = 2^+$ resonance.				
$\bar{p}p \rightarrow \pi\pi$				
VALUE (MeV)	DOCUMENT ID	TECN	COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
~ 2090	⁵ OAKDEN	94	RVUE	0.36–1.55 $\bar{p}p \rightarrow \pi\pi$
~ 2120	⁶ OAKDEN	94	RVUE	0.36–1.55 $\bar{p}p \rightarrow \pi\pi$
~ 2170	⁷ MARTIN	80B	RVUE	
~ 2150	⁷ MARTIN	80C	RVUE	
~ 2150	⁸ DULUDE	78B	OSPK	1–2 $\bar{p}p \rightarrow \pi^0\pi^0$
⁵ OAKDEN 94 makes an amplitude analysis of LEAR data on $\bar{p}p \rightarrow \pi\pi$ using a method based on Barrelet zeros. This is solution A. The amplitude analysis of HASAN 94 includes earlier data as well, and assume that the data can be parametrized in terms of towers of nearly degenerate resonances on the leading Regge trajectory. See also KLOET 96 and MARTIN 97 who make related analyses.				
⁶ From solution B of amplitude analysis of data on $\bar{p}p \rightarrow \pi\pi$.				
⁷ $I(J^P) = 0(2^+)$ from simultaneous analysis of $p\bar{p} \rightarrow \pi^-\pi^+$ and $\pi^0\pi^0$.				
⁸ $I^G(J^P) = 0^+(2^+)$ from partial-wave amplitude analysis.				
S-CHANNEL $\bar{p}p$, $\bar{N}N$ or $\bar{K}K$				
VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2139 ⁺ ₈	⁹ EVANGELIS...	97	SPEC	0.6–2.4 $\bar{p}p \rightarrow K_S^0 K_S^0$
~ 2190	⁹ CUTTS	78B	CNTR	0.97–3 $\bar{p}p \rightarrow \bar{N}N$
2155±15	^{9,10} COUPLAND	77	CNTR 0	0.7–2.4 $\bar{p}p \rightarrow \bar{p}p$
2193±2	^{9,11} ALSPECTOR	73	CNTR	$\bar{p}p$ S channel
⁹ Isospins 0 and 1 not separated.				
¹⁰ From a fit to the total elastic cross section.				
¹¹ Referred to as T or T region by ALSPECTOR 73.				

KK̄ MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
2200±13	VLADIMIRSK...06	SPEC	40 π ⁻ p → K _S ⁰ K _S ⁰ n
2150±20	ABLIKIM	04E BES2	J/ψ → ω K ⁺ K ⁻
2130±35	BARBERIS	99 OMEG	450 p p → p _s p _f K ⁺ K ⁻

NODE=M042M5
NODE=M042M5

f₂(2150) WIDTH

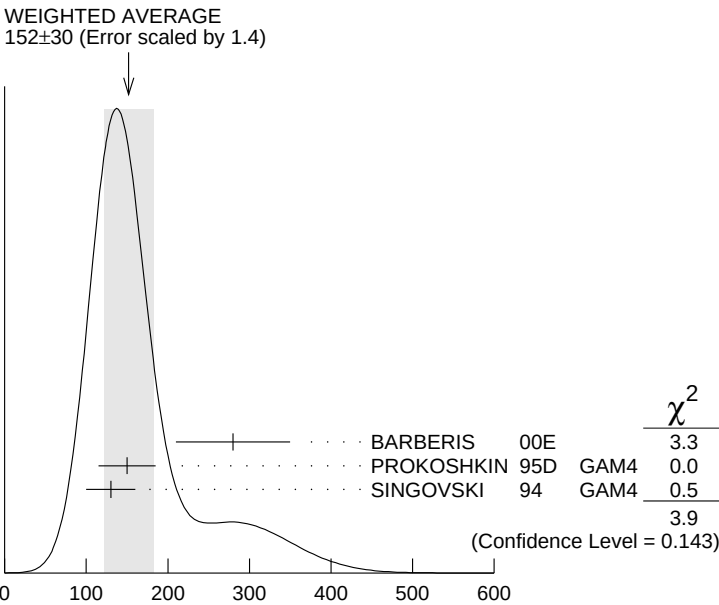
NODE=M042210

f₂(2150) WIDTH, COMBINED MODES (MeV)

NODE=M042W
NODE=M042W

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
152±30 OUR AVERAGE Includes data from the 2 datablocks that follow this one. Error includes scale factor of 1.4. See the ideogram below.				
• • • We do not use the following data for averages, fits, limits, etc. • • •				
182±11	80k	¹² UMAN	06 E835	5.2 p̄ p → η η π ⁰
¹² Statistical error only.				

NODE=M042W;LINKAGE=ST



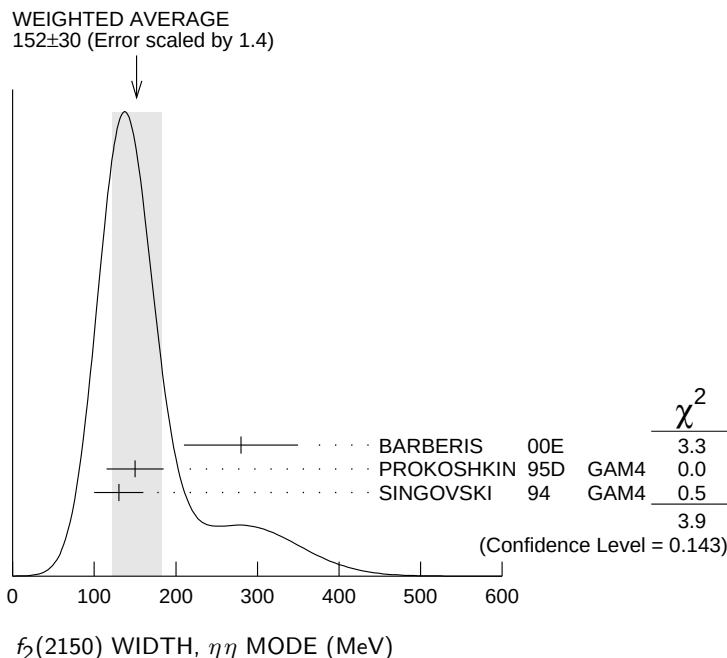
f₂(2150) WIDTH, COMBINED MODES (MeV)

ηη MODE

NODE=M042W3
NODE=M042W3

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
The data in this block is included in the average printed for a previous datablock.			
152±30 OUR AVERAGE Error includes scale factor of 1.4. See the ideogram below.			
280±70	BARBERIS	00E	450 p p → p _f η η p _s
150±35	PROKOSHKIN 95D	GAM4	300 π ⁻ N → π ⁻ N 2η, 450 p p → p p 2η
130±30	SINGOVSKI 94	GAM4	450 p p → p p 2η
• • • We do not use the following data for averages, fits, limits, etc. • • •			
310±50	¹³ ABELE	99B CBAR	
203±10	¹⁴ ARMSTRONG 93C	E760	p̄ p → π ⁰ η η → 6γ
¹³ Spin not determined.			
¹⁴ No J ^{PC} determination.			

NODE=M042W3;LINKAGE=K3
NODE=M042W3;LINKAGE=A

 **$\eta\pi\pi$ MODE**

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT

The data in this block is included in the average printed for a previous datablock.

• • • We do not use the following data for averages, fits, limits, etc. • • •

250±25±45 ¹⁵ ADOMEIT 96 CBAR 0 1.94 $\bar{p}p \rightarrow \eta 3\pi^0$
¹⁵ ANISOVICH 00E recommends to withdraw ADOMEIT 96 that assumed a single $J^P = 2^+$ resonance.

NODE=M042W4
 NODE=M042W4

NODE=M042W4;LINKAGE=AD

 $\bar{p}p \rightarrow \pi\pi$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

250 OUR ESTIMATE

• • • We do not use the following data for averages, fits, limits, etc. • • •

~ 70 ¹⁶ OAKDEN 94 RVUE 0.36–1.55 $\bar{p}p \rightarrow \pi\pi$
 ~ 250 ¹⁷ MARTIN 80B RVUE
 ~ 250 ¹⁷ MARTIN 80C RVUE
 ~ 250 ¹⁸ DULUDE 78B OSPK 1–2 $\bar{p}p \rightarrow \pi^0\pi^0$

¹⁶ See however KLOET 96 who fit $\pi^+\pi^-$ only and find waves only up to $J = 3$ to be important but not significantly resonant.

¹⁷ $I(J^P) = 0(2^+)$ from simultaneous analysis of $p\bar{p} \rightarrow \pi^-\pi^+$ and $\pi^0\pi^0$.

¹⁸ $I^G(J^P) = 0^+(2^+)$ from partial-wave amplitude analysis.

NODE=M042W1
 NODE=M042W1
 → UNCHECKED ←

NODE=M042W1;LINKAGE=CC

NODE=M042W1;LINKAGE=P
 NODE=M042W1;LINKAGE=L

S-CHANNEL $\bar{p}p$, $\bar{N}N$ or $\bar{K}K$

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

56⁺³¹₋₁₆ ¹⁹ EVANGELIS... 97 SPEC 0.6–2.4 $\bar{p}p \rightarrow K_S^0 K_S^0$
 135±75 ^{20,21} COUPLAND 77 CNTR 0 0.7–2.4 $\bar{p}p \rightarrow \bar{p}p$
 98± 8 ²¹ ALSPECTOR 73 CNTR $\bar{p}p$ S channel

¹⁹ Isospin 0 and 2 not separated.

²⁰ From a fit to the total elastic cross section.

²¹ Isospins 0 and 1 not separated.

NODE=M042W2;LINKAGE=F
 NODE=M042W2;LINKAGE=E
 NODE=M042W2;LINKAGE=I

 $K\bar{K}$ MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

91±62 VLADIMIRSK...06 SPEC 40 $\pi^- p \rightarrow K_S^0 K_S^0 n$
 150±30 ABLIKIM 04E BES2 $J/\psi \rightarrow \omega K^+ K^-$
 270±50 BARBERIS 99 OMEG 450 $p\bar{p} \rightarrow p_S p_f K^+ K^-$

NODE=M042W5
 NODE=M042W5

$f_2(2150)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \pi\pi$	
$\Gamma_2 \quad \eta\eta$	seen
$\Gamma_3 \quad K\bar{K}$	seen
$\Gamma_4 \quad f_2(1270)\eta$	seen
$\Gamma_5 \quad a_2(1320)\pi$	seen
$\Gamma_6 \quad \rho\bar{\rho}$	seen

NODE=M042215;NODE=M042

DESIG=1

DESIG=2;OUR EST;→ UNCHECKED ←

DESIG=3;OUR EST;→ UNCHECKED ←

DESIG=4;OUR EST;→ UNCHECKED ←

DESIG=5;OUR EST;→ UNCHECKED ←

DESIG=6

 $f_2(2150)$ BRANCHING RATIOS

NODE=M042220

 $\Gamma(K\bar{K})/\Gamma(\eta\eta)$ Γ_3/Γ_2

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
1.28±0.23		BARBERIS	00E	450 $p\bar{p} \rightarrow p_f \eta \eta p_s$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.1	95	²² PROKOSHKIN 95D	GAM4	300 $\pi^- N \rightarrow \pi^- N 2\eta$, 450 $p\bar{p} \rightarrow p p 2\eta$

²² Using data from ARMSTRONG 89D.

NODE=M042R1;LINKAGE=A

 $\Gamma(\pi\pi)/\Gamma(\eta\eta)$ Γ_1/Γ_2

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.33	95	²³ PROKOSHKIN 95D	GAM4	300 $\pi^- N \rightarrow \pi^- N 2\eta$, 450 $p\bar{p} \rightarrow p p 2\eta$

²³ Derived from a $\pi^0\pi^0/\eta\eta$ limit.

NODE=M042R2

NODE=M042R2

NODE=M042R2;LINKAGE=A

 $\Gamma(f_2(1270)\eta)/\Gamma(a_2(1320)\pi)$ Γ_4/Γ_5

VALUE	DOCUMENT ID	TECN	COMMENT
0.79±0.11	²⁴ ADOMEIT 96	CBAR	1.94 $\bar{p}p \rightarrow \eta 3\pi^0$

²⁴ Using $B(a_2(1320) \rightarrow \eta\pi) = 0.145$

NODE=M042R3

NODE=M042R3

NODE=M042R3;LINKAGE=A

 $\Gamma(\rho\bar{\rho})/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
seen	73	ALEXANDER 10	CLEO	$\psi(2S) \rightarrow \gamma p\bar{p}$

NODE=M042R04

NODE=M042R04

 $f_2(2150)$ REFERENCES

NODE=M042

ALEXANDER 10	PR D82 092002	J.P. Alexander <i>et al.</i>	(CLEO Collab.)
UMAN 06	PR D73 052009	I. Uman <i>et al.</i>	(FNAL E835)
VLADIMIRSK... 06	PAN 69 493	V.V. Vladimirovsky <i>et al.</i>	(ITEP, Moscow)
	Translated from YAF 69 515.		
ABLIKIM 04E	PL B603 138	M. Ablikim <i>et al.</i>	(BES Collab.)
ANISOVICH 00E	PL B477 19	A.V. Anisovich <i>et al.</i>	
BARBERIS 00E	PL B479 59	D. Barberis <i>et al.</i>	(WA 102 Collab.)
ABELE 99B	EPJ C8 67	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
BARBERIS 99	PL B453 305	D. Barberis <i>et al.</i>	(Omega Expt.)
EVANGELIS... 97	PR D56 3803	C. Evangelista <i>et al.</i>	(LEAR Collab.)
MARTIN 97	PR C56 1114	B.R. Martin, G.C. Oades	(LOUC, AARH)
ADOMEIT 96	ZPHY C71 227	J. Adomeit <i>et al.</i>	(Crystal Barrel Collab.)
KLOET 96	PR D53 6120	W.M. Kloet, F. Myhrer	(RUTG, NORD)
PROKOSHKIN 95D	SPD 40 495	Y.D. Prokoshkin	(SERP) IGJPC
	Translated from DANS 344 469.		
HASAN 94	PL B334 215	A. Hasan, D.V. Bugg	(LOQM)
OAKDEN 94	NP A574 731	M.N. Oakden, M.R. Pennington	(DURH)
SINGOVSKI 94	NC 107A 1911	A.V. Singovsky	(SERP)
ARMSTRONG 93C	PL B307 394	T.A. Armstrong <i>et al.</i>	(FNAL, FERR, GENO+)
ARMSTRONG 89D	PL B227 186	T.A. Armstrong, M. Benayoun	(ATHU, BARI, BIRM+)
MARTIN 80B	NP B176 355	B.R. Martin, D. Morgan	(LOUC, RHEL) JP
MARTIN 80C	NP B169 216	A.D. Martin, M.R. Pennington	(DURH) JP
CUTTS 78B	PR D17 16	D. Cutts <i>et al.</i>	(STON, WISC)
DULUDE 78B	PL 79B 335	R.S. Dulude <i>et al.</i>	(BROW, MIT, BARI) JP
COUPLAND 77	PL 71B 460	M. Coupland <i>et al.</i>	(LOQM, RHEL)
ALSPECTOR 73	PRL 30 511	J. Alspector <i>et al.</i>	(RUTG, UPNJ)

REFID=53525

REFID=51063

REFID=51191

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REFID=21837

REFID=21733

REFID=21850

REFID=21830

REFID=21813

$\rho(2150)$

$$I^G(J^{PC}) = 1^+(1^{--})$$

OMITTED FROM SUMMARY TABLE

This entry was previously called $T_1(2190)$. See our mini-review under the $\rho(1700)$.

NODE=M032

NODE=M032

NODE=M032205

NODE=M032M3

NODE=M032M3

OCCUR=2

NODE=M032M1

NODE=M032M1

NODE=M032M2

NODE=M032M2

NODE=M032M4

NODE=M032M4

NODE=M032M3;LINKAGE=LE

NODE=M032M3;LINKAGE=A

NODE=M032M1;LINKAGE=CC

NODE=M032M;LINKAGE=P

NODE=M032M;LINKAGE=AY

NODE=M032M;LINKAGE=I

NODE=M032M;LINKAGE=E

NODE=M032M;LINKAGE=M

NODE=M032M;LINKAGE=B

NODE=M032210

NODE=M032W3

NODE=M032W3

OCCUR=2

$\rho(2150)$ MASS

e^+e^- PRODUCED

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
2254 ± 22	¹ LEES	12G BABR	$e^+e^- \rightarrow \pi^+\pi^-\gamma$
$2150 \pm 40 \pm 50$	AUBERT	07AU BABR	$10.6 e^+e^- \rightarrow f_1(1285)\pi^+\pi^-\gamma$
1990 ± 80	AUBERT	07AU BABR	$10.6 e^+e^- \rightarrow \eta'\pi^+\pi^-\gamma$
2153 ± 37	BIAGINI	91 RVUE	$e^+e^- \rightarrow \pi^+\pi^-, K^+K^-$
2110 ± 50	² CLEGG	90 RVUE	$e^+e^- \rightarrow 3(\pi^+\pi^-), 2(\pi^+\pi^-\pi^0)$

$\bar{p}p \rightarrow \pi\pi$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
~ 2191	HASAN	94 RVUE	$\bar{p}p \rightarrow \pi\pi$
~ 2070	³ OAKDEN	94 RVUE	$0.36\text{--}1.55 \bar{p}p \rightarrow \pi\pi$
~ 2170	⁴ MARTIN	80B RVUE	
~ 2100	⁴ MARTIN	80C RVUE	

S-CHANNEL $\bar{N}N$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
2110 ± 35	⁵ ANISOVICH	02 SPEC	$0.6\text{--}1.9 \bar{p}p \rightarrow \omega\pi^0, \omega\eta\pi^0, \pi^+\pi^-$
~ 2190	⁶ CUTTS	78B CNTR	$0.97\text{--}3 \bar{p}p \rightarrow \bar{N}N$
2155 ± 15	^{6,7} COUPLAND	77 CNTR	$0.7\text{--}2.4 \bar{p}p \rightarrow \bar{p}p$
2193 ± 2	^{6,8} ALSPECTOR	73 CNTR	$\bar{p}p$ S channel
2190 ± 10	⁹ ABRAMS	70 CNTR	S channel $\bar{p}N$

$\pi^-p \rightarrow \omega\pi^0n$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
2155 ± 21 OUR AVERAGE			
2140 ± 30	ALDE	95 GAM2	$38 \pi^-p \rightarrow \omega\pi^0n$
2170 ± 30	ALDE	92C GAM4	$100 \pi^-p \rightarrow \omega\pi^0n$

¹ Using the GOUNARIS 68 parametrization of the pion form factor leaving the masses and widths of the $\rho(1450)$, $\rho(1700)$, and $\rho(2150)$ resonances as free parameters of the fit.

² Includes ATKINSON 85.

³ See however KLOET 96 who fit $\pi^+\pi^-$ only and find waves only up to $J = 3$ to be important but not significantly resonant.

⁴ $I(J^P) = 1(1^-)$ from simultaneous analysis of $p\bar{p} \rightarrow \pi^-\pi^+$ and $\pi^0\pi^0$.

⁵ From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.

⁶ Isospins 0 and 1 not separated.

⁷ From a fit to the total elastic cross section.

⁸ Referred to as T or T region by ALSPECTOR 73.

⁹ Seen as bump in $I = 1$ state. See also COOPER 68. PEASLEE 75 confirm $\bar{p}p$ results of ABRAMS 70, no narrow structure.

$\rho(2150)$ WIDTH

e^+e^- PRODUCED

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
109 ± 76	¹⁰ LEES	12G BABR	$e^+e^- \rightarrow \pi^+\pi^-\gamma$
$350 \pm 40 \pm 50$	AUBERT	07AU BABR	$10.6 e^+e^- \rightarrow f_1(1285)\pi^+\pi^-\gamma$
310 ± 140	AUBERT	07AU BABR	$10.6 e^+e^- \rightarrow \eta'\pi^+\pi^-\gamma$
389 ± 79	BIAGINI	91 RVUE	$e^+e^- \rightarrow \pi^+\pi^-, K^+K^-$
410 ± 100	¹¹ CLEGG	90 RVUE	$e^+e^- \rightarrow 3(\pi^+\pi^-), 2(\pi^+\pi^-\pi^0)$

$\bar{p}p \rightarrow \pi\pi$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
~ 296	HASAN	94	RVUE $\bar{p}p \rightarrow \pi\pi$
~ 40	12 OAKDEN	94	RVUE 0.36–1.55 $\bar{p}p \rightarrow \pi\pi$
~ 250	13 MARTIN	80B	RVUE
~ 200	13 MARTIN	80C	RVUE

NODE=M032W1
NODE=M032W1

S-CHANNEL $\bar{N}N$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
230 ± 50	14 ANISOVICH	02	SPEC 0.6–1.9 $p\bar{p} \rightarrow \omega\pi^0, \omega\eta\pi^0, \pi^+\pi^-$
135 ± 75	15,16 COUPLAND	77	CNTR 0.7–2.4 $\bar{p}p \rightarrow \bar{p}p$
98 ± 8	16 ALSPECTOR	73	CNTR $\bar{p}p$ S channel
~ 85	17 ABRAMS	70	CNTR S channel $\bar{p}N$

NODE=M032W2
NODE=M032W2

 $\pi^- p \rightarrow \omega\pi^0 n$

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 $\pi^- p \rightarrow \omega\pi^0 n$
¹⁰ Using the GOUNARIS 68 parametrization of the pion form factor leaving the masses and widths of the $\rho(1450)$, $\rho(1700)$, and $\rho(2150)$ resonances as free parameters of the fit. ¹¹ Includes ATKINSON 85. ¹² See however KLOET 96 who fit $\pi^+\pi^-$ only and find waves only up to $J = 3$ to be important but not significantly resonant. ¹³ $I(J^P) = 1(1^-)$ from simultaneous analysis of $p\bar{p} \rightarrow \pi^-\pi^+$ and $\pi^0\pi^0$. ¹⁴ From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02. ¹⁵ From a fit to the total elastic cross section. ¹⁶ Isospins 0 and 1 not separated. ¹⁷ Seen as bump in $I = 1$ state. See also COOPER 68. PEASLEE 75 confirm $\bar{p}p$ results of ABRAMS 70, no narrow structure.			

NODE=M032W4
NODE=M032W4

NODE=M032W3;LINKAGE=LE

NODE=M032W3;LINKAGE=A
NODE=M032W1;LINKAGE=CC

NODE=M032W;LINKAGE=P
NODE=M032W;LINKAGE=AY

NODE=M032W;LINKAGE=E
NODE=M032W;LINKAGE=I
NODE=M032W;LINKAGE=B

 $\rho(2150)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 e^+e^-	
Γ_2 $\pi^+\pi^-$	seen
Γ_3 K^+K^-	seen
Γ_4 $3(\pi^+\pi^-)$	seen
Γ_5 $2(\pi^+\pi^-\pi^0)$	seen
Γ_6 $\eta'\pi^+\pi^-$	seen
Γ_7 $f_1(1285)\pi^+\pi^-$	seen
Γ_8 $\omega\pi^0$	seen
Γ_9 $\omega\pi^0\eta$	seen
Γ_{10} $p\bar{p}$	

NODE=M032215;NODE=M032

DESIG=1

DESIG=2;OUR EVAL;→ UNCHECKED ←
DESIG=3;OUR EVAL;→ UNCHECKED ←
DESIG=4;OUR EVAL;→ UNCHECKED ←
DESIG=5;OUR EVAL;→ UNCHECKED ←
DESIG=6;OUR EVAL;→ UNCHECKED ←
DESIG=7;OUR EVAL;→ UNCHECKED ←
DESIG=8;OUR EVAL;→ UNCHECKED ←
DESIG=9;OUR EVAL;→ UNCHECKED ←
DESIG=10

 $\rho(2150) \Gamma(i)\Gamma(e^+e^-)/\Gamma^2(\text{total})$

$\Gamma(f_1(1285)\pi^+\pi^-)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$		$\Gamma_7/\Gamma \times \Gamma_1/\Gamma$	
VALUE (units 10^{-7})	DOCUMENT ID	TECN	COMMENT
3.1 ± 0.6 ± 0.5	18 AUBERT	07AU BABR	10.6 $e^+e^- \rightarrow f_1(1285)\pi^+\pi^-\gamma$
¹⁸ Calculated by us from the reported value of cross section at the peak.			

NODE=M032230

NODE=M032G01
NODE=M032G01

NODE=M032G01;LINKAGE=AU

$\Gamma(\eta'\pi^+\pi^-)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$		$\Gamma_6/\Gamma \times \Gamma_1/\Gamma$	
VALUE (units 10^{-8})	DOCUMENT ID	TECN	COMMENT
4.9 ± 1.9	19 AUBERT	07AU BABR	10.6 $e^+e^- \rightarrow \eta'\pi^+\pi^-\gamma$
¹⁹ Calculated by us from the reported value of cross section at the peak.			

NODE=M032G02
NODE=M032G02

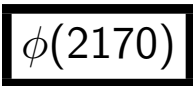
NODE=M032G02;LINKAGE=AU

ρ(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

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REFID=21813
REFID=21807
REFID=21805
REFID=48054



$I^G(J^{PC}) = 0^-(1^--)$

Observed by AUBERT,BE 06D in the initial-state radiation process
 $e^+e^- \rightarrow \phi f_0(980)\gamma$.

NODE=M103

NODE=M103

ϕ(2170) MASS

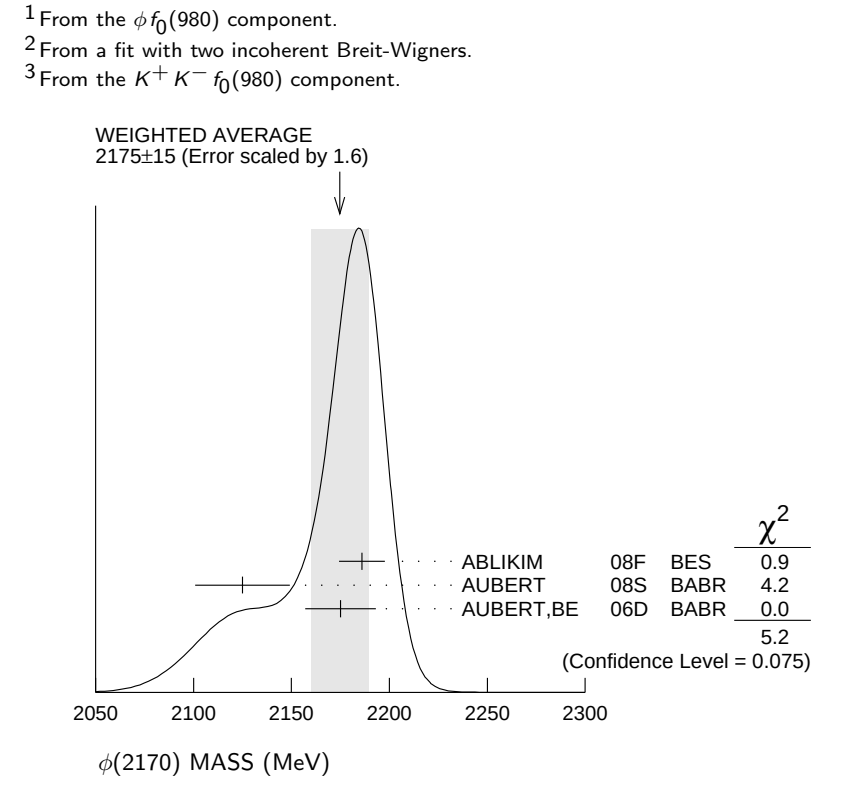
NODE=M103M

NODE=M103M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2175±15 OUR AVERAGE		Error includes scale factor of 1.6. See the ideogram below.		
2186±10± 6	52	ABLIKIM	08F BES	$J/\psi \rightarrow \eta \phi f_0(980)$
2125±22±10	483	AUBERT	08S BABR	$10.6 e^+e^- \rightarrow \phi \eta \gamma$
2175±10±15	201	¹ AUBERT,BE	06D BABR	$10.6 e^+e^- \rightarrow K^+K^- \pi \pi \gamma$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
2079±13 ⁺⁷⁹ ₋₂₈	4.8k	² SHEN	09 BELL	$10.6 e^+e^- \rightarrow K^+K^- \pi^+ \pi^- \gamma$
2192±14	116 ± 95	³ AUBERT	07AK BABR	$10.6 e^+e^- \rightarrow K^+K^- \pi^+ \pi^- \gamma$
2169±20	149 ± 36	³ AUBERT	07AK BABR	$10.6 e^+e^- \rightarrow K^+K^- \pi^0 \pi^0 \gamma$

OCCUR=2

NODE=M103M;LINKAGE=AB
NODE=M103M;LINKAGE=SH
NODE=M103M;LINKAGE=AU



$\phi(2170)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
61±18 OUR AVERAGE				
65±23±17	52	ABLIKIM	08F BES	$J/\psi \rightarrow \eta \phi f_0(980)$
61±50±13	483	AUBERT	08S BABR	$10.6 e^+ e^- \rightarrow \phi \eta \gamma$
58±16±20	201	⁴ AUBERT,BE	06D BABR	$10.6 e^+ e^- \rightarrow K^+ K^- \pi \pi \gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$192 \pm 23^{+25}_{-61}$	4.8k	⁵ SHEN	09 BELL	$10.6 e^+ e^- \rightarrow K^+ K^- \pi^+ \pi^- \gamma$
71±21	116 ± 95	⁶ AUBERT	07AK BABR	$10.6 e^+ e^- \rightarrow K^+ K^- \pi^+ \pi^- \gamma$
102±27	149 ± 36	⁶ AUBERT	07AK BABR	$10.6 e^+ e^- \rightarrow K^+ K^- \pi^0 \pi^0 \gamma$
⁴ From the $\phi f_0(980)$ component.				
⁵ From a fit with two incoherent Breit-Wigners.				
⁶ From the $K^+ K^- f_0(980)$ component.				

NODE=M103W

NODE=M103W

OCCUR=2

NODE=M103W;LINKAGE=AB
 NODE=M103W;LINKAGE=SH
 NODE=M103W;LINKAGE=AU

 $\phi(2170)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 e^+ e^-$	seen
$\Gamma_2 \phi \eta$	
$\Gamma_3 \phi \pi \pi$	
$\Gamma_4 \phi f_0(980)$	seen
$\Gamma_5 K^+ K^- \pi^+ \pi^-$	
$\Gamma_6 K^+ K^- f_0(980) \rightarrow K^+ K^- \pi^+ \pi^-$	seen
$\Gamma_7 K^+ K^- \pi^0 \pi^0$	
$\Gamma_8 K^+ K^- f_0(980) \rightarrow K^+ K^- \pi^0 \pi^0$	seen
$\Gamma_9 K^{*0} K^\pm \pi^\mp$	not seen
$\Gamma_{10} K^*(892)^0 \bar{K}^*(892)^0$	not seen

NODE=M103215;NODE=M103

DESIG=1;OUR EVAL;→ UNCHECKED ←
 DESIG=5
 DESIG=9
 DESIG=2;OUR EVAL;→ UNCHECKED ←
 DESIG=3
 DESIG=6
 DESIG=4
 DESIG=7
 DESIG=8
 DESIG=10

 $\phi(2170) \Gamma(i) \Gamma(e^+ e^-) / \Gamma(\text{total})$

$\Gamma(\phi \eta) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$					$\Gamma_2 \Gamma_1 / \Gamma$
VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1.7±0.7±1.3	483	AUBERT	08S BABR	$10.6 e^+ e^- \rightarrow \phi \eta \gamma$	
$\Gamma(\phi f_0(980)) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$					$\Gamma_4 \Gamma_1 / \Gamma$
VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT	
2.5±0.8±0.4	201	⁷ AUBERT,BE	06D BABR	$10.6 e^+ e^- \rightarrow K^+ K^- \pi \pi \gamma$	
⁷ From the $\phi f_0(980)$ component.					

NODE=M103230

NODE=M103G2
 NODE=M103G2

NODE=M103G1
 NODE=M103G1

NODE=M103G1;LINKAGE=AB

 $\phi(2170) \Gamma(i) \Gamma(e^+ e^-) / \Gamma^2(\text{total})$

$\Gamma(\phi \pi \pi) / \Gamma_{\text{total}} \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$					$\Gamma_3 / \Gamma \times \Gamma_1 / \Gamma$
VALUE (units 10 ⁻⁷)	EVTS	DOCUMENT ID	TECN	COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1.65±0.15±0.18	4.8k	⁸ SHEN	09 BELL	$10.6 e^+ e^- \rightarrow K^+ K^- \pi^+ \pi^- \gamma$	
⁸ Multiplied by 3/2 to take into account the $\phi \pi^0 \pi^0$ mode. Using $B(\phi \rightarrow K^+ K^-) = (49.2 \pm 0.6)\%$.					

NODE=M103220

NODE=M103G01
 NODE=M103G01

NODE=M103G01;LINKAGE=SH

 $\phi(2170)$ BRANCHING RATIOS

$\Gamma(K^+ K^- f_0(980) \rightarrow K^+ K^- \pi^+ \pi^-) / \Gamma_{\text{total}}$				Γ_6 / Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
seen	AUBERT	07AK BABR	$10.6 e^+ e^- \rightarrow K^+ K^- \pi^+ \pi^- \gamma$	
$\Gamma(K^+ K^- f_0(980) \rightarrow K^+ K^- \pi^0 \pi^0) / \Gamma_{\text{total}}$				Γ_8 / Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
seen	AUBERT	07AK BABR	$10.6 e^+ e^- \rightarrow K^+ K^- \pi^0 \pi^0 \gamma$	

NODE=M103225

NODE=M103R01
 NODE=M103R01

NODE=M103R02
 NODE=M103R02

$\Gamma(K^{*0} K^{\pm} \pi^{\mp})/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	AUBERT	07AK BABR	10.6 GeV $e^+ e^-$

NODE=M103R03
 NODE=M103R03

 $\Gamma(K^*(892)^0 \bar{K}^*(892)^0)/\Gamma_{\text{total}}$ Γ_{10}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	ABLIKIM	10C BES2	$J/\psi \rightarrow \eta K^+ \pi^- K^- \pi^+$

NODE=M103R04
 NODE=M103R04

 $\phi(2170)$ REFERENCES

NODE=M103

ABLIKIM	10C	PL B685 27	M. Ablikim <i>et al.</i>	(BES II Collab.)
SHEN	09	PR D80 031101	C.P. Shen <i>et al.</i>	(BELLE Collab.)
ABLIKIM	08F	PRL 100 102003	M. Ablikim <i>et al.</i>	(BES Collab.)
AUBERT	08S	PR D77 092002	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT	07AK	PR D76 012008	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT,BE	06D	PR D74 091103	B. Aubert <i>et al.</i>	(BABAR Collab.)

REFID=53349
 REFID=53000
 REFID=52154
 REFID=52242
 REFID=51908
 REFID=51511

 $f_0(2200)$

$$I^G(J^{PC}) = 0^+(0^{++})$$

NODE=M112

OMITTED FROM SUMMARY TABLE

Seen in $K_S^0 K_S^0$ (AUGUSTIN 88), $K^+ K^-$ (ABLIKIM 05Q) and $\eta\eta$ (BINON 05) system. Not seen in $\Upsilon(1S)$ radiative decays (BARU 89).

NODE=M112

 $f_0(2200)$ MASS

NODE=M112M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
2189±13 OUR AVERAGE			
2170±20 ⁺¹⁰ ₋₁₅	ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$
2210±50	¹ BINON	05 GAMS	$33 \pi^- p \rightarrow \eta \eta n$
2197±17	² AUGUSTIN	88 DM2	$J/\psi \rightarrow \gamma K_S^0 K_S^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
~ 2122	HASAN	94 RVUE	$\bar{p} p \rightarrow \pi \pi$
~ 2321	HASAN	94 RVUE	$\bar{p} p \rightarrow \pi \pi$

NODE=M112M

¹ First solution, PWA is ambiguous.² Cannot determine spin to be 0.

OCCUR=2

NODE=M112M;LINKAGE=BI
 NODE=M112M;LINKAGE=A

 $f_0(2200)$ WIDTH

NODE=M112W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
238±50 OUR AVERAGE	Error includes scale factor of 1.2.		
220±60 ⁺⁴⁰ ₋₄₅	ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$
380±90	³ BINON	05 GAMS	$33 \pi^- p \rightarrow \eta \eta n$
201±51	⁴ AUGUSTIN	88 DM2	$J/\psi \rightarrow \gamma K_S^0 K_S^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
~ 273	HASAN	94 RVUE	$\bar{p} p \rightarrow \pi \pi$
~ 223	HASAN	94 RVUE	$\bar{p} p \rightarrow \pi \pi$

NODE=M112W

³ First solution, PWA is ambiguous.⁴ Cannot determine spin to be 0.

OCCUR=2

NODE=M112W;LINKAGE=BI
 NODE=M112W;LINKAGE=A

 $f_0(2200)$ REFERENCES

NODE=M112

ABLIKIM	05Q	PR D72 092002	M. Ablikim <i>et al.</i>	(BES Collab.)
BINON	05	PAN 68 960	F. Binon <i>et al.</i>	
		Translated from YAF 68 998.		
HASAN	94	PL B334 215	A. Hasan, D.V. Bugg	(LOQM)
BARU	89	ZPHY C42 505	S.E. Baru <i>et al.</i>	(NOVO)
AUGUSTIN	88	PRL 60 2238	J.E. Augustin <i>et al.</i>	(DM2 Collab.)

REFID=50958
 REFID=50780
 REFID=44103
 REFID=40917
 REFID=40574

$f_J(2220)$

$$J^{PC} = 0^{++} \text{ or } 4^{++}$$

OMITTED FROM SUMMARY TABLE

Needs confirmation. See our mini-review in the 2004 edition of this Review, PDG 04.

NODE=M082

NODE=M082

 $f_J(2220)$ MASS

NODE=M082M

NODE=M082M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2231.1 ± 3.5 OUR AVERAGE				
2235 ± 4 ± 6	74	BAI	96B BES	$e^+e^- \rightarrow J/\psi \rightarrow \gamma\pi^+\pi^-$
2230 $^{+6}_{-7}$ ± 16	46	BAI	96B BES	$e^+e^- \rightarrow J/\psi \rightarrow \gamma K^+K^-$
2232 $^{+8}_{-7}$ ± 15	23	BAI	96B BES	$e^+e^- \rightarrow J/\psi \rightarrow \gamma K_S^0 K_S^0$
2235 ± 4 ± 5	32	BAI	96B BES	$e^+e^- \rightarrow J/\psi \rightarrow \gamma p\bar{p}$
2209 $^{+17}_{-15}$ ± 10		ASTON	88F LASS	$11 K^- p \rightarrow K^+ K^- \Lambda$
2230 ± 20		BOLONKIN	88 SPEC	$40 \pi^- p \rightarrow K_S^0 K_S^0 n$
2220 ± 10	41	¹ ALDE	86B GA24	$38-100 \pi p \rightarrow n\eta\eta'$
2230 ± 6 ± 14	93	BALTRUSAIT..86D	MRK3	$e^+e^- \rightarrow \gamma K^+ K^-$
2232 ± 7 ± 7	23	BALTRUSAIT..86D	MRK3	$e^+e^- \rightarrow \gamma K_S^0 K_S^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2223.9 ± 2.5		² VLADIMIRSK...08	SPEC	$40 \pi^- p \rightarrow K_S^0 K_S^0 n + m\pi^0$
2246 ± 36		BAI	98H BES	$J/\psi \rightarrow \gamma \pi^0 \pi^0$

¹ALDE 86B uses data from both the GAMS-2000 and GAMS-4000 detectors.² $J^{PC} = 2^{++}$. Systematic uncertainties not evaluatedNODE=M082M;LINKAGE=A
NODE=M082M;LINKAGE=VL **$f_J(2220)$ WIDTH**

NODE=M082W

NODE=M082W

VALUE (MeV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
23 $^{+8}_{-7}$ OUR AVERAGE					
19 $^{+13}_{-11}$ ± 12		74	BAI	96B BES	$e^+e^- \rightarrow J/\psi \rightarrow \gamma\pi^+\pi^-$
20 $^{+20}_{-15}$ ± 17		46	BAI	96B BES	$e^+e^- \rightarrow J/\psi \rightarrow \gamma K^+K^-$
20 $^{+25}_{-16}$ ± 14		23	BAI	96B BES	$e^+e^- \rightarrow J/\psi \rightarrow \gamma K_S^0 K_S^0$
15 $^{+12}_{-9}$ ± 9		32	BAI	96B BES	$e^+e^- \rightarrow J/\psi \rightarrow \gamma p\bar{p}$
60 $^{+107}_{-57}$			ASTON	88F LASS	$11 K^- p \rightarrow K^+ K^- \Lambda$
80 ± 30			BOLONKIN	88 SPEC	$40 \pi^- p \rightarrow K_S^0 K_S^0 n$
26 $^{+20}_{-16}$ ± 17		93	BALTRUSAIT..86D	MRK3	$e^+e^- \rightarrow \gamma K^+ K^-$
18 $^{+23}_{-15}$ ± 10		23	BALTRUSAIT..86D	MRK3	$e^+e^- \rightarrow \gamma K_S^0 K_S^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
8.6 ± 2.5			³ VLADIMIRSK...08	SPEC	$40 \pi^- p \rightarrow K_S^0 K_S^0 n + m\pi^0$
<80	90		ALDE	87C GAM2	$38 \pi^- p \rightarrow \eta'\eta n$

³ $J^{PC} = 2^{++}$. Systematic uncertainties not evaluated

NODE=M082W;LINKAGE=VL

 $f_J(2220)$ DECAY MODES

NODE=M082215;NODE=M082

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \pi\pi$	seen
$\Gamma_2 \pi^+\pi^-$	seen
$\Gamma_3 K\bar{K}$	seen
$\Gamma_4 p\bar{p}$	
$\Gamma_5 \gamma\gamma$	not seen
$\Gamma_6 \eta\eta'(958)$	seen
$\Gamma_7 \phi\phi$	not seen
$\Gamma_8 \eta\eta$	not seen

DESIG=5;OUR EST;→ UNCHECKED ←
DESIG=6;OUR EST;→ UNCHECKED ←
DESIG=1;OUR EST;→ UNCHECKED ←
DESIG=4
DESIG=2;OUR EST;→ UNCHECKED ←
DESIG=3;OUR EST;→ UNCHECKED ←
DESIG=7;OUR EST;→ UNCHECKED ←
DESIG=8;OUR EST;→ UNCHECKED ←

$f_J(2220) \Gamma(i) \Gamma(\gamma\gamma) / \Gamma(\text{total})$

NODE=M082220

 $\Gamma(K\bar{K}) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$ $\Gamma_3 \Gamma_5 / \Gamma$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
< 1.4	95	⁴ ACCIARRI	01H L3	$\gamma\gamma \rightarrow K_S^0 K_S^0, E_{\text{cm}}^{\text{ee}} = 91, 183-209 \text{ GeV}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 5.6	95	⁴ GODANG	97 CLE2	$\gamma\gamma \rightarrow K_S^0 K_S^0$
< 86	95	⁴ ALBRECHT	90G ARG	$\gamma\gamma \rightarrow K^+ K^-$
< 1000	95	⁵ ALTHOFF	85B TASS	$\gamma\gamma, K \bar{K} \pi$

 $\Gamma(\pi\pi) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$ $\Gamma_1 \Gamma_5 / \Gamma$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
< 2.5	95	ALAM	98C CLE2	$\gamma\gamma \rightarrow \pi^+ \pi^-$

⁴ Assuming $J^P = 2^+$.⁵ True for $J^P = 0^+$ and $J^P = 2^+$.NODE=M082G3
NODE=M082G3NODE=M082G1;LINKAGE=D
NODE=M082G1;LINKAGE=C $f_J(2220) \Gamma(i) \Gamma(p\bar{p}) / \Gamma^2(\text{total})$

NODE=M082223

 $\Gamma(p\bar{p}) / \Gamma_{\text{total}} \times \Gamma(\pi\pi) / \Gamma_{\text{total}}$ $\Gamma_4 / \Gamma \times \Gamma_1 / \Gamma$

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
< 18	95	⁶ AMSLER	01 CBAR	$1.4-1.5 \text{ } p\bar{p} \rightarrow \pi^0 \pi^0$

• • • We do not use the following data for averages, fits, limits, etc. • • •

< (11-42)	99	⁷ HASAN	96 SPEC	$1.35-1.55 \text{ } p\bar{p} \rightarrow \pi^+ \pi^-$

NODE=M082GG1
NODE=M082GG1 $\Gamma(p\bar{p}) / \Gamma_{\text{total}} \times \Gamma(\phi\phi) / \Gamma_{\text{total}}$ $\Gamma_4 / \Gamma \times \Gamma_7 / \Gamma$

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
< 6	95	⁸ EVANGELIS...	98 SPEC	$1.1-2.0 \text{ } p\bar{p} \rightarrow \phi\phi$

NODE=M082GG2
NODE=M082GG2 $\Gamma(p\bar{p}) / \Gamma_{\text{total}} \times \Gamma(\eta\eta) / \Gamma_{\text{total}}$ $\Gamma_4 / \Gamma \times \Gamma_8 / \Gamma$

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
< 4	95	⁶ AMSLER	01 CBAR	$1.4-1.5 \text{ } p\bar{p} \rightarrow \eta\eta$

⁶ For $J^P = 2^+$ in the mass range 2222-2240 MeV and the total width between 10 and 20 MeV.⁷ For $J^P = 2^+$ and $J^P = 4^+$ in the mass range 2220-2245 MeV and the total width of 15 MeV.⁸ For $J^P = 2^+$, the mass of 2235 MeV and the total width of 15 MeV.NODE=M082GG3
NODE=M082GG3

NODE=M082GG;LINKAGE=A

NODE=M082GG;LINKAGE=B

NODE=M082GG;LINKAGE=C

 $f_J(2220) \text{ BRANCHING RATIOS}$

NODE=M082225

 $\Gamma(p\bar{p}) / \Gamma_{\text{total}}$ Γ_4 / Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

not seen ⁹ AUBERT 07AV BABR $B \rightarrow p\bar{p} K^*$ not seen WANG 05A BELL $B^+ \rightarrow \bar{p} p K^+$

< 3.0	95	¹⁰ EVANGELIS...	97 SPEC	$1.96-2.40 \text{ } \bar{p} p \rightarrow K_S^0 K_S^0$

< 1.1	99.7	¹¹ BARNES	93 SPEC	$1.3-1.57 \text{ } \bar{p} p \rightarrow K_S^0 K_S^0$

< 2.6	99.7	¹¹ BARDIN	87 CNTR	$1.3-1.5 \text{ } \bar{p} p \rightarrow K^+ K^-$

< 3.6	99.7	¹¹ SCULLI	87 CNTR	$1.29-1.55 \text{ } \bar{p} p \rightarrow K^+ K^-$

⁹ Assuming $\Gamma < 30 \text{ MeV}$.¹⁰ Assuming $\Gamma \sim 20 \text{ MeV}$, $J^P = 2^+$ and $B(f_J(2220) \rightarrow K\bar{K}) = 100\%$.¹¹ Assuming $\Gamma = 30-35 \text{ MeV}$, $J^P = 2^+$ and $B(f_J(2220) \rightarrow K\bar{K}) = 100\%$.NODE=M082R1
NODE=M082R1

NODE=M082R1;LINKAGE=AU

NODE=M082R1;LINKAGE=C

NODE=M082R1;LINKAGE=B

 $\Gamma(\pi\pi) / \Gamma(K\bar{K})$ Γ_1 / Γ_3

VALUE	DOCUMENT ID	TECN	COMMENT
1.0 ± 0.5	BAI	96B BES	$e^+ e^- \rightarrow J/\psi \rightarrow \gamma 2\pi, K\bar{K}$

NODE=M082R2
NODE=M082R2 $\Gamma(p\bar{p}) / \Gamma(K\bar{K})$ Γ_4 / Γ_3

VALUE	DOCUMENT ID	TECN	COMMENT
0.17 ± 0.09	BAI	96B BES	$e^+ e^- \rightarrow J/\psi \rightarrow \gamma p\bar{p}, K\bar{K}$

NODE=M082R3
NODE=M082R3

f_J(2220) REFERENCES

VLADIMIRSK... 08	PAN 71 2129	V.V. Vladimirsky <i>et al.</i>	(ITEP)
AUBERT 07AV	Translated from YAF 71 2166.	B. Aubert <i>et al.</i>	(BABAR Collab.)
WANG 05A	PR D76 092004	M.-Z. Wang <i>et al.</i>	(BELLE Collab.)
PDG 04	PL B617 141	S. Eidelman <i>et al.</i>	(PDG Collab.)
ACCIARRI 01H	PL B592 1	M. Acciarri <i>et al.</i>	(L3 Collab.)
AMSLER 01	PL B501 173	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
ALAM 98C	PL B520 175	M.S. Alam <i>et al.</i>	(CLEO Collab.)
BAI 98H	PRL 81 3328	J.Z. Bai <i>et al.</i>	(BES Collab.)
EVANGELIS... 98	PRL 81 1179	C. Evangelista <i>et al.</i>	(JETSET Collab.)
EVANGELIS... 97	PR D57 5370	C. Evangelista <i>et al.</i>	(LEAR Collab.)
GODANG 97	PR D56 3803	R. Godang <i>et al.</i>	(CLEO Collab.)
BAI 96B	PRL 79 3829	J.Z. Bai <i>et al.</i>	(BES Collab.)
HASAN 96	PRL 76 3502	A. Hasan, D.V. Bugg	(BRUN, LOQM)
BARNES 93	PL B388 376	P.D. Barnes <i>et al.</i>	(PS185 Collab.)
ALBRECHT 90G	PL B309 469	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
ASTON 88F	ZPHY C48 183	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS) JP
BOLONKIN 88	PRL B215 199	B.V. Bolonkin <i>et al.</i>	(ITEP, SERP)
ALDE 87C	NP B309 426	D. Alde <i>et al.</i>	
BARDIN 87	SJNP 45 255	G. Bardin <i>et al.</i>	(SACL, FERR, CERN, PADO+)
SCULLI 87	Translated from YAF 45 405.	J. Sculli <i>et al.</i>	(NYU, BNL)
ALDE 86B	PL B195 292	D.M. Alde <i>et al.</i>	(SERP, BELG, LANL, LAPP)
BALTRUSAIT... 86D	PRL 58 1715	R.M. Baltrusaitis	(CIT, UCSC, ILL, SLAC+)
ALTHOFF 85B	PL B177 120	M. Althoff <i>et al.</i>	(TASSO Collab.)
	PRL 56 107		
	ZPHY C29 189		

NODE=M082

REFID=52681

REFID=51990
REFID=50651
REFID=49653
REFID=48321
REFID=48558
REFID=46326
REFID=46342
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REFID=43601
REFID=41374
REFID=40585
REFID=40580
REFID=47474

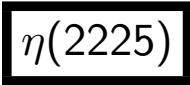
REFID=40235
REFID=40023
REFID=21864
REFID=21865
REFID=21349

OTHER RELATED PAPERS

DEL-AMO-SA... 100	PRL 105 172001	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)

REFID=53533

NODE=M115



$I^G(J^{PC}) = 0^+(0^{-+})$

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

η(2225) MASS

NODE=M115M

NODE=M115M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2226±16 OUR AVERAGE				
2240 ⁺³⁰⁺³⁰ ₋₂₀₋₂₀	196 ± 19	ABLIKIM	08I BES	$J/\psi \rightarrow \gamma K^+ K^- K_S^0 K_L^0$
2230±25±15		BAI	90B MRK3	$J/\psi \rightarrow \gamma K^+ K^- K^+ K^-$
2214±20±13		BAI	90B MRK3	$J/\psi \rightarrow \gamma K^+ K^- K_S^0 K_L^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
~ 2220		BISELLO	86B DM2	$J/\psi \rightarrow \gamma K^+ K^- K^+ K^-$

OCCUR=2

η(2225) WIDTH

NODE=M115W

NODE=M115W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
185⁺⁷⁰₋₄₀ OUR AVERAGE				
190± 30 ⁺⁶⁰ ₋₄₀	196 ± 19	ABLIKIM	08I BES	$J/\psi \rightarrow \gamma K^+ K^- K_S^0 K_L^0$
150 ⁺³⁰⁰ ₋₆₀ ±60		BAI	90B MRK3	$J/\psi \rightarrow \gamma K^+ K^- K^+ K^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
~ 80		BISELLO	86B DM2	$J/\psi \rightarrow \gamma K^+ K^- K^+ K^-$

η(2225) REFERENCES

NODE=M115

LEES 11A	PR D84 012001	J.P. Lees <i>et al.</i>	(BABAR Collab.)
ABLIKIM 08I	PL B662 330	M. Ablikim <i>et al.</i>	(BES Collab.)
BAI 90B	PRL 65 1309	Z. Bai <i>et al.</i>	(Mark III Collab.)
BISELLO 86B	PL B179 294	D. Bisello <i>et al.</i>	(DM2 Collab.)

REFID=16595
REFID=52255
REFID=41354
REFID=22101

$\rho_3(2250)$

$$I^G(J^{PC}) = 1^+(3^{--})$$

OMITTED FROM SUMMARY TABLE

Contains results mostly from formation experiments. For further production experiments see the Further States entry. See also $\rho(2150)$, $f_2(2150)$, $f_4(2300)$, $\rho_5(2350)$.

NODE=M044

NODE=M044

$\rho_3(2250)$ MASS

$\bar{p}p \rightarrow \pi\pi$ 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	0.36–1.55 $\bar{p}p \rightarrow \pi\pi$
~ 2250	² MARTIN	80B	RVUE	
~ 2300	² MARTIN	80C	RVUE	
~ 2140	³ CARTER	78B	CNTR 0	0.7–2.4 $\bar{p}p \rightarrow K^- K^+$
~ 2150	⁴ CARTER	77	CNTR 0	0.7–2.4 $\bar{p}p \rightarrow \pi\pi$

¹ See however KLOET 96 who fit $\pi^+\pi^-$ only and find waves only up to $J = 3$ to be important but not significantly resonant.

² $I(J^P) = 1(3^-)$ from simultaneous analysis of $p\bar{p} \rightarrow \pi^-\pi^+$ and $\pi^0\pi^0$.

³ $I = 0, 1. J^P = 3^-$ from Barrelet-zero analysis.

⁴ $I(J^P) = 1(3^-)$ from amplitude analysis.

NODE=M044205

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	0.6–1.9 $p\bar{p} \rightarrow \omega\pi^0, \omega\eta\pi^0, \pi^+\pi^-$
~ 2190	⁶ CUTTS	78B	CNTR	0.97–3 $\bar{p}p \rightarrow \bar{N}N$
2155 ± 15	^{6,7} COUPLAND	77	CNTR 0	0.7–2.4 $\bar{p}p \rightarrow \bar{p}p$
2193 ± 2	^{6,8} ALSPECTOR	73	CNTR	$\bar{p}p$ S channel
2190 ± 10	⁹ ABRAMS	70	CNTR	S channel $\bar{p}N$

⁵ From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.

⁶ Isospins 0 and 1 not separated.

⁷ From a fit to the total elastic cross section.

⁸ Referred to as T or T region by ALSPECTOR 73.

⁹ Seen as bump in $I = 1$ state. See also COOPER 68. PEASLEE 75 confirm $\bar{p}p$ results of ABRAMS 70, no narrow structure.

NODE=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 ± 20 ± 30	AMELIN	00	VES 37 $\pi^- p \rightarrow \eta\pi^+\pi^- n$

NODE=M044M3
NODE=M044M3

$\rho_3(2250)$ WIDTH

$\bar{p}p \rightarrow \pi\pi$ 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=M044210

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	$0.6-1.9 \bar{p} \bar{p} \rightarrow \omega \pi^0, \omega \eta \pi^0, \pi^+ \pi^-$
135 ± 75	^{15,16} COUPLAND	77	CNTR	$0.7-2.4 \bar{p} p \rightarrow \bar{p} p$
98 ± 8	¹⁶ ALSPECTOR	73	CNTR	$\bar{p} p$ S channel
~ 85	¹⁷ ABRAMS	70	CNTR	S channel $\bar{p} N$

¹⁴ From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.

¹⁵ From a fit to the total elastic cross section.

¹⁶ Isospins 0 and 1 not separated.

¹⁷ Seen as bump in $I = 1$ state. See also COOPER 68. PEASLEE 75 confirm $\bar{p} p$ results of ABRAMS 70, no narrow structure.

NODE=M044W2
NODE=M044W2

NODE=M044W;LINKAGE=AY

NODE=M044W2;LINKAGE=E

NODE=M044W2;LINKAGE=I

NODE=M044W2;LINKAGE=B

 $\pi^- p \rightarrow \eta \pi \pi$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$230 \pm 50 \pm 80$	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
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REFID=21838
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REFID=21964
REFID=21733
REFID=21963
REFID=21830
REFID=21824
REFID=21813
REFID=21807
REFID=21805

NODE=M107

$f_2(2300)$

$$I^G(J^{PC}) = 0^+(2^{++})$$

 $f_2(2300)$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
2297 ± 28	¹ ETKIN	88	MPS $22 \pi^- p \rightarrow \phi \phi n$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$2243^{+7}_{-6} \pm 29$	UEHARA	13	BELL $\gamma \gamma \rightarrow K_S^0 K_S^0$
2270 ± 12	VLADIMIRSK...06	SPEC	$40 \pi^- p \rightarrow K_S^0 K_S^0 n$
$2327 \pm 9 \pm 6$	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

NODE=M107M;LINKAGE=C

 $f_2(2300)$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
149 ± 41	² ETKIN	88	MPS $22 \pi^- p \rightarrow \phi \phi n$

NODE=M107W

NODE=M107W

• • • We do not use the following data for averages, fits, limits, etc. • • •

$145 \pm 12^{+27}_{-34}$	UEHARA	13	BELL	$\gamma\gamma \rightarrow K_S^0 K_S^0$
90 ± 29	VLADIMIRSK...	06	SPEC	$40 \pi^- p \rightarrow K_S^0 K_S^0 n$
$275 \pm 36 \pm 20$	ABE	04	BELL	$10.6 e^+ e^- \rightarrow e^+ e^- K^+ K^-$
133 ± 50	BOOTH	86	OMEG	$85 \pi^- \text{Be} \rightarrow 2\phi \text{Be}$
200 ± 50	LINDENBAUM	84	RVUE	
220 ± 70	ETKIN	82	MPS	$22 \pi^- p \rightarrow 2\phi n$

²Includes data of ETKIN 85.

NODE=M107W;LINKAGE=C

$f_2(2300)$ DECAY MODES

NODE=M107215;NODE=M107

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \phi\phi$	seen
$\Gamma_2 \quad K\bar{K}$	seen
$\Gamma_3 \quad \gamma\gamma$	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

$\Gamma(K\bar{K}) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$	$\Gamma_2\Gamma_3/\Gamma$
VALUE (eV)	DOCUMENT ID TECN COMMENT

NODE=M107G1
NODE=M107G1

• • • We do not use the following data for averages, fits, limits, etc. • • •

$3.2^{+0.5+1.3}_{-0.4-2.2}$	UEHARA	13	BELL	$\gamma\gamma \rightarrow K_S^0 K_S^0$
$44 \pm 6 \pm 12$	³ ABE	04	BELL	$10.6 e^+ e^- \rightarrow e^+ e^- K^+ K^-$

³ Assuming spin 2.

NODE=M107G1;LINKAGE=AB

$f_2(2300)$ REFERENCES

NODE=M107

UEHARA	13	PTEP 2013 123C01	S. Uehara <i>et al.</i>	(BELLE Collab.)
VLADIMIRSK...	06	PAN 69 493	V.V. Vladimirov <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

NODE=M041

$f_4(2300)$

$I^G(J^{PC}) = 0^+(4^{++})$

OMITTED FROM SUMMARY TABLE

This entry was previously called $U_0(2350)$. Contains results mostly from formation experiments. For further production experiments see the Further States entry. See also $\rho(2150)$, $f_2(2150)$, $\rho_3(2250)$, $\rho_5(2350)$.

NODE=M041

$f_4(2300)$ MASS

NODE=M041205

NODE=M041M

$\bar{p}p \rightarrow \pi\pi \text{ or } K\bar{K}$

NODE=M041M1
NODE=M041M1

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	$0.7\text{--}2.4 \bar{p}p \rightarrow K^- K^+$
~ 2330	DULUDE	78B	OSPK	$1\text{--}2 \bar{p}p \rightarrow \pi^0 \pi^0$
~ 2310	³ CARTER	77	CNTR	$0.7\text{--}2.4 \bar{p}p \rightarrow \pi\pi$

¹ $I(J^P) = 0(4^+)$ from simultaneous analysis of $p\bar{p} \rightarrow \pi^- \pi^+$ and $\pi^0 \pi^0$.

² $I(J^P) = 0(4^+)$ from Barrelet-zero analysis.

³ $I(J^P) = 0(4^+)$ from amplitude analysis.

NODE=M041M1;LINKAGE=P
NODE=M041M1;LINKAGE=K
NODE=M041M1;LINKAGE=J

S-CHANNEL $\bar{p}p$ or $\bar{N}N$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
2283±17	⁴ ANISOVICH	00J	SPEC
~ 2380	⁵ CUTTS	78B	CNTR 0.97–3 $\bar{p}p \rightarrow \bar{N}N$
2345±15	^{5,6} COUPLAND	77	CNTR 0.7–2.4 $\bar{p}p \rightarrow \bar{p}p$
2359± 2	^{5,7} ALSPECTOR	73	CNTR $\bar{p}p$ S channel
2375±10	ABRAMS	70	CNTR S channel $\bar{N}N$
⁴ From the combined analysis of ANISOVICH 99C and ANISOVICH 99F on $\bar{p}p \rightarrow \eta\pi^0\pi^0$, $\pi^0\pi^0$, $\eta\eta$, $\eta\eta'$, $\pi^+\pi^-$.			
⁵ Isospins 0 and 1 not separated.			
⁶ From a fit to the total elastic cross section.			
⁷ Referred to as U or U region by ALSPECTOR 73.			

NODE=M041M2
 NODE=M041M2

NODE=M041M2;LINKAGE=AN

NODE=M041M2;LINKAGE=I
 NODE=M041M2;LINKAGE=E
 NODE=M041M2;LINKAGE=M

 $\pi^-p \rightarrow \eta\pi\pi n$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
2330±20±40	AMELIN	00	VES 37 $\pi^-p \rightarrow \eta\pi^+\pi^-n$

NODE=M041M3
 NODE=M041M3

 pp CENTRAL PRODUCTION

VALUE (MeV)	DOCUMENT ID	COMMENT
2320±60 OUR ESTIMATE		
• • • We do not use the following data for averages, fits, limits, etc. • • •		
2332±15	BARBERIS	00F 450 $pp \rightarrow p_f\omega\omega p_s$

NODE=M041M4
 NODE=M041M4
 → UNCHECKED ←

 $f_4(2300)$ WIDTH

NODE=M041210

 $\bar{p}p \rightarrow \pi\pi$ or $\bar{K}K$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
~ 278	HASAN	94	RVUE $\bar{p}p \rightarrow \pi\pi$
~ 200	⁸ MARTIN	80C	RVUE
~ 150	⁹ CARTER	78B	CNTR 0.7–2.4 $\bar{p}p \rightarrow K^-K^+$
~ 210	¹⁰ CARTER	77	CNTR 0.7–2.4 $\bar{p}p \rightarrow \pi\pi$
⁸ $I(J^P) = 0(4^+)$ from simultaneous analysis of $p\bar{p} \rightarrow \pi^-\pi^+$ and $\pi^0\pi^0$.			
⁹ $I(J^P) = 0(4^+)$ from Barrelet-zero analysis.			
¹⁰ $I(J^P) = 0(4^+)$ from amplitude analysis.			

NODE=M041W1;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±50±40	AMELIN	00	VES 37 $\pi^-p \rightarrow \eta\pi^+\pi^-n$

NODE=M041W3
 NODE=M041W3

 pp CENTRAL PRODUCTION

VALUE (MeV)	DOCUMENT ID	COMMENT
250±80 OUR ESTIMATE		
• • • We do not use the following data for averages, fits, limits, etc. • • •		
260±57	BARBERIS	00F 450 $pp \rightarrow p_f\omega\omega p_s$

NODE=M041W4
 NODE=M041W4
 → UNCHECKED ←

$f_4(2300)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $\rho\rho$	seen
Γ_2 $\omega\omega$	seen
Γ_3 $\eta\pi\pi$	seen
Γ_4 $\pi\pi$	seen
Γ_5 $K\bar{K}$	seen
Γ_6 $N\bar{N}$	seen

NODE=M041215;NODE=M041

DESIG=1;OUR EST;→ UNCHECKED ←
 DESIG=2;OUR EST;→ UNCHECKED ←
 DESIG=3;OUR EST;→ UNCHECKED ←
 DESIG=4;OUR EST;→ UNCHECKED ←
 DESIG=5;OUR EST;→ UNCHECKED ←
 DESIG=6;OUR EST;→ UNCHECKED ←

 $f_4(2300)$ BRANCHING RATIOS

$\Gamma(\rho\rho)/\Gamma(\omega\omega)$	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 $\rho\rho \rightarrow p_f \omega \omega p_s$

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

NODE=M169

 $f_0(2330)$ 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

$f_2(2340)$

$I^G(J^{PC}) = 0^+(2^{++})$

NODE=M108

$f_2(2340)$ MASS

NODE=M108M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2339±55		¹ ETKIN 88	MPS	22 $\pi^- p \rightarrow \phi \phi n$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2350± 7	80k	² UMAN 06	E835	5.2 $\bar{p} p \rightarrow \eta \eta \pi^0$
2392±10		BOOTH 86	OMEG	85 $\pi^- Be \rightarrow 2 \phi Be$
2360±20		LINDENBAUM 84	RVUE	
¹ Includes data of ETKIN 85. The percentage of the resonance going into $\phi \phi 2^{++} S_2$, D_2 , and D_0 is 37 ± 19 , 4^{+12}_{-4} , and 59^{+21}_{-19} , respectively.				
² Statistical error only.				

NODE=M108M

NODE=M108M;LINKAGE=C

NODE=M108M;LINKAGE=ST

$f_2(2340)$ WIDTH

NODE=M108W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
319 ⁺ ₆₉		³ ETKIN 88	MPS	22 $\pi^- p \rightarrow \phi \phi n$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
218± 16	80k	⁴ UMAN 06	E835	5.2 $\bar{p} p \rightarrow \eta \eta \pi^0$
198± 50		BOOTH 86	OMEG	85 $\pi^- Be \rightarrow 2 \phi Be$
150 ⁺ ₅₀		LINDENBAUM 84	RVUE	
³ Includes data of ETKIN 85.				
⁴ Statistical error only.				

NODE=M108W

NODE=M108W;LINKAGE=C
NODE=M108W;LINKAGE=ST

$f_2(2340)$ DECAY MODES

NODE=M108215;NODE=M108

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \phi \phi$	seen
$\Gamma_2 \quad \eta \eta$	seen

DESIG=1;OUR EST;→ UNCHECKED ←
DESIG=2

$f_2(2340)$ BRANCHING RATIOS

NODE=M108220

$\Gamma(\eta\eta)/\Gamma_{\text{total}}$				Γ_2/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
seen	UMAN	06	E835	5.2 $\bar{p}p \rightarrow \eta\eta\pi^0$

NODE=M108R01
NODE=M108R01

$f_2(2340)$ REFERENCES

NODE=M108

UMAN 06	PR D73 052009	I. Uman <i>et al.</i>	(FNAL E835)
ETKIN 88	PL B201 568	A. Etkin <i>et al.</i>	(BNL, CUNY)
BOOTH 86	NP B273 677	P.S.L. Booth <i>et al.</i>	(LIVP, GLAS, CERN)
ETKIN 85	PL 165B 217	A. Etkin <i>et al.</i>	(BNL, CUNY)
LINDENBAUM 84	CNPP 13 285	S.J. Lindenbaum	(CUNY)

REFID=51063
REFID=40285
REFID=21870
REFID=21871
REFID=21869

$\rho_5(2350)$

$$I^G(J^{PC}) = 1^+(5^{--})$$

OMITTED FROM SUMMARY TABLE

This entry was previously called $U_1(2400)$. See also $\rho(2150)$, $f_2(2150)$, $\rho_3(2250)$, $f_4(2300)$.

NODE=M033

NODE=M033

 $\rho_5(2350)$ MASS

NODE=M033205

NODE=M033M

 $\pi^- p \rightarrow \omega \pi^0 n$
 NODE=M033M3
 NODE=M033M3

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
2330±35	ALDE	95	GAM2 38 $\pi^- p \rightarrow \omega \pi^0 n$

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT

NODE=M033M1

• • • We do not use the following data for averages, fits, limits, etc. • • •

~ 2303	HASAN	94	RVUE	$\bar{p} p \rightarrow \pi \pi$
~ 2300	¹ MARTIN	80B	RVUE	
~ 2250	¹ MARTIN	80C	RVUE	
~ 2500	² CARTER	78B	CNTR 0	0.7-2.4 $\bar{p} p \rightarrow$ $K^- K^+$
~ 2480	³ CARTER	77	CNTR 0	0.7-2.4 $\bar{p} p \rightarrow$ $\pi \pi$

S-CHANNEL $\bar{N} N$
 NODE=M033M2
 NODE=M033M2

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

2300±45	⁴ ANISOVICH	02	SPEC	0.6-1.9 $\bar{p} \bar{p} \rightarrow$ $\omega \pi^0, \omega \eta \pi^0,$ $\pi^+ \pi^-$
2295±30	ANISOVICH	00J	SPEC	
~ 2380	⁵ CUTTS	78B	CNTR	0.97-3 $\bar{p} p \rightarrow$ $\bar{N} N$
2345±15	^{5,6} COUPLAND	77	CNTR 0	0.7-2.4 $\bar{p} p \rightarrow$ $\bar{p} p$
2359± 2	^{5,7} ALSPECTOR	73	CNTR	$\bar{p} p$ S channel
2350±10	⁸ ABRAMS	70	CNTR	S channel $\bar{N} N$
2360±25	⁹ OH	70B	HDBC -0	$\bar{p}(pn), K^* K 2\pi$

 $\pi^- p \rightarrow K^+ K^- n$
 NODE=M033M4
 NODE=M033M4

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

2307±6	ALPER	80	CNTR 0	62 $\pi^- p \rightarrow$ $K^+ K^- n$

¹ $I(J^P) = 1(5^-)$ from simultaneous analysis of $\bar{p} \bar{p} \rightarrow \pi^- \pi^+$ and $\pi^0 \pi^0$.

² $I = 0(1); J^P = 5^-$ from Barrelet-zero analysis.

³ $I(J^P) = 1(5^-)$ from amplitude analysis.

⁴ From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.

⁵ Isospins 0 and 1 not separated.

⁶ From a fit to the total elastic cross section.

⁷ Referred to as U or U region by ALSPECTOR 73.

⁸ For $I = 1 \bar{N} N$.

⁹ No evidence for this bump seen in the $\bar{p} p$ data of CHAPMAN 71B. Narrow state not confirmed by OH 73 with more data.

 NODE=M033M1;LINKAGE=P
 NODE=M033M1;LINKAGE=K
 NODE=M033M1;LINKAGE=J
 NODE=M033M2;LINKAGE=AY

 NODE=M033M2;LINKAGE=I
 NODE=M033M2;LINKAGE=E
 NODE=M033M2;LINKAGE=M
 NODE=M033M2;LINKAGE=A
 NODE=M033M2;LINKAGE=N
 $\rho_5(2350)$ WIDTH

NODE=M033210

 $\pi^- p \rightarrow \omega \pi^0 n$
 NODE=M033W3
 NODE=M033W3

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
400±100	ALDE	95	GAM2 38 $\pi^- p \rightarrow \omega \pi^0 n$

$\bar{p}p \rightarrow \pi\pi$ or $\bar{K}K$

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
~ 169	HASAN	94	RVUE	$\bar{p}p \rightarrow \pi\pi$
~ 250	10 MARTIN	80B	RVUE	
~ 300	10 MARTIN	80C	RVUE	
~ 150	11 CARTER	78B	CNTR 0	0.7-2.4 $\bar{p}p \rightarrow$ $K^- K^+$
~ 210	12 CARTER	77	CNTR 0	0.7-2.4 $\bar{p}p \rightarrow$ $\pi\pi$

NODE=M033W1
 NODE=M033W1

S-CHANNEL $\bar{N}N$

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
260 ± 75	13 ANISOVICH	02	SPEC	0.6-1.9 $p\bar{p} \rightarrow$ $\omega\pi^0, \omega\eta\pi^0,$ $\pi^+\pi^-$
235 ⁺⁶⁵ ₋₄₀	ANISOVICH	00J	SPEC	
135 ⁺¹⁵⁰ ₋₆₅	14,15 COUPLAND	77	CNTR 0	0.7-2.4 $\bar{p}p \rightarrow$ $\bar{p}p$
165 ⁺¹⁸ ₋₈	15 ALSPECTOR	73	CNTR	$\bar{p}p$ S channel
< 60	16 OH	70B	HDBC -0	$\bar{p}(pn), K^*K2\pi$
~ 140	ABRAMS	67C	CNTR	S channel $\bar{p}N$

NODE=M033W2
 NODE=M033W2

 $\pi^- p \rightarrow K^+ K^- n$

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
245 ± 20	ALPER	80	CNTR 0	62 $\pi^- p \rightarrow$ $K^+ K^- n$
¹⁰ $I(J^P) = 1(5^-)$ from simultaneous analysis of $p\bar{p} \rightarrow \pi^- \pi^+$ and $\pi^0 \pi^0$. ¹¹ $I = 0(1); J^P = 5^-$ from Barrelet-zero analysis. ¹² $I(J^P) = 1(5^-)$ from amplitude analysis. ¹³ From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02. ¹⁴ From a fit to the total elastic cross section. ¹⁵ Isospins 0 and 1 not separated. ¹⁶ No evidence for this bump seen in the $\bar{p}p$ data of CHAPMAN 71B. Narrow state not confirmed by OH 73 with more data.				

NODE=M033W4
 NODE=M033W4

OCCUR=2

NODE=M033W1;LINKAGE=P
 NODE=M033W1;LINKAGE=K
 NODE=M033W1;LINKAGE=J
 NODE=M033W2;LINKAGE=AY
 NODE=M033W2;LINKAGE=E
 NODE=M033W2;LINKAGE=I
 NODE=M033W2;LINKAGE=N

 $\rho_5(2350)$ REFERENCES

ANISOVICH 02	PL B542 8	A.V. Anisovich <i>et al.</i>	
ANISOVICH 01D	PL B508 6	A.V. Anisovich <i>et al.</i>	
ANISOVICH 01E	PL B513 281	A.V. Anisovich <i>et al.</i>	
ANISOVICH 00J	PL B491 47	A.V. Anisovich <i>et al.</i>	
ALDE 95	ZPHY C66 379	D.M. Alde <i>et al.</i>	(GAMS Collab.) JP
HASAN 94	PL B334 215	A. Hasan, D.V. Bugg	(LOQM)
ALPER 80	PL 94B 422	B. Alper <i>et al.</i>	(AMST, CERN, CRAC, MPIM+)
MARTIN 80B	NP B176 355	B.R. Martin, D. Morgan	(LOUC, RHEL) JP
MARTIN 80C	NP B169 216	A.D. Martin, M.R. Pennington	(DURH) JP
CARTER 78B	NP B141 467	A.A. Carter	(LOQM)
CUTTS 78B	PR D17 16	D. Cutts <i>et al.</i>	(STON, WISC)
CARTER 77	PL 67B 117	A.A. Carter <i>et al.</i>	(LOQM, RHEL) JP
COUPLAND 77	PL 71B 460	M. Coupland <i>et al.</i>	(LOQM, RHEL)
ALSPECTOR 73	PRL 30 511	J. Alspector <i>et al.</i>	(RUTG, UPNJ)
OH 73	NP B51 57	B.Y. Oh <i>et al.</i>	(MSU)
CHAPMAN 71B	PR D4 1275	J.W. Chapman <i>et al.</i>	(MICH)
ABRAMS 70	PR D1 1917	R.J. Abrams <i>et al.</i>	(BNL)
OH 70B	PRL 24 1257	B.Y. Oh <i>et al.</i>	(MSU)
ABRAMS 67C	PRL 18 1209	R.J. Abrams <i>et al.</i>	(BNL)

NODE=M033

REFID=48828
 REFID=48327
 REFID=48349
 REFID=47950
 REFID=44371
 REFID=44103
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 REFID=21733
 REFID=21963
 REFID=21830
 REFID=21813
 REFID=21931
 REFID=21926
 REFID=21807
 REFID=21925
 REFID=21804

$a_6(2450)$

$I^G(J^{PC}) = 1^-(6^{++})$

OMITTED FROM SUMMARY TABLE
Needs confirmation.

$a_6(2450)$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
2450±130	¹ CLELAND	82B	SPEC	± 50 $\pi p \rightarrow K_S^0 K^\pm p$

¹ From an amplitude analysis.

$a_6(2450)$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
400±250	² CLELAND	82B	SPEC	± 50 $\pi p \rightarrow K_S^0 K^\pm p$

² From an amplitude analysis.

$a_6(2450)$ DECAY MODES

Mode
$\Gamma_1 \quad K \bar{K}$

$a_6(2450)$ REFERENCES

CLELAND	82B	NP B208 228	W.E. Cleland <i>et al.</i>	(DURH, GEVA, LAUS+)

$f_6(2510)$

$I^G(J^{PC}) = 0^+(6^{++})$

OMITTED FROM SUMMARY TABLE
Needs confirmation.

$f_6(2510)$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
2469±29 OUR AVERAGE	Error includes scale factor of 1.5. See the ideogram below.		
2485±40	¹ ANISOVICH	00J	SPEC 1.92–2.41 $p\bar{p}$
2420±30	ALDE	98	GAM4 100 $\pi^- p \rightarrow \pi^0 \pi^0 n$
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.

NODE=M024

NODE=M024

NODE=M024M

NODE=M024M

NODE=M024M;LINKAGE=C

NODE=M024W

NODE=M024W

NODE=M024W;LINKAGE=C

NODE=M024215;NODE=M024

DESIG=1

NODE=M024

REFID=21281

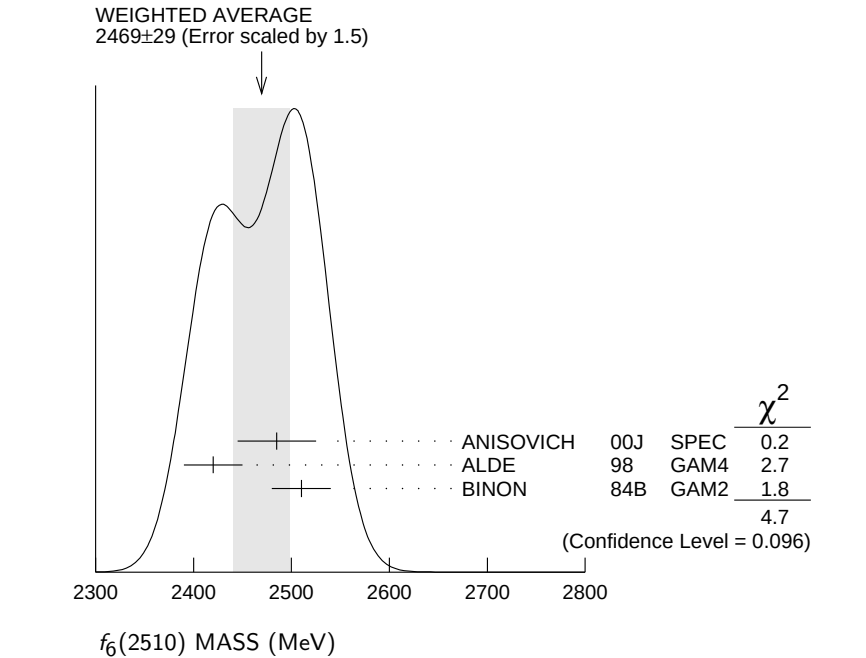
NODE=M089

NODE=M089

NODE=M089M

NODE=M089M

NODE=M089M;LINKAGE=AN



$f_6(2510)$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
283±40 OUR AVERAGE	Error includes scale factor of 1.1.		
410±90	² ANISOVICH	00J SPEC	1.92–2.41 $p\bar{p}$
270±60	ALDE	98 GAM4	100 $\pi^- p \rightarrow \pi^0 \pi^0 n$
240±60	BINON	84B GAM2	38 $\pi^- p \rightarrow n 2\pi^0$

²From the combined analysis of ANISOVICH 99C, ANISOVICH 99F, ANISOVICH 99J, ANISOVICH 99K, and ANISOVICH 00B.

NODE=M089W

NODE=M089W

NODE=M089W;LINKAGE=AN

$f_6(2510)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \pi\pi$	(6.0±1.0) %

NODE=M089215;NODE=M089

DESIG=1

$f_6(2510)$ BRANCHING RATIOS

$\Gamma(\pi\pi)/\Gamma_{\text{total}}$	DOCUMENT ID	TECN	COMMENT	Γ_1/Γ
0.06±0.01	³ BINON	83C GAM2	38 $\pi^- p \rightarrow n 4\gamma$	

³ Assuming one pion exchange and using data of BOLOTOV 74.

NODE=M089220

NODE=M089R1

NODE=M089R1

NODE=M089R1;LINKAGE=A

$f_6(2510)$ REFERENCES

ANISOVICH	00B	NP A662 319	A.V. Anisovich <i>et al.</i>	
ANISOVICH	00J	PL B491 47	A.V. Anisovich <i>et al.</i>	
ANISOVICH	99C	PL B452 173	A.V. Anisovich <i>et al.</i>	
ANISOVICH	99F	NP A651 253	A.V. Anisovich <i>et al.</i>	
ANISOVICH	99J	PL B471 271	A.V. Anisovich <i>et al.</i>	
ANISOVICH	99K	PL B468 309	A.V. Anisovich <i>et al.</i>	
ALDE	98	EPJ A3 361	D. Alde <i>et al.</i>	(GAM4 Collab.)
Also		PAN 62 405	D. Alde <i>et al.</i>	(GAMS Collab.)
		Translated from YAF 62 446.		
BINON	84B	LNC 39 41	F.G. Binon <i>et al.</i>	(SERP, BELG, LAPP) JP
BINON	83C	SJNP 38 723	F.G. Binon <i>et al.</i>	(SERP, BRUX+)
		Translated from YAF 38 1199.		
BOLOTOV	74	PL 52B 489	V.N. Bolotov <i>et al.</i>	(SERP)

NODE=M089

REFID=47942

REFID=47950

REFID=46903

REFID=46926

REFID=47416

REFID=47472

REFID=46605

REFID=46914

REFID=21780

REFID=40288

REFID=44705

OTHER LIGHT MESONS

NODE=MXXX015

Further States

OMITTED FROM SUMMARY TABLE

This section contains states observed by a single group or states poorly established that thus need confirmation.

QUANTUM NUMBERS, MASSES, WIDTHS, AND BRANCHING RATIOS

X(360) $I^G(J^{PC}) = ?^?(?^{++})$					
MASS (MeV)	WIDTH (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
$360 \pm 7 \pm 9$	64 ± 18	2.3k	¹ ABRAAMYAN 09	CNTR	$2.75 d C \rightarrow \gamma \gamma X$

¹ Not seen in $p C \rightarrow \gamma \gamma X$ at 5.5 GeV/c.

NODE=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

NODE=M300J30
NODE=M300J30

f₀(1200–1600) $I^G(J^{PC}) = 0^{+}(0^{++})$					
MASS (MeV)	WIDTH (MeV)		DOCUMENT ID	TECN	COMMENT
1323 ± 8	237 ± 20		VLADIMIRSK...06	SPEC	$40 \pi^- p \rightarrow K_S^0 K_S^0 n$
1480^{+100}_{-150}	1030^{+80}_{-170}	³	ANISOVICH 03	SPEC	
1530^{+90}_{-250}	560 ± 40	⁴	ANISOVICH 03	SPEC	

³ K-matrix pole from combined analysis of $\pi^- p \rightarrow \pi^0 \pi^0 n$, $\pi^- p \rightarrow K \bar{K} n$, $\pi^+ \pi^- \rightarrow \pi^+ \pi^-$, $\bar{p} p \rightarrow \pi^0 \pi^0 \pi^0$, $\pi^0 \pi^0 \eta$, $\pi^0 \pi^0 \eta$, $\pi^+ \pi^- \pi^0$, $K^+ K^- \pi^0$, $K_S^0 K_S^0 \pi^0$, $K^+ K_S^0 \pi^-$ at rest, $\bar{p} n \rightarrow \pi^- \pi^- \pi^+$, $K_S^0 K^- \pi^0$, $K_S^0 K_S^0 \pi^-$ at rest.

⁴ K-matrix pole from combined analysis of $\pi^- p \rightarrow \pi^0 \pi^0 n$, $\pi^- p \rightarrow K \bar{K} n$, $\bar{p} p \rightarrow \pi^0 \pi^0 \pi^0$, $\pi^0 \pi^0 \eta$, $\pi^0 \pi^0 \eta$ at rest.

NODE=M300J98
NODE=M300J98

OCCUR=2

NODE=M300;LINKAGE=KM

NODE=M300;LINKAGE=MK

X(1420) $I^G(J^{PC}) = 2^{+}(0^{++})$					
MASS (MeV)	WIDTH (MeV)		DOCUMENT ID	TECN	COMMENT
1420 ± 20	160 ± 10		FILIPPI	00	OBLX

NODE=M300J61
NODE=M300J61

X(1545) $I^G(J^{PC}) = ?^?(?^{++})$					
MASS (MeV)	WIDTH (MeV)		DOCUMENT ID		COMMENT
1545 ± 3	6.0 ± 2.5	⁵	VLADIMIRSK...08		$40 \pi^- p \rightarrow K_S^0 K_S^0 n + m\pi^0$

⁵ Supersedes VLADIMIRSKII 00.

NODE=M300K07
NODE=M300K07

NODE=M300K07;LINKAGE=VL

X(1575) $I^G(J^{PC}) = ?^?(1^{--})$					
MASS (MeV)	WIDTH (MeV)		DOCUMENT ID	TECN	COMMENT
1576^{+49+98}_{-55-91}	$818^{+22+64}_{-23-133}$	⁶	ABLIKIM	06S	BES

NODE=M300J08
NODE=M300J08

$J/\psi \rightarrow K^+ K^- \pi^0$

⁶ A broad peak observed at $K^+ K^-$ invariant mass. Mass and width above are its pole position. The observed branching ratio is $B(J/\psi \rightarrow X \pi^0) B(X \rightarrow K^+ K^-) = (8.5 \pm 0.6^{+2.7}_{-3.6}) \times 10^{-4}$.

NODE=M300J08;LINKAGE=AB

X(1600) $I^G(J^{PC}) = 2^+(2^{++})$					
<u>MASS (MeV)</u>	<u>WIDTH (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
1600±100	400 ± 200	⁷ ALBRECHT	91F ARG	10.2	$e^+ e^- \rightarrow e^+ e^- 2(\pi^+ \pi^-)$
⁷ Our estimate.					

NODE=M300J99
NODE=M300J99

NODE=M300J99;LINKAGE=A

X(1650) $I^G(J^{PC}) = 0^-(?^{? -})$					
MASS (MeV)	WIDTH (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1652 ± 7	< 50	100	PROKOSHKIN 96	GAM2	32,38 $\pi p \rightarrow \omega \eta n$

NODE=M300J62
NODE=M300J62

X(1730) $I^G(J^{PC}) = ?^?(?^{?+})$					
MASS (MeV)	WIDTH (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1731.0 ± 1.2 ± 2.0	3.2 ± 0.8 ± 1.3	58	VLADIMIRSK...07	SPEC	40 $\pi^- p \rightarrow K_S^0 K_S^0 X$

NODE=M300K06
NODE=M300K06

X(1750) $I^G(J^{PC}) = ?^?(1^{--})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
1753.5 ± 1.5 ± 2.3	122.2 ± 6.2 ± 8.0	LINK	02K	FOCS	20–160 $\gamma p \rightarrow K^+ K^- p$

NODE=M300J94
NODE=M300J94

B(X(1750) → $\bar{K}^*(892)^0 K^0 \rightarrow K^\pm \pi^\mp K_S^0$)/B(X(1750) → $K^+ K^-$)					
VALUE	CL%	DOCUMENT ID	TECN		
< 0.065	90	LINK	02K	FOCS	

NODE=M300B5
NODE=M300B5

B(X(1750) → $\bar{K}^*(892)^\pm K^\mp \rightarrow K^\pm \pi^\mp K_S^0$)/B(X(1750) → $K^+ K^-$)					
VALUE	CL%	DOCUMENT ID	TECN		
< 0.183	90	LINK	02K	FOCS	

NODE=M300B6
NODE=M300B6

f₂(1750) $I^G(J^{PC}) = 0^+(2^{++})$					
MASS (MeV)	WIDTH (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1755 ± 10	67 ± 12	870	⁸ SCHEGELSKY 06A	RVUE	$\gamma\gamma \rightarrow K_S^0 K_S^0$

NODE=M300JAM
NODE=M300JAM

Γ(K$\bar{K}$)					
VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT	
17 ± 5	870	⁹ SCHEGELSKY 06A	RVUE	$\gamma\gamma \rightarrow K_S^0 K_S^0$	

NODE=M300JA1
NODE=M300JA1

Γ(γγ)					
VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT	
0.13 ± 0.04	870	⁹ SCHEGELSKY 06A	RVUE	$\gamma\gamma \rightarrow K_S^0 K_S^0$	

NODE=M300JA2
NODE=M300JA2

Γ(ππ)					
VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT	
1.3 ± 1.0	870	⁹ SCHEGELSKY 06A	RVUE	$\gamma\gamma \rightarrow K_S^0 K_S^0$	

NODE=M300JA3
NODE=M300JA3

Γ(ηη)					
VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT	
2.0 ± 0.5	870	⁹ SCHEGELSKY 06A	RVUE	$\gamma\gamma \rightarrow K_S^0 K_S^0$	

NODE=M300JA4
NODE=M300JA4

⁸ From analysis of L3 data at 91 and 183–209 GeV.

⁹ From analysis of L3 data at 91 and 183–209 GeV and using SU(3) relations.

NODE=M300JAM;LINKAGE=SC
NODE=M300JA;LINKAGE=SC

X(1775) $I^G(J^{PC}) = 1^-(?^{-+})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
1763 ± 20	192 ± 60	CONDO 91	SHF	$\gamma p \rightarrow (p \pi^+)(\pi^+ \pi^- \pi^-)$	
1787 ± 18	118 ± 60	CONDO 91	SHF	$\gamma p \rightarrow n \pi^+ \pi^+ \pi^-$	

NODE=M300J60
NODE=M300J60

OCCUR=2

f₀(1800) $I^G(J^{PC}) = 0^+(0^{++})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
1795 ± 7 ⁺²³ ₋₂₀	95 ± 10 ⁺⁷⁸ ₋₈₂	ABLIKIM	13J	BES3	$J/\psi \rightarrow \gamma \omega \phi$
1812 ⁺¹⁹ ₋₂₆ ± 18	105 ± 20 ± 28	¹⁰ ABLIKIM	06J	BES2	$J/\psi \rightarrow \gamma \omega \phi$

NODE=M300K29
NODE=M300K29

¹⁰ Not seen by LIU 09 in $B^\pm \rightarrow K^\pm \omega \phi$.

NODE=M300K29;LINKAGE=AB

X(1850 - 3100) $I^G(J^{PC}) = ?^?(1^- -)$					
$\Gamma(e^+e^-) \cdot B(X \rightarrow \text{hadrons})$ (eV)	CL%	DOCUMENT ID	TECN	COMMENT	
<120	90	¹¹ ANASHIN	11	KEDR	$e^+e^- \rightarrow \text{hadrons}$

¹¹ This limit is center-of-mass energy dependent. We quote the most stringent one.

NODE=M300K28
NODE=M300K28

NODE=M300K28;LINKAGE=AN

X(1855) $I^G(J^{PC}) = ?^?(???)$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
1856.6 ± 5	20 ± 5	BRIDGES	86D	SPEC	0. $\bar{p}d \rightarrow \pi\pi N$

NODE=M300J31
NODE=M300J31

X(1870) $I^G(J^{PC}) = ?^?(2^{??})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
1870 ± 40	250 ± 30	ALDE	86D	GAM4	100 $\pi^- p \rightarrow 2\eta X$

NODE=M300J45
NODE=M300J45

$a_3(1875)$ $I^G(J^{PC}) = 1^-(3^{++})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
1874 ± 43 ± 96	385 ± 121 ± 114	CHUNG	02	B852	18.3 $\pi^- p \rightarrow \pi^+\pi^-\pi^-p$

NODE=M300J95
NODE=M300J95

$B(a_3(1875) \rightarrow f_2(1270)\pi)/B(a_3(1875) \rightarrow \rho\pi)$					
VALUE	DOCUMENT ID	TECN	COMMENT		
0.8 ± 0.2	¹² CHUNG	02	B852	18.3 $\pi^- p \rightarrow \pi^+\pi^-\pi^-p$	

¹² Using the observable fractions of 50.0% $\rho\pi$, 56.5% $f_2\pi$, and 11.8% $\rho_3\pi$.

NODE=M300B7
NODE=M300B7

NODE=M300B;LINKAGE=C1

$B(a_3(1875) \rightarrow \rho_3(1690)\pi)/B(a_3(1875) \rightarrow \rho\pi)$					
VALUE	DOCUMENT ID	TECN	COMMENT		
0.9 ± 0.3	¹³ CHUNG	02	B852	18.3 $\pi^- p \rightarrow \pi^+\pi^-\pi^-p$	

¹³ Using the observable fractions of 50.0% $\rho\pi$, 56.5% $f_2\pi$, and 11.8% $\rho_3\pi$.

NODE=M300B8
NODE=M300B8

NODE=M300B8;LINKAGE=C1

$a_1(1930)$ $I^G(J^{PC}) = 1^-(1^{++})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
1930 ⁺³⁰ ₋₇₀	155 ± 45	ANISOVICH	01F	SPEC	2.0 $\bar{p}p \rightarrow 3\pi^0, \pi^0\eta, \pi^0\eta'$

NODE=M300J92
NODE=M300J92

X(1935) $I^G(J^{PC}) = 1^+(1^{-?})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
1935 ± 20	215 ± 30	EVANGELIS...	79	OMEG	10,16 $\pi^- p \rightarrow \bar{p}pn$

NODE=M300J33
NODE=M300J33

$\rho_2(1940)$ $I^G(J^{PC}) = 1^+(2^{--})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
1940 ± 40	155 ± 40	¹⁴ ANISOVICH	02	SPEC	0.6–1.9 $p\bar{p} \rightarrow \omega\pi^0, \omega\eta\pi^0, \pi^+\pi^-$

NODE=M300J85
NODE=M300J85

¹⁴ From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.

NODE=M300J85;LINKAGE=AY

$\omega_3(1945)$ $I^G(J^{PC}) = 0^-(3^{--})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
1945 ± 20	115 ± 22	¹⁵ ANISOVICH	02B	SPEC	0.6–1.9 $p\bar{p} \rightarrow \omega\eta, \omega\pi^0\pi^0$

¹⁵ From the combined analysis of ANISOVICH 00D, ANISOVICH 01C, and ANISOVICH 02B.

NODE=M300J65
NODE=M300J65

NODE=M300J65;LINKAGE=AZ

$a_2(1950)$ $I^G(J^{PC}) = 1^-(2^{++})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
1950 ⁺³⁰ ₋₇₀	180 ⁺³⁰ ₋₇₀	¹⁶ ANISOVICH	01F	SPEC	1.96–2.41 $\bar{p}p$

NODE=M300K24
NODE=M300K24

¹⁶ From the combined analysis of ANISOVICH 99C, ANISOVICH 99E, and ANISOVICH 01F.

NODE=M300K24;LINKAGE=AN

$\omega(1960)$ $I^G(J^{PC}) = 0^-(1^--)$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
1960 ± 25	195 ± 60	¹⁷ ANISOVICH	02B	SPEC	0.6–1.9 $p\bar{p} \rightarrow \omega\eta, \omega\pi^0\pi^0$

NODE=M300J79
NODE=M300J79

¹⁷ From the combined analysis of ANISOVICH 00D, ANISOVICH 01C, and ANISOVICH 02B.

NODE=M300J79;LINKAGE=AZ

$b_1(1960)$ $I^G(J^{PC}) = 1^+(1^{+-})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
1960 ± 35	230 ± 50	¹⁸ ANISOVICH	02	SPEC	0.6–1.9 $p\bar{p} \rightarrow \omega\pi^0, \omega\eta\pi^0, \pi^+\pi^-$

NODE=M300J67
NODE=M300J67

¹⁸ From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.

NODE=M300J67;LINKAGE=AY

$h_1(1965)$ $I^G(J^{PC}) = 0^-(1^{+-})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
1965 ± 45	345 ± 75	¹⁹ ANISOVICH	02B	SPEC	0.6–1.9 $p\bar{p} \rightarrow \omega\eta, \omega\pi^0\pi^0$

NODE=M300J64
NODE=M300J64

¹⁹ From the combined analysis of ANISOVICH 00D, ANISOVICH 01C, and ANISOVICH 02B.

NODE=M300J64;LINKAGE=AZ

$f_1(1970)$ $I^G(J^{PC}) = 0^+(1^{++})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
1971 ± 15	240 ± 45	ANISOVICH	00J	SPEC	

NODE=M300J1
NODE=M300J1

$X(1970)$ $I^G(J^{PC}) = ?^?(???)$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
1970 ± 10	40 ± 20	CHLIAPNIK...	80	HBC	32 $K^+p \rightarrow 2K_S^0 2\pi X$

NODE=M300J46
NODE=M300J46

$X(1975)$ $I^G(J^{PC}) = ?^?(???)$					
MASS (MeV)	WIDTH (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
1973 ± 15	80	30	CASO	70	HBC 11.2 $\pi^-p \rightarrow \rho 2\pi$

NODE=M300J47
NODE=M300J47

$\omega_2(1975)$ $I^G(J^{PC}) = 0^-(2^{--})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
1975 ± 20	175 ± 25	²⁰ ANISOVICH	02B	SPEC	0.6–1.9 $p\bar{p} \rightarrow \omega\eta, \omega\pi^0\pi^0$

²⁰ From the combined analysis of ANISOVICH 00D, ANISOVICH 01C, and ANISOVICH 02B.

NODE=M300J81;LINKAGE=AZ

$a_2(1990)$ $I^G(J^{PC}) = 1^-(2^{++})$					
MASS (MeV)	WIDTH (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
2050 ± 10 ± 40	190 ± 22 ± 100	18k	²¹ SCHEGELSKY	06	RVUE $\gamma\gamma \rightarrow \pi^+\pi^-\pi^0$
2003 ± 10 ± 19	249 ± 23 ± 32		LU	05	B852 18 $\pi^-p \rightarrow \omega\pi^-\pi^0p$

²¹ From analysis of L3 data at 183–209 GeV.

NODE=M300J2;LINKAGE=SC

$\Gamma(\gamma\gamma) \Gamma(\pi^+\pi^-\pi^0) / \Gamma(\text{total})$					
VALUE (keV)	EVTs	DOCUMENT ID	TECN	COMMENT	
0.11 ± 0.04 ± 0.05	18k	²² SCHEGELSKY	06	RVUE	$\gamma\gamma \rightarrow \pi^+\pi^-\pi^0$

²² From analysis of L3 data at 183–209 GeV.

NODE=M300J2G
NODE=M300J2G

NODE=M300J2G;LINKAGE=SC

$\rho(2000)$ $I^G(J^{PC}) = 1^+(1^{--})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2000 ± 30	260 ± 45	²³ BUGG	04C	RVUE	Compilation
~ 1988	~ 244	HASAN	94	RVUE	$\bar{p}p \rightarrow \pi\pi$

NODE=M300J77
NODE=M300J77

²³From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.

NODE=M300;LINKAGE=AY

$f_2(2000)$		$I^G(J^{PC}) = 0^+(2^{++})$			
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2001 ± 10	312 ± 32	ANISOVICH 00J	SPEC		
~ 1996	~ 134	HASAN 94	RVUE	$\bar{p}p \rightarrow \pi\pi$	

NODE=M300J25
NODE=M300J25

$X(2000)$		$I^G(J^{PC}) = 1^-(?^{?+})$			
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
1964 ± 35	225 ± 50	²⁴ ARMSTRONG 93D	E760		$\bar{p}p \rightarrow 3\pi^0 \rightarrow 6\gamma$
~ 2100	~ 500	²⁴ ANTIPOV 77	CIBS	-	$25 \pi^- p \rightarrow p\pi^- \rho_3$
2214 ± 15	355 ± 21	²⁵ BALTAY 77	HBC	0	$15 \pi^- p \rightarrow \Delta^{++} 3\pi$
2080 ± 40	340 ± 80	KALELKAR 75	HBC	+	$15 \pi^+ p \rightarrow p\pi^+ \rho_3$

NODE=M300K01
NODE=M300K01

²⁴ Cannot determine spin to be 3.

²⁵ BALTAY 77 favors $J^P = ,3^+$.

NODE=M300K01;LINKAGE=AA
NODE=M300K01;LINKAGE=B

$X(2000)$		$I^G(J^{PC}) = ?^?(4^{++})$			
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
1998 ± 3 ± 5	<15	VLADIMIRSK...03	SPEC	$\pi^- p \rightarrow K_S^0 K_S^0 M M$	

NODE=M300J97
NODE=M300J97

$\pi_2(2005)$		$I^G(J^{PC}) = 1^-(2^{-+})$			
MASS (MeV)	WIDTH (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
1974 ± 14 ± 83	341 ± 61 ± 139	145k	LU 05	B852	$18 \pi^- p \rightarrow \omega \pi^- \pi^0 p$
2005 ± 15	200 ± 40		ANISOVICH 01F	SPEC	$2.0 \bar{p}p \rightarrow 3\pi^0, \pi^0 \eta, \pi^0 \eta'$

NODE=M300J71
NODE=M300J71

$\eta(2010)$		$I^G(J^{PC}) = 0^+(0^{-+})$			
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2010 ⁺³⁵ ₋₆₀	270 ± 60	ANISOVICH 00J	SPEC		

NODE=M300J5
NODE=M300J5

$\pi_1(2015)$		$I^G(J^{PC}) = 1^-(1^{-+})$			
MASS (MeV)	WIDTH (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
2014 ± 20 ± 16	230 ± 32 ± 73	145k	LU 05	B852	$18 \pi^- p \rightarrow \omega \pi^- \pi^0 p$
2001 ± 30 ± 92	333 ± 52 ± 49	69k	KUHN 04	B852	$18 \pi^- p \rightarrow \eta \pi^+ \pi^- \pi^- p$

NODE=M300J05
NODE=M300J05

$a_0(2020)$		$I^G(J^{PC}) = 1^-(0^{++})$			
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2025 ± 30	330 ± 75	ANISOVICH 99C	SPEC		

NODE=M300J6
NODE=M300J6

$X(2020)$		$I^G(J^{PC}) = ?^?(?^{??})$			
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2015 ± 3	10 ± 4	FERRER 99	RVUE	$\pi p \rightarrow p p \bar{p} \pi(\pi)$	

NODE=M300J34
NODE=M300J34

$h_3(2025)$		$I^G(J^{PC}) = 0^-(3^{+-})$			
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2025 ± 20	145 ± 30	²⁶ ANISOVICH 02B	SPEC	$0.6-1.9 p\bar{p} \rightarrow \omega \eta, \omega \pi^0 \pi^0$	

NODE=M300J78
NODE=M300J78

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.

NODE=M300J01;LINKAGE=AB

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.

$X(2080)$ $I^G(J^{PC}) = ??(???)$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2080 ± 10	110 ± 20	KREYMER	80	STRC	13 $\pi^- d \rightarrow p\bar{p}n(n_s)$

NODE=M300J35
NODE=M300J35

X(2080) $I^G(J^{PC}) = ?^?(3^{-?})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2080 ± 10	190 ± 15	ROZANSKA	80	SPRK	18 $\pi^- p \rightarrow p \bar{p} n$

NODE=M300J37
NODE=M300J37

a₁(2095) $I^G(J^{PC}) = 1^-(1^{++})$					
MASS (MeV)	WIDTH (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2096 ± 17 ± 121	451 ± 41 ± 81	69k	KUHN	04	B852 18 $\pi^- p \rightarrow \eta \pi^+ \pi^- \pi^- p$

NODE=M300J04
NODE=M300J04

B(a₁(2095) → f₁(1285)π) / B(a₁(2095) → a₁(1260))					
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
3.18 ± 0.64	69k	KUHN	04	B852	18 $\pi^- p \rightarrow \eta \pi^+ \pi^- \pi^- p$

NODE=M300B03
NODE=M300B03

η(2100) $I^G(J^{PC}) = 0^+(0^{-+})$					
MASS (MeV)	WIDTH (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2103 ± 50	187 ± 75	586	³⁵ BISELLO	89B	DM2 $J/\psi \rightarrow 4\pi\gamma$

³⁵ ASTON 81B sees no peak, has 850 events in Ajinenko+Barth bins. ARESTOV 80 sees no peak.

NODE=M300J48
NODE=M300J48

NODE=M300J;LINKAGE=A1

X(2100) $I^G(J^{PC}) = ?^?(0^{??})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2100 ± 40	250 ± 40	ALDE	86D	GAM4	100 $\pi^- p \rightarrow 2\eta X$

NODE=M300J49
NODE=M300J49

X(2110) $I^G(J^{PC}) = 1^+(3^{-?})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2110 ± 10	330 ± 20	EVANGELIS...	79	OMEG	10,16 $\pi^- p \rightarrow \bar{p} p n$

NODE=M300J36
NODE=M300J36

f₂(2140) $I^G(J^{PC}) = 0^+(2^{++})$					
MASS (MeV)	WIDTH (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2141 ± 12	49 ± 28	389	GREEN	86	MPSF 400 $pA \rightarrow 4KX$

NODE=M300J50
NODE=M300J50

X(2150) $I^G(J^{PC}) = ?^?(2^{+?})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2150 ± 10	260 ± 10	ROZANSKA	80	SPRK	18 $\pi^- p \rightarrow p \bar{p} n$

NODE=M300J38
NODE=M300J38

a₂(2175) $I^G(J^{PC}) = 1^-(2^{++})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2175 ± 40	310 ⁺⁹⁰ ₋₄₅	ANISOVICH	01F	SPEC	2.0 $\bar{p} p \rightarrow 3\pi^0, \pi^0\eta, \pi^0\eta'$

NODE=M300J88
NODE=M300J88

η(2190) $I^G(J^{PC}) = 0^+(0^{-+})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2190 ± 50	850 ± 100	BUGG	99	BES	

NODE=M300J13
NODE=M300J13

ω₂(2195) $I^G(J^{PC}) = 0^-(2^{--})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2195 ± 30	225 ± 40	³⁶ ANISOVICH	02B	SPEC	0.6–1.9 $p\bar{p} \rightarrow \omega\eta, \omega\pi^0\pi^0$

³⁶ From the combined analysis of ANISOVICH 00D, ANISOVICH 01C, and ANISOVICH 02B.

NODE=M300J82
NODE=M300J82

NODE=M300J82;LINKAGE=AZ

ω(2205) $I^G(J^{PC}) = 0^-(1^{--})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2205 ± 30	350 ± 90	³⁷ ANISOVICH	02B	SPEC	0.6–1.9 $p\bar{p} \rightarrow \omega\eta, \omega\pi^0\pi^0$

NODE=M300J80
NODE=M300J80

³⁷ From the combined analysis of ANISOVICH 00D, ANISOVICH 01C, and ANISOVICH 02B.

NODE=M300J80;LINKAGE=AZ

X(2210) $I^G(J^{PC}) = ?^?(???)$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2210 ⁺⁷⁹ ₋₂₁	203 ⁺⁴³⁷ ₋₈₇	EVANGELIS...	79B	OMEG	10 $\pi^- p \rightarrow K^+ K^- n$

NODE=M300J39
NODE=M300J39

X(2210) $I^G(J^{PC}) = ?^?(???)$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2207 ± 22	130	CASO	70	HBC	11.2 $\pi^- p$

NODE=M300J51
NODE=M300J51

h₁(2215) $I^G(J^{PC}) = 0^-(1^+ -)$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2215 ± 40	325 ± 55	³⁸ ANISOVICH	02B	SPEC	0.6–1.9 $p\bar{p} \rightarrow \omega\eta, \omega\pi^0\pi^0$

³⁸ From the combined analysis of ANISOVICH 00D, ANISOVICH 01C, and ANISOVICH 02B.

NODE=M300J27
NODE=M300J27

NODE=M300J27;LINKAGE=AZ

ρ₂(2225) $I^G(J^{PC}) = 1^+(2^- -)$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2225 ± 35	335 ⁺¹⁰⁰ ₋₅₀	³⁹ ANISOVICH	02	SPEC	0.6–1.9 $p\bar{p} \rightarrow \omega\pi^0, \omega\eta\pi^0, \pi^+\pi^-$

NODE=M300J70
NODE=M300J70

³⁹ From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.

NODE=M300J70;LINKAGE=AY

ρ₄(2230) $I^G(J^{PC}) = 1^+(4^- -)$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2230 ± 25	210 ± 30	⁴⁰ ANISOVICH	02	SPEC	0.6–1.9 $p\bar{p} \rightarrow \omega\pi^0, \omega\eta\pi^0, \pi^+\pi^-$

NODE=M300J74
NODE=M300J74

⁴⁰ From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.

NODE=M300J74;LINKAGE=AY

b₁(2240) $I^G(J^{PC}) = 1^+(1^+ -)$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2240 ± 35	320 ± 85	⁴¹ ANISOVICH	02	SPEC	0.6–1.9 $p\bar{p} \rightarrow \omega\pi^0, \omega\eta\pi^0, \pi^+\pi^-$

NODE=M300J87
NODE=M300J87

⁴¹ From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.

NODE=M300J87;LINKAGE=AY

f₂(2240) $I^G(J^{PC}) = 0^+(2^+ +)$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2240 ± 15	241 ± 30	⁴² ANISOVICH	00J	SPEC	1.92–2.41 $p\bar{p}$

NODE=M300K26
NODE=M300K26

• • • We do not use the following data for averages, fits, limits, etc. • • •

~ 2226 ~ 226 HASAN 94 RVUE $p\bar{p} \rightarrow \pi\pi$

⁴² From the combined analysis of ANISOVICH 99C, ANISOVICH 99F, ANISOVICH 99J, ANISOVICH 99K, and ANISOVICH 00B. See also ANISOVICH 12.

NODE=M300K26;LINKAGE=AN

b₃(2245) $I^G(J^{PC}) = 1^+(3^+ -)$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN		
2245 ± 50	320 ± 70	⁴³ BUGG	04C	RVUE	

NODE=M300K10
NODE=M300K10

⁴³ From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.

NODE=M300K10;LINKAGE=AY

η₂(2250) $I^G(J^{PC}) = 0^+(2^- +)$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN		
2248 ± 20	280 ± 20	ANISOVICH	00I	SPEC	
2267 ± 14	290 ± 50	ANISOVICH	00J	SPEC	

NODE=M300J17
NODE=M300J17

$\pi_4(2250)$ $I^G(J^{PC}) = 1^-(4^-+)$					
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	⁴⁴ ANISOVICH	02B	SPEC	0.6–1.9 $p\bar{p} \rightarrow \omega\eta, \omega\pi^0\pi^0$
⁴⁴ From the combined analysis of ANISOVICH 00D, ANISOVICH 01C, and ANISOVICH 02B.					

NODE=M300J84
NODE=M300J84

NODE=M300J84;LINKAGE=AZ

$\omega_5(2250)$ $I^G(J^{PC}) = 0^-(5^{--})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2250 ± 70	320 ± 95	⁴⁵ BUGG	04	RVUE	
⁴⁵ From the combined analysis of ANISOVICH 00D, ANISOVICH 01C, and ANISOVICH 02B.					

NODE=M300K11
NODE=M300K11

NODE=M300;LINKAGE=AZ

$\omega_3(2255)$ $I^G(J^{PC}) = 0^-(3^{--})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2255 ± 15	175 ± 30	⁴⁶ ANISOVICH	02B	SPEC	0.6–1.9 $p\bar{p} \rightarrow \omega\eta, \omega\pi^0\pi^0$
⁴⁶ From the combined analysis of ANISOVICH 00D, ANISOVICH 01C, and ANISOVICH 02B.					

NODE=M300J66
NODE=M300J66

NODE=M300J66;LINKAGE=AZ

$a_4(2255)$ $I^G(J^{PC}) = 1^-(4^{++})$					
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	⁴⁷ ANISOVICH	01F	SPEC	1.96–2.41 $\bar{p}p$
⁴⁷ From the combined analysis of ANISOVICH 99C, ANISOVICH 99E, and ANISOVICH 01F.					

NODE=M300K21
NODE=M300K21

NODE=M300K21;LINKAGE=AN

$a_2(2255)$ $I^G(J^{PC}) = 1^-(2^{++})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2255 ± 20	230 ± 15	⁴⁸ ANISOVICH	01G	SPEC	1.96–2.41 $\bar{p}p$
⁴⁸ From the combined analysis of ANISOVICH 99C, ANISOVICH 99E, ANISOVICH 01F, and ANISOVICH 01G.					

NODE=M300K22
NODE=M300K22

NODE=M300K22;LINKAGE=AN

$X(2260)$ $I^G(J^{PC}) = 0^+(4^{+?})$					
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	⁴⁹ ANISOVICH	02	SPEC	0.6–1.9 $p\bar{p} \rightarrow \omega\pi^0, \omega\eta\pi^0, \pi^+\pi^-$
2280 ± 50	440 ± 110	ATKINSON	85	OMEG	20–70 $\gamma p \rightarrow p\omega\pi^+\pi^-\pi^0$
⁴⁹ From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.					

NODE=M300J86
NODE=M300J86

NODE=M300J86;LINKAGE=AY

$a_1(2270)$ $I^G(J^{PC}) = 1^-(1^{++})$					
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	⁵⁰ ANISOVICH	02B	SPEC	0.6–1.9 $p\bar{p} \rightarrow \omega\eta, \omega\pi^0\pi^0$
⁵⁰ From the combined analysis of ANISOVICH 00D, ANISOVICH 01C, and ANISOVICH 02B.					

NODE=M300J28
NODE=M300J28

NODE=M300J28;LINKAGE=AZ

$a_3(2275)$ $I^G(J^{PC}) = 1^-(3^{++})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2275 ± 35	350 ⁺¹⁰⁰ ₋₅₀	⁵¹ ANISOVICH	01G	SPEC	1.96–2.41 $\bar{p}p$

NODE=M300K19
NODE=M300K19

⁵¹ From the combined analysis of ANISOVICH 99C, ANISOVICH 99E, ANISOVICH 01F, and ANISOVICH 01G.

NODE=M300K19;LINKAGE=AN

$\pi_2(2285)$ $I^G(J^{PC}) = 1^-(2^-+)$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2285 ± 20 ± 25	250 ± 20 ± 25	⁵² ANISOVICH	11	SPEC	0.9–1.94 $p\bar{p}$

NODE=M300K25
NODE=M300K25

⁵² Reanalysis of ADOMEIT 96 and ANISOVICH 00E.

NODE=M300K25;LINKAGE=AN

$\omega_3(2285)$ $I^G(J^{PC}) = 0^-(3^{--})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2278 ± 28	224 ± 50	⁵³ BUGG	04A	RVUE	
2285 ± 60	230 ± 40	⁵⁴ ANISOVICH	02B	SPEC	0.6–1.9 $p\bar{p} \rightarrow \omega\eta, \omega\pi^0\pi^0$

NODE=M300J83
NODE=M300J83

⁵³ Partial wave analysis of the data on $p\bar{p} \rightarrow \bar{\Lambda}\Lambda$ from BARNES 00.

NODE=M300J83;LINKAGE=BU

⁵⁴ 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	⁵⁵ BUGG	04A	RVUE	

NODE=M300J02
NODE=M300J02

⁵⁵ Partial wave analysis of the data on $p\bar{p} \rightarrow \bar{\Lambda}\Lambda$ from BARNES 00.

NODE=M300J02;LINKAGE=BU

$f_2(2295)$ $I^G(J^{PC}) = 0^+(2^{++})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2293 ± 13	216 ± 37	⁵⁶ ANISOVICH	00J	SPEC	1.92–2.41 $p\bar{p}$

NODE=M300K27
NODE=M300K27

⁵⁶ From the combined analysis of ANISOVICH 99C, ANISOVICH 99F, ANISOVICH 99J, ANISOVICH 99K, and ANISOVICH 00B. See also ANISOVICH 12.

NODE=M300K27;LINKAGE=AN

$f_3(2300)$ $I^G(J^{PC}) = 0^+(3^{++})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2334 ± 25	200 ± 20	⁵⁷ BUGG	04A	RVUE	

NODE=M300J19
NODE=M300J19

⁵⁷ Partial wave analysis of the data on $p\bar{p} \rightarrow \bar{\Lambda}\Lambda$ from BARNES 00.

NODE=M300J19;LINKAGE=BU

$f_1(2310)$ $I^G(J^{PC}) = 0^+(1^{++})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2310 ± 60	255 ± 70	ANISOVICH	00J	SPEC	

NODE=M300J23
NODE=M300J23

$\eta(2320)$ $I^G(J^{PC}) = 0^+(0^{-+})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2320 ± 15	230 ± 35	⁵⁸ ANISOVICH	00M	SPEC	

NODE=M300J18
NODE=M300J18

⁵⁸ From the combined analysis of $\bar{p}p \rightarrow \eta\eta\eta$ from ANISOVICH 00M and $\bar{p}p \rightarrow \eta\pi^0\pi^0$ from ANISOVICH 00J.

NODE=M300;LINKAGE=B

$\eta_4(2330)$ $I^G(J^{PC}) = 0^+(4^{-+})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2328 ± 38	240 ± 90	ANISOVICH	00J	SPEC	2.0 $p\bar{p} \rightarrow \eta\pi^0\pi^0$

NODE=M300J22
NODE=M300J22

$\omega(2330)$ $I^G(J^{PC}) = 0^-(1^{--})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2330 ± 30	435 ± 75	ATKINSON	88	OMEG	25–50 $\gamma p \rightarrow \rho^\pm \rho^0 \pi^\mp$

NODE=M300J53
NODE=M300J53

$X(2340)$ $I^G(J^{PC}) = ??(???)$					
MASS (MeV)	WIDTH (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2340 ± 20	180 ± 60	126	⁵⁹ BALTAY	75	HBC 15 $\pi^+ p \rightarrow p5\pi$

NODE=M300J54
NODE=M300J54

⁵⁹ Dominant decay into $\rho^0 \rho^0 \pi^+$. BALTAY 78 finds confirmation in $2\pi^+ \pi^- 2\pi^0$ events which contain $\rho^+ \rho^0 \pi^0$ and $2\rho^+ \pi^-$.

NODE=M300J;LINKAGE=B1

$\pi(2360)$ $I^G(J^{PC}) = 1^-(0^-+)$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2360 ± 25	300 ⁺¹⁰⁰ ₋₅₀	ANISOVICH	01F SPEC	2.0 $\bar{p}p \rightarrow 3\pi^0, \pi^0\eta, \pi^0\eta'$	

NODE=M300J90
NODE=M300J90

$X(2360)$ $I^G(J^{PC}) = ?^?(4^+?)$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2360 ± 10	430 ± 30	ROZANSKA	80 SPRK	18 $\pi^- p \rightarrow p\bar{p}n$	

NODE=M300J42
NODE=M300J42

$X(2440)$ $I^G(J^{PC}) = ?^?(5^-?)$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2440 ± 10	310 ± 20	ROZANSKA	80 SPRK	18 $\pi^- p \rightarrow p\bar{p}n$	

NODE=M300J43
NODE=M300J43

$X(2540)$ $I^G(J^{PC}) = 0^+(0^++)$					
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		⁶⁰ EVDOKIMOV	04 SELX	$X(2632) \rightarrow D_s^+ \eta$	
2631.6 ± 2.1	< 17	⁶¹ EVDOKIMOV	04 SELX	$X(2632) \rightarrow D_s^0 K^+$	

NODE=M300J03
NODE=M300J03

OCCUR=2

⁶⁰ From a mass difference to D_s^+ of 666.9 ± 3.3 MeV.

⁶¹ From a mass difference to D_s^0 of 767.0 ± 2.0 MeV.

NODE=M300J03;LINKAGE=EV
NODE=M300J03;LINKAGE=ED

$B(X(2632) \rightarrow D_s^0 K^+)/B(X(2632) \rightarrow D_s^+ \eta)$					
VALUE	DOCUMENT ID	TECN			
0.14 ± 0.06	⁶² EVDOKIMOV	04 SELX			

NODE=M300B01
NODE=M300B01

⁶² Possible interpretation of this decay pattern is discussed by YASUI 07.

NODE=M300B01;LINKAGE=YA

$X(2680)$ $I^G(J^{PC}) = ?^?(???)$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2676 ± 27	150	CASO	70 HBC	11.2 $\pi^- p \rightarrow \rho^- \pi^+ \pi^- p$	

NODE=M300J55
NODE=M300J55

$X(2710)$ $I^G(J^{PC}) = ?^?(6^+?)$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2710 ± 20	170 ± 40	ROZANSKA	80 SPRK	18 $\pi^- p \rightarrow p\bar{p}n$	

NODE=M300J44
NODE=M300J44

$X(2750)$ $I^G(J^{PC}) = ?^?(7^-?)$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2747 ± 32	195 ± 75	DENNEY	83 LASS	10 $\pi^+ p \rightarrow K^+ K^- \pi^+ p$	

NODE=M300J56
NODE=M300J56

$f_6(3100)$ $I^G(J^{PC}) = 0^+(6^++)$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
3100 ± 100	700 ± 130	BINON	05 GAMS	33 $\pi^- p \rightarrow \eta\eta n$	

NODE=M300J06
NODE=M300J06

$X(3250)$ $I^G(J^{PC}) = ?^?(???)$ 3-Body Decays					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
3250 ± 8 ± 20	45 ± 18	ALEEV	93 BIS2	$X(3250) \rightarrow \Lambda \bar{p} K^+$	
3265 ± 7 ± 20	40 ± 18	ALEEV	93 BIS2	$X(3250) \rightarrow \bar{\Lambda} p K^-$	

NODE=M300J57
NODE=M300J57

OCCUR=2

X(3250)		$I^G(J^{PC}) = ?^?(???)$ 4-Body Decays			
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
3245 ± 8 ± 20	25 ± 11	ALEEV	93	BIS2	$X(3250) \rightarrow \Lambda \bar{p} K^+ \pi^\pm$
3250 ± 9 ± 20	50 ± 20	ALEEV	93	BIS2	$X(3250) \rightarrow \bar{\Lambda} p K^- \pi^\mp$
3270 ± 8 ± 20	25 ± 11	ALEEV	93	BIS2	$X(3250) \rightarrow K_S^0 p \bar{p} K^\pm$

NODE=M300J58
NODE=M300J58

OCCUR=2
OCCUR=3

X(3350)		$I^G(J^{PC}) = ?^?(???)$			
MASS (MeV)	WIDTH (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
3350 ⁺¹⁰ ₋₂₀ ± 20	70 ⁺⁴⁰ ₋₃₀ ± 40	50 ± 10	⁶³ GABYSHEV	06A	BELL $B^- \rightarrow \Lambda_c^+ \bar{p} \pi^-$

NODE=M300J09
NODE=M300J09

⁶³A similar enhancement in the $\Lambda_c^+ \bar{p}$ final state is also reported by BABAR collaboration in AUBERT 10H.

NODE=M300J09;LINKAGE=AU

REFERENCES for Further States

NODE=M300

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UEHARA	13	PTEP 2013 123C01	S. Uehara <i>et al.</i>	(BELLE Collab.)	
ANISOVICH	12	PR D85 014001	A.V. Anisovich <i>et al.</i>		
ANASHIN	11	PL B703 543	V.V. Anashin <i>et al.</i>	(KEDR Collab.)	
ANISOVICH	11	EPJ C71 1511	A.V. Anisovich <i>et al.</i>	(LOQM, RAL, PNPI)	
CHEN	11F	PR D84 071501	P. Chen <i>et al.</i>	(BELLE Collab.)	
AUBERT	10H	PR D82 031102	B. AUBERT <i>et al.</i>	(BABAR Collab.)	
ABRAAMYAN	09	PR C80 034001	Kh.U. Abraamyan <i>et al.</i>		
LIU	09	PR D79 071102	C. Liu <i>et al.</i>	(BELLE Collab.)	
VLADIMIRSK...	08	PAN 71 2129	V.V. Vladimirovsky <i>et al.</i>	(ITEP)	
		Translated from YAF 71 2166.			
VLADIMIRSK...	07	PAN 70 1706	V. Vladimirovsky <i>et al.</i>		
		Translated from YAF 70 1751.			
YASUI	07	PR D76 034009	S. Yasui, M. Oka		
ABLIKIM	06J	PRL 96 162002	M. Ablikim <i>et al.</i>	(BES Collab.)	
ABLIKIM	06S	PRL 97 142002	M. Ablikim <i>et al.</i>	(BES Collab.)	
GABYSHEV	06A	PRL 97 242001	N. Gabyshev <i>et al.</i>	(BELLE Collab.)	
SCHEGELSKY	06	EPJ A27 199	V.A. Schegelsky <i>et al.</i>		
SCHEGELSKY	06A	EPJ A27 207	V.A. Schegelsky <i>et al.</i>		
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)	
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BINON	05	PAN 68 960	F. Binon <i>et al.</i>		
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GRIGOR'EV	05	PAN 68 1271	V.K. Grigor'ev <i>et al.</i>	(ITEP)	
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LU	05	PRL 94 032002	M. Lu <i>et al.</i>	(BNL E852 Collab.)	
ABLIKIM	04J	PRL 93 112002	M. Ablikim <i>et al.</i>	(BES Collab.)	
BUGG	04	PL B595 556 (errata)	D.V. Bugg		
BUGG	04A	EPJ C36 161	D.V. Bugg		
BUGG	04C	PRPL 397 257	D.V. Bugg		
EVDOKIMOV	04	PRL 93 242001	A.V. Evdokimov <i>et al.</i>	(SELEX Collab.)	
KUHN	04	PL B595 109	J. Kuhn <i>et al.</i>	(BNL E852 Collab.)	
ANISOVICH	03	EPJ A16 229	V.V. Anisovich <i>et al.</i>		
VLADIMIRSK...	03	PAN 66 700	V.V. Vladimirovsky <i>et al.</i>		
		Translated from YAF 66 729.			
ANISOVICH	02	PL B542 8	A.V. Anisovich <i>et al.</i>		
ANISOVICH	02B	PL B542 19	A.V. Anisovich <i>et al.</i>		
CHUNG	02	PR D65 072001	S.U. Chung <i>et al.</i>	(BNL E852 Collab.)	
LINK	02K	PL B545 50	J.M. Link <i>et al.</i>	(FNAL FOCUS Collab.)	
ANISOVICH	01C	PL B507 23	A.V. Anisovich <i>et al.</i>		
ANISOVICH	01D	PL B508 6	A.V. Anisovich <i>et al.</i>		
ANISOVICH	01E	PL B513 281	A.V. Anisovich <i>et al.</i>		
ANISOVICH	01F	PL B517 261	A.V. Anisovich <i>et al.</i>		
ANISOVICH	01G	PL B517 273	A.V. Anisovich <i>et al.</i>		
ANISOVICH	00B	NP A662 319	A.V. Anisovich <i>et al.</i>		
ANISOVICH	00D	PL B476 15	A.V. Anisovich <i>et al.</i>		
ANISOVICH	00E	PL B477 19	A.V. Anisovich <i>et al.</i>		
ANISOVICH	00I	PL B491 40	A.V. Anisovich <i>et al.</i>		
ANISOVICH	00J	PL B491 47	A.V. Anisovich <i>et al.</i>		
ANISOVICH	00M	PL B496 145	A.V. Anisovich <i>et al.</i>		
BARNES	00	PR C62 055203	P.D. Barnes <i>et al.</i>		
FILIPPI	00	PL B495 284	A. Filippi <i>et al.</i>	(OBELIX Experiment)	
VLADIMIRSKII	00	JETPL 72 486	V.V. Vladimirovskii <i>et al.</i>		
		Translated from ZETFP 72 698.			
ANISOVICH	99C	PL B452 173	A.V. Anisovich <i>et al.</i>		
ANISOVICH	99E	PL B452 187	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>		
BUGG	99	PL B458 511	D.V. Bugg <i>et al.</i>		
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KLOET	96	PR D53 6120	W.M. Kloet, F. Myhrer	(RUTG, NORD)	
PROKOSHIN	96	SPD 41 247	Y.D. Prokoshin, V.D. Samoilenko	(SERP)	
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OAKDEN	94	NP A574 731	M.N. Oakden, M.R. Pennington	(DURH)	
ALEEV	93	PAN 56 1358	A.N. Aleev <i>et al.</i>	(BIS-2 Collab.)	
		Translated from YAF 56 100.			

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ARMSTRONG	93D	PL B307 399	T.A. Armstrong <i>et al.</i>	(FNAL, FERR, GENO+)
ALBRECHT	91F	ZPHY C50 1	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
CONDO	91	PR D43 2787	G.T. Condo <i>et al.</i>	(SLAC Hybrid Collab.)
BISELLO	89B	PR D39 701	G. Busetto <i>et al.</i>	(DM2 Collab.)
ATKINSON	88	ZPHY C38 535	M. Atkinson <i>et al.</i>	(BONN, CERN, GLAS+)
DAFTARI	87	PRL 58 859	I.K. Daftari <i>et al.</i>	(SYRA)
ALDE	86D	NP B269 485	D.M. Alde <i>et al.</i>	(BELG, LAPP, SERP, CERN+)
BRIDGES	86D	PL B180 313	D.L. Bridges <i>et al.</i>	(SYRA, BNL, CASE+)
GREEN	86	PRL 56 1639	D.R. Green <i>et al.</i>	(FNAL, ARIZ, FSU+)
ATKINSON	85	ZPHY C29 333	M. Atkinson <i>et al.</i>	(BONN, CERN, GLAS+)
DENNEY	83	PR D28 2726	D.L. Denney <i>et al.</i>	(IOWA, MICH)
ASTON	81B	NP B189 205	D. Aston <i>et al.</i>	(BONN, CERN, EPOL, GLAS+)
ARESTOV	80	IHEP 80-165	Y.I. Arestov <i>et al.</i>	(SERP)
CHLIAPNIK...	80	ZPHY C3 285	P.V. Chliapnikov <i>et al.</i>	(SERP, BRUX, MONS)
KREYMER	80	PR D22 36	A.E. Kreymer <i>et al.</i>	(IND, PURD, SLAC+)
ROZANSKA	80	NP B162 505	M. Rozanska <i>et al.</i>	(MPIM, CERN)
EVANGELIS...	79	NP B153 253	C. Evangelista <i>et al.</i>	(BARI, BONN, CERN+)
EVANGELIS...	79B	NP B154 381	C. Evangelista <i>et al.</i>	(BARI, BONN, CERN+)
BALTAY	78	PR D17 52	C. Baltay <i>et al.</i>	(COLU, BING)
ANTIPOV	77	NP B119 45	Y.M. Antipov <i>et al.</i>	(SERP, GEVA)
BALTAY	77	PRL 39 591	C. Baltay, C.V. Cautis, M. Kalelkar	(COLU)
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KALELKAR	75	Thesis Nevis 207	M.S. Kalelkar	(COLU)
CASO	70	LNC 3 707	C. Caso <i>et al.</i>	(GENO, HAMB, MILA, SACL)

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STRANGE MESONS ($S = \pm 1$, $C = B = 0$)

$$K^+ = u\bar{s}, K^0 = d\bar{s}, \bar{K}^0 = \bar{d}s, K^- = \bar{u}s, \text{ similarly for } K^{*'}s$$

NODE=MXXX020

NODE=MXXX020

NODE=M174

$K_0^{*}(800)$
or κ

$$I(J^P) = \frac{1}{2}(0^+)$$

OMITTED FROM SUMMARY TABLE

Needs confirmation. See the mini-review on scalar mesons under $f_0(500)$ (see the index for the page number).

NODE=M174

$K_0^{*}(800)$ MASS

NODE=M174M

NODE=M174M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
682 ± 29	OUR AVERAGE	Error includes scale factor of 2.4. See the ideogram below.		
826 ± 49	$^{+49}_{-34}$	1338	¹ ABLIKIM	11B BES2 $J/\psi \rightarrow K_S^0 K_S^0 \pi^+ \pi^-$
849 ± 77	$^{+18}_{-14}$	1421	^{2,3} ABLIKIM	10E BES2 $J/\psi \rightarrow K^\pm K_S^0 \pi^\mp \pi^0$
841 ± 30	$^{+81}_{-73}$	25k	^{4,5} ABLIKIM	06C BES2 $J/\psi \rightarrow \bar{K}^{*}(892)^0 K^+ \pi^-$
658 ± 13			⁶ DESCOTES-G..06	RVUE $\pi K \rightarrow \pi K$
797 ± 19	± 43	15k	^{7,8} AITALA	02 E791 $D^+ \rightarrow K^- \pi^+ \pi^+$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
663 ± 8	± 34		⁹ BUGG	10 RVUE S-matrix pole
706.0 ± 1.8	± 22.8	141k	¹⁰ BONVICINI	08A CLEO $D^+ \rightarrow K^- \pi^+ \pi^+$
856 ± 17	± 13	54k	¹¹ LINK	07B FOCUS $D^+ \rightarrow K^- \pi^+ \pi^+$
750	$^{+30}_{-55}$		¹² BUGG	06 RVUE
855 ± 15		0.6k	¹³ CAWLFIELD	06A CLEO $D^0 \rightarrow K^+ K^- \pi^0$
694 ± 53			^{3,14} ZHOU	06 RVUE $K p \rightarrow K^- \pi^+ n$
753 ± 52			¹⁵ PELAEZ	04A RVUE $K \pi \rightarrow K \pi$
594 ± 79			¹⁴ ZHENG	04 RVUE $K^- p \rightarrow K^- \pi^+ n$
722 ± 60			¹⁶ BUGG	03 RVUE $11 K^- p \rightarrow K^- \pi^+ n$
905	$^{+65}_{-30}$		¹⁷ ISHIDA	97B RVUE $11 K^- p \rightarrow K^- \pi^+ n$

- ¹ The Breit-Wigner parameters from a fit with seven intermediate resonances. The S-matrix pole position is $(764 \pm 63^{+71}_{-54}) - i(306 \pm 149^{+143}_{-85})$ MeV.
- ² From a fit including ten additional resonances and energy-independent Breit-Wigner width.
- ³ S-matrix pole.
- ⁴ S-matrix pole. GUO 06 in a chiral unitary approach report a mass of 757 ± 33 MeV and a width of 558 ± 82 MeV.
- ⁵ A fit in the $K_0^*(800) + K^*(892) + K^*(1410)$ model with mass and width of the $K_0^*(800)$ from ABLIKIM 06C well describes the left slope of the $K_S^0 \pi^-$ 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.
- ¹⁴ Using ASTON 88.
- ¹⁵ T-matrix pole. Reanalysis of data from LINGLIN 73, ESTABROOKS 78, and ASTON 88 in the unitarized ChPT model.
- ¹⁶ T-matrix pole. Reanalysis of ASTON 88 data.
- ¹⁷ Reanalysis of ASTON 88 using interfering Breit-Wigner amplitudes.

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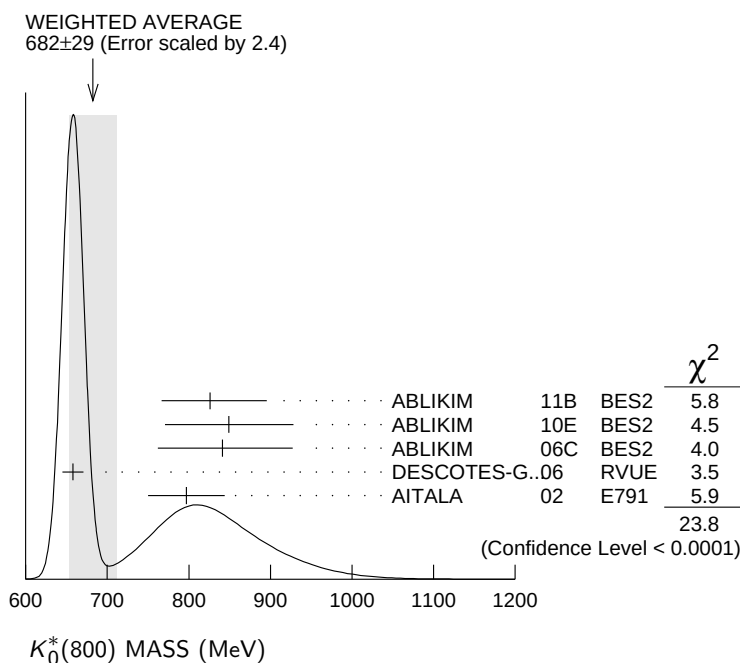
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 **$K_0^*(800)$ WIDTH**

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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	$J/\psi \rightarrow K_S^0 K_S^0 \pi^+ \pi^-$
512 ± 80	$^{+92}_{-44}$	1421	19,20 ABLIKIM	$J/\psi \rightarrow K^\pm K_S^0 \pi^\mp \pi^0$
618 ± 90	$^{+96}_{-144}$	25k	19,21 ABLIKIM	$J/\psi \rightarrow \bar{K}^*(892)^0 K^+ \pi^-$
557 ± 24			22 DESCOTES-G..06	$\pi K \rightarrow \pi K$
410 ± 43	± 87	15k	23,24 AITALA	$D^+ \rightarrow K^- \pi^+ \pi^+$

• • • 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 $K^- p \rightarrow K^- \pi^+ n$

18 The Breit-Wigner parameters from a fit with seven intermediate resonances. The S-matrix pole position is $(764 \pm 63^{+71}_{-54}) - i(306 \pm 149^{+143}_{-85})$ MeV.

19 S-matrix pole.

20 From a fit including ten additional resonances and energy-independent Breit-Wigner width.

21 A fit in the $K_0^*(800) + K^*(892) + K^*(1410)$ model with mass and width of the $K_0^*(800)$ from ABLIKIM 06C well describes the left slope of the $K_S^0 \pi^-$ invariant mass spectrum in $\tau^- \rightarrow K_S^0 \pi^- \nu_\tau$ decay studied by EPIFANOV 07.

22 S-matrix pole. Using Roy-Steiner equations (ROY 71) as well as unitarity, analyticity and crossing symmetry constraints.

23 Not seen by KOPP 01 using 7070 events of $D^0 \rightarrow K^- \pi^+ \pi^0$. LINK 02E and LINK 05I show clear evidence for a constant non-resonant scalar amplitude rather than $K_0^*(800)$ in their high statistics analysis of $D^+ \rightarrow K^- \pi^+ \mu^+ \nu_\mu$.

24 AUBERT 07T does not find evidence for the charged $K_0^*(800)$ using 11k events of $D^0 \rightarrow K^- K^+ \pi^0$.

25 S-Matrix pole. Supersedes BUGG 06. Combined analysis of ASTON 88, ABLIKIM 06C, AITALA 06, and LINK 09 using an s-dependent width with couplings to $K \pi$ and $K \eta'$, and the Adler zero near thresholds.

26 T-matrix pole.

27 A Breit-Wigner mass and width.

28 S-matrix pole. Reanalysis of ASTON 88, AITALA 02, and ABLIKIM 06C using for the κ an s-dependent width with an Adler zero near threshold.

29 Statistical error only. A fit to the Dalitz plot including the $K_0^*(800)^\pm$, $K^*(892)^\pm$, and ϕ resonances modeled as Breit-Wigners. A significant S-wave can be also modeled as a non-resonant contribution.

30 Using ASTON 88.

31 T-matrix pole. Reanalysis of data from LINGLIN 73, ESTABROOKS 78, and ASTON 88 in the unitarized ChPT model.

32 T-matrix pole. Reanalysis of ASTON 88 data.

33 Reanalysis of ASTON 88 using interfering Breit-Wigner amplitudes.

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$K_0^*(800)$ REFERENCES

ABLIKIM	11B	PL B698 183	M. Ablikim <i>et al.</i>	(BES II Collab.)
ABLIKIM	10E	PL B693 88	M. Ablikim <i>et al.</i>	(BES II Collab.)
BUGG	10	PR D81 014002	D.V. Bugg	(LOQM)
LINK	09	PL B681 14	J.M. Link <i>et al.</i>	(FNAL FOCUS Collab.)
BONVICINI	08A	PR D78 052001	G. Bonvicini <i>et al.</i>	(CLEO Collab.)
AUBERT	07T	PR D76 011102	B. Aubert <i>et al.</i>	(BABAR Collab.)
EPIFANOV	07	PL B654 65	D. Epifanov <i>et al.</i>	(BELLE Collab.)
LINK	07B	PL B653 1	J.M. Link <i>et al.</i>	(FNAL FOCUS Collab.)
ABLIKIM	06C	PL B633 681	M. Ablikim <i>et al.</i>	(BES Collab.)
AITALA	06	PR D73 032004	E.M. Aitala <i>et al.</i>	(FNAL E791 Collab.)
Also		PR D74 059901 (errat.)	E.M. Aitala <i>et al.</i>	(FNAL E791 Collab.)
BUGG	06	PL B632 471	D.V. Bugg	(LOQM)
CAWLFIELD	06A	PR D74 031108	C. Cawfield <i>et al.</i>	(CLEO Collab.)
DESCOTES-G...	06	EPJ C48 553	S. Descotes-Genon, B. Moussallam	
GUO	06	NP A773 78	F.K. Guo <i>et al.</i>	
ZHOU	06	NP A775 212	Z.Y. Zhou, H.Q. Zheng	
LINK	05I	PL B621 72	J.M. Link <i>et al.</i>	(FNAL FOCUS Collab.)
PELAEZ	04A	MPL A19 2879	J.R. Pelaez	
ZHENG	04	NP A733 235	H.Q. Zheng <i>et al.</i>	
BUGG	03	PL B572 1	D.V. Bugg	
AITALA	02E	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

 NODE=M018M1
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VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
891.66±0.26 OUR AVERAGE					
892.6 ±0.5	5840	BAUBILLIER 84B	HBC	—	8.25 $K^- p \rightarrow \bar{K}^0 \pi^- p$
888 ±3		NAPIER 84	SPEC	+	200 $\pi^- p \rightarrow 2K_S^0 X$
891 ±1		NAPIER 84	SPEC	—	200 $\pi^- p \rightarrow 2K_S^0 X$
891.7 ±2.1	3700	BARTH 83	HBC	+	70 $K^+ p \rightarrow K^0 \pi^+ X$
891 ±1	4100	TOAFF 81	HBC	—	6.5 $K^- p \rightarrow \bar{K}^0 \pi^- p$
892.8 ±1.6		AJINENKO 80	HBC	+	32 $K^+ p \rightarrow K^0 \pi^+ X$
890.7 ±0.9	1800	AGUILAR-... 78B	HBC	±	0.76 $\bar{p} p \rightarrow K^\mp K_S^0 \pi^\pm$
886.6 ±2.4	1225	BALAND 78	HBC	±	12 $\bar{p} p \rightarrow (K\pi)^\pm X$
891.7 ±0.6	6706	COOPER 78	HBC	±	0.76 $\bar{p} p \rightarrow (K\pi)^\pm X$
891.9 ±0.7	9000	¹ PALER 75	HBC	—	14.3 $K^- p \rightarrow (K\pi)^- X$
892.2 ±1.5	4404	AGUILAR-... 71B	HBC	—	3.9,4.6 $K^- p \rightarrow (K\pi)^- p$
891 ±2	1000	CRENNELL 69D	DBC	—	3.9 $K^- N \rightarrow K^0 \pi^- X$
890 ±3.0	720	BARLOW 67	HBC	±	1.2 $\bar{p} p \rightarrow (K^0 \pi)^\pm K^\mp$
889 ±3.0	600	BARLOW 67	HBC	±	1.2 $\bar{p} p \rightarrow (K^0 \pi)^\pm K\pi$
891 ±2.3	620	² DEBAERE 67B	HBC	+	3.5 $K^+ p \rightarrow K^0 \pi^+ p$
891.0 ±1.2	1700	³ WOJCICKI 64	HBC	—	1.7 $K^- p \rightarrow \bar{K}^0 \pi^- p$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
893.5 ±1.1	27k	⁴ ABELE 99D	CBAR	±	0.0 $\bar{p} p \rightarrow K^+ K^- \pi^0$
890.4 ±0.2 ±0.5	80±0.8k	⁵ BIRD 89	LASS	—	11 $K^- p \rightarrow \bar{K}^0 \pi^- p$
890.0 ±2.3	800	^{2,3} CLELAND 82	SPEC	+	30 $K^+ p \rightarrow K_S^0 \pi^+ p$
896.0 ±1.1	3200	^{2,3} CLELAND 82	SPEC	+	50 $K^+ p \rightarrow K_S^0 \pi^+ p$
893 ±1	3600	^{2,3} CLELAND 82	SPEC	—	50 $K^+ p \rightarrow K_S^0 \pi^- p$
896.0 ±1.9	380	DELFO SSE 81	SPEC	+	50 $K^\pm p \rightarrow K^\pm \pi^0 p$
886.0 ±2.3	187	DELFO SSE 81	SPEC	—	50 $K^\pm p \rightarrow K^\pm \pi^0 p$
894.2 ±2.0	765	² CLARK 73	HBC	—	3.13 $K^- p \rightarrow \bar{K}^0 \pi^- p$
894.3 ±1.5	1150	^{2,3} CLARK 73	HBC	—	3.3 $K^- p \rightarrow \bar{K}^0 \pi^- p$
892.0 ±2.6	341	² SCHWEING...68	HBC	—	5.5 $K^- p \rightarrow \bar{K}^0 \pi^- p$

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VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
895.47±0.20±0.74				
	53k	⁶ EPIFANOV 07	BELL	$\tau^- \rightarrow K_S^0 \pi^- \nu_\tau$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
892.0 ±0.5		⁷ BOITO 10	RVUE	$\tau^- \rightarrow K_S^0 \pi^- \nu_\tau$
892.0 ±0.9		^{8,9} BOITO 09	RVUE	$\tau^- \rightarrow K_S^0 \pi^- \nu_\tau$
895.3 ±0.2		^{8,10} JAMIN 08	RVUE	$\tau^- \rightarrow K_S^0 \pi^- \nu_\tau$
896.4 ±0.9	11970	¹¹ BONVICINI 02	CLEO	$\tau^- \rightarrow K^- \pi^0 \nu_\tau$
895 ±2		¹² BARATE 99R	ALEP	$\tau^- \rightarrow K^- \pi^0 \nu_\tau$

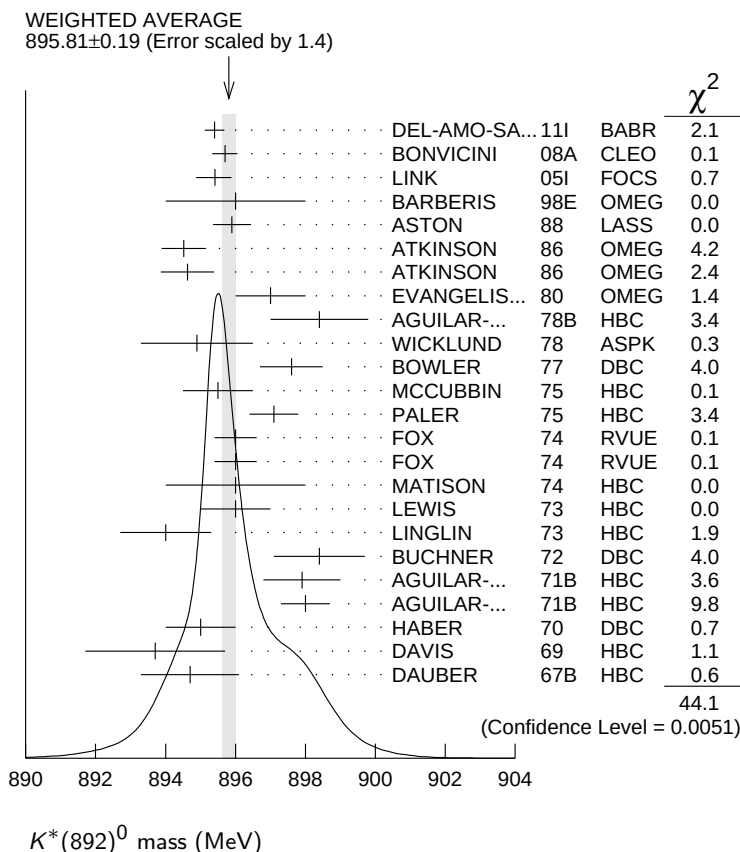
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VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
895.81±0.19 OUR AVERAGE				
Error includes scale factor of 1.4. See the ideogram below.				
895.4 ±0.2 ±0.2	243k	¹³ DEL-AMO-SA...11I	BABR	$D^+ \rightarrow K^- \pi^+ e^+ \nu_e$
895.7 ±0.2 ±0.3	141k	¹⁴ BONVICINI 08A	CLEO	$D^+ \rightarrow K^- \pi^+ \pi^+$
895.41±0.32 ^{+0.35} _{-0.43}	18k	¹⁵ LINK 05I	FOCS	$D^+ \rightarrow K^- \pi^+ \mu^+ \nu_\mu$
896 ±2		BARBERIS 98E	OMEG	450 $pp \rightarrow p_f p_s K^* \bar{K}^*$
895.9 ±0.5 ±0.2		ASTON 88	LASS	11 $K^- p \rightarrow K^- \pi^+ n$
894.52±0.63	25k	¹ ATKINSON 86	OMEG	20-70 γp
894.63±0.76	20k	¹ ATKINSON 86	OMEG	20-70 γp
897 ±1	28k	EVANGELIS... 80	OMEG	10 $\pi^- p \rightarrow K^+ \pi^- (\Lambda, \Sigma)$
898.4 ±1.4	1180	AGUILAR-... 78B	HBC	0.76 $\bar{p} p \rightarrow K^\mp K_S^0 \pi^\pm$
894.9 ±1.6		WICKLUND 78	ASPK	3,4,6 $K^\pm N \rightarrow (K\pi)^0 N$
897.6 ±0.9		BOWLER 77	DBC	5.4 $K^+ d \rightarrow K^+ \pi^- pp$
895.5 ±1.0	3600	MCCUBBIN 75	HBC	3.6 $K^- p \rightarrow K^- \pi^+ n$
897.1 ±0.7	22k	¹ PALER 75	HBC	14.3 $K^- p \rightarrow (K\pi)^0 X$
896.0 ±0.6	10k	FOX 74	RVUE	2 $K^- p \rightarrow K^- \pi^+ n$

OCCUR=2

896.0 ±0.6		FOX	74	RVUE	2 $K^+ n \rightarrow K^+ \pi^- p$	OCCUR=2
896 ±2		¹⁶ MATISON	74	HBC	12 $K^+ p \rightarrow K^+ \pi^- \Delta$	
896 ±1	3186	LEWIS	73	HBC	2.1-2.7 $K^+ p \rightarrow K \pi \pi p$	
894.0 ±1.3		¹⁶ LINGLIN	73	HBC	2-13 $K^+ p \rightarrow$ $K^+ \pi^- \pi^+ p$	
898.4 ±1.3	1700	² BUCHNER	72	DBC	4.6 $K^+ n \rightarrow K^+ \pi^- p$	
897.9 ±1.1	2934	² AGUILAR-...	71B	HBC	3.9,4.6 $K^- p \rightarrow K^- \pi^+ n$	
898.0 ±0.7	5362	² AGUILAR-...	71B	HBC	3.9,4.6 $K^- p \rightarrow$ $K^- \pi^+ \pi^- p$	OCCUR=2
895 ±1	4300	³ HABER	70	DBC	3 $K^- N \rightarrow K^- \pi^+ X$	
893.7 ±2.0	10k	DAVIS	69	HBC	12 $K^+ p \rightarrow K^+ \pi^- \pi^+ p$	
894.7 ±1.4	1040	² DAUBER	67B	HBC	2.0 $K^- p \rightarrow K^- \pi^+ \pi^- p$	
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●						
894.9 ±0.5 ±0.7	14.4k	¹⁷ MITCHELL	09A	CLEO	$D_s^+ \rightarrow K^+ K^- \pi^+$	
896.2 ±0.3	20k	⁸ AUBERT	07AK	BABR	10.6 $e^+ e^- \rightarrow$ $K^{*0} K^\pm \pi^\mp \gamma$	
900.7 ±1.1	5900	BARTH	83	HBC	70 $K^+ p \rightarrow K^+ \pi^- X$	



¹ Inclusive reaction. Complicated background and phase-space effects.

² Mass errors enlarged by us to $\Gamma/\sqrt{N}$. See note.

³ Number of events in peak reevaluated by us.

⁴ K-matrix pole.

⁵ From a partial wave amplitude analysis.

⁶ From a fit in the $K_0^*(800) + K^*(892) + K^*(1410)$ model.

⁷ From the pole position of the $K\pi$ vector form factor using EPIFANOV 07 and constraints from K_{J3} decays in ANTONELLI 10.

⁸ Systematic uncertainties not estimated.

⁹ From the pole position of the $K\pi$ vector form factor in the complex s -plane and using EPIFANOV 07 data.

¹⁰ Reanalysis of EPIFANOV 07 using resonance chiral theory.

¹¹ Calculated by us from the shift by 4.7 ± 0.9 MeV (statistical uncertainty only) reported in BONVICINI 02 with respect to the world average value from PDG 00.

¹² With mass and width of the $K^*(1410)$ fixed at 1412 MeV and 227 MeV, respectively.

¹³ Taking into account the $K^*(892)^0$, S -wave and P -wave ($K^*(1410)^0$).

¹⁴ From the isobar model with a complex pole for the κ .

¹⁵ Fit to $K\pi$ mass spectrum includes a non-resonant scalar component.

¹⁶ From pole extrapolation.

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¹⁷ This value comes from a fit with χ^2 of 178/117.

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$m_{K^*(892)^0} - m_{K^*(892)^\pm}$

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
6.7±1.2 OUR AVERAGE					
7.7±1.7	2980	AGUILAR-...	78B	HBC	±0 0.76 $\bar{p}p \rightarrow K^\mp K_S^0 \pi^\pm$
5.7±1.7	7338	AGUILAR-...	71B	HBC	-0 3.9,4.6 $K^- p$
6.3±4.1	283	¹⁸ BARASH	67B	HBC	0.0 $\bar{p}p$

¹⁸ Number of events in peak reevaluated by us.

$K^*(892)$ RANGE PARAMETER

All from partial wave amplitude analyses.

VALUE (GeV ⁻¹)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
2.1 ±0.5 ±0.5	243k	¹⁹ DEL-AMO-SA.11i	BABR	0	$D^+ \rightarrow K^- \pi^+ e^+ \nu_e$
3.96±0.54 ^{+1.31} _{-0.90}	18k	²⁰ LINK	05i	FOCS	0 $D^+ \rightarrow K^- \pi^+ \mu^+ \nu_\mu$
3.4 ±0.7		ASTON	88	LASS	0 11 $K^- p \rightarrow K^- \pi^+ n$
12.1 ±3.2 ±3.0		BIRD	89	LASS	- 11 $K^- p \rightarrow \bar{K}^0 \pi^- p$

• • • We do not use the following data for averages, fits, limits, etc. • • •

¹⁹ Taking into account the $K^*(892)^0$, S -wave and P -wave ($K^*(1410)^0$).

²⁰ Fit to $K\pi$ mass spectrum includes a non-resonant scalar component.

$K^*(892)$ WIDTH

CHARGED ONLY, HADROPRODUCED

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
50.8±0.9 OUR FIT					
50.8±0.9 OUR AVERAGE					
49 ±2	5840	BAUBILLIER	84B	HBC	- 8.25 $K^- p \rightarrow \bar{K}^0 \pi^- p$
56 ±4		NAPIER	84	SPEC	- 200 $\pi^- p \rightarrow 2K_S^0 X$
51 ±2	4100	TOAFF	81	HBC	- 6.5 $K^- p \rightarrow \bar{K}^0 \pi^- p$
50.5±5.6		AJINENKO	80	HBC	+ 32 $K^+ p \rightarrow K^0 \pi^+ X$
45.8±3.6	1800	AGUILAR-...	78B	HBC	± 0.76 $\bar{p}p \rightarrow K^\mp K_S^0 \pi^\pm$
52.0±2.5	6706	²¹ COOPER	78	HBC	± 0.76 $\bar{p}p \rightarrow (K\pi)^\pm X$
52.1±2.2	9000	²² PALER	75	HBC	- 14.3 $K^- p \rightarrow (K\pi)^- X$
46.3±6.7	765	²¹ CLARK	73	HBC	- 3.13 $K^- p \rightarrow \bar{K}^0 \pi^- p$
48.2±5.7	1150	^{21,23} CLARK	73	HBC	- 3.3 $K^- p \rightarrow \bar{K}^0 \pi^- p$
54.3±3.3	4404	²¹ AGUILAR-...	71B	HBC	- 3.9,4.6 $K^- p \rightarrow (K\pi)^- p$
46 ±5	1700	^{21,23} WOJCICKI	64	HBC	- 1.7 $K^- p \rightarrow \bar{K}^0 \pi^- p$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
54.8±1.7	27k	²⁴ ABELE	99D	CBAR	± 0.0 $\bar{p}p \rightarrow K^+ K^- \pi^0$
45.2±1 ±2	79.7±0.8k	²⁵ BIRD	89	LASS	- 11 $K^- p \rightarrow \bar{K}^0 \pi^- p$
42.8±7.1	3700	BARTH	83	HBC	+ 70 $K^+ p \rightarrow K^0 \pi^+ X$
64.0±9.2	800	^{21,23} CLELAND	82	SPEC	+ 30 $K^+ p \rightarrow K_S^0 \pi^+ p$
62.0±4.4	3200	^{21,23} CLELAND	82	SPEC	+ 50 $K^+ p \rightarrow K_S^0 \pi^+ p$
55 ±4	3600	^{21,23} CLELAND	82	SPEC	- 50 $K^+ p \rightarrow K_S^0 \pi^- p$
62.6±3.8	380	DELFOSSSE	81	SPEC	+ 50 $K^\pm p \rightarrow K^\pm \pi^0 p$
50.5±3.9	187	DELFOSSSE	81	SPEC	- 50 $K^\pm p \rightarrow K^\pm \pi^0 p$

CHARGED ONLY, PRODUCED IN τ LEPTON DECAYS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
46.2±0.6±1.2				
	53k	²⁶ EPIFANOV	07	BELL $\tau^- \rightarrow K_S^0 \pi^- \nu_\tau$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
46.5±1.1		²⁷ BOITO	10	RVUE $\tau^- \rightarrow K_S^0 \pi^- \nu_\tau$
46.2±0.4		^{28,29} BOITO	09	RVUE $\tau^- \rightarrow K_S^0 \pi^- \nu_\tau$
47.5±0.4		^{28,30} JAMIN	08	RVUE $\tau^- \rightarrow K_S^0 \pi^- \nu_\tau$
55 ±8		³¹ BARATE	99R	ALEP $\tau^- \rightarrow K^- \pi^0 \nu_\tau$

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OCCUR=2

NODE=M018W5

NODE=M018W5

NEUTRAL ONLY

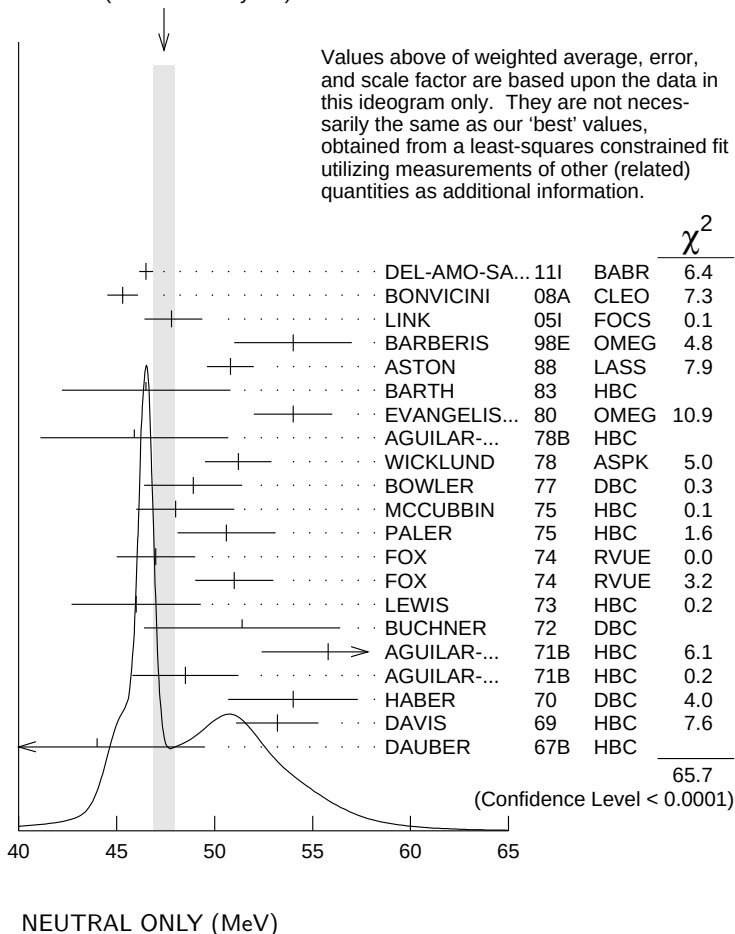
VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
47.4 ±0.6 OUR FIT	Error includes scale factor of 2.2.			
47.4 ±0.6 OUR AVERAGE	Error includes scale factor of 2.0. See the ideogram below.			
46.5 ±0.3 ±0.2	243k	32 DEL-AMO-SA...11I	BABR	$D^+ \rightarrow K^- \pi^+ e^+ \nu_e$
45.3 ±0.5 ±0.6	141k	33 BONVICINI	08A CLEO	$D^+ \rightarrow K^- \pi^+ \pi^+$
47.79 ±0.86 ^{+1.32} _{-1.06}	18k	34 LINK	05I FOCS	$D^+ \rightarrow K^- \pi^+ \mu^+ \nu_\mu$
54 ±3		BARBERIS	98E OMEG	450 $pp \rightarrow p_f p_s K^* \bar{K}^*$
50.8 ±0.8 ±0.9		ASTON	88 LASS	11 $K^- p \rightarrow K^- \pi^+ n$
46.5 ±4.3	5900	BARTH	83 HBC	70 $K^+ p \rightarrow K^+ \pi^- X$
54 ±2	28k	EVANGELIS...	80 OMEG	10 $\pi^- p \rightarrow K^+ \pi^- (\Lambda, \Sigma)$
45.9 ±4.8	1180	AGUILAR-...	78B HBC	0.76 $\bar{p} p \rightarrow K^\mp K_S^0 \pi^\pm$
51.2 ±1.7		WICKLUND	78 ASPK	3,4,6 $K^\pm N \rightarrow (K\pi)^0 N$
48.9 ±2.5		BOWLER	77 DBC	5.4 $K^+ d \rightarrow K^+ \pi^- pp$
48 ⁺³ ₋₂	3600	MCCUBBIN	75 HBC	3.6 $K^- p \rightarrow K^- \pi^+ n$
50.6 ±2.5	22k	22 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	21 LEWIS	73 HBC	2.1-2.7 $K^+ p \rightarrow K\pi\pi p$
51.4 ±5.0	1700	21 BUCHNER	72 DBC	4.6 $K^+ n \rightarrow K^+ \pi^- p$
55.8 ^{+4.2} _{-3.4}	2934	21 AGUILAR-...	71B HBC	3.9,4.6 $K^- p \rightarrow K^- \pi^+ n$
48.5 ±2.7	5362	AGUILAR-...	71B HBC	3.9,4.6 $K^- p \rightarrow$ $K^- \pi^+ \pi^- p$
54.0 ±3.3	4300	21,23 HABER	70 DBC	3 $K^- N \rightarrow K^- \pi^+ X$
53.2 ±2.1	10k	21 DAVIS	69 HBC	12 $K^+ p \rightarrow K^+ \pi^- \pi^+ p$
44 ±5.5	1040	21 DAUBER	67B HBC	2.0 $K^- p \rightarrow K^- \pi^+ \pi^- p$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
45.7 ±1.1 ±0.5	14.4k	35 MITCHELL	09A CLEO	$D_s^+ \rightarrow K^+ K^- \pi^+$
50.6 ±0.9	20k	28 AUBERT	07AK BABR	10.6 $e^+ e^- \rightarrow$ $K^{*0} K^\pm \pi^\mp \gamma$

NODE=M018W2
NODE=M018W2

OCCUR=2

OCCUR=2

WEIGHTED AVERAGE
47.4±0.6 (Error scaled by 2.0)



- 21 Width errors enlarged by us to $4 \times \Gamma/\sqrt{N}$; see note.
 22 Inclusive reaction. Complicated background and phase-space effects.
 23 Number of events in peak reevaluated by us.
 24 K-matrix pole.
 25 From a partial wave amplitude analysis.
 26 From a fit in the $K_0^*(800) + K^*(892) + K^*(1410)$ model.
 27 From the pole position of the $K\pi$ vector form factor using EPIFANOV 07 and constraints from K_{J3} decays in ANTONELLI 10.
 28 Systematic uncertainties not estimated.
 29 From the pole position of the $K\pi$ vector form factor in the complex s -plane and using EPIFANOV 07 data.
 30 Reanalysis of EPIFANOV 07 using resonance chiral theory.
 31 With mass and width of the $K^*(1410)$ fixed at 1412 MeV and 227 MeV, respectively.
 32 Taking into account the $K^*(892)^0$, S -wave and P -wave ($K^*(1410)^0$).
 33 From the isobar model with a complex pole for the κ .
 34 Fit to $K\pi$ mass spectrum includes a non-resonant scalar component.
 35 This value comes from a fit with χ^2 of 178/117.

NODE=M018W;LINKAGE=D
 NODE=M018W;LINKAGE=I
 NODE=M018W;LINKAGE=W
 NODE=M018W1;LINKAGE=AN
 NODE=M018W1;LINKAGE=F
 NODE=M018W5;LINKAGE=EF
 NODE=M018W5;LINKAGE=BT

NODE=M018W2;LINKAGE=NS
 NODE=M018W5;LINKAGE=BI

NODE=M018W2;LINKAGE=JA
 NODE=M018W5;LINKAGE=BA
 NODE=M018W2;LINKAGE=DE
 NODE=M018W2;LINKAGE=BO
 NODE=M018M2;LINKAGE=LI
 NODE=M018W2;LINKAGE=MI

NODE=M018220;NODE=M018

DESIG=1;OUR EVAL;→ UNCHECKED ←
 DESIG=11
 DESIG=12
 DESIG=4
 DESIG=3
 DESIG=2

$K^*(892)$ DECAY MODES

	Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1	$K\pi$	~ 100	%
Γ_2	$(K\pi)^\pm$	$(99.901 \pm 0.009)\%$	
Γ_3	$(K\pi)^0$	$(99.754 \pm 0.021)\%$	
Γ_4	$K^0\gamma$	$(2.46 \pm 0.21) \times 10^{-3}$	
Γ_5	$K^\pm\gamma$	$(9.9 \pm 0.9) \times 10^{-4}$	
Γ_6	$K\pi\pi$	$< 7 \times 10^{-4}$	95%

CONSTRAINED FIT INFORMATION

An overall fit to the total width and a partial width uses 13 measurements and one constraint to determine 3 parameters. The overall fit has a $\chi^2 = 7.8$ for 11 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta p_i \delta p_j \rangle / (\delta p_i \delta p_j)$, in percent, from the fit to parameters p_i , including the branching fractions, $x_i \equiv \Gamma_i/\Gamma_{\text{total}}$. The fit constrains the x_i whose labels appear in this array to sum to one.

$$\begin{array}{c|cc} x_5 & -100 & \\ \Gamma & 19 & -19 \\ & x_2 & x_5 \end{array}$$

	Mode	Rate (MeV)
Γ_2	$(K\pi)^\pm$	50.7 ± 0.9
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 22 measurements and one constraint to determine 3 parameters. The overall fit has a $\chi^2 = 66.8$ for 20 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta p_i \delta p_j \rangle / (\delta p_i \delta p_j)$, in percent, from the fit to parameters p_i , including the branching fractions, $x_i \equiv \Gamma_i/\Gamma_{\text{total}}$. The fit constrains the x_i whose labels appear in this array to sum to one.

$$\begin{array}{c|cc} x_4 & -100 & \\ \Gamma & 15 & -15 \\ & x_3 & x_4 \end{array}$$

	Mode	Rate (MeV)	Scale factor
Γ_3	$(K\pi)^0$	47.3 ± 0.6	2.1
Γ_4	$K^0\gamma$	0.116 ± 0.010	

DESIG=12
 DESIG=4

K*(892) PARTIAL WIDTHS

NODE=M018225

 $\Gamma(K^0\gamma)$ Γ_4

VALUE (keV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
116 ± 10 OUR FIT					
116.5 ± 9.9	584	CARLSMITH	86	SPEC	0 $K_L^0 A \rightarrow K_S^0 \pi^0 A$

NODE=M018W4
NODE=M018W4 $\Gamma(K^\pm\gamma)$ Γ_5

VALUE (keV)	DOCUMENT ID	TECN	CHG	COMMENT
50 ± 5 OUR FIT				
50 ± 5 OUR AVERAGE				
48 ± 11	BERG	83	SPEC	- 156 $K^- A \rightarrow \bar{K} \pi A$
51 ± 5	CHANDLEE	83	SPEC	+ 200 $K^+ A \rightarrow K \pi A$

NODE=M018W3
NODE=M018W3**K*(892) BRANCHING RATIOS**

NODE=M018230

 $\Gamma(K^0\gamma)/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE (units 10 ⁻³)	DOCUMENT ID	TECN	CHG	COMMENT
2.46 ± 0.21 OUR FIT				
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1.5 ± 0.7	CARITHERS	75B	CNTR	0 8-16 $\bar{K}^0 A$

NODE=M018R3
NODE=M018R3 $\Gamma(K^\pm\gamma)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE (units 10 ⁻³)	CL%	DOCUMENT ID	TECN	CHG	COMMENT
0.99 ± 0.09 OUR FIT					
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 1.6	95	BEMPORAD	73	CNTR	+ 10-16 $K^+ A$

NODE=M018R2
NODE=M018R2 $\Gamma(K\pi\pi)/\Gamma((K\pi)^\pm)$ Γ_6/Γ_2

VALUE	CL%	DOCUMENT ID	TECN	CHG	COMMENT
< 7 × 10⁻⁴	95	JONGEJANS	78	HBC	4 $K^- p \rightarrow p \bar{K}^0 2\pi$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 20 × 10 ⁻⁴		WOJCICKI	64	HBC	- 1.7 $K^- p \rightarrow \bar{K}^0 \pi^- p$

NODE=M018R1
NODE=M018R1**K*(892) REFERENCES**

NODE=M018

DEL-AMO-SA... 111	PR D83 072001	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)
ANTONELLI 10	EPJ C69 399	M. Antonelli <i>et al.</i>	(FlaviaNet Working Group)
BOITO 10	JHEP 1009 031	D.R. Boito, R. Escribano, M. Jamin	(BARC)
BOITO 09	EPJ C59 821	D.R. Boito, R. Escribano, M. Jamin	
MITCHELL 09A	PR D79 072008	R.E. Mitchell <i>et al.</i>	(CLEO Collab.)
BONVICINI 08A	PR D78 052001	G. Bonvicini <i>et al.</i>	(CLEO Collab.)
JAMIN 08	PL B664 78	M. Jamin, A. Pich, J. Portoles	
AUBERT 07AK	PR D76 012008	B. Aubert <i>et al.</i>	(BABAR Collab.)
EPIFANOV 07	PL B654 65	D. Epifanov <i>et al.</i>	(BELLE Collab.)
LINK 05I	PL B621 72	J.M. Link <i>et al.</i>	(FNAL FOCUS Collab.)
BONVICINI 02	PRL 88 111803	G. Bonvicini <i>et al.</i>	(CLEO Collab.)
PDG 00	EPJ C15 1	D.E. Groom <i>et al.</i>	(PDG Collab.)
ABELE 99D	PL B468 178	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
BARATE 99R	EPJ C11 599	R. Barate <i>et al.</i>	(ALEPH Collab.)
BARBERIS 98E	PL B436 204	D. Barberis <i>et al.</i>	(Omega Expt.)
BIRD 89	SLAC-332	P.F. Bird	(SLAC)
ASTON 88	NP B296 493	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)
ATKINSON 86	ZPHY C30 521	M. Atkinson <i>et al.</i>	(BONN, CERN, GLAS+)
CARLSMITH 86	PRL 56 18	D. Carlsmith <i>et al.</i>	(EFI, SACL)
BAUBILLIER 84B	ZPHY C26 37	M. Baubillier <i>et al.</i>	(BIRM, CERN, GLAS+)
NAPIER 84	PL 149B 514	A. Napier <i>et al.</i>	(TUFTS, ARIZ, FNAL, FLOR+)
BARTH 83	NP B223 296	M. Barth <i>et al.</i>	(BRUX, CERN, GENO, MONS+)
BERG 83	Thesis UMI 83-21652	D.M. Berg	(ROCH)
CHANDLEE 83	PRL 51 168	C. Chandlee <i>et al.</i>	(ROCH, FNAL, MINN)
CLELAND 82	NP B208 189	W.E. Cleland <i>et al.</i>	(DURH, GEVA, LAUS+)
DELFOSSSE 81	NP B183 349	A. Delfosse <i>et al.</i>	(GEVA, LAUS)
TOAFF 81	PR D23 1500	S. Toaff <i>et al.</i>	(ANL, KANS)
AJINENKO 80	ZPHY C5 177	I.V. Ajinenko <i>et al.</i>	(SERP, BRUX, MONS+)
EVANGELIS... 80	NP B165 383	C. Evangelista <i>et al.</i>	(BARI, BONN, CERN+)
AGUILAR-... 78B	NP B141 101	M. Aguilar-Benitez <i>et al.</i>	(MADR, TATA+)
BALAND 78	NP B140 220	J.F. Baland <i>et al.</i>	(MONS, BELG, CERN+)
COOPER 78	NP B136 365	A.M. Cooper <i>et al.</i>	(TATA, CERN, CDEF+)
JONGEJANS 78	NP B139 383	B. Jongejans <i>et al.</i>	(ZEEM, CERN, NUM+)
WICKLUND 78	PR D17 1197	A.B. Wicklund <i>et al.</i>	(ANL)
BOWLER 77	NP B126 31	M.G. Bowler <i>et al.</i>	(OXF)
CARITHERS 75B	PRL 35 349	W.C.J. Carithers <i>et al.</i>	(ROCH, MCGI)
MCCUBBIN 75	NP B86 13	N.A. McCubbin, L. Lyons	(OXF)
PALER 75	NP B96 1	K. Paler <i>et al.</i>	(RHEL, SACL, EPOL)
FOX 74	NP B80 403	G.C. Fox, M.L. Griss	(CIT)
MATISON 74	PR D9 1872	M.J. Matison <i>et al.</i>	(LBL)
BEMPORAD 73	NP B51 1	C. Bemporad <i>et al.</i>	(CERN, ETH, LOIC)
CLARK 73	NP B54 432	A.G. Clark, L. Lyons, D. Radojicic	(OXF)
LEWIS 73	NP B60 283	P.H. Lewis <i>et al.</i>	(LOWC, LOIC, CDEF)
LINGLIN 73	NP B55 408	D. Linglin	(CERN)
BUCHNER 72	NP B45 333	K. Buchner <i>et al.</i>	(MPIM, CERN, BRUX)
AGUILAR-... 71B	PR D4 2583	M. Aguilar-Benitez, R.L. Eisner, J.B. Kinson	(BNL)
HABER 70	NP B17 289	B. Haber <i>et al.</i>	(REHO, SACL, BGNA, EPOL)
CRENNELL 69D	PRL 22 487	D.J. Crennell <i>et al.</i>	(BNL)
DAVIS 69	PRL 23 1071	P.J. Davis <i>et al.</i>	(LRL)
SCHWEING... 68	PR 166 1317	F. Schweingruber <i>et al.</i>	(ANL, NWES)
BARASH 67B	PR 156 1399	N. Barash <i>et al.</i>	(COLU)
BARLOW 67	NC 50A 701	J. Barlow <i>et al.</i>	(CERN, CDEF, IRAD, LVP)
DAUBER 67B	PR 153 1403	P.M. Dauber <i>et al.</i>	(UCLA)
DEBAERE 67B	NC 51A 401	W. de Baere <i>et al.</i>	(BRUX, CERN)
WOJCICKI 64	PR 135 B484	S.G. Wojcicki	(LRL)

REF ID=	16493
REF ID=	53448
REF ID=	53632
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$K_1(1270)$

$$I(J^P) = \frac{1}{2}(1^+)$$

NODE=M028

 $K_1(1270)$ MASS

NODE=M028205

VALUE (MeV)	DOCUMENT ID

1272±7 OUR AVERAGE Includes data from the 2 datablocks that follow this one.

NODE=M028MX

PRODUCED BY K^- , BACKWARD SCATTERING, HYPERON EXCHANGE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

The data in this block is included in the average printed for a previous datablock.

 NODE=M028M2
 NODE=M028M2

1275±10 700 GAVILLET 78 HBC + $4.2 K^- p \rightarrow \Xi^- (K \pi \pi)^+$
PRODUCED BY K BEAMS

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT

The data in this block is included in the average printed for a previous datablock.

 NODE=M028M3
 NODE=M028M3

1270±10 ¹ DAUM 81C CNTR - $63 K^- p \rightarrow K^- 2\pi p$

• • • We do not use the following data for averages, fits, limits, etc. • • •

~ 1276	² TORNQVIST	82B	RVUE		
~ 1300	VERGEEST	79	HBC	-	$4.2 K^- p \rightarrow (\bar{K} \pi \pi)^- p$
1289±25	³ CARNEGIE	77	ASPK	±	$13 K^\pm p \rightarrow (K \pi \pi)^\pm p$
~ 1300	BRANDENB...	76	ASPK	±	$13 K^\pm p \rightarrow (K \pi \pi)^\pm p$
~ 1270	OTTER	76	HBC	-	$10,14,16 K^- p \rightarrow (\bar{K} \pi \pi)^- p$
1260	DAVIS	72	HBC	+	$12 K^+ p$
1234±12	FIRESTONE	72B	DBC	+	$12 K^+ d$

¹ Well described in the chiral unitary approach of GENG 07 with two poles at 1195 and 1284 MeV and widths of 246 and 146 MeV, respectively.² From a unitarized quark-model calculation.³ From a model-dependent fit with Gaussian background to BRANDENBURG 76 data.

NODE=M028M3;LINKAGE=DA

 NODE=M028M3;LINKAGE=T
 NODE=M028M3;LINKAGE=E
PRODUCED BY BEAMS OTHER THAN K MESONS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	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	$4.5 \pi^- p \rightarrow \Lambda K 2\pi$
1242 $^{+9}_{-10}$		⁵ ASTIER	69	HBC	$\bar{p} p$
1300	45	CRENNELL	67	HBC	$6 \pi^- p \rightarrow \Lambda K 2\pi$

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

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

1254±33±34 7k ASNER 00B CLEO ± $\tau^- \rightarrow K^- \pi^+ \pi^- \nu_\tau$

 NODE=M028MT
 NODE=M028MT
 $K_1(1270)$ 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

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

The data in this block is included in the average printed for a previous datablock.

 NODE=M028W2
 NODE=M028W2

75±15 700 GAVILLET 78 HBC + $4.2 K^- p \rightarrow \Xi^- K \pi \pi$

PRODUCED BY K BEAMS

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT

The data in this block is included in the average printed for a previous datablock.

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 ± 13 $K^\pm p \rightarrow (K\pi\pi)^\pm p$
 ~ 200 BRANDENB... 76 ASPK ± 13 $K^\pm p \rightarrow (K\pi\pi)^\pm p$
 120 DAVIS 72 HBC + 12 $K^+ p$
 188 ± 21 FIRESTONE 72B DBC + 12 $K^+ d$

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 $^{+90}_{-70}$ ± 80 7k ASNER 00B CLEO ± $\tau^- \rightarrow K^- \pi^+ \pi^- \nu_\tau$

NODE=M028WT
 NODE=M028WT

 $K_1(1270)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $K\rho$	(42 ± 6) %
Γ_2 $K_0^*(1430)\pi$	(28 ± 4) %
Γ_3 $K^*(892)\pi$	(16 ± 5) %
Γ_4 $K\omega$	(11.0 ± 2.0) %
Γ_5 $K f_0(1370)$	(3.0 ± 2.0) %
Γ_6 γK^0	seen

NODE=M028215;NODE=M028

DESIG=2

DESIG=7

DESIG=1

DESIG=5

DESIG=8

DESIG=9;OUR EST;→ UNCHECKED ←

 $K_1(1270)$ PARTIAL WIDTHS **$\Gamma(K\rho)$** **Γ_1**

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

57 ± 5 MAZZUCATO 79 HBC + 4.2 $K^- p \rightarrow \Xi^- (K\pi\pi)^+$
 75 ± 6 CARNEGIE 77B ASPK ± 13 $K^\pm p \rightarrow (K\pi\pi)^\pm p$

 $\Gamma(K_0^*(1430)\pi)$ **Γ_2**

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

26 ± 6 CARNEGIE 77B ASPK ± 13 $K^\pm p \rightarrow (K\pi\pi)^\pm p$

 $\Gamma(K^*(892)\pi)$ **Γ_3**

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

14 ± 11 MAZZUCATO 79 HBC + 4.2 $K^- p \rightarrow \Xi^- (K\pi\pi)^+$
 2 ± 2 CARNEGIE 77B ASPK ± 13 $K^\pm p \rightarrow (K\pi\pi)^\pm p$

NODE=M028W7
 NODE=M028W7

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=22536
REFID=22532
REFID=22533
REFID=22419
REFID=22505
REFID=22506
REFID=22482
REFID=22473

 $K_1(1400)$

$$I(J^P) = \frac{1}{2}(1^+)$$

NODE=M064

 $K_1(1400)$ MASS

NODE=M064M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
1403± 7 OUR AVERAGE					
1463±64±68	7k	ASNER	00B	CLEO	± $\tau^- \rightarrow K^- \pi^+ \pi^- \nu_\tau$
1373±14±18		¹ ASTON	87	LASS	0 $11 K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$
1392±18		BAUBILLIER	82B	HBC	0 $8.25 K^- p \rightarrow K_S^0 \pi^+ \pi^- n$
1410±25		DAUM	81C	CNTR	— $63 K^- p \rightarrow K^- 2\pi p$
1415±15		ETKIN	80	MPS	0 $6 K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$
1404±10		² CARNEGIE	77	ASPK	± $13 K^\pm p \rightarrow (K\pi\pi)^\pm p$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1418± 8	25k	³ ABLIKIM	06C	BES2	$J/\psi \rightarrow \bar{K}^*(892)^0 K^+ \pi^-$
~ 1350		⁴ TORNQVIST	82B	RVUE	
~ 1400		VERGEEST	79	HBC	— $4.2 K^- p \rightarrow (\bar{K}\pi\pi)^- p$
~ 1400		BRANDENB...	76	ASPK	± $13 K^\pm p \rightarrow (K\pi\pi)^\pm p$
1420		DAVIS	72	HBC	+ $12 K^+ p$
1368±18		FIRESTONE	72B	DBC	+ $12 K^+ d$

¹ From partial-wave analysis of $K^0 \pi^+ \pi^-$ system.² From a model-dependent fit with Gaussian background to BRANDENBURG 76 data.³ Systematic errors not estimated.⁴ From a unitarized quark-model calculation.

NODE=M064M;LINKAGE=P
NODE=M064M;LINKAGE=E
NODE=M064M;LINKAGE=AB
NODE=M064M;LINKAGE=T

 $K_1(1400)$ WIDTH

NODE=M064W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
174± 13 OUR AVERAGE Error includes scale factor of 1.6. See the ideogram below.					
$300^{+370}_{-110} \pm 140$	7k	ASNER	00B	CLEO	± $\tau^- \rightarrow K^- \pi^+ \pi^- \nu_\tau$
188± 54± 60		⁵ ASTON	87	LASS	0 $11 K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$
276± 65		BAUBILLIER	82B	HBC	0 $8.25 K^- p \rightarrow K_S^0 \pi^+ \pi^- n$
195± 25		DAUM	81C	CNTR	— $63 K^- p \rightarrow K^- 2\pi p$
180± 10		ETKIN	80	MPS	0 $6 K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$
142± 16		⁶ CARNEGIE	77	ASPK	± $13 K^\pm p \rightarrow (K\pi\pi)^\pm p$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
152± 16	25k	⁷ ABLIKIM	06C	BES2	$J/\psi \rightarrow \bar{K}^*(892)^0 K^+ \pi^-$
~ 200		VERGEEST	79	HBC	— $4.2 K^- p \rightarrow (\bar{K}\pi\pi)^- p$
~ 160		BRANDENB...	76	ASPK	± $13 K^\pm p \rightarrow (K\pi\pi)^\pm p$
80		DAVIS	72	HBC	+ $12 K^+ p$
241± 30		FIRESTONE	72B	DBC	+ $12 K^+ d$

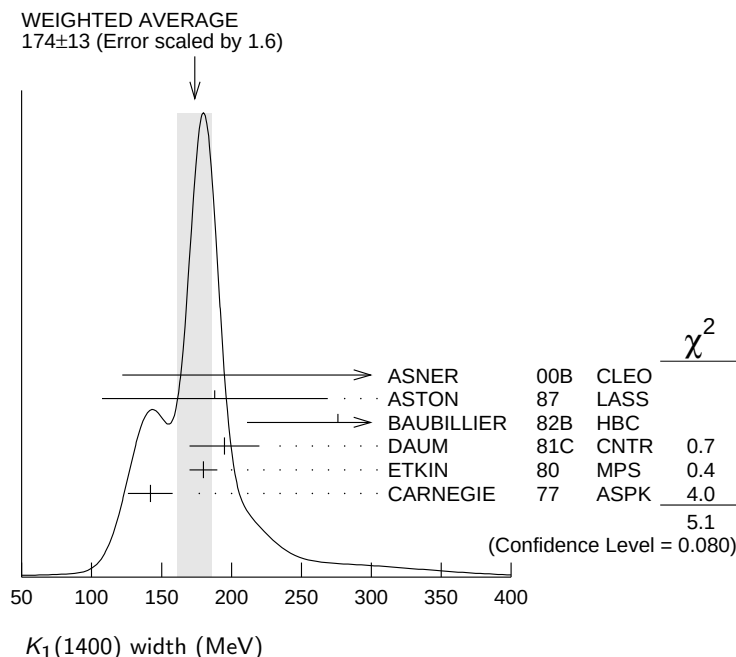
NODE=M064W

⁵ From partial-wave analysis of $K^0 \pi^+ \pi^-$ system.

⁶ From a model-dependent fit with Gaussian background to BRANDENBURG 76 data.

⁷ Systematic errors not estimated.

NODE=M064W;LINKAGE=P
NODE=M064W;LINKAGE=E
NODE=M064W;LINKAGE=AB



$K_1(1400)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $K^*(892)\pi$	(94 ± 6) %
Γ_2 $K\rho$	(3.0 ± 3.0) %
Γ_3 $K f_0(1370)$	(2.0 ± 2.0) %
Γ_4 $K\omega$	(1.0 ± 1.0) %
Γ_5 $K_0^*(1430)\pi$	not seen
Γ_6 γK^0	seen

NODE=M064215;NODE=M064

DESIG=1

DESIG=2

DESIG=8

DESIG=5

DESIG=7;OUR EST;→ UNCHECKED ←

DESIG=9;OUR EST;→ UNCHECKED ←

$K_1(1400)$ PARTIAL WIDTHS

$\Gamma(K^*(892)\pi)$	Γ_1
VALUE (MeV)	DOCUMENT ID TECN CHG COMMENT
117 ± 10	CARNEGIE 77 ASPK ± 13 $K^\pm p \rightarrow (K\pi\pi)^\pm p$
$\Gamma(K\rho)$	Γ_2
VALUE (MeV)	DOCUMENT ID TECN CHG COMMENT
2 ± 1	CARNEGIE 77 ASPK ± 13 $K^\pm p \rightarrow (K\pi\pi)^\pm p$
$\Gamma(K\omega)$	Γ_4
VALUE (MeV)	DOCUMENT ID TECN CHG COMMENT
23 ± 12	CARNEGIE 77 ASPK ± 13 $K^\pm p \rightarrow (K\pi\pi)^\pm p$
$\Gamma(\gamma K^0)$	Γ_6
VALUE (keV)	DOCUMENT ID TECN COMMENT
280.8 ± 23.2 ± 40.4	ALAVI-HARATI02B KTEV $K + A \rightarrow K^* + A$

NODE=M064220

NODE=M064W1
NODE=M064W1

NODE=M064W2
NODE=M064W2

NODE=M064W5
NODE=M064W5

NODE=M064W6
NODE=M064W6

$K_1(1400)$ BRANCHING RATIOS

$\Gamma(K^*(892)\pi)/\Gamma_{\text{total}}$	Γ_1/Γ
VALUE	DOCUMENT ID TECN COMMENT
0.94 ± 0.06	⁸ DAUM 81C CNTR 63 $K^- p \rightarrow K^- 2\pi p$
$\Gamma(K\rho)/\Gamma_{\text{total}}$	Γ_2/Γ
VALUE	DOCUMENT ID TECN COMMENT
0.03 ± 0.03	⁸ DAUM 81C CNTR 63 $K^- p \rightarrow K^- 2\pi p$

NODE=M064225

NODE=M064R1
NODE=M064R1

NODE=M064R2
NODE=M064R2

$\Gamma(K f_0(1370))/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
0.02±0.02	⁸ DAUM	81C	CNTR 63 $K^- p \rightarrow K^- 2\pi p$

NODE=M064R5
 NODE=M064R5

 $\Gamma(K\omega)/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
0.01±0.01	⁸ DAUM	81C	CNTR 63 $K^- p \rightarrow K^- 2\pi p$

NODE=M064R3
 NODE=M064R3

 $\Gamma(K_0^*(1430)\pi)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	⁸ DAUM	81C	CNTR 63 $K^- p \rightarrow K^- 2\pi p$

NODE=M064R4
 NODE=M064R4

D-wave/S-wave RATIO FOR $K_1(1400) \rightarrow K^*(892)\pi$

VALUE	DOCUMENT ID	TECN	COMMENT
0.04±0.01	⁸ DAUM	81C	CNTR 63 $K^- p \rightarrow K^- 2\pi p$

NODE=M064R9
 NODE=M064R9

⁸ Average from low and high t data.

NODE=M064R;LINKAGE=F

 $K_1(1400)$ REFERENCES

ABLIKIM	06C	PL B633 681	M. Ablikim <i>et al.</i>	(BES Collab.)
ALAVI-HARATI	02B	PRL 89 072001	A. Alavi-Harati <i>et al.</i>	(FNAL KTeV Collab.)
ASNER	00B	PR D62 072006	D.M. Asner <i>et al.</i>	(CLEO Collab.)
ASTON	87	NP B292 693	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)
BAUBILLIER	82B	NP B202 21	M. Baubillier <i>et al.</i>	(BIRM, CERN, GLAS+)
TORNQVIST	82B	NP B203 268	N.A. Tornqvist	(HELS)
DAUM	81C	NP B187 1	C. Daum <i>et al.</i>	(AMST, CERN, CRAC, MPIM+)
ETKIN	80	PR D22 42	A. Etkin <i>et al.</i>	(BNL, CUNY) JP
VERGEEST	79	NP B158 265	J.S.M. Vergeest <i>et al.</i>	(NIJM, AMST, CERN+)
CARNEGIE	77	NP B127 509	R.K. Carnegie <i>et al.</i>	(SLAC)
BRANDENB...	76	PRL 36 703	G.W. Brandenburg <i>et al.</i>	(SLAC) JP
DAVIS	72	PR D5 2688	P.J. Davis <i>et al.</i>	(LBL)
FIRESTONE	72B	PR D5 505	A. Firestone <i>et al.</i>	(LBL)

NODE=M064

REFID=51037
 REFID=48822
 REFID=47766
 REFID=40234
 REFID=22551
 REFID=20573
 REFID=22548
 REFID=22545
 REFID=22542
 REFID=22535
 REFID=22532
 REFID=22505
 REFID=22506

 $K^*(1410)$

$$I(J^P) = \frac{1}{2}(1^-)$$

NODE=M094

 $K^*(1410)$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
1414±15 OUR AVERAGE	Error includes scale factor of 1.3.			

1380±21±19	ASTON	88	LASS	0	11 $K^- p \rightarrow K^- \pi^+ n$
1420±7±10	ASTON	87	LASS	0	11 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$

• • • We do not use the following data for averages, fits, limits, etc. • • •

1276 ⁺⁷² ₋₇₇	^{1,2} BOITO	09	RVUE		$\tau^- \rightarrow K_S^0 \pi^- \nu_\tau$
1367±54	BIRD	89	LASS	-	11 $K^- p \rightarrow \bar{K}^0 \pi^- p$
1474±25	BAUBILLIER	82B	HBC	0	8.25 $K^- p \rightarrow \bar{K}^0 2\pi n$
1500±30	ETKIN	80	MPS	0	6 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$

¹ From the pole position of the $K\pi$ vector form factor in the complex s -plane and using EPIFANOV 07 data.² Systematic uncertainties not estimated.

NODE=M094M

NODE=M094M

NODE=M094M;LINKAGE=BI

NODE=M094M;LINKAGE=NS

 $K^*(1410)$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
232±21 OUR AVERAGE	Error includes scale factor of 1.1.			

176±52±22	ASTON	88	LASS	0	11 $K^- p \rightarrow K^- \pi^+ n$
240±18±12	ASTON	87	LASS	0	11 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$

• • • We do not use the following data for averages, fits, limits, etc. • • •

198 ⁺⁶¹ ₋₈₇	^{3,4} BOITO	09	RVUE		$\tau^- \rightarrow K_S^0 \pi^- \nu_\tau$
114±101	BIRD	89	LASS	-	11 $K^- p \rightarrow \bar{K}^0 \pi^- p$
275±65	BAUBILLIER	82B	HBC	0	8.25 $K^- p \rightarrow \bar{K}^0 2\pi n$
500±100	ETKIN	80	MPS	0	6 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$

³ From the pole position of the $K\pi$ vector form factor in the complex s -plane and using EPIFANOV 07 data.⁴ Systematic uncertainties not estimated.

NODE=M094W

NODE=M094W

NODE=M094W;LINKAGE=BI

NODE=M094W;LINKAGE=NS

$K^*(1410)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 $K^*(892)\pi$	> 40 %	95%
Γ_2 $K\pi$	(6.6 ± 1.3) %	
Γ_3 $K\rho$	< 7 %	95%
Γ_4 γK^0	seen	

NODE=M094215;NODE=M094

DESIG=2;OUR EST;→ UNCHECKED ←
 DESIG=1
 DESIG=3;OUR EST;→ UNCHECKED ←
 DESIG=4;OUR EST;→ UNCHECKED ←

 $K^*(1410)$ 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	
$0.066\pm0.010\pm0.008$	ASTON	88	LASS	0	11 $K^-p \rightarrow K^- \pi^+ n$

NODE=M094R3
 NODE=M094R3

 $K^*(1410)$ REFERENCES

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=52728
 REFID=51929
 REFID=48822
 REFID=41002
 REFID=40262
 REFID=40234
 REFID=22689
 REFID=22551
 REFID=22545

 $K_0^*(1430)$

$$I(J^P) = \frac{1}{2}(0^+)$$

NODE=M019

See our minireview in the 1994 edition and in this edition under the $f_0(500)$.

NODE=M019

 $K_0^*(1430)$ MASS

NODE=M019M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
1425 ± 50 OUR ESTIMATE					
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1427 ± 4 ± 13	1	BUGG	10	RVUE	S-matrix pole
1466.6 ± 0.7 ± 3.4 141k	2	BONVICINI	08A	CLEO	$D^+ \rightarrow K^- \pi^+ \pi^+$
~ 1412	3	LINK	07	FOCS	0 $D^+ \rightarrow K^- K^+ \pi^+$
1461.0 ± 4.0 ± 2.1 54k	4	LINK	07B	FOCS	$D^+ \rightarrow K^- \pi^+ \pi^+$
1406 ± 29	5	BUGG	06	RVUE	
1435 ± 6	6	ZHOU	06	RVUE	$K\rho \rightarrow K^- \pi^+ n$
1455 ± 20 ± 15		ABLIKIM	05Q	BES2	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$
1456 ± 8	7	ZHENG	04	RVUE	$K^- p \rightarrow K^- \pi^+ n$
~ 1419	8	BUGG	03	RVUE	11 $K^- p \rightarrow K^- \pi^+ n$
~ 1440	9	LI	03	RVUE	11 $K^- p \rightarrow K^- \pi^+ n$

NODE=M019M
 → UNCHECKED ←

1459 ± 9	15k	10 AITALA	02	E791	$D^+ \rightarrow K^- \pi^+ \pi^+$
~ 1440		11 JAMIN	00	RVUE	$K p \rightarrow K p$
1436 ± 8		12 BARBERIS	98E	OMEG	450 $p p \rightarrow$ $p_f p_s K^+ K^- \pi^+ \pi^-$
1415 ± 25		8 ANISOVICH	97C	RVUE	11 $K^- p \rightarrow K^- \pi^+ n$
~ 1450		13 TORNQVIST	96	RVUE	$\pi \pi \rightarrow \pi \pi, K \bar{K}, K \pi$
1412 ± 6		14 ASTON	88	LASS 0	11 $K^- p \rightarrow K^- \pi^+ n$
~ 1430		BAUBILLIER	84B	HBC -	8.25 $K^- p \rightarrow \bar{K}^0 \pi^- p$
~ 1425		15,16 ESTABROOKS	78	ASPK	13 $K^\pm p \rightarrow$ $K^\pm \pi^\pm (n, \Delta)$
~ 1450.0		MARTIN	78	SPEC	10 $K^\pm p \rightarrow K_S^0 \pi p$

¹ S-Matrix pole. Supersedes BUGG 06. Combined analysis of ASTON 88, ABLIKIM 06C, AITALA 06, and LINK 09 using an s-dependent width with couplings to $K \pi$ and $K \eta'$, and the Adler zero near thresholds.

² From the isobar model with a complex pole for the κ .

³ From a non-parametric analysis.

⁴ A Breit-Wigner mass and width.

⁵ S-matrix pole. Reanalysis of ASTON 88, AITALA 02, and ABLIKIM 06C including the κ with an s-dependent width and an Adler zero near threshold.

⁶ S-matrix pole. Using ASTON 88 and assuming $K_0^*(800)$, $K_0^*(1950)$.

⁷ Using ASTON 88 and assuming $K_0^*(800)$.

⁸ T-matrix pole. Reanalysis of ASTON 88 data.

⁹ Breit-Wigner fit. Using ASTON 88.

¹⁰ Assuming a low-mass scalar $K \pi$ resonance, $\kappa(800)$.

¹¹ T-matrix pole. Using data from ESTABROOKS 78 and ASTON 88.

¹² J^P not determined, could be $K_2^*(1430)$.

¹³ T-matrix pole.

¹⁴ Uses a model for the background, without this background they get a mass 1340 MeV, where the phase shift passes 90° .

¹⁵ Mass defined by pole position.

¹⁶ From elastic $K \pi$ partial-wave analysis.

NODE=M019M;LINKAGE=BG

NODE=M019M;LINKAGE=BO

NODE=M019M;LINKAGE=LI

NODE=M019M;LINKAGE=BW

NODE=M019M;LINKAGE=BU

NODE=M019M;LINKAGE=ZU

NODE=M019M;LINKAGE=ZH

NODE=M019M;LINKAGE=A1

NODE=M019M;LINKAGE=E

NODE=M019M;LINKAGE=A0

NODE=M019M;LINKAGE=JM

NODE=M019M;LINKAGE=JP

NODE=M019M;LINKAGE=TT

NODE=M019M;LINKAGE=D

NODE=M019M;LINKAGE=A

NODE=M019M;LINKAGE=C

$K_0^*(1430)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
270 ± 80 OUR ESTIMATE					
• • • We do not use the following data for averages, fits, limits, etc. • • •					
270 ± 10 ± 40		17 BUGG	10	RVUE	S-matrix pole
174.2 ± 1.9 ± 3.2 141k		18 BONVICINI	08A	CLEO	$D^+ \rightarrow K^- \pi^+ \pi^+$
~ 500		19 LINK	07	FOCS 0	$D^+ \rightarrow K^- K^+ \pi^+$
177.0 ± 8.0 ± 3.4 54k		20 LINK	07B	FOCS	$D^+ \rightarrow K^- \pi^+ \pi^+$
350 ± 40		21 BUGG	06	RVUE	
288 ± 22		22 ZHOU	06	RVUE	$K p \rightarrow K^- \pi^+ n$
270 ± 45 $^{+30}_{-35}$		ABLIKIM	05Q	BES2	$\psi(2S) \rightarrow$ $\gamma \pi^+ \pi^- K^+ K^-$
217 ± 31		23 ZHENG	04	RVUE	$K^- p \rightarrow K^- \pi^+ n$
~ 316		24 BUGG	03	RVUE	11 $K^- p \rightarrow K^- \pi^+ n$
~ 350		25 LI	03	RVUE	11 $K^- p \rightarrow K^- \pi^+ n$
175 ± 17	15k	26 AITALA	02	E791	$D^+ \rightarrow K^- \pi^+ \pi^+$
~ 300		27 JAMIN	00	RVUE	$K p \rightarrow K p$
196 ± 45		28 BARBERIS	98E	OMEG	450 $p p \rightarrow$ $p_f p_s K^+ K^- \pi^+ \pi^-$
330 ± 50		24 ANISOVICH	97C	RVUE	11 $K^- p \rightarrow K^- \pi^+ n$
~ 320		29 TORNQVIST	96	RVUE	$\pi \pi \rightarrow \pi \pi, K \bar{K}, K \pi$
294 ± 23		ASTON	88	LASS 0	11 $K^- p \rightarrow K^- \pi^+ n$
~ 200		BAUBILLIER	84B	HBC -	8.25 $K^- p \rightarrow \bar{K}^0 \pi^- p$
200 to 300		30 ESTABROOKS	78	ASPK	13 $K^\pm p \rightarrow$ $K^\pm \pi^\pm (n, \Delta)$

¹⁷ S-Matrix pole. Supersedes BUGG 06. Combined analysis of ASTON 88, ABLIKIM 06C, AITALA 06, and LINK 09 using an s-dependent width with couplings to $K \pi$ and $K \eta'$, and the Adler zero near thresholds.

¹⁸ From the isobar model with a complex pole for the κ .

¹⁹ From a non-parametric analysis.

²⁰ A Breit-Wigner mass and width.

²¹ S-matrix pole. Reanalysis of ASTON 88, AITALA 02, and ABLIKIM 06C including the κ with an s-dependent width and an Adler zero near threshold.

NODE=M019W

NODE=M019W

→ UNCHECKED ←

NODE=M019W;LINKAGE=BG

NODE=M019W;LINKAGE=BO

NODE=M019W;LINKAGE=LI

NODE=M019W;LINKAGE=BW

NODE=M019W;LINKAGE=BU

- 22 S-matrix pole. Using ASTON 88 and assuming $K_0^*(800)$, $K_0^*(1950)$.
- 23 Using ASTON 88 and assuming $K_0^*(800)$.
- 24 T-matrix pole. Reanalysis of ASTON 88 data.
- 25 Breit-Wigner fit. Using ASTON 88.
- 26 Assuming a low-mass scalar $K\pi$ resonance, $\kappa(800)$.
- 27 T-matrix pole. Using data from ESTABROOKS 78 and ASTON 88.
- 28 J^P not determined, could be $K_2^*(1430)$.
- 29 T-matrix pole.
- 30 From elastic $K\pi$ partial-wave analysis.

NODE=M019W;LINKAGE=ZU
NODE=M019W;LINKAGE=ZH
NODE=M019W;LINKAGE=A1
NODE=M019W;LINKAGE=E
NODE=M019W;LINKAGE=A0
NODE=M019W;LINKAGE=JM
NODE=M019W;LINKAGE=JP
NODE=M019W;LINKAGE=TT
NODE=M019W;LINKAGE=C

$K_0^*(1430)$ DECAY MODES

NODE=M019215;NODE=M019

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad K\pi$	(93±10) %

DESIG=1

$K_0^*(1430)$ BRANCHING RATIOS

NODE=M019220

$\Gamma(K\pi)/\Gamma_{\text{total}}$					Γ_1/Γ
VALUE	DOCUMENT ID	TECN	CHG	COMMENT	
0.93±0.04±0.09	ASTON	88	LASS	0	11 $K^- p \rightarrow K^- \pi^+ n$

NODE=M019R1
NODE=M019R1

$K_0^*(1430)$ REFERENCES

NODE=M019

BUGG	10	PR D81 014002	D.V. Bugg	(LOQM)
LINK	09	PL B681 14	J.M. Link <i>et al.</i>	(FNAL FOCUS Collab.)
BONVICINI	08A	PR D78 052001	G. Bonvicini <i>et al.</i>	(CLEO Collab.)
LINK	07	PL B648 156	J.M. Link <i>et al.</i>	(FNAL FOCUS Collab.)
LINK	07B	PL B653 1	J.M. Link <i>et al.</i>	(FNAL FOCUS Collab.)
ABLIKIM	06C	PL B633 681	M. Ablikim <i>et al.</i>	(BES Collab.)
AITALA	06	PR D73 032004	E.M. Aitala <i>et al.</i>	(FNAL E791 Collab.)
Also		PR D74 059901 (errat.)	E.M. Aitala <i>et al.</i>	(FNAL E791 Collab.)
BUGG	06	PL B632 471	D.V. Bugg	(LOQM)
ZHOU	06	NP A775 212	Z.Y. Zhou, H.Q. Zheng	
ABLIKIM	05Q	PR D72 092002	M. Ablikim <i>et al.</i>	(BES Collab.)
ZHENG	04	NP A733 235	H.Q. Zheng <i>et al.</i>	
BUGG	03	PL B572 1	D.V. Bugg	
LI	03	PR D67 034025	L. Li, B. Zou, G. Li	
AITALA	02	PRL 89 121801	E.M. Aitala <i>et al.</i>	(FNAL E791 Collab.)
JAMIN	00	NP B587 331	M. Jamin <i>et al.</i>	
BARBERIS	98E	PL B436 204	D. Barberis <i>et al.</i>	(Omega Expt.)
ANISOVICH	97C	PL B413 137	A.V. Anisovich, A.V. Sarantsev	
TORNQVIST	96	PRL 76 1575	N.A. Tornqvist, M. Roos	(HELS)
ASTON	88	NP B296 493	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)
BAUBILLIER	84B	ZPHY C26 37	M. Baubillier <i>et al.</i>	(BIRM, CERN, GLAS+)
ESTABROOKS	78	NP B133 490	P.G. Estabrooks <i>et al.</i>	(MCGI, CARL, DURH+)
MARTIN	78	NP B134 392	A.D. Martin <i>et al.</i>	(DURH, GEVA)

REFID=53213
REFID=53056
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REFID=46348
REFID=45815
REFID=44507
REFID=40262
REFID=22459
REFID=22443
REFID=22446

$K_2^*(1430)$

$$I(J^P) = \frac{1}{2}(2^+)$$

We consider that phase-shift analyses provide more reliable determinations of the mass and width.

NODE=M022

NODE=M022

$K_2^*(1430)$ MASS

NODE=M022205

CHARGED ONLY, WITH FINAL STATE $K\pi$

 NODE=M022M1
 NODE=M022M1

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
1425.6 ± 1.5 OUR AVERAGE		Error includes scale factor of 1.1.			
1420 ± 4	1587	BAUBILLIER	84B	HBC	— 8.25 $K^- p \rightarrow \bar{K}^0 \pi^- p$
1436 ± 5.5	400	^{1,2} CLELAND	82	SPEC	+ 30 $K^+ p \rightarrow K_S^0 \pi^+ p$
1430 ± 3.2	1500	^{1,2} CLELAND	82	SPEC	+ 50 $K^+ p \rightarrow K_S^0 \pi^+ p$
1430 ± 3.2	1200	^{1,2} CLELAND	82	SPEC	— 50 $K^+ p \rightarrow K_S^0 \pi^- p$
1423 ± 5	935	TOAFF	81	HBC	— 6.5 $K^- p \rightarrow \bar{K}^0 \pi^- p$
1428.0 ± 4.6		³ MARTIN	78	SPEC	+ 10 $K^\pm p \rightarrow K_S^0 \pi p$
1423.8 ± 4.6		³ MARTIN	78	SPEC	— 10 $K^\pm p \rightarrow K_S^0 \pi p$
1420.0 ± 3.1	1400	AGUILAR-...	71B	HBC	— 3.9, 4.6 $K^- p$
1425 ± 8.0	225	^{1,2} BARNHAM	71C	HBC	+ $K^+ p \rightarrow K^0 \pi^+ p$
1416 ± 10	220	CRENNELL	69D	DBC	— 3.9 $K^- N \rightarrow \bar{K}^0 \pi^- N$
1414 ± 13.0	60	¹ LIND	69	HBC	+ 9 $K^+ p \rightarrow K^0 \pi^+ p$
1427 ± 12	63	¹ SCHWEING...	68	HBC	— 5.5 $K^- p \rightarrow \bar{K} \pi N$
1423 ± 11.0	39	¹ BASSANO	67	HBC	— 4.6–5.0 $K^- p \rightarrow \bar{K}^0 \pi^- p$

OCCUR=2

OCCUR=3

OCCUR=2

OCCUR=2

• • • We do not use the following data for averages, fits, limits, etc. • • •

1423.4 ± 2 ± 3	24809 ± 820	⁴ BIRD	89	LASS	— 11 $K^- p \rightarrow \bar{K}^0 \pi^- p$

NEUTRAL 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 $K^- p$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
98 ± 4 ± 4	25k	10 BIRD	89	LASS -	11 $K^- p \rightarrow \bar{K}^0 \pi^- p$

OCCUR=2

OCCUR=3

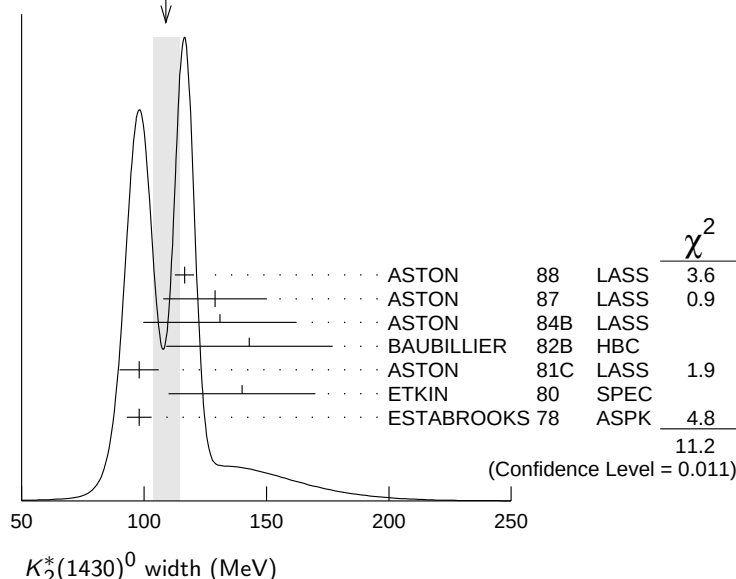
OCCUR=2

NEUTRAL ONLY

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
109 ± 5 OUR AVERAGE Error includes scale factor of 1.9. See the ideogram below.				
116.5 ± 3.6 ± 1.7		11 ASTON	88	LASS 11 $K^- p \rightarrow K^- \pi^+ n$
129 ± 15 ± 15		11 ASTON	87	LASS 11 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$
131 ± 24 ± 20		11 ASTON	84B	LASS 11 $K^- p \rightarrow \bar{K}^0 2\pi n$
143 ± 34		11 BAUBILLIER	82B	HBC 8.25 $K^- p \rightarrow NK_S^0 \pi \pi$
98 ± 8		11 ASTON	81C	LASS 11 $K^- p \rightarrow K^- \pi^+ n$
140 ± 30		11 ETKIN	80	SPEC 6 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$
98 ± 5		11 ESTABROOKS	78	ASPK 13 $K^\pm p \rightarrow pK\pi$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
113.7 ± 9.2	1786 ± 127	12 AUBERT	07AK	BABR 10.6 $e^+ e^- \rightarrow K^{*0} K^\pm \pi^\mp \gamma$
125 ± 29	300	8 HENDRICK	76	DBC 8.25 $K^+ N \rightarrow K^+ \pi N$
116 ± 18	800	MCCUBBIN	75	HBC 3.6 $K^- p \rightarrow K^- \pi^+ n$
61 ± 14		13 LINGLIN	73	HBC 2-13 $K^+ p \rightarrow K^+ \pi^- X$
116.6 ^{+10.3} _{-15.5}	1800	AGUILAR-...	71B	HBC 3.9,4.6 $K^- p$
144 ± 24.0	600	8 CORDS	71	DBC 9 $K^+ n \rightarrow K^+ \pi^- p$
101 ± 10	2200	DAVIS	69	HBC 12 $K^+ p \rightarrow K^+ \pi^- \pi^+ p$

NODE=M022W4

NODE=M022W4

WEIGHTED AVERAGE
109 ± 5 (Error scaled by 1.9)⁸ Errors enlarged by us to $4\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.⁹ Number of events in peak re-evaluated by us.¹⁰ From a partial wave amplitude analysis.¹¹ From phase shift or partial-wave analysis.¹² Systematic errors not estimated.¹³ From pole extrapolation, using world $K^+ p$ data summary tape.

NODE=M022W;LINKAGE=D

NODE=M022W;LINKAGE=W

NODE=M022W;LINKAGE=F

NODE=M022W;LINKAGE=P

NODE=M022W4;LINKAGE=NS

NODE=M022W;LINKAGE=C

$K_2^*(1430)$ DECAY MODES

NODE=M022215;NODE=M022

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
Γ_1 $K\pi$	$(49.9 \pm 1.2) \%$	
Γ_2 $K^*(892)\pi$	$(24.7 \pm 1.5) \%$	
Γ_3 $K^*(892)\pi\pi$	$(13.4 \pm 2.2) \%$	
Γ_4 $K\rho$	$(8.7 \pm 0.8) \%$	S=1.2
Γ_5 $K\omega$	$(2.9 \pm 0.8) \%$	
Γ_6 $K^+\gamma$	$(2.4 \pm 0.5) \times 10^{-3}$	S=1.1
Γ_7 $K\eta$	$(1.5^{+3.4}_{-1.0}) \times 10^{-3}$	S=1.3
Γ_8 $K\omega\pi$	$< 7.2 \times 10^{-4}$	CL=95%
Γ_9 $K^0\gamma$	$< 9 \times 10^{-4}$	CL=90%

DESIG=1

DESIG=2

DESIG=6

DESIG=3

DESIG=4

DESIG=8

DESIG=5

DESIG=7

DESIG=10;OUR EVAL;→ UNCHECKED ←

CONSTRAINED FIT INFORMATION

An overall fit to the total width, a partial width, and 10 branching ratios uses 31 measurements and one constraint to determine 8 parameters. The overall fit has a $\chi^2 = 20.2$ for 24 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta p_i \delta p_j \rangle / (\delta p_i \delta p_j)$, in percent, from the fit to parameters p_i , including the branching fractions, $x_i \equiv \Gamma_i / \Gamma_{\text{total}}$. The fit constrains the x_i whose labels appear in this array to sum to one.

x_2	−9						
x_3	−40	−73					
x_4	−8	36	−52				
x_5	−11	−3	−26	−7			
x_6	−1	−1	−1	−1	0		
x_7	−4	−7	−5	−5	−2	0	
Γ	0	0	0	0	0	−13	0
	x_1	x_2	x_3	x_4	x_5	x_6	x_7

Mode	Rate (MeV)	Scale factor
Γ_1 $K\pi$	49.1 ± 1.8	
Γ_2 $K^*(892)\pi$	24.3 ± 1.6	
Γ_3 $K^*(892)\pi\pi$	13.2 ± 2.2	
Γ_4 $K\rho$	8.5 ± 0.8	1.2
Γ_5 $K\omega$	2.9 ± 0.8	
Γ_6 $K^+\gamma$	0.24 ± 0.05	1.1
Γ_7 $K\eta$	$0.15^{+0.33}_{-0.10}$	1.3

DESIG=1

DESIG=2

DESIG=6

DESIG=3

DESIG=4

DESIG=8

DESIG=5

 $K_2^*(1430)$ PARTIAL WIDTHS

NODE=M022220

 $\Gamma(K^+\gamma)$ **Γ_6**

VALUE (keV)	DOCUMENT ID	TECN	CHG	COMMENT
241 ± 50 OUR FIT	Error includes scale factor of 1.1.			
240 ± 45	CIHANGIR	82	SPEC +	200 $K^+ Z \rightarrow Z K^+ \pi^0$, $Z K_S^0 \pi^+$

NODE=M022W8

NODE=M022W8

 $\Gamma(K^0\gamma)$ **Γ_9**

VALUE (keV)	CL%	DOCUMENT ID	TECN	CHG	COMMENT
< 5.4	90	ALAVI-HARATI02B	KTEV		$K + A \rightarrow K^* + A$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<84	90	CARLSMITH	87	SPEC 0	60–200 $K_L^0 A \rightarrow$ $K_S^0 \pi^0 A$

NODE=M022W9

NODE=M022W9

$K^*(1430)$ BRANCHING RATIOS

NODE=M022225

 $\Gamma(K\pi)/\Gamma_{\text{total}}$ **Γ_1/Γ**

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
0.499 ± 0.012 OUR FIT				
0.488 ± 0.014 OUR AVERAGE				
$0.485 \pm 0.006 \pm 0.020$	¹⁴ ASTON	88	LASS	0 11 $K^- p \rightarrow K^- \pi^+ n$
0.49 ± 0.02	¹⁴ ESTABROOKS	78	ASPK	$\pm$ 13 $K^\pm p \rightarrow p K \pi$

NODE=M022R1
NODE=M022R1 **$\Gamma(K^*(892)\pi)/\Gamma(K\pi)$** **$\Gamma_2/\Gamma_1$**

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
0.496 ± 0.034 OUR FIT				
0.47 ± 0.04 OUR AVERAGE				
0.44 ± 0.09	ASTON	84B	LASS	0 11 $K^- p \rightarrow \bar{K}^0 2\pi n$
0.62 ± 0.19	LAUSCHER	75	HBC	0 10,16 $K^- p \rightarrow K^- \pi^+ n$
0.54 ± 0.16	DEHM	74	DBC	0 4.6 $K^+ N$
0.47 ± 0.08	AGUILAR-...	71B	HBC	3.9,4.6 $K^- p$
0.47 ± 0.10	BASSANO	67	HBC	-0 4.6,5.0 $K^- p$
0.45 ± 0.13	BADIER	65C	HBC	- 3 $K^- p$

NODE=M022R4
NODE=M022R4 **$\Gamma(K\omega)/\Gamma(K\pi)$** **$\Gamma_5/\Gamma_1$**

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
0.059 ± 0.017 OUR FIT				
0.070 ± 0.035 OUR AVERAGE				
0.05 ± 0.04	AGUILAR-...	71B	HBC	3.9,4.6 $K^- p$
0.13 ± 0.07	BASSOMPIE...	69	HBC	0 5 $K^+ p$

NODE=M022R5
NODE=M022R5

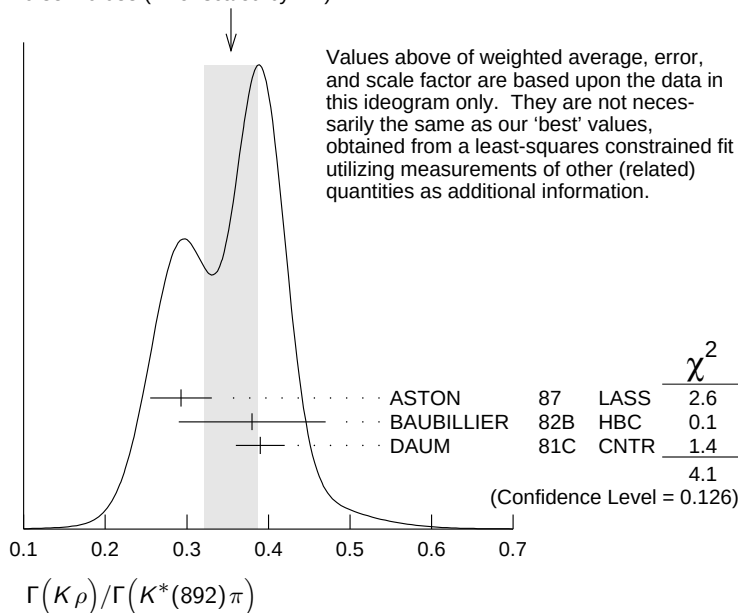
OCCUR=2

 $\Gamma(K\rho)/\Gamma(K\pi)$ **Γ_4/Γ_1**

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
0.174 ± 0.017 OUR FIT	Error includes scale factor of 1.2.			
$0.150^{+0.029}_{-0.017}$ OUR AVERAGE				

NODE=M022R6
NODE=M022R6 **$\Gamma(K\rho)/\Gamma(K^*(892)\pi)$** **$\Gamma_4/\Gamma_2$**

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
0.350 ± 0.031 OUR FIT	Error includes scale factor of 1.4.			
0.354 ± 0.033 OUR AVERAGE	Error includes scale factor of 1.4. See the ideogram below.			
$0.293 \pm 0.032 \pm 0.020$	ASTON	87	LASS	0 11 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$
0.38 ± 0.09	BAUBILLIER	82B	HBC	0 8.25 $K^- p \rightarrow N K_S^0 \pi \pi$
0.39 ± 0.03	DAUM	81C	CNTR	63 $K^- p \rightarrow K^- 2\pi p$

NODE=M022R7
NODE=M022R7WEIGHTED AVERAGE
 0.354 ± 0.033 (Error scaled by 1.4)

$\Gamma(K\omega)/\Gamma(K^*(892)\pi)$ Γ_5/Γ_2

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
0.118±0.034 OUR FIT				
0.10 ±0.04	FIELD	67	HBC	— 3.8 $K^- p$

NODE=M022R8
 NODE=M022R8

 $\Gamma(K\eta)/\Gamma(K^*(892)\pi)$ Γ_7/Γ_2

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
0.006^{+0.014}_{-0.004} OUR FIT	Error includes scale factor of 1.2.			
0.07 ±0.04	FIELD	67	HBC	— 3.8 $K^- p$

NODE=M022R9
 NODE=M022R9

 $\Gamma(K\eta)/\Gamma(K\pi)$ Γ_7/Γ_1

VALUE	CL%	DOCUMENT ID	TECN	CHG	COMMENT
0.0030^{+0.0070}_{-0.0020} OUR FIT		Error includes scale factor of 1.3.			
0 ±0.0056	15	ASTON	88B	LASS	— 11 $K^- p \rightarrow K^- \eta p$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.04	95	AGUILAR-...	71B	HBC	3.9,4.6 $K^- p$
<0.065	16	BASSOMPIE...	69	HBC	5.0 $K^+ p$
<0.02		BISHOP	69	HBC	3.5 $K^+ p$

NODE=M022R10
 NODE=M022R10

 $\Gamma(K^*(892)\pi\pi)/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
0.134±0.022 OUR FIT				
0.12 ±0.04	¹⁷ GOLDBERG	76	HBC	— 3 $K^- p \rightarrow p \bar{K}^0 \pi \pi \pi$

NODE=M022R11
 NODE=M022R11

 $\Gamma(K^*(892)\pi\pi)/\Gamma(K\pi)$ Γ_3/Γ_1

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
0.27±0.05 OUR FIT				
0.21±0.08	^{16,17} JONGEJANS	78	HBC	— 4 $K^- p \rightarrow p \bar{K}^0 \pi \pi \pi$

NODE=M022R12
 NODE=M022R12

 $\Gamma(K\omega\pi)/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE (units 10 ⁻³)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<0.72	95	0	JONGEJANS	78	HBC 4 $K^- p \rightarrow p \bar{K}^0 4\pi$

NODE=M022R13
 NODE=M022R13

¹⁴ From phase shift analysis.

¹⁵ ASTON 88B quote < 0.0092 at CL=95%. We convert this to a central value and 1 sigma error in order to be able to use it in our constrained fit.

¹⁶ Restated by us.

¹⁷ Assuming $\pi\pi$ system has isospin 1, which is supported by the data.

NODE=M022R;LINKAGE=P
 NODE=M022R;LINKAGE=PQ

NODE=M022R;LINKAGE=R
 NODE=M022R;LINKAGE=T

 $K_2^*(1430)$ REFERENCES

NODE=M022

AUBERT	07AK	PR D76 012008	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51908
ALAVI-HARATI	02B	PRL 89 072001	A. Alavi-Harati <i>et al.</i>	(FNAL KTeV Collab.)	REFID=48822
BIRD	89	SLAC-332	P.F. Bird	(SLAC)	REFID=41002
ASTON	88	NP B296 493	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)	REFID=40262
ASTON	88B	PL B201 169	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)	REFID=40281
ASTON	87	NP B292 693	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)	REFID=40234
CARLSMITH	87	PR D36 3502	D. Carlsmith <i>et al.</i>	(EFI, SACL)	REFID=40557
ASTON	84B	NP B247 261	D. Aston <i>et al.</i>	(SLAC, CARL, OTTA)	REFID=22763
BAUBILLIER	84B	ZPHY C26 37	M. Baubillier <i>et al.</i>	(BIRM, CERN, GLAS+)	REFID=22459
BAUBILLIER	82B	NP B202 21	M. Baubillier <i>et al.</i>	(BIRM, CERN, GLAS+)	REFID=22551
CIHANGIR	82	PL 117B 123	S. Cihangir <i>et al.</i>	(FNAL, MINN, ROCH)	REFID=21280
CLELAND	82	NP B208 189	W.E. Cleland <i>et al.</i>	(DURH, GEVA, LAUS+)	REFID=22455
ASTON	81C	PL 106B 235	D. Aston <i>et al.</i>	(SLAC, CARL, OTTA) 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, NIJ+)	REFID=22445
MARTIN	78	NP B134 392	A.D. Martin <i>et al.</i>	(DURH, GEVA)	REFID=22446
BOWLER	77	NP B126 31	M.G. Bowler <i>et al.</i>	(OXF)	REFID=22437
GOLDBERG	76	LNC 17 253	J. Goldberg	(HAIF)	REFID=22742
HENDRICK	76	NP B112 189	K. Hendrickx <i>et al.</i>	(MONS, SACL, PARIS+)	REFID=22743
LAUSCHER	75	NP B86 189	P. Lauscher <i>et al.</i>	(ABCLV Collab.) JP	REFID=22582
MCCUBBIN	75	NP B86 13	N.A. McCubbin, L. Lyons	(OXF)	REFID=22434
DEHM	74	NP B75 47	G. Dehm <i>et al.</i>	(MPIM, BRUX, MONS, CERN)	REFID=22736
LINGLIN	73	NP B55 408	D. Linglin	(CERN)	REFID=22428
AGUILAR-...	71B	PR D4 2583	M. Aguilar-Benitez, R.L. Eisner, J.B. Kinson	(BNL)	REFID=22408
BARNHAM	71C	NP B28 171	K.W.J. Barnham <i>et al.</i>	(BIRM, GLAS)	REFID=22409
CORDS	71	PR D4 1974	D. Cords <i>et al.</i>	(PURD, UCD, IUPU)	REFID=22411
BASSOMPIE...	69	NP B13 189	G. Bassompierre <i>et al.</i>	(CERN, BRUX) JP	REFID=22710
BISHOP	69	NP B9 403	J.M. Bishop <i>et al.</i>	(WISC)	REFID=22485
CRENNELL	69D	PRL 22 487	D.J. Crennell <i>et al.</i>	(BNL)	REFID=22399
DAVIS	69	PRL 23 1071	D.J. Davis <i>et al.</i>	(LRL)	REFID=22400
LIND	69	NP B14 1	V.G. Lind <i>et al.</i>	(LRL) JP	REFID=22404
SCHWEING...	68	PR 166 1317	F. Schweingruber <i>et al.</i>	(ANL, NWES)	REFID=22398
Also		Thesis	F.L. Schweingruber	(NWES, NWES)	REFID=22709
BASSANO	67	PRL 19 968	D. Bassano <i>et al.</i>	(BNL, SYRA)	REFID=22695
FIELD	67	PL 24B 638	J.H. Field <i>et al.</i>	(UCSD)	REFID=22701
BADIER	65C	PL 19 612	J. Badier <i>et al.</i>	(EPOL, SACL, AMST)	REFID=22690

K(1460)

$$I(J^P) = \frac{1}{2}(0^-)$$

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 $K^- p \rightarrow K^- 2\pi p$
~ 1400	¹ BRANDENB...	76B	ASPK	± 13 $K^\pm p \rightarrow K^\pm 2\pi p$
¹ Coupled mainly to $K f_0(1370)$. Decay into $K^*(892)\pi$ seen.				

K(1460) WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
~ 260	DAUM	81C	CNTR	— 63 $K^- p \rightarrow K^- 2\pi p$
~ 250	² BRANDENB...	76B	ASPK	± 13 $K^\pm p \rightarrow K^\pm 2\pi p$
² Coupled mainly to $K f_0(1370)$. Decay into $K^*(892)\pi$ seen.				

K(1460) DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $K^*(892)\pi$	seen
Γ_2 $K\rho$	seen
Γ_3 $K_0^*(1430)\pi$	seen

K(1460) PARTIAL WIDTHS **$\Gamma(K^*(892)\pi)$** **Γ_1**

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
~ 109	DAUM	81C	CNTR 63 $K^- p \rightarrow K^- 2\pi p$

 $\Gamma(K\rho)$ **Γ_2**

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
~ 34	DAUM	81C	CNTR 63 $K^- p \rightarrow K^- 2\pi p$

 $\Gamma(K_0^*(1430)\pi)$ **Γ_3**

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
~ 117	DAUM	81C	CNTR 63 $K^- p \rightarrow K^- 2\pi p$

K(1460) REFERENCES

DAUM	81C	NP B187 1	C. Daum <i>et al.</i>	(AMST, CERN, CRAC, MPIM+)
BRANDENB...	76B	PRL 36 1239	G.W. Brandenburg <i>et al.</i>	(SLAC) JP

NODE=M021

NODE=M021

NODE=M021M

NODE=M021M

NODE=M021M;LINKAGE=A

NODE=M021W

NODE=M021W

NODE=M021W;LINKAGE=A

NODE=M021215;NODE=M021

DESIG=1;OUR EST;→ UNCHECKED ←

DESIG=2;OUR EST;→ UNCHECKED ←

DESIG=3;OUR EST;→ UNCHECKED ←

NODE=M021220

NODE=M021W1
NODE=M021W1NODE=M021W2
NODE=M021W2NODE=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

VALUE (MeV)	DOCUMENT ID	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
~ 1580	OTTER	79	— 10,14,16 $K^- p$

NODE=M039M

 $K_2(1580)$ WIDTH

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 $K^- p$

NODE=M039W

 $K_2(1580)$ DECAY MODES

NODE=M039215;NODE=M039

Mode	Fraction (Γ_i/Γ)
Γ_1 $K^*(892)\pi$	seen
Γ_2 $K_2^*(1430)\pi$	possibly seen

DESIG=1

DESIG=2

 $K_2(1580)$ BRANCHING RATIOS

NODE=M039220

$\Gamma(K^*(892)\pi)/\Gamma_{\text{total}}$					Γ_1/Γ
<i>VALUE</i>	<i>DOCUMENT ID</i>	<i>TECN</i>	<i>CHG</i>	<i>COMMENT</i>	
seen	OTTER	79	HBC	—	10,14,16 $K^- p$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
possibly seen	GULER	11	BELL	$B^+ \rightarrow J/\psi K^+ \pi^+ \pi^-$	

NODE=M039R1
NODE=M039R1

$\Gamma(K_2^*(1430)\pi)/\Gamma_{\text{total}}$						Γ_2/Γ
<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>CHG</u>	<u>COMMENT</u>		
possibly seen	OTTER	79	HBC	—	10,14,16 $K^- p$	

NODE=M039R2
NODE=M039R2 **$K_2(1580)$ REFERENCES**

NODE=M039

GULER	11	PR D83 032005	H. Guler <i>et al.</i>	(BELLE Collab.)
OTTER	79	NP B147 1	G. Otter <i>et al.</i>	(AACH3, BERL, CERN, LOIC+) JP

REFID=53668
REFID=22772

K(1630)

$I(J^P) = \frac{1}{2}(?^?)$

OMITTED FROM SUMMARY TABLE
Seen as a narrow peak, compatible with the experimental resolution, in the invariant mass of the $K_S^0 \pi^+ \pi^-$ system produced in $\pi^- p$ interactions at high momentum transfers.

K(1630) MASS

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
1629±7	~ 75	KARNAUKHOV98	BC	16.0 $\pi^- p \rightarrow$ ($K_S^0 \pi^+ \pi^-$) $X^+ \pi^- X^0$

K(1630) WIDTH

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
16 ⁺¹⁹ ₋₁₆	~ 75	¹ KARNAUKHOV98	BC	16.0 $\pi^- p \rightarrow$ ($K_S^0 \pi^+ \pi^-$) $X^+ \pi^- X^0$

¹ Compatible with an experimental resolution of 14 ± 1 MeV.

K(1630) DECAY MODES

Mode
$\Gamma_1 \quad K_S^0 \pi^+ \pi^-$

K(1630) REFERENCES

KARNAUKHOV 98 PAN 61 203 V.M. Karnaukhov, C. Coca, V.I. Moroz
Translated from YAF 61 252.

K₁(1650)

$I(J^P) = \frac{1}{2}(1^+)$

OMITTED FROM SUMMARY TABLE
This entry contains various peaks in strange meson systems ($K^+ \phi$, $K \pi \pi$) reported in partial-wave analysis in the 1600–1900 mass region.

K₁(1650) MASS

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
1650±50	FRAME	86	OMEG +	13 $K^+ p \rightarrow \phi K^+ p$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
~ 1840	ARMSTRONG	83	OMEG –	18.5 $K^- p \rightarrow 3 K p$
~ 1800	DAUM	81C	CNTR –	63 $K^- p \rightarrow K^- 2 \pi p$

K₁(1650) WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
150±50	FRAME	86	OMEG +	13 $K^+ p \rightarrow \phi K^+ p$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
~ 250	DAUM	81C	CNTR –	63 $K^- p \rightarrow K^- 2 \pi p$

K₁(1650) DECAY MODES

Mode
$\Gamma_1 \quad K \pi \pi$
$\Gamma_2 \quad K \phi$

NODE=M160

NODE=M160

NODE=M160M

NODE=M160M

NODE=M160W

NODE=M160W

NODE=M160W;LINKAGE=A

NODE=M160215;NODE=M160

DESIG=1

NODE=M160

REFID=46371

NODE=M099

NODE=M099

NODE=M099M

NODE=M099M

NODE=M099W

NODE=M099W

NODE=M099215;NODE=M099

DESIG=1

DESIG=2

$K_1(1650)$ REFERENCES

FRAME	86	NP B276 667	D. Frame <i>et al.</i>	(GLAS)
ARMSTRONG	83	NP B221 1	T.A. Armstrong <i>et al.</i>	(BARI, BIRM, CERN+)
DAUM	81C	NP B187 1	C. Daum <i>et al.</i>	(AMST, CERN, CRAC, MPIM+)

NODE=M099

REFID=20569
REFID=22801
REFID=22548

NODE=M095

 $K^*(1680)$

$$I(J^P) = \frac{1}{2}(1^-)$$

 $K^*(1680)$ MASS

NODE=M095M

NODE=M095M

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
1717±27 OUR AVERAGE	Error includes scale factor of 1.4.			
1677±10±32	ASTON	88	LASS	0 11 $K^- p \rightarrow K^- \pi^+ n$
1735±10±20	ASTON	87	LASS	0 11 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1678±64	BIRD	89	LASS	— 11 $K^- p \rightarrow \bar{K}^0 \pi^- p$
1800±70	ETKIN	80	MPS	0 6 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$
~ 1650	ESTABROOKS	78	ASPK	0 13 $K^\pm p \rightarrow K^\pm \pi^\pm n$

 $K^*(1680)$ WIDTH

NODE=M095W

NODE=M095W

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
322±110 OUR AVERAGE	Error includes scale factor of 4.2.			
205± 16±34	ASTON	88	LASS	0 11 $K^- p \rightarrow K^- \pi^+ n$
423± 18±30	ASTON	87	LASS	0 11 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
454±270	BIRD	89	LASS	— 11 $K^- p \rightarrow \bar{K}^0 \pi^- p$
170± 30	ETKIN	80	MPS	0 6 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$
250 to 300	ESTABROOKS	78	ASPK	0 13 $K^\pm p \rightarrow K^\pm \pi^\pm n$

 $K^*(1680)$ DECAY MODES

NODE=M095215;NODE=M095

Mode	Fraction (Γ_i/Γ)
Γ_1 $K\pi$	(38.7±2.5) %
Γ_2 $K\rho$	(31.4 ^{+5.0} _{-2.1}) %
Γ_3 $K^*(892)\pi$	(29.9 ^{+2.2} _{-5.0}) %

DESIG=1

DESIG=3

DESIG=2

CONSTRAINED FIT INFORMATION

An overall fit to 4 branching ratios uses 4 measurements and one constraint to determine 3 parameters. The overall fit has a $\chi^2 = 2.9$ for 2 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta x_i \delta x_j \rangle / (\delta x_i \cdot \delta x_j)$, in percent, from the fit to the branching fractions, $x_i \equiv \Gamma_i/\Gamma_{\text{total}}$. The fit constrains the x_i whose labels appear in this array to sum to one.

x_2	—36	
x_3	—39	—72
	x_1	x_2

 $K^*(1680)$ BRANCHING RATIOS

NODE=M095220

$\Gamma(K\pi)/\Gamma_{\text{total}}$	DOCUMENT ID	TECN	CHG	COMMENT	Γ_1/Γ
0.387±0.026 OUR FIT					
0.388±0.014±0.022	ASTON	88	LASS	0 11 $K^- p \rightarrow K^- \pi^+ n$	

NODE=M095R4
NODE=M095R4

$\Gamma(K\pi)/\Gamma(K^*(892)\pi)$

VALUE	DOCUMENT ID	TECN	CHG	COMMENT

1.30^{+0.23}_{-0.14} OUR FIT**2.8 ± 1.1** ASTON 84 LASS 0 11 $K^- p \rightarrow \bar{K}^0 2\pi n$ $\Gamma(K\rho)/\Gamma(K\pi)$

VALUE	DOCUMENT ID	TECN	CHG	COMMENT

0.81^{+0.14}_{-0.09} OUR FIT**1.2 ± 0.4** ASTON 84 LASS 0 11 $K^- p \rightarrow \bar{K}^0 2\pi n$ $\Gamma(K\rho)/\Gamma(K^*(892)\pi)$

VALUE	DOCUMENT ID	TECN	CHG	COMMENT

1.05^{+0.27}_{-0.11} OUR FIT**0.97 ± 0.09^{+0.30}_{-0.10}** ASTON 87 LASS 0 11 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$ **$K^*(1680)$ REFERENCES**

BIRD	89	SLAC-332	P.F. Bird	(SLAC)
ASTON	88	NP B296 493	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)
ASTON	87	NP B292 693	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)
ASTON	84	PL 149B 258	D. Aston <i>et al.</i>	(SLAC, CARL, OTTA) JP
ETKIN	80	PR D22 42	A. Etkin <i>et al.</i>	(BNL, CUNY) JP
ESTABROOKS	78	NP B133 490	P.G. Estabrooks <i>et al.</i>	(MCGI, CARL, DURH+) JP

 $K_2(1770)$

$$I(J^P) = \frac{1}{2}(2^-)$$

See our mini-review in the 2004 edition of this *Review*, PDG 04. **$K_2(1770)$ MASS**

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

1773 ± 8 ¹ ASTON 93 LASS 11 $K^- p \rightarrow K^- \omega p$

• • • We do not use the following data for averages, fits, limits, etc. • • •

1743 ± 15		TIKHOMIROV 03	SPEC		40.0 $\pi^- C \rightarrow K_S^0 K_S^0 K_L^0 X$
1810 ± 20		FRAME 86	OMEG +		13 $K^+ p \rightarrow \phi K^+ p$
~ 1730		ARMSTRONG 83	OMEG -		18.5 $K^- p \rightarrow 3K p$
~ 1780		² DAUM 81C	CNTR -		63 $K^- p \rightarrow K^- 2\pi p$
1710 ± 15	60	CHUNG 74	HBC -		7.3 $K^- p \rightarrow K^- \omega p$
1767 ± 6		BLIEDEN 72	MMS -		11-16 $K^- p$
1730 ± 20	306	³ FIRESTONE 72B	DBC +		12 $K^+ d$
1765 ± 40		⁴ COLLEY 71	HBC +		10 $K^+ p \rightarrow K 2\pi N$
1740		DENEGRI 71	DBC -		12.6 $K^- d \rightarrow \bar{K} 2\pi d$
1745 ± 20		AGUILAR-...	70C HBC -		4.6 $K^- p$
1780 ± 15		BARTSCH 70C	HBC -		10.1 $K^- p$
1760 ± 15		LUDLAM 70	HBC -		12.6 $K^- p$

¹ From a partial wave analysis of the $K^- \omega$ system.² From a partial wave analysis of the $K^- 2\pi$ system.³ Produced in conjunction with excited deuteron.⁴ Systematic errors added correspond to spread of different fits. **$K_2(1770)$ WIDTH**

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

186 ± 14 ⁵ ASTON 93 LASS 11 $K^- p \rightarrow K^- \omega p$ NODE=M095R2
NODE=M095R2NODE=M095R3
NODE=M095R3NODE=M095R1
NODE=M095R1

NODE=M095

REFID=41002
REFID=40262
REFID=40234
REFID=22689
REFID=22545
REFID=22443

NODE=M023

NODE=M023

NODE=M023M

NODE=M023M

NODE=M023M;LINKAGE=A
NODE=M023M;LINKAGE=B
NODE=M023M;LINKAGE=P
NODE=M023M;LINKAGE=X

NODE=M023W

NODE=M023W

• • • We do not use the following data for averages, fits, limits, etc. • • •

147±70		TIKHOMIROV 03	SPEC	40.0 $\pi^- C \rightarrow K_S^0 K_S^0 K_L^0 X$
140±40		FRAME 86	OMEG +	13 $K^+ p \rightarrow \phi K^+ p$
~ 220		ARMSTRONG 83	OMEG -	18.5 $K^- p \rightarrow 3K p$
~ 210		⁶ DAUM 81C	CNTR -	63 $K^- p \rightarrow K^- 2\pi p$
110±50	60	CHUNG 74	HBC -	7.3 $K^- p \rightarrow K^- \omega p$
100±26		BLIEDEN 72	MMS -	11-16 $K^- p$
210±30	306	⁷ FIRESTONE 72B	DBC +	12 $K^+ d$
90±70		⁸ COLLEY 71	HBC +	10 $K^+ p \rightarrow K 2\pi N$
130		DENEGRI 71	DBC -	12.6 $K^- d \rightarrow \bar{K} 2\pi d$
100±50		AGUILAR-...	70C HBC -	4.6 $K^- p$
138±40		BARTSCH 70C	HBC -	10.1 $K^- p$
50 ⁺⁴⁰ ₋₂₀		LUDLAM 70	HBC -	12.6 $K^- p$

⁵ From a partial wave analysis of the $K^- \omega$ system.

⁶ From a partial wave analysis of the $K^- 2\pi$ system.

⁷ Produced in conjunction with excited deuteron.

⁸ Systematic errors added correspond to spread of different fits.

NODE=M023W;LINKAGE=B

NODE=M023W;LINKAGE=C

NODE=M023W;LINKAGE=P

NODE=M023W;LINKAGE=X

$K_2(1770)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $K \pi \pi$	
Γ_2 $K_2^*(1430) \pi$	dominant
Γ_3 $K^*(892) \pi$	seen
Γ_4 $K f_2(1270)$	seen
Γ_5 $K f_0(980)$	
Γ_6 $K \phi$	seen
Γ_7 $K \omega$	seen

NODE=M023215;NODE=M023

DESIG=1;OUR EST;→ UNCHECKED ←

DESIG=2;OUR EST;→ UNCHECKED ←

DESIG=4;OUR EST;→ UNCHECKED ←

DESIG=9;OUR EST;→ UNCHECKED ←

DESIG=11

DESIG=10

DESIG=8

$K_2(1770)$ BRANCHING RATIOS

$\Gamma(K_2^*(1430)\pi)/\Gamma(K\pi\pi)$ Γ_2/Γ_1
 $(K_2^*(1430) \rightarrow K\pi)$

VALUE	DOCUMENT ID	TECN	CHG	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

~ 0.03	DAUM 81C	CNTR	63 $K^- p \rightarrow K^- 2\pi p$
~ 1.0	⁹ FIRESTONE 72B	DBC +	12 $K^+ d$
<1.0	COLLEY 71	HBC	10 $K^+ p$
0.2 ± 0.2	AGUILAR-...	70C HBC -	4.6 $K^- p$
<1.0	BARTSCH 70C	HBC -	10.1 $K^- p$
1.0	BARBARO-...	69 HBC +	12.0 $K^+ p$

⁹ Produced in conjunction with excited deuteron.

NODE=M023220

NODE=M023R1

NODE=M023R1

NODE=M023R1

$\Gamma(K^*(892)\pi)/\Gamma(K\pi\pi)$ Γ_3/Γ_1

VALUE	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

~ 0.23	DAUM 81C	CNTR	63 $K^- p \rightarrow K^- 2\pi p$

$\Gamma(K f_2(1270))/\Gamma(K\pi\pi)$ Γ_4/Γ_1

VALUE	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

~ 0.74	DAUM 81C	CNTR	63 $K^- p \rightarrow K^- 2\pi p$

$\Gamma(K f_0(980))/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

possibly seen	TIKHOMIROV 03	SPEC	40.0 $\pi^- C \rightarrow K_S^0 K_S^0 K_L^0 X$

NODE=M023R1;LINKAGE=P

NODE=M023R3

NODE=M023R3

NODE=M023R4

NODE=M023R4

NODE=M023R4

NODE=M023R6

NODE=M023R6

$\Gamma(K\phi)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
seen	ARMSTRONG 83	OMEG	—	$18.5 K^- p \rightarrow K^- \phi N$

NODE=M023R5
 NODE=M023R5

 $\Gamma(K\omega)/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
seen	OTTER 81	HBC	±	$8.25, 10, 16 K^\pm p$
seen	CHUNG 74	HBC	—	$7.3 K^- p \rightarrow K^- \omega p$

NODE=M023R2
 NODE=M023R2

 $K_2(1770)$ REFERENCES

PDG 04	PL B592 1	S. Eidelman <i>et al.</i>	(PDG Collab.)
TIKHOMIROV 03	PAN 66 828	G.D. Tikhomirov <i>et al.</i>	
	Translated from YAF 66 860.		
ASTON 93	PL B308 186	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)
FRAME 86	NP B276 667	D. Frame <i>et al.</i>	(GLAS)
ARMSTRONG 83	NP B221 1	T.A. Armstrong <i>et al.</i>	(BARI, BIRM, CERN+)
DAUM 81C	NP B187 1	C. Daum <i>et al.</i>	(AMST, CERN, CRAC, MPIM+)
OTTER 81	NP B181 1	G. Otter	(AACH3, BERL, LOIC, VIEN, BIRM+)
CHUNG 74	PL 51B 413	S.U. Chung <i>et al.</i>	(BNL)
BLIEDEN 72	PL 39B 668	H.R. Blieden <i>et al.</i>	(STON, NEAS)
FIRESTONE 72B	PR D5 505	A. Firestone <i>et al.</i>	(LBL)
COLLEY 71	NP B26 71	D.C. Colley <i>et al.</i>	(BIRM, GLAS)
DENEGRI 71	NP B28 13	D. Denegri <i>et al.</i>	(JHU) JP
AGUILAR-... 70C	PRL 25 54	M. Aguilar-Benitez <i>et al.</i>	(BNL)
BARTSCH 70C	PL 33B 186	J. Bartsch <i>et al.</i>	(AACH, BERL, CERN+)
LUDLAM 70	PR D2 1234	T. Ludlam, J. Sandweiss, A.J. Slaughter	(YALE)
BARBARO-... 69	PRL 22 1207	A. Barbaro-Galtieri <i>et al.</i>	(LRL)

NODE=M023

REFID=49653
 REFID=49423

REFID=43597
 REFID=20569
 REFID=22801
 REFID=22548
 REFID=22549
 REFID=22735
 REFID=22788
 REFID=22506
 REFID=22785
 REFID=22497
 REFID=22782
 REFID=22783
 REFID=22784
 REFID=22483

NODE=M060

 $K_3^*(1780)$

$$I(J^P) = \frac{1}{2}(3^-)$$

 $K_3^*(1780)$ MASS

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	+
1776 ± 26		³ BRANDENB...	76D	ASPK	0 10 $K^+ p \rightarrow K^0 \pi^+ p$
					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 $K^- p \rightarrow K^- \pi^+ n$

NODE=M060M

¹ From energy-independent partial-wave analysis.² From a fit to Y_6^2 moment. $J^P = 3^-$ found.³ Confirmed by phase shift analysis of ESTABROOKS 78, yields $J^P = 3^-$.⁴ From a partial wave amplitude analysis.⁵ From a fit to the Y_6^0 moment.

NODE=M060M;LINKAGE=K

NODE=M060M;LINKAGE=M

NODE=M060M;LINKAGE=A

NODE=M060M;LINKAGE=F

NODE=M060M;LINKAGE=J

 $K_3^*(1780)$ WIDTH

NODE=M060W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
159±21 OUR AVERAGE		Error includes scale factor of 1.3. See the ideogram below.			
203±30± 8		⁶ ASTON	88	LASS	0 11 $K^- p \rightarrow K^- \pi^+ n$
171±42±20		⁶ ASTON	87	LASS	0 11 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$
135±22		⁷ BALDI	76	SPEC	+ 10 $K^+ p \rightarrow K^0 \pi^+ p$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
187±31±20	6111	⁸ BIRD	89	LASS	- 11 $K^- p \rightarrow \bar{K}^0 \pi^- p$
193 ⁺⁵¹ ₋₃₇		ASTON	88B	LASS	- 11 $K^- p \rightarrow K^- \eta p$
99±30	300	BAUBILLIER	84B	HBC	- 8.25 $K^- p \rightarrow \bar{K}^0 \pi^- p$
~ 130		BAUBILLIER	82B	HBC	0 8.25 $K^- p \rightarrow K_S^0 2\pi N$
191±24	2060	CLELAND	82	SPEC	± 50 $K^+ p \rightarrow K_S^0 \pi^\pm p$
225±60		⁹ ASTON	81D	LASS	0 11 $K^- p \rightarrow K^- \pi^+ n$
~ 80	190	TOAFF	81	HBC	- 6.5 $K^- p \rightarrow \bar{K}^0 \pi^- p$
240±50		ETKIN	80	MPS	0 6 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^-$
181±44		¹⁰ BEUSCH	78	OMEG	10 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$
96±31		CHUNG	78	MPS	0 6 $K^- p \rightarrow K^- \pi^+ n$
270±70		¹¹ BRANDENB...	76D	ASPK	0 13 $K^\pm p \rightarrow K^\pm \pi^\mp N$

⁶ From energy-independent partial-wave analysis.

⁷ From a fit to Y_6^2 moment. $J^P = 3^-$ found.

⁸ From a partial wave amplitude analysis.

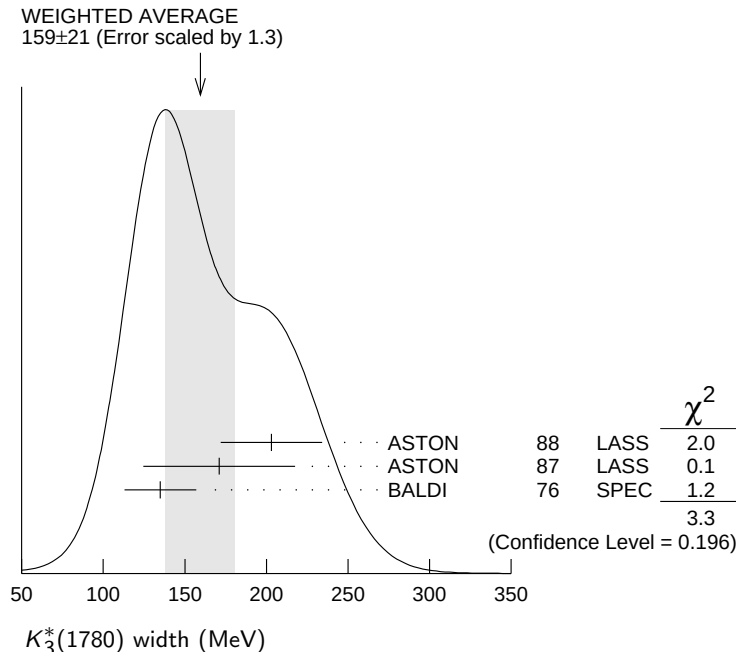
⁹ From a fit to Y_6^0 moment.

¹⁰ Errors enlarged by us to $4\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.

¹¹ ESTABROOKS 78 find that BRANDENBURG 76D data are consistent with 175 MeV width. Not averaged.

NODE=M060W

NODE=M060W;LINKAGE=K
 NODE=M060W;LINKAGE=M
 NODE=M060W;LINKAGE=F
 NODE=M060W;LINKAGE=J
 NODE=M060W;LINKAGE=D
 NODE=M060W;LINKAGE=E



$K_3^*(1780)$ DECAY MODES

NODE=M060215;NODE=M060

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 $K\rho$	(31 ± 9) %	DESIG=3
Γ_2 $K^*(892)\pi$	(20 ± 5) %	DESIG=2
Γ_3 $K\pi$	(18.8 ± 1.0) %	DESIG=1
Γ_4 $K\eta$	(30 ± 13) %	DESIG=6
Γ_5 $K_2^*(1430)\pi$	< 16 %	95% DESIG=4

CONSTRAINED FIT INFORMATION

An overall fit to 3 branching ratios uses 4 measurements and one constraint to determine 4 parameters. The overall fit has a $\chi^2 = 0.0$ for 1 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta x_i \delta x_j \rangle / (\delta x_i \cdot \delta x_j)$, in percent, from the fit to the branching fractions, $x_i \equiv \Gamma_i / \Gamma_{\text{total}}$. The fit constrains the x_i whose labels appear in this array to sum to one.

x_2	85		
x_3	18	21	
x_4	-98	-94	-27
	x_1	x_2	x_3

$K_3^*(1780)$ BRANCHING RATIOS

NODE=M060220

$\Gamma(K\rho)/\Gamma(K^*(892)\pi)$

 Γ_1/Γ_2

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
1.52±0.23 OUR FIT				
1.52±0.21±0.10	ASTON	87	LASS	0 11 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$

NODE=M060R5
NODE=M060R5

$\Gamma(K^*(892)\pi)/\Gamma(K\pi)$

 Γ_2/Γ_3

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
1.09±0.26 OUR FIT				
1.09±0.26	ASTON	84B	LASS	0 11 $K^- p \rightarrow \bar{K}^0 2\pi n$

NODE=M060R7
NODE=M060R7

$\Gamma(K\pi)/\Gamma_{\text{total}}$

 Γ_3/Γ

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
0.188±0.010 OUR FIT				
0.188±0.010 OUR AVERAGE				
0.187±0.008±0.008	ASTON	88	LASS	0 11 $K^- p \rightarrow K^- \pi^+ n$
0.19 ±0.02	ESTABROOKS	78	ASPK	0 13 $K^\pm p \rightarrow K\pi N$

NODE=M060R4
NODE=M060R4

$\Gamma(K\eta)/\Gamma(K\pi)$

 Γ_4/Γ_3

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
1.6 ±0.7 OUR FIT				
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.41±0.050	¹² BIRD	89	LASS	- 11 $K^- p \rightarrow \bar{K}^0 \pi^- p$
0.50±0.18	ASTON	88B	LASS	- 11 $K^- p \rightarrow K^- \eta p$

NODE=M060R8
NODE=M060R8

¹² This result supersedes ASTON 88B.

NODE=M060R8;LINKAGE=H

$\Gamma(K_2^*(1430)\pi)/\Gamma(K^*(892)\pi)$

 Γ_5/Γ_2

VALUE	CL%	DOCUMENT ID	TECN	CHG	COMMENT
<0.78	95	ASTON	87	LASS	0 11 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$

NODE=M060R6
NODE=M060R6

$K_3^*(1780)$ REFERENCES

NODE=M060

BIRD	89	SLAC-332	P.F. Bird	(SLAC)	REFID=41002
ASTON	88	NP B296 493	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)	REFID=40262
ASTON	88B	PL B201 169	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS) JP	REFID=40281
ASTON	87	NP B292 693	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)	REFID=40234
ASTON	84B	NP B247 261	D. Aston <i>et al.</i>	(SLAC, CARL, OTTA)	REFID=22763
BAUBILLIER	84B	ZPHY C26 37	M. Baubillier <i>et al.</i>	(BIRM, CERN, GLAS+)	REFID=22459
BAUBILLIER	82B	NP B202 21	M. Baubillier <i>et al.</i>	(BIRM, CERN, GLAS+)	REFID=22551
CLELAND	82	NP B208 189	W.E. Cleland <i>et al.</i>	(DURH, GEVA, LAUS+)	REFID=22455
ASTON	81D	PL 99B 502	D. Aston <i>et al.</i>	(SLAC, CARL, OTTA) JP	REFID=22820
TOAFF	81	PR D23 1500	S. Toaff <i>et al.</i>	(ANL, KANS)	REFID=22454
ETKIN	80	PR D22 42	A. Etkin <i>et al.</i>	(BNL, CUNY) JP	REFID=22545
BEUSCH	78	PL 74B 282	W. Beusch <i>et al.</i>	(CERN, AACH3, ETH) JP	REFID=22537
CHUNG	78	PRL 40 355	S.U. Chung <i>et al.</i>	(BNL, BRAN, CUNY+) JP	REFID=22814
ESTABROOKS	78	NP B133 490	P.G. Estabrooks <i>et al.</i>	(MCGI, CARL, DURH+) JP	REFID=22443
Also		PR D17 658	P.G. Estabrooks <i>et al.</i>	(MCGI, CARL, DURH+)	REFID=22444
BALDI	76	PL 63B 344	R. Baldi <i>et al.</i>	(GEVA) JP	REFID=22807
BRANDENB...	76D	PL 60B 478	G.W. Brandenburg <i>et al.</i>	(SLAC) JP	REFID=22808

$K_2(1820)$

$$I(J^P) = \frac{1}{2}(2^-)$$

See our mini-review in the 2004 edition of this *Review* (PDG 04) under $K_2(1770)$.

NODE=M146

NODE=M146

NODE=M146M

NODE=M146M

NODE=M146M;LINKAGE=A
NODE=M146M;LINKAGE=C

NODE=M146W

NODE=M146W

NODE=M146W;LINKAGE=B
NODE=M146W;LINKAGE=C

NODE=M146215;NODE=M146

DESIG=5
DESIG=1;OUR EVAL;→ UNCHECKED ←
DESIG=2;OUR EVAL;→ UNCHECKED ←
DESIG=3;OUR EVAL;→ UNCHECKED ←
DESIG=6;OUR EVAL;→ UNCHECKED ←

NODE=M146220

NODE=M146R1
NODE=M146R1

NODE=M146R2
NODE=M146R2

NODE=M146R3
NODE=M146R3

NODE=M146

REFID=49653
REFID=43597
REFID=22548

$K_2(1820)$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
1816±13	¹ ASTON	93 LASS	11 $K^- p \rightarrow K^- \omega p$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
~ 1840	² DAUM	81C CNTR	63 $K^- p \rightarrow K^- 2\pi p$
¹ From a partial wave analysis of the $K^- \omega$ system.			
² From a partial wave analysis of the $K^- 2\pi$ system.			

$K_2(1820)$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
276±35	³ ASTON	93 LASS	11 $K^- p \rightarrow K^- \omega p$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
~ 230	⁴ DAUM	81C CNTR	63 $K^- p \rightarrow K^- 2\pi p$
³ From a partial wave analysis of the $K^- \omega$ system.			
⁴ From a partial wave analysis of the $K^- 2\pi$ system.			

$K_2(1820)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $K \pi \pi$	
Γ_2 $K_2^*(1430) \pi$	seen
Γ_3 $K^*(892) \pi$	seen
Γ_4 $K f_2(1270)$	seen
Γ_5 $K \omega$	seen

$K_2(1820)$ BRANCHING RATIOS

$\Gamma(K_2^*(1430)\pi)/\Gamma(K\pi\pi)$				Γ_2/Γ_1
VALUE	DOCUMENT ID	TECN	COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
~ 0.77	DAUM	81C CNTR	63 $K^- p \rightarrow \bar{K} 2\pi p$	
$\Gamma(K^*(892)\pi)/\Gamma(K\pi\pi)$				Γ_3/Γ_1
VALUE	DOCUMENT ID	TECN	COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
~ 0.05	DAUM	81C CNTR	63 $K^- p \rightarrow \bar{K} 2\pi p$	
$\Gamma(K f_2(1270))/\Gamma(K\pi\pi)$				Γ_4/Γ_1
VALUE	DOCUMENT ID	TECN	COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
~ 0.18	DAUM	81C CNTR	63 $K^- p \rightarrow \bar{K} 2\pi p$	

$K_2(1820)$ REFERENCES

PDG	04	PL B592 1	S. Eidelman <i>et al.</i>	(PDG Collab.)
ASTON	93	PL B308 186	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)
DAUM	81C	NP B187 1	C. Daum <i>et al.</i>	(AMST, CERN, CRAC, MPIM+)

K(1830)

$$I(J^P) = \frac{1}{2}(0^-)$$

OMITTED FROM SUMMARY TABLE
Seen in partial-wave analysis of $K^- \phi$ system. Needs confirmation.

K(1830) MASS

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
~ 1830	ARMSTRONG 83	OMEG	-	18.5 $K^- p \rightarrow 3Kp$

K(1830) WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
~ 250	ARMSTRONG 83	OMEG	-	18.5 $K^- p \rightarrow 3Kp$

K(1830) DECAY MODES

Mode
$\Gamma_1 \quad K\phi$

K(1830) REFERENCES

ARMSTRONG 83	NP B221 1	T.A. Armstrong <i>et al.</i>	(BARI, BIRM, CERN+) JP

K₀^{*}(1950)

$$I(J^P) = \frac{1}{2}(0^+)$$

OMITTED FROM SUMMARY TABLE
Seen in partial-wave analysis of the $K^- \pi^+$ system. Needs confirmation.

K₀^{*}(1950) MASS

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	$Kp \rightarrow K^- \pi^+ n$
1820±40	³ ANISOVICH	97C	RVUE	11 $K^- p \rightarrow K^- \pi^+ n$

¹We take the central value of the two solutions and the larger error given.
²S-matrix pole. Using ASTON 88 and assuming $K_0^*(800)$, $K_0^*(1430)$.
³T-matrix pole. Reanalysis of ASTON 88 data.

K₀^{*}(1950) WIDTH

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	$Kp \rightarrow K^- \pi^+ n$
250±100	⁶ ANISOVICH	97C	RVUE	11 $K^- p \rightarrow K^- \pi^+ n$

⁴We take the central value of the two solutions and the larger error given.
⁵S-matrix pole. Using ASTON 88 and assuming $K_0^*(800)$, $K_0^*(1430)$.
⁶T-matrix pole. Reanalysis of ASTON 88 data.

K₀^{*}(1950) DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad K\pi$	(52±14) %

NODE=M088

NODE=M088

NODE=M088M

NODE=M088M

NODE=M088W

NODE=M088W

NODE=M088215;NODE=M088

DESIG=1

NODE=M088

REFID=22801

NODE=M134

NODE=M134

NODE=M134M

NODE=M134M

NODE=M134M;LINKAGE=A
NODE=M134M;LINKAGE=ZU
NODE=M134M;LINKAGE=A1

NODE=M134W

NODE=M134W

NODE=M134W;LINKAGE=A
NODE=M134W;LINKAGE=ZU
NODE=M134W;LINKAGE=A1

NODE=M134215;NODE=M134

DESIG=1

$K_0^*(1950)$ BRANCHING RATIOS

$\Gamma(K\pi)/\Gamma_{\text{total}}$						Γ_1/Γ
VALUE	DOCUMENT ID	TECN	CHG	COMMENT		
$0.52 \pm 0.08 \pm 0.12$	⁷ ASTON	88	LASS	0	11 $K^- p \rightarrow K^- \pi^+ n$	
• • • We do not use the following data for averages, fits, limits, etc. • • •						
~ 0.60	⁸ ZHOU	06	RVUE		$K p \rightarrow K^- \pi^+ n$	
⁷ We take the central value of the two solutions and the larger error given.						
⁸ S-matrix pole. Using ASTON 88 and assuming $K_0^*(800)$, $K_0^*(1430)$.						

NODE=M134220

NODE=M134R1
NODE=M134R1NODE=M134R1;LINKAGE=A
NODE=M134R1;LINKAGE=ZU **$K_0^*(1950)$ REFERENCES**

ZHOU	06	NP A775 212	Z.Y. Zhou, H.Q. Zheng
ANISOVICH	97C	PL B413 137	A.V. Anisovich, A.V. Sarantsev
ASTON	88	NP B296 493	D. Aston <i>et al.</i> (SLAC, NAGO, CINC, INUS)

NODE=M134

REFID=51198
REFID=45815
REFID=40262

NODE=M104

 $K_2^*(1980)$

$$I(J^P) = \frac{1}{2}(2^+)$$

OMITTED FROM SUMMARY TABLE

Needs confirmation.

NODE=M104

 $K_2^*(1980)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
$1973 \pm 8 \pm 25$		ASTON	87	LASS	0
• • • We do not use the following data for averages, fits, limits, etc. • • •					
2020 ± 20		TIKHOMIROV	03	SPEC	40.0 $\pi^- C \rightarrow K_S^0 K_S^0 K_L^0 X$
1978 ± 40	241 ± 47	BIRD	89	LASS	—
					11 $K^- p \rightarrow \bar{K}^0 \pi^- p$

NODE=M104M

NODE=M104M

 $K_2^*(1980)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
$373 \pm 33 \pm 60$		ASTON	87	LASS	0
• • • We do not use the following data for averages, fits, limits, etc. • • •					
180 ± 70		TIKHOMIROV	03	SPEC	40.0 $\pi^- C \rightarrow K_S^0 K_S^0 K_L^0 X$
398 ± 47	241 ± 47	BIRD	89	LASS	—
					11 $K^- p \rightarrow \bar{K}^0 \pi^- p$

NODE=M104W

NODE=M104W

 $K_2^*(1980)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $K^*(892)\pi$	possibly seen
Γ_2 $K\rho$	possibly seen
Γ_3 $K f_2(1270)$	possibly seen

NODE=M104215;NODE=M104

DESIG=2

DESIG=3

DESIG=4

 $K_2^*(1980)$ BRANCHING RATIOS

$\Gamma(K^*(892)\pi)/\Gamma_{\text{total}}$						Γ_1/Γ
VALUE	DOCUMENT ID	TECN	CHG	COMMENT		
possibly seen	GULER	11	BELL	$B^+ \rightarrow J/\psi K^+ \pi^+ \pi^-$		
$\Gamma(K\rho)/\Gamma_{\text{total}}$						Γ_2/Γ
VALUE	DOCUMENT ID	TECN	CHG	COMMENT		
possibly seen	GULER	11	BELL	$B^+ \rightarrow J/\psi K^+ \pi^+ \pi^-$		
$\Gamma(K\rho)/\Gamma(K^*(892)\pi)$						Γ_2/Γ_1
VALUE	DOCUMENT ID	TECN	CHG	COMMENT		
$1.49 \pm 0.24 \pm 0.09$	ASTON	87	LASS	0	11 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$	

NODE=M104220

NODE=M104R01
NODE=M104R01NODE=M104R02
NODE=M104R02NODE=M104R1
NODE=M104R1

$\Gamma(K f_2(1270))/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
possibly seen	TIKHOMIROV 03	SPEC	$40.0 \pi^- C \rightarrow K_S^0 K_S^0 K_L^0 X$

NODE=M104R3
 NODE=M104R3

 $K_2^*(1980)$ REFERENCES

GULER	11	PR D83 032005	H. Guler <i>et al.</i>	(BELLE Collab.)
TIKHOMIROV	03	PAN 66 828	G.D. Tikhomirov <i>et al.</i>	
BIRD	89	Translated from YAF 66 860	P.F. Bird	(SLAC)
ASTON	87	NP B292 693	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)

NODE=M104

REFID=53668
 REFID=49423

REFID=41002
 REFID=40234

NODE=M035

 $K_4^*(2045)$

$$I(J^P) = \frac{1}{2}(4^+)$$

 $K_4^*(2045)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
2045 ± 9 OUR AVERAGE		Error includes scale factor of 1.1.			
2062 ± 14 ± 13		¹ ASTON	86	LASS	0 11 $K^- p \rightarrow K^- \pi^+ n$
2039 ± 10	400	^{2,3} CLELAND	82	SPEC	± 50 $K^+ p \rightarrow K_S^0 \pi^\pm p$
2070 ⁺¹⁰⁰ - 40		⁴ ASTON	81C	LASS	0 11 $K^- p \rightarrow K^- \pi^+ n$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
2079 ± 7	431	TORRES	86	MPSF	400 $pA \rightarrow 4K X$
2088 ± 20	650	BAUBILLIER	82	HBC	— 8.25 $K^- p \rightarrow K_S^0 \pi^- p$
2115 ± 46	488	CARMONY	77	HBC	0 9 $K^+ d \rightarrow K^+ \pi's X$

¹ From a fit to all moments.² From a fit to 8 moments.³ Number of events evaluated by us.⁴ From energy-independent partial-wave analysis.

NODE=M035M

NODE=M035M

NODE=M035M;LINKAGE=E
 NODE=M035M;LINKAGE=B
 NODE=M035M;LINKAGE=W
 NODE=M035M;LINKAGE=D

 $K_4^*(2045)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
198 ± 30 OUR AVERAGE					
221 ± 48 ± 27		⁵ ASTON	86	LASS	0 11 $K^- p \rightarrow K^- \pi^+ n$
189 ± 35	400	^{6,7} CLELAND	82	SPEC	± 50 $K^+ p \rightarrow K_S^0 \pi^\pm p$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
61 ± 58	431	TORRES	86	MPSF	400 $pA \rightarrow 4K X$
170 ⁺¹⁰⁰ - 50	650	BAUBILLIER	82	HBC	— 8.25 $K^- p \rightarrow K_S^0 \pi^- p$
240 ⁺⁵⁰⁰ - 100		⁸ ASTON	81C	LASS	0 11 $K^- p \rightarrow K^- \pi^+ n$
300 ± 200		CARMONY	77	HBC	0 9 $K^+ d \rightarrow K^+ \pi's X$

⁵ From a fit to all moments.⁶ From a fit to 8 moments.⁷ Number of events evaluated by us.⁸ From energy-independent partial-wave analysis.

NODE=M035W

NODE=M035W

NODE=M035W;LINKAGE=E
 NODE=M035W;LINKAGE=B
 NODE=M035W;LINKAGE=W
 NODE=M035W;LINKAGE=D

 $K_4^*(2045)$ DECAY MODES

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) %

NODE=M035215;NODE=M035

DESIG=1

DESIG=2

DESIG=5

DESIG=3

DESIG=4

DESIG=6

DESIG=7

$K_4^*(2045)$ BRANCHING RATIOS

NODE=M035220

$\Gamma(K\pi)/\Gamma_{\text{total}}$						Γ_1/Γ
VALUE	DOCUMENT ID	TECN	CHG	COMMENT		
0.099±0.012	ASTON	88	LASS	0	11 $K^- p \rightarrow K^- \pi^+ n$	

NODE=M035R1
NODE=M035R1

$\Gamma(K^*(892)\pi\pi)/\Gamma(K\pi)$						Γ_2/Γ_1
VALUE	DOCUMENT ID	TECN	CHG	COMMENT		
0.89±0.53	BAUBILLIER	82	HBC	—	8.25 $K^- p \rightarrow p K_S^0 3\pi$	

NODE=M035R2
NODE=M035R2

$\Gamma(K^*(892)\pi\pi\pi)/\Gamma(K\pi)$						Γ_3/Γ_1
VALUE	DOCUMENT ID	TECN	CHG	COMMENT		
0.75±0.49	BAUBILLIER	82	HBC	—	8.25 $K^- p \rightarrow p K_S^0 3\pi$	

NODE=M035R5
NODE=M035R5

$\Gamma(\rho K\pi)/\Gamma(K\pi)$						Γ_4/Γ_1
VALUE	DOCUMENT ID	TECN	CHG	COMMENT		
0.58±0.32	BAUBILLIER	82	HBC	—	8.25 $K^- p \rightarrow p K_S^0 3\pi$	

NODE=M035R3
NODE=M035R3

$\Gamma(\omega K\pi)/\Gamma(K\pi)$						Γ_5/Γ_1
VALUE	DOCUMENT ID	TECN	CHG	COMMENT		
0.50±0.30	BAUBILLIER	82	HBC	—	8.25 $K^- p \rightarrow p K_S^0 3\pi$	

NODE=M035R4
NODE=M035R4

$\Gamma(\phi K\pi)/\Gamma_{\text{total}}$						Γ_6/Γ
VALUE	DOCUMENT ID	TECN	COMMENT			
0.028±0.014	⁹ TORRES	86	MPSF	400 $pA \rightarrow 4KX$		

NODE=M035R6
NODE=M035R6

$\Gamma(\phi K^*(892))/\Gamma_{\text{total}}$						Γ_7/Γ
VALUE	DOCUMENT ID	TECN	COMMENT			
0.014±0.007	⁹ TORRES	86	MPSF	400 $pA \rightarrow 4KX$		

NODE=M035R7
NODE=M035R7⁹ Error determination is model dependent.

NODE=M035R;LINKAGE=A

 $K_4^*(2045)$ REFERENCES

NODE=M035

ASTON	88	NP B296 493	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)
ASTON	86	PL B180 308	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)
TORRES	86	PR D34 707	S. Torres <i>et al.</i>	(VPI, ARIZ, FNAL, FSU+)
BAUBILLIER	82	PL 118B 447	M. Baubillier <i>et al.</i>	(BIRM, CERN, GLAS+)
CLELAND	82	NP B208 189	W.E. Cleland <i>et al.</i>	(DURH, GEVA, LAUS+)
ASTON	81C	PL 106B 235	D. Aston <i>et al.</i>	(SLAC, CARL, OTTA) JP
CARMONY	77	PR D16 1251	D.D. Carmony <i>et al.</i>	(PURD, UCD, IUPU)

REFID=40262
REFID=22462
REFID=22845
REFID=22842
REFID=22455
REFID=22821
REFID=22811 **$K_2(2250)$**

$$I(J^P) = \frac{1}{2}(2^-)$$

NODE=M040

OMITTED FROM SUMMARY TABLE

This entry contains various peaks in strange meson systems reported in the 2150–2260 MeV region, as well as enhancements seen in the antihyperon-nucleon system, either in the mass spectra or in the $J^P = 2^-$ wave.

NODE=M040

 $K_2(2250)$ MASS

NODE=M040M

VALUE (MeV)	EVS	DOCUMENT ID	TECN	CHG	COMMENT
2247±17 OUR AVERAGE					
2200±40		¹ ARMSTRONG	83C	OMEG	— 18 $K^- p \rightarrow \Lambda \bar{p} X$
2235±50		¹ BAUBILLIER	81	HBC	— 8 $K^- p \rightarrow \Lambda \bar{p} X$
2260±20		¹ CLELAND	81	SPEC	± 50 $K^+ p \rightarrow \Lambda \bar{p} X$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
2280±20		TIKHOMIROV	03	SPEC	40.0 $\pi^- C \rightarrow K_S^0 K_S^0 K_L^0 X$
2147±4	37	CHLIAPNIK...	79	HBC	+ 32 $K^+ p \rightarrow \bar{\Lambda} p X$
2240±20	20	LISSAUER	70	HBC	9 $K^+ p$

NODE=M040M

$1 J^P = 2^-$ from moments analysis.

NODE=M040M;LINKAGE=Q

$K_2(2250)$ WIDTH

NODE=M040W

NODE=M040W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT	
180±30 OUR AVERAGE		Error includes scale factor of 1.4.				
150±30		² ARMSTRONG 83c	OMEG	—	18 $K^- p \rightarrow \Lambda \bar{p} X$	
210±30		² CLELAND 81	SPEC	±	50 $K^+ p \rightarrow \Lambda \bar{p} X$	
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●						
180±60		TIKHOMIROV 03	SPEC		40.0 $\pi^- C \rightarrow K_S^0 K_S^0 K_L^0 X$	
~ 200		² BAUBILLIER 81	HBC	—	8 $K^- p \rightarrow \Lambda \bar{p} X$	
~ 40	37	CHLIAPNIK...	79	HBC	+	32 $K^+ p \rightarrow \bar{\Lambda} p X$
80±20	20	LISSAUER 70	HBC		9 $K^+ p$	
$2 J^P = 2^-$ from moments analysis.						

NODE=M040W;LINKAGE=Q

$K_2(2250)$ DECAY MODES

NODE=M040215;NODE=M040

Mode	
Γ_1	$K \pi \pi$
Γ_2	$K f_2(1270)$
Γ_3	$K^*(892) f_0(980)$
Γ_4	$p \bar{\Lambda}$

DESIG=1
DESIG=3
DESIG=4
DESIG=2

$K_2(2250)$ REFERENCES

NODE=M040

REFID=49423

REFID=22852
REFID=22850
REFID=22851
REFID=22849
REFID=22847

NODE=M090

$K_3(2320)$

$I(J^P) = \frac{1}{2}(3^+)$

OMITTED FROM SUMMARY TABLE
Seen in the $J^P = 3^+$ wave of the antihyperon-nucleon system.
Needs confirmation.

NODE=M090

$K_3(2320)$ MASS

NODE=M090M

NODE=M090M

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
2324±24 OUR AVERAGE				
2330±40	¹ ARMSTRONG 83c	OMEG	—	18 $K^- p \rightarrow \Lambda \bar{p} X$
2320±30	¹ CLELAND 81	SPEC	±	50 $K^+ p \rightarrow \Lambda \bar{p} X$
$1 J^P = 3^+$ from moments analysis.				

NODE=M090M;LINKAGE=P

$K_3(2320)$ WIDTH

NODE=M090W

NODE=M090W

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
150±30	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

$K_3(2320)$ DECAY MODES

NODE=M090215;NODE=M090

Mode	
Γ_1	$p \bar{\Lambda}$

DESIG=1

$K_3(2320)$ REFERENCES

NODE=M090

REFID=22852
REFID=22851

ARMSTRONG 83c	NP B227 365	T.A. Armstrong <i>et al.</i>	(BARI, BIRM, CERN+)
CLELAND 81	NP B184 1	W.E. Cleland <i>et al.</i>	(PITT, GEVA, LAUS+)

$K_5^*(2380)$

$$I(J^P) = \frac{1}{2}(5^-)$$

OMITTED FROM SUMMARY TABLE
Needs confirmation. **$K_5^*(2380)$ MASS**

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
$2382 \pm 14 \pm 19$	¹ ASTON	86	LASS	0 11 $K^- p \rightarrow K^- \pi^+ n$

¹ From a fit to all the moments. **$K_5^*(2380)$ WIDTH**

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
$178 \pm 37 \pm 32$	² ASTON	86	LASS	0 11 $K^- p \rightarrow K^- \pi^+ n$

² From a fit to all the moments. **$K_5^*(2380)$ DECAY MODES**

Mode	Fraction (Γ_i/Γ)
Γ_1 $K \pi$	$(6.1 \pm 1.2) \%$

 $K_5^*(2380)$ BRANCHING RATIOS

$\Gamma(K\pi)/\Gamma_{\text{total}}$					Γ_1/Γ
VALUE	DOCUMENT ID	TECN	CHG	COMMENT	
0.061 ± 0.012	ASTON	88	LASS	0 11 $K^- p \rightarrow K^- \pi^+ n$	

 $K_5^*(2380)$ REFERENCES

ASTON	88	NP B296 493	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)
ASTON	86	PL B180 308	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)

 $K_4(2500)$

$$I(J^P) = \frac{1}{2}(4^-)$$

OMITTED FROM SUMMARY TABLE
Needs confirmation. **$K_4(2500)$ MASS**

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
2490 ± 20	¹ CLELAND	81	SPEC	$\pm$ 50 $K^+ p \rightarrow \Lambda \bar{p}$

¹ $J^P = 4^-$ from moments analysis. **$K_4(2500)$ WIDTH**

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
~ 250	² CLELAND	81	SPEC	$\pm$ 50 $K^+ p \rightarrow \Lambda \bar{p}$

² $J^P = 4^-$ from moments analysis. **$K_4(2500)$ DECAY MODES**

Mode	
Γ_1 $p \bar{\Lambda}$	

 $K_4(2500)$ REFERENCES

CLELAND	81	NP B184 1	W.E. Cleland <i>et al.</i>	(PITT, GEVA, LAUS+)

NODE=M098

NODE=M098

NODE=M098M

NODE=M098M

NODE=M098M;LINKAGE=E

NODE=M098W

NODE=M098W

NODE=M098W;LINKAGE=E

NODE=M098215;NODE=M098

DESIG=1

NODE=M098220

NODE=M098R1
NODE=M098R1

NODE=M098

REFID=40262
REFID=22462

NODE=M091

NODE=M091

NODE=M091M

NODE=M091M

NODE=M091M;LINKAGE=R

NODE=M091W

NODE=M091W

NODE=M091W;LINKAGE=R

NODE=M091215;NODE=M091

DESIG=1

NODE=M091

REFID=22851

K(3100)

$$I^G(J^{PC}) = ?^?(?^{??})$$

OMITTED FROM SUMMARY TABLE

Narrow peak observed in several ($\Lambda\bar{p}$ + pions) and ($\bar{\Lambda}p$ + pions) states in Σ^- Be reactions by BOURQUIN 86 and in np and nA reactions by ALEEV 93. Not seen by BOEHNLEIN 91. If due to strong decays, this state has exotic quantum numbers ($B=0, Q=+1, S=-1$ for $\Lambda\bar{p}\pi^+\pi^+$ and $I \geq 3/2$ for $\Lambda\bar{p}\pi^-$). Needs confirmation.

NODE=M129

NODE=M129

K(3100) MASS

VALUE (MeV)

DOCUMENT ID

≈ 3100 OUR ESTIMATE

NODE=M129205

NODE=M129M
→ UNCHECKED ←**3-BODY DECAYS**

VALUE (MeV)

DOCUMENT ID

TECN

COMMENT

3054±11 OUR AVERAGE

3060± 7±20

¹ ALEEV 93 BIS2 $K(3100) \rightarrow \Lambda\bar{p}\pi^+$

3056± 7±20

¹ ALEEV 93 BIS2 $K(3100) \rightarrow \bar{\Lambda}p\pi^-$

3055± 8±20

¹ ALEEV 93 BIS2 $K(3100) \rightarrow \Lambda\bar{p}\pi^-$

3045± 8±20

¹ ALEEV 93 BIS2 $K(3100) \rightarrow \bar{\Lambda}p\pi^+$ NODE=M129M1
NODE=M129M1OCCUR=2
OCCUR=3
OCCUR=4**4-BODY DECAYS**

VALUE (MeV)

DOCUMENT ID

TECN

COMMENT

3059±11 OUR AVERAGE

3067± 6±20

¹ ALEEV 93 BIS2 $K(3100) \rightarrow \Lambda\bar{p}\pi^+\pi^+$

3060± 8±20

¹ ALEEV 93 BIS2 $K(3100) \rightarrow \Lambda\bar{p}\pi^+\pi^-$

3055± 7±20

¹ ALEEV 93 BIS2 $K(3100) \rightarrow \bar{\Lambda}p\pi^-\pi^-$

3052± 8±20

¹ ALEEV 93 BIS2 $K(3100) \rightarrow \bar{\Lambda}p\pi^-\pi^+$

• • • We do not use the following data for averages, fits, limits, etc. • • •

3105±30

BOURQUIN 86 SPEC $K(3100) \rightarrow \Lambda\bar{p}\pi^+\pi^+$

3115±30

BOURQUIN 86 SPEC $K(3100) \rightarrow \Lambda\bar{p}\pi^+\pi^-$ NODE=M129M2
NODE=M129M2OCCUR=2
OCCUR=3
OCCUR=4

OCCUR=2

5-BODY DECAYS

VALUE (MeV)

DOCUMENT ID

TECN

COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

3095±30

BOURQUIN 86 SPEC $K(3100) \rightarrow \Lambda\bar{p}\pi^+\pi^+\pi^-$ NODE=M129M3
NODE=M129M3¹Supersedes ALEEV 90.

NODE=M129M;LINKAGE=A

K(3100) WIDTH

NODE=M129210

3-BODY DECAYS

VALUE (MeV)

DOCUMENT ID

TECN

COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

42±16

² ALEEV 93 BIS2 $K(3100) \rightarrow \Lambda\bar{p}\pi^+$

36±15

² ALEEV 93 BIS2 $K(3100) \rightarrow \bar{\Lambda}p\pi^-$

50±18

² ALEEV 93 BIS2 $K(3100) \rightarrow \Lambda\bar{p}\pi^-$

30±15

² ALEEV 93 BIS2 $K(3100) \rightarrow \bar{\Lambda}p\pi^+$ NODE=M129W1
NODE=M129W1OCCUR=2
OCCUR=3
OCCUR=4**4-BODY DECAYS**

VALUE (MeV)

CL%

DOCUMENT ID

TECN

COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

22± 8

² ALEEV 93 BIS2 $K(3100) \rightarrow \Lambda\bar{p}\pi^+\pi^+$

28±12

² ALEEV 93 BIS2 $K(3100) \rightarrow \Lambda\bar{p}\pi^+\pi^-$

32±15

² ALEEV 93 BIS2 $K(3100) \rightarrow \bar{\Lambda}p\pi^-\pi^-$

30±15

² ALEEV 93 BIS2 $K(3100) \rightarrow \bar{\Lambda}p\pi^-\pi^+$

<30 90

BOURQUIN 86 SPEC $K(3100) \rightarrow \Lambda\bar{p}\pi^+\pi^+$

<80 90

BOURQUIN 86 SPEC $K(3100) \rightarrow \Lambda\bar{p}\pi^+\pi^-$ NODE=M129W2
NODE=M129W2OCCUR=2
OCCUR=3
OCCUR=4

OCCUR=2

5-BODY DECAYS

VALUE (MeV)

CL%

DOCUMENT ID

TECN

COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

<30

90

BOURQUIN 86 SPEC $K(3100) \rightarrow \Lambda\bar{p}\pi^+\pi^+\pi^-$ NODE=M129W3
NODE=M129W3²Supersedes 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

NODE=M129

ALEEV	93	PAN 56 1358	A.N. Aleev <i>et al.</i>	(BIS-2 Collab.)
		Translated from YAF 56 100.		
BOEHNLEIN	91	NPBPS B21 174	A. Boehnlein <i>et al.</i>	(FLOR, BNL, IND+)
ALEEV	90	ZPHY C47 533	A.N. Aleev <i>et al.</i>	(BIS-2 Collab.)
BOURQUIN	86	PL B172 113	M.H. Bourquin <i>et al.</i>	(GEVA, RAL, HEIDP+)

REFID=43668

REFID=41743

REFID=42173

REFID=22928

CHARMED MESONS

($C = \pm 1$)

$$D^+ = c\bar{d}, D^0 = c\bar{u}, \bar{D}^0 = \bar{c}u, D^- = \bar{c}d, \text{ similarly for } D^{*'}\text{'s}$$

NODE=MXXX035

NODE=MXXX035

 $D^*(2007)^0$

$$I(J^P) = \frac{1}{2}(1^-)$$

I, J, P need confirmation.

J consistent with 1, value 0 ruled out (NGUYEN 77).

NODE=M061

NODE=M061

 $D^*(2007)^0$ MASS

NODE=M061M

The fit includes $D^\pm, D^0, D_s^\pm, D^{*\pm}, D^{*0}, D_s^{*\pm}, D_1(2420)^0, D_2^*(2460)^0$, and $D_{s1}(2536)^\pm$ mass and mass difference measurements.

NODE=M061M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
2006.96$\pm$0.10 OUR FIT			
[2006.99 $\pm$ 0.15 MeV OUR 2013 FIT]			

NODE=M061M

NEW

• • • We do not use the following data for averages, fits, limits, etc. • • •

2006 ± 1.5 ¹ GOLDHABER 77 MRK1 e^+e^-

¹ From simultaneous fit to $D^*(2010)^+, D^*(2007)^0, D^+$, and D^0 .

NODE=M061M;LINKAGE=G

 $m_{D^*(2007)^0} - m_{D^0}$

NODE=M061DM

The fit includes $D^\pm, D^0, D_s^\pm, D^{*\pm}, D^{*0}, D_s^{*\pm}, D_1(2420)^0, D_2^*(2460)^0$, and $D_{s1}(2536)^\pm$ mass and mass difference measurements.

NODE=M061DM

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
142.12$\pm$0.07 OUR FIT				
142.12$\pm$0.07 OUR AVERAGE				

NODE=M061DM

142.2 $\pm 0.3 \pm 0.2$	145	ALBRECHT	95F	ARG	$e^+e^- \rightarrow$ hadrons
142.12 $\pm$ 0.05 $\pm$ 0.05	1176	BORTOLETTO	92B	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 ² GOLDHABER 77 MRK1 e^+e^-

²From simultaneous fit to $D^*(2010)^+$, $D^*(2007)^0$, D^+ , and D^0 .

NODE=M061DM;LINKAGE=G

$D^*(2007)^0$ WIDTH

VALUE (MeV)	CL%	DOCUMENT ID	TECN	COMMENT
<2.1	90	³ ABACHI	88B HRS	$D^{*0} \rightarrow D^+ \pi^-$

³ Assuming $m_{D^{*0}} = 2007.2 \pm 2.1 \text{ MeV}/c^2$.

NODE=M061W

NODE=M061W

NODE=M061W;LINKAGE=A

$D^*(2007)^0$ DECAY MODES

$\bar{D}^*(2007)^0$ modes are charge conjugates of modes below.

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad D^0 \pi^0$	(61.9 $\pm$ 2.9) %
$\Gamma_2 \quad D^0 \gamma$	(38.1 $\pm$ 2.9) %

NODE=M061220;NODE=M061

NODE=M061

DESIG=1

DESIG=2

CONSTRAINED FIT INFORMATION

An overall fit to a branching ratio uses 3 measurements and one constraint to determine 2 parameters. The overall fit has a $\chi^2 = 0.5$ for 2 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta x_i \delta x_j \rangle / (\delta x_i \cdot \delta x_j)$, in percent, from the fit to the branching fractions, $x_i \equiv \Gamma_i/\Gamma_{\text{total}}$. The fit constrains the x_i whose labels appear in this array to sum to one.

$$\begin{array}{c|c} x_2 & -100 \\ \hline & x_1 \end{array}$$

$D^*(2007)^0$ BRANCHING RATIOS

NODE=M061225

$\Gamma(D^0 \pi^0)/\Gamma(D^0 \gamma)$

Γ_1/Γ_2

VALUE	DOCUMENT ID	TECN	COMMENT
1.74$\pm$0.02$\pm$0.13	AUBERT,BE	05G BABR	10.6 $e^+ e^- \rightarrow$ hadrons

NODE=M061R3
NODE=M061R3

$\Gamma(D^0 \pi^0)/\Gamma_{\text{total}}$

Γ_1/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.619$\pm$0.029 OUR FIT				

NODE=M061R2
NODE=M061R2

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.635 $\pm$ 0.003 $\pm$ 0.017	69k	⁴ AUBERT,BE	05G BABR	10.6 $e^+ e^- \rightarrow$ hadrons
0.596 $\pm$ 0.035 $\pm$ 0.028	858	⁵ ALBRECHT	95F ARG	$e^+ e^- \rightarrow$ hadrons
0.636 $\pm$ 0.023 $\pm$ 0.033	1097	⁵ BUTLER	92 CLE2	$e^+ e^- \rightarrow$ hadrons

$\Gamma(D^0 \gamma)/\Gamma_{\text{total}}$

Γ_2/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.381$\pm$0.029 OUR FIT				
0.381$\pm$0.029 OUR AVERAGE				

NODE=M061R1
NODE=M061R1

0.404 $\pm$ 0.035 $\pm$ 0.028	456	⁵ ALBRECHT	95F ARG	$e^+ e^- \rightarrow$ hadrons
0.364 $\pm$ 0.023 $\pm$ 0.033	621	⁵ BUTLER	92 CLE2	$e^+ e^- \rightarrow$ hadrons
0.37 $\pm$ 0.08 $\pm$ 0.08		ADLER	88D MRK3	$e^+ e^-$
0.365 $\pm$ 0.003 $\pm$ 0.017	68k	⁴ AUBERT,BE	05G BABR	10.6 $e^+ e^- \rightarrow$ hadrons
0.47 $\pm$ 0.23		LOW	87 HRS	29 GeV $e^+ e^-$
0.53 $\pm$ 0.13		BARTEL	85G JADE	$e^+ e^-$, hadrons
0.47 $\pm$ 0.12		COLES	82 MRK2	$e^+ e^-$
0.45 $\pm$ 0.15		GOLDHABER	77 MRK1	$e^+ e^-$

⁴ Derived from the ratio $\Gamma(D^0 \pi^0) / \Gamma(D^0 \gamma)$ assuming that the branching fractions of $D^{*0} \rightarrow D^0 \pi^0$ and $D^{*0} \rightarrow D^0 \gamma$ decays sum to 100%

⁵ The BUTLER 92 and ALBRECHT 95F branching ratios are not independent, they have been constrained by the authors to sum to 100%.

NODE=M061R;LINKAGE=AU

NODE=M061R;LINKAGE=A

$D^*(2007)^0$ REFERENCES

AUBERT,BE	05G	PR D72 091101	B. Aubert <i>et al.</i>	(BABAR Collab.)
ALBRECHT	95F	ZPHY C66 63	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
BORTOLETTO	92B	PRL 69 2046	D. Bortoletto <i>et al.</i>	(CLEO Collab.)
BUTLER	92	PRL 69 2041	F. Butler <i>et al.</i>	(CLEO Collab.)
ABACHI	88B	PL B212 533	S. Abachi <i>et al.</i>	(ANL, IND, MICH, PURD+)
ADLER	88D	PL B208 152	J. Adler <i>et al.</i>	(Mark III Collab.)
LOW	87	PL B183 232	E.H. Low <i>et al.</i>	(HRS Collab.)
BARTEL	85G	PL 161B 197	W. Bartel <i>et al.</i>	(JADE Collab.)
COLES	82	PR D26 2190	M.W. Coles <i>et al.</i>	(LBL, SLAC)
SADROZINSKI	80	Madison Conf. 681	H.F.W. Sadrozinski <i>et al.</i>	(PRIN, CIT+)
GOLDHABER	77	PL 69B 503	G. Goldhaber <i>et al.</i>	(Mark I Collab.)
NGUYEN	77	PRL 39 262	H.K. Nguyen <i>et al.</i>	(LBL, SLAC) J

NODE=M061

REFID=50942
REFID=44374
REFID=43116
REFID=43170
REFID=40584
REFID=40579
REFID=40017
REFID=22880
REFID=22866
REFID=22877
REFID=11434
REFID=11543

 $D^*(2010)^\pm$

$I(J^P) = \frac{1}{2}(1^-)$
 I, J, P need confirmation.

NODE=M062

 $D^*(2010)^\pm$ MASS

The fit includes $D^\pm, D^0, D_s^\pm, D^{*\pm}, D^{*0}, D_s^{*\pm}, D_1(2420)^0, D_2^*(2460)^0$,
and $D_{s1}(2536)^\pm$ mass and mass difference measurements.

NODE=M062M

NODE=M062M

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
2010.26±0.07 OUR FIT	Error includes scale factor of 1.1.	[2010.29 ± 0.13 MeV OUR 2013 FIT]		

NODE=M062M

NEW

• • • 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;LINKAGE=G

NODE=M062M;LINKAGE=P

 $m_{D^*(2010)^+} - m_{D^+}$

The fit includes $D^\pm, D^0, D_s^\pm, D^{*\pm}, D^{*0}, D_s^{*\pm}, D_1(2420)^0, D_2^*(2460)^0$,
and $D_{s1}(2536)^\pm$ mass and mass difference measurements.

NODE=M062MD

NODE=M062MD

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
140.66±0.08 OUR FIT				
[140.66 ± 0.10 MeV OUR 2013 FIT Scale factor = 1.1]				
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				
[145.421 ± 0.010 MeV OUR 2013 FIT Scale factor = 1.1]				
145.4258±0.0020 OUR AVERAGE	Error includes scale factor of 1.2.	[145.421 ± 0.010 MeV OUR 2013 AVERAGE]		
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

NEW

NEW

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 ±0.06 ±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 ±0.05 ±0.10		ABACHI	88B	HRS	$D^{*\pm} \rightarrow D^0 \pi^\pm$	
145.46 ±0.07 ±0.03		ALBRECHT	85F	ARG	$D^{*\pm} \rightarrow D^0 \pi^+$	
145.5 ±0.3	28	BAILEY	83	SPEC	$D^{*\pm} \rightarrow D^0 \pi^\pm$	OCCUR=2
145.5 ±0.3	60	FITCH	81	SPEC	$\pi^- A$	
145.3 ±0.5	30	FELDMAN	77B	MRK1	$D^{*+} \rightarrow D^0 \pi^+$	

• • • We do not use the following data for averages, fits, limits, etc. • • •

145.4256±0.0006±0.0017	138.5k	LEES	13X	BABR	$D^{*\pm} \rightarrow D^0 \pi^\pm \rightarrow$ $(K^- \pi^+) \pi^\pm$	OCCUR=2
145.4266±0.0005±0.0019	174.3k	LEES	13X	BABR	$D^{*\pm} \rightarrow D^0 \pi^\pm \rightarrow$ $(K^- 2\pi^+ \pi^-) \pi^\pm$	OCCUR=2
145.44 ±0.09	122	⁴ BREITWEG	97B	ZEUS	$D^{*\pm} \rightarrow D^0 \pi^\pm,$ $D^0 \rightarrow K^- \pi^+$	
145.8 ±1.5	16	AHLEN	83	HRS	$D^{*+} \rightarrow D^0 \pi^+$	
145.1 ±1.8	12	BAILEY	83	SPEC	$D^{*\pm} \rightarrow D^0 \pi^\pm$	OCCUR=3
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

• • • We do not use the following data for averages, fits, limits, etc. • • •

2.6±1.8	⁵ PERUZZI	77	LGW	$e^+ e^-$	

⁵ Not independent of FELDMAN 77B mass difference above, PERUZZI 77 D^0 mass, and GOLDHABER 77 $D^*(2007)^0$ mass.

NODE=M062EM

NODE=M062EM;LINKAGE=P

$D^*(2010)^\pm$ WIDTH

NODE=M062W

VALUE (keV) CL% EVTS DOCUMENT ID TECN COMMENT

83.4±1.8 OUR AVERAGE
[96 ± 22 keV OUR 2013 AVERAGE]

83.3±1.2± 1.4	312.8k	⁶ LEES	13X	BABR	$D^{*\pm} \rightarrow D^0 \pi^\pm \rightarrow$ $(K \pi, K 3\pi) \pi^\pm$	OCCUR=3
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	$D^{*\pm} \rightarrow D^0 \pi^\pm \rightarrow$ $(K^- \pi^+) \pi^\pm$	OCCUR=2
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
<u>VALUE</u>	<u>CL%</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
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=22866
REFID=22867
REFID=22863
REFID=11498
REFID=22861
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).

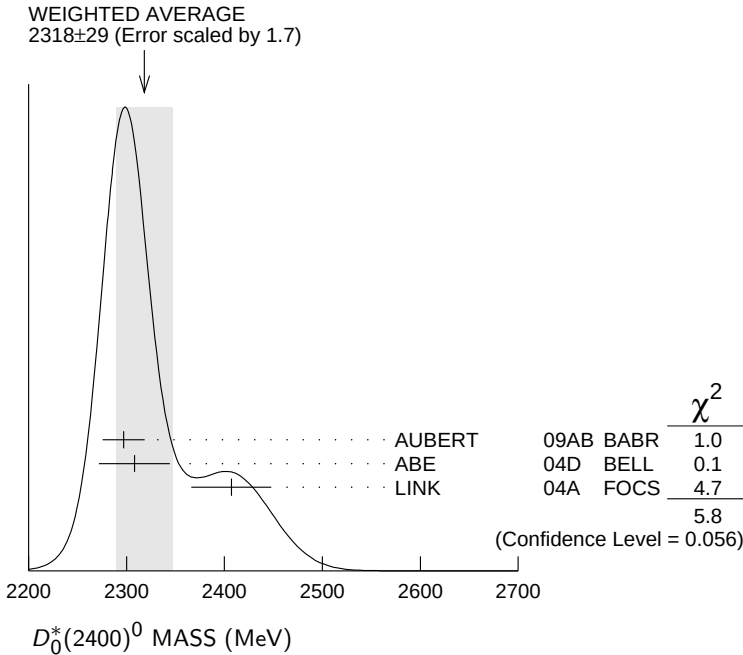
NODE=M178

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
$2403 \pm 14 \pm 35$	18.8k	LINK	04A FOCS	γ A

NODE=M179M

 $D_0^*(2400)^\pm$ WIDTH

NODE=M179W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$283 \pm 24 \pm 34$	18.8k	LINK	04A FOCS	γ A

NODE=M179W

 $D_0^*(2400)^\pm$ 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

LINK	04A PL B586 11	J.M. Link <i>et al.</i>	(FOCUS Collab.)

NODE=M179

REFID=49775

NODE=M097

$$D_1(2420)^0$$

$$I(J^P) = \frac{1}{2}(1^+)$$

 I needs confirmation. **$D_1(2420)^0$ MASS**

NODE=M097M

The fit includes $D^\pm, D^0, D_s^\pm, D^{*\pm}, D^{*0}, D_s^{*\pm}, D_1(2420)^0, D_2^*(2460)^0$,
and $D_{s1}(2536)^\pm$ mass and mass difference measurements.

NODE=M097M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2421.4 ± 0.6 OUR FIT	Error includes scale factor of 1.2.			
2421.1 ± 0.7 OUR AVERAGE	Error includes scale factor of 1.2.			

NODE=M097M

$2423.1 \pm 1.5^{+0.4}_{-1.0}$	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	$B^- \rightarrow D^{*+} \pi^- \pi^-$
$2421 \quad {}^{+1}_{-2} \pm 2$	286	AVERY	94C CLE2	$e^+ e^- \rightarrow D^{*+} \pi^- X$
$2422 \pm 2 \pm 2$	51	FRABETTI	94B E687	$\gamma \text{Be} \rightarrow D^{*+} \pi^- X$
$2428 \pm 3 \pm 2$	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	$e^+ e^-$

- 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_s^{*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
411.1±0.6 OUR FIT	Error includes scale factor of 1.2.			
411.5±0.8 OUR AVERAGE				
410.2±2.1±0.9	3110±340	CHEKANOV	09 ZEUS	$e^\pm p \rightarrow D^{*+}\pi^- X$
411.7±0.7±0.4	7.5k	ABULENCIA	06A CDF	1900 $p\bar{p} \rightarrow D^{*+}\pi^- X$

NODE=M097DM

$D_1(2420)^0$ WIDTH

NODE=M097W

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
27.4± 2.5 OUR AVERAGE	Error includes scale factor of 2.3. See the ideogram below.			
38.8± 5.0 ^{+1.9} _{-5.4}	2.7k	⁵ ABRAMOWICZ13	ZEUS	$e^\pm p \rightarrow D^{(*)+}\pi^- X$
31.4± 0.5± 1.3	103k	DEL-AMO-SA...10P	BABR	$e^+e^- \rightarrow D^{*+}\pi^- X$
20.0± 1.7± 1.3	7.5k	ABULENCIA	06A CDF	1900 $p\bar{p} \rightarrow D^{*+}\pi^- X$
24 ± 7 ± 8	151	ABE	05A BELL	$B^- \rightarrow D^0\pi^+\pi^-\pi^-$
23.7± 2.7± 4.0		⁶ ABE	04D BELL	$B^- \rightarrow D^{*+}\pi^-\pi^-$
20 ⁺⁶ ₋₅ ± 3	286	AVERY	94C CLE2	$e^+e^- \rightarrow D^{*+}\pi^- X$
15 ± 8 ± 4	51	FRABETTI	94B E687	$\gamma Be \rightarrow D^{*+}\pi^- X$
23 ⁺⁸ ₋₆ ⁺¹⁰ ₋₃	279	AVERY	90 CLEO	$e^+e^- \rightarrow D^{*+}\pi^- X$
13 ± 6 ⁺¹⁰ ₋₅	171	ALBRECHT	89H ARG	$e^+e^- \rightarrow D^{*+}\pi^- X$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
53.2± 7.2 ^{+3.3} _{-4.9}	3110±340	CHEKANOV	09 ZEUS	$e^\pm p \rightarrow D^{*+}\pi^- X$
58 ±14 ±10	171	ANJOS	89C TPS	$\gamma N \rightarrow D^{*+}\pi^- X$

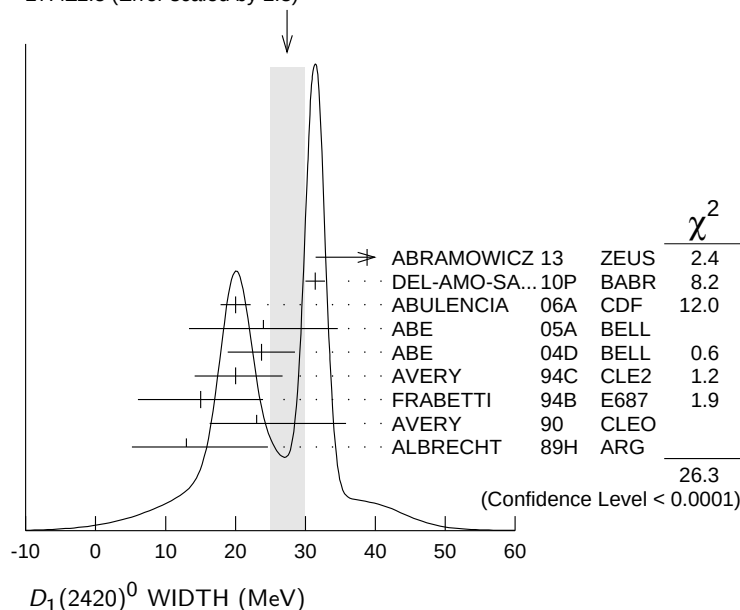
NODE=M097W

- ⁵ From the combined fit of the $M(D^+\pi^-)$ and $M(D^{*+}\pi^-)$ distributions. and A_{D_2} fixed to the theoretical prediction of -1 .
- ⁶ Fit includes the contribution from $D_1^*(2430)^0$.

NODE=M097W;LINKAGE=AR

NODE=M097W;LINKAGE=AB

WEIGHTED AVERAGE
27.4±2.5 (Error scaled by 2.3)



$D_1(2420)^0$ DECAY MODES

$\bar{D}_1(2420)^0$ modes are charge conjugates of modes below.

Mode	Fraction (Γ_i/Γ)
Γ_1 $D^{*}(2010)^+ \pi^-$	seen
Γ_2 $D^0 \pi^+ \pi^-$	seen
Γ_3 $D^0 \rho^0$	
Γ_4 $D^0 f_0(500)$	
Γ_5 $D_0^{*}(2400)^+ \pi^-$	
Γ_6 $D^+ \pi^-$	not seen
Γ_7 $D^{*0} \pi^+ \pi^-$	not seen

NODE=M097215;NODE=M097

NODE=M097

DESIG=1

DESIG=3;OUR EST;→ UNCHECKED ←

DESIG=4

DESIG=5

DESIG=6

DESIG=2;OUR EST;→ UNCHECKED ←

DESIG=7;OUR EST;→ UNCHECKED ←

 $D_1(2420)^0$ BRANCHING RATIOS

$\Gamma(D^{*}(2010)^+ \pi^-)/\Gamma_{\text{total}}$	Γ_1/Γ
VALUE	DOCUMENT ID TECN COMMENT
seen	ACKERSTAFF 97W OPAL $e^+ e^- \rightarrow D^{*+} \pi^- X$
seen	AVERY 90 CLEO $e^+ e^- \rightarrow D^{*+} \pi^- X$
seen	ALBRECHT 89H ARG $e^+ e^- \rightarrow D^{*+} \pi^- X$
seen	ANJOS 89C TPS $\gamma N \rightarrow D^{*+} \pi^- X$

$\Gamma(D^+ \pi^-)/\Gamma(D^{*}(2010)^+ \pi^-)$	Γ_6/Γ_1
VALUE CL%	DOCUMENT ID TECN COMMENT
<0.24 90	AVERY 90 CLEO $e^+ e^- \rightarrow D^+ \pi^- X$

NODE=M097220

NODE=M097R1
NODE=M097R1NODE=M097R2
NODE=M097R2 **$D_1(2420)^0$ POLARIZATION AMPLITUDE A_{D_1}**

A polarization amplitude A_{D_1} is a parameter that depends on the initial polarization of the D_1 and is sensitive to a possible S -wave contribution to its decay. For D_1 decays the helicity angle, θ_h , distribution varies like $1 + A_{D_1} \cos^2 \theta_h$, where θ_h is the angle in the D^{*} rest frame between the two pions emitted by the $D_1 \rightarrow D^{*} \pi$ and the $D^{*} \rightarrow D \pi$.

Unpolarized D_1 decaying purely via D -wave is predicted to give $A_{D_1} = 3$.

NODE=M097PAH

NODE=M097PAH

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
5.73 ± 0.25 OUR AVERAGE				
$7.8^{+6.7}_{-2.7} {}^{+4.6}_{-1.8}$	2.7k	⁷ ABRAMOWICZ13	ZEUS	$e^{\pm} p \rightarrow D^{(*)+} \pi^- X$
5.72 ± 0.25	103k	DEL-AMO-SA...10P	BABR	$e^+ e^- \rightarrow D^{*+} \pi^- X$
$5.9^{+3.0}_{-1.7} {}^{+2.4}_{-1.0}$		CHEKANOV 09	ZEUS	$e^{\pm} p \rightarrow D^{*+} \pi^- X$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$3.8 \pm 0.6 \pm 0.8$		⁸ AUBERT 09Y	BABR	$B^+ \rightarrow D_1^0 \ell^+ \nu_\ell$
$2.74^{+1.40}_{-0.93}$		⁹ AVERY 94C	CLE2	$e^+ e^- \rightarrow D^{*+} \pi^- X$

NODE=M097PAH

⁷ From the combined fit of the $M(D^+ \pi^-)$ and $M(D^{*+} \pi^-)$ distributions. and A_{D_2} fixed to the theoretical prediction of -1 . A pure D -wave not excluded although some $\bar{S}$ -wave mixing possible.

⁸ Assuming $\Gamma(\Upsilon(4S) \rightarrow B^+ B^-) / \Gamma(\Upsilon(4S) \rightarrow B^0 \bar{B}^0) = 1.065 \pm 0.026$ and equal partial widths and helicity angle distributions for charged and neutral D_1 mesons.

⁹ Systematic uncertainties not estimated.

NODE=M097PAH;LINKAGE=AR

NODE=M097PAH;LINKAGE=AU

NODE=M097PAH;LINKAGE=AV

 $D_1(2420)^0$ REFERENCES

ABRAMOWICZ 13	NP B866 229	H. Abramowicz <i>et al.</i>	(ZEUS Collab.)
DEL-AMO-SA... 10P	PR D82 11101	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)
AUBERT 09Y	PRL 103 051803	B. Aubert <i>et al.</i>	(BABAR Collab.)
CHEKANOV 09	EPJ C60 25	S. Chekanov <i>et al.</i>	(ZEUS Collab.)
ABULENCIA 06A	PR D73 051104	A. Abulencia <i>et al.</i>	(CDF Collab.)
ABE 05A	PRL 94 221805	K. Abe <i>et al.</i>	(BELLE Collab.)
ABE 04D	PR D69 112002	K. Abe <i>et al.</i>	(BELLE Collab.)
ABREU 98M	PL B426 231	P. Abreu <i>et al.</i>	(DELPHI Collab.)
ACKERSTAFF 97W	ZPHY C76 425	K. Ackerstaff <i>et al.</i>	(OPAL Collab.)
AVERY 94C	PL B331 236	P. Avery <i>et al.</i>	(CLEO Collab.)
FRABETTI 94B	PRL 72 324	P.L. Frabetti <i>et al.</i>	(FNAL E687 Collab.)
AVERY 90	PR D41 774	P. Avery, D. Besson	(CLEO Collab.)
ALBRECHT 89H	PL B232 398	H. Albrecht <i>et al.</i>	(ARGUS Collab.) JP
ANJOS 89C	PRL 62 1717	J.C. Anjos <i>et al.</i>	(FNAL E691 Collab.)

NODE=M097

REFID=54743
REFID=53534
REFID=52929
REFID=52733
REFID=51054
REFID=50755
REFID=50011
REFID=46315
REFID=45788
REFID=44096
REFID=43687
REFID=41013
REFID=41001
REFID=40737

$D_1(2420)^\pm$

 $I(J^P) = \frac{1}{2}(?)$
 I needs confirmation.

OMITTED FROM SUMMARY TABLE

Seen in $D^*(2007)^0 \pi^+$. $J^P = 0^+$ ruled out.

NODE=M120

NODE=M120

NODE=M120M

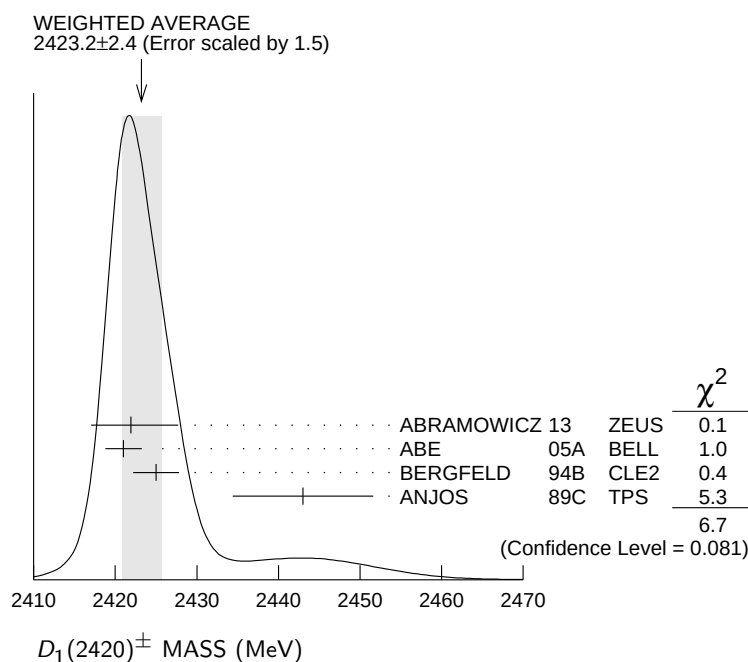
NODE=M120M

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
VALUE	DOCUMENT ID TECN COMMENT
seen	ANJOS 89C TPS $\gamma N \rightarrow D^0 \pi^+ \chi^0$

NODE=M120220

NODE=M120R1

NODE=M120R1

$\Gamma(D^0 \pi^+)/\Gamma(D^*(2007)^0 \pi^+)$	Γ_6/Γ_1
VALUE	CL% DOCUMENT ID TECN COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •	
<0.18	90 BERGFELD 94B CLE2 $e^+ e^- \rightarrow \text{hadrons}$

NODE=M120R2

NODE=M120R2

 $D_1(2420)^\pm$ POLARIZATION AMPLITUDE A_{D_1}

A polarization amplitude A_{D_1} is a parameter that depends on the initial polarization of the D_1 and is sensitive to a possible S -wave contribution to its decay. For D_1 decays the helicity angle, θ_h , distribution varies like $1 + A_{D_1} \cos^2 \theta_h$, where θ_h is the angle in the D^* rest frame between the two pions emitted by the $D_1 \rightarrow D^* \pi$ and the $D^* \rightarrow D \pi$.

Unpolarized D_1 decaying purely via D -wave is predicted to give $A_{D_1} = 3$.

NODE=M120PAH

NODE=M120PAH

VALUE	DOCUMENT ID TECN COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •	
$3.8 \pm 0.6 \pm 0.8$	² AUBERT 09Y BABR $B^0 \rightarrow D_1^- \ell^+ \nu_\ell$

NODE=M120PAH

² Assuming $\Gamma(\Upsilon(4S) \rightarrow B^+ B^-) / \Gamma(\Upsilon(4S) \rightarrow B^0 \bar{B}^0) = 1.065 \pm 0.026$ and equal partial widths and helicity angle distributions for charged and neutral D_1 mesons.

NODE=M120PAH;LINKAGE=AU

 $D_1(2420)^\pm$ REFERENCES

ABRAMOWICZ 13	NP B866 229	H. Abramowicz <i>et al.</i>	(ZEUS Collab.)
AUBERT 09Y	PRL 103 051803	B. Aubert <i>et al.</i>	(BABAR Collab.)
ABE 05A	PRL 94 221805	K. Abe <i>et al.</i>	(BELLE Collab.)
BERGFELD 94B	PL B340 194	T. Bergfeld <i>et al.</i>	(CLEO Collab.)
ANJOS 89C	PRL 62 1717	J.C. Anjos <i>et al.</i>	(FNAL E691 Collab.)

NODE=M120

REFID=54743

REFID=52929

REFID=50755

REFID=44099

REFID=40737

$D_1(2430)^0$

$$I(J^P) = \frac{1}{2}(1^+)$$

OMITTED FROM SUMMARY TABLE
 $J = 1^+$ assignment favored (ABE 04D).

 $D_1(2430)^0$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$2427 \pm 26 \pm 25$	ABE	04D	BELL $B^- \rightarrow D^{*+} \pi^- \pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
2477 ± 28	¹ AUBERT	06L	BABR $\bar{B}^0 \rightarrow D^{*+} \omega \pi^-$
¹ Systematic errors not estimated.			

 $D_1(2430)^0$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$384^{+107}_{-75} \pm 74$	ABE	04D	BELL $B^- \rightarrow D^{*+} \pi^- \pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
266 ± 97	² AUBERT	06L	BABR $\bar{B}^0 \rightarrow D^{*+} \omega \pi^-$
² Systematic errors not estimated.			

 $D_1(2430)^0$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
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),

 $D_2^*(2460)^0$ MASS

The fit includes $D^\pm$, D^0 , $D_s^\pm$, $D^{*\pm}$, D^{*0} , $D_s^{*\pm}$, $D_1(2420)^0$, $D_2^*(2460)^0$, and $D_{s1}(2536)^\pm$ mass and mass difference measurements.

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2462.6 ± 0.6 OUR FIT	Error includes scale factor of 1.2.			
2461.8 ± 0.7 OUR AVERAGE	Error includes scale factor of 1.1.			
$2462.5 \pm 2.4^{+1.3}_{-1.1}$	2.3k	¹ ABRAMOWICZ13	ZEUS	$e^\pm p \rightarrow D^{(*)+} \pi^- X$
$2462.2 \pm 0.1 \pm 0.8$	243k	DEL-AMO-SA...10P	BABR	$e^+ e^- \rightarrow D^+ \pi^- X$
$2460.4 \pm 1.2 \pm 2.2$	3.4k	AUBERT	09AB	BABR $B^- \rightarrow D^+ \pi^- \pi^-$
$2461.6 \pm 2.1 \pm 3.3$		² ABE	04D	BELL $B^- \rightarrow D^+ \pi^- \pi^-$
$2464.5 \pm 1.1 \pm 1.9$	5.8k	² LINK	04A	FOCS γA
$2465 \pm 3 \pm 3$	486	AVERY	94C	CLE2 $e^+ e^- \rightarrow D^+ \pi^- X$
$2453 \pm 3 \pm 2$	128	FRABETTI	94B	E687 $\gamma Be \rightarrow D^+ \pi^- X$
$2461 \pm 3 \pm 1$	440	AVERY	90	CLEO $e^+ e^- \rightarrow D^{*+} \pi^- X$
$2455 \pm 3 \pm 5$	337	ALBRECHT	89B	ARG $e^+ e^- \rightarrow D^+ \pi^- X$
$2459 \pm 3 \pm 2$	153	ANJOS	89C	TPS $\gamma N \rightarrow D^+ \pi^- X$

NODE=M180

NODE=M180

NODE=M180M

NODE=M180M

NODE=M180M;LINKAGE=AU

NODE=M180W

NODE=M180W

NODE=M180W;LINKAGE=AU

NODE=M180215;NODE=M180

DESIG=1;OUR EVAL;→ UNCHECKED ←

NODE=M180

REFID=51140
REFID=50011

NODE=M119

NODE=M119

NODE=M119M

NODE=M119M

NODE=M119M

• • • We do not use the following data for averages, fits, limits, etc. • • •

2469.1 ± 3.7 ^{+1.2} _{-1.3}	1560 ± 230	³ 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	⁴ ABREU	98M	DLPH	$e^+ e^-$
2466 ± 7	1	ASRATYAN	95	BEBC	53,40 $\nu(\bar{\nu}) \rightarrow pX, dX$

¹ From the combined fit of the $M(D^+ \pi^-)$ and $M(D^{*+} \pi^-)$ distributions. and A_{D_2} fixed to the theoretical prediction of -1 .

² Fit includes the contribution from $D_0^{*0}(2400)^0$.

³ Calculated using the mass difference $m(D_2^{*0}) - m(D^{*+})_{PDG}$ reported below and $m(D^{*+})_{PDG} = 2010.27 \pm 0.17$ MeV. The 0.17 MeV uncertainty of the PDG mass value should be added to the experimental uncertainty of $^{+1.2}_{-1.3}$ MeV.

⁴ No systematic error given.

NODE=M119M;LINKAGE=AR

NODE=M119M;LINKAGE=LI

NODE=M119M;LINKAGE=CH

NODE=M119M;LINKAGE=K

$m_{D_2^{*0}} - m_{D^+}$

The fit includes $D^\pm$, D^0 , $D_s^\pm$, $D^{*\pm}$, D^{*0} , $D_s^{*\pm}$, $D_1(2420)^0$, $D_2^*(2460)^0$, and $D_{s1}(2536)^\pm$ mass and mass difference measurements.

NODE=M119DM

NODE=M119DM

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
593.0 ± 0.6 OUR FIT	Error includes scale factor of 1.2.	[593.0 ± 0.6 MeV OUR 2013		
	FIT Scale factor = 1.3]			
593.9 ± 0.6 ± 0.5	20k	ABULENCIA	06A	CDF 1900 $p\bar{p} \rightarrow D^+ \pi^- X$

NODE=M119DM

NEW

$m_{D_2^{*0}} - m_{D^{*+}}$

The fit includes $D^\pm$, D^0 , $D_s^\pm$, $D^{*\pm}$, D^{*0} , $D_s^{*\pm}$, $D_1(2420)^0$, $D_2^*(2460)^0$, and $D_{s1}(2536)^\pm$ mass and mass difference measurements.

NODE=M119DM2

NODE=M119DM2

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
452.3 ± 0.6 OUR FIT	Error includes scale factor of 1.2.	[452.3 ± 0.6 MeV OUR 2013		
	FIT Scale factor = 1.3]			
458.8 ± 3.7^{+1.2}_{-1.3}	1560 ± 230	CHEKANOV	09	ZEUS $e^\pm p \rightarrow D^{(*)+} \pi^- X$

NODE=M119DM2

NEW

$D_2^{*0}(2460)^0$ WIDTH

NODE=M119W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
49.0 ± 1.3 OUR AVERAGE	Error includes scale factor of 1.5. See the ideogram below.			
46.6 ± 8.1 ^{+5.9} _{-3.8}	2.3k	⁵ 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		⁶ ABE	04D	BELL $B^- \rightarrow D^+ \pi^- \pi^-$
38.7 ± 5.3 ± 2.9	5.8k	⁶ LINK	04A	FOCS γA
28 ⁺⁸ ₋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 ⁺⁹ ₋₁₂ ⁺⁹ ₋₁₀	440	AVERY	90	CLEO $e^+ e^- \rightarrow D^{*+} \pi^- X$
15 ⁺¹³ ₋₁₀ ⁺⁵ ₋₁₀	337	ALBRECHT	89B	ARG $e^+ e^- \rightarrow D^+ \pi^- X$
20 ± 10 ± 5	153	ANJOS	89C	TPS $\gamma N \rightarrow D^+ \pi^- X$

NODE=M119W

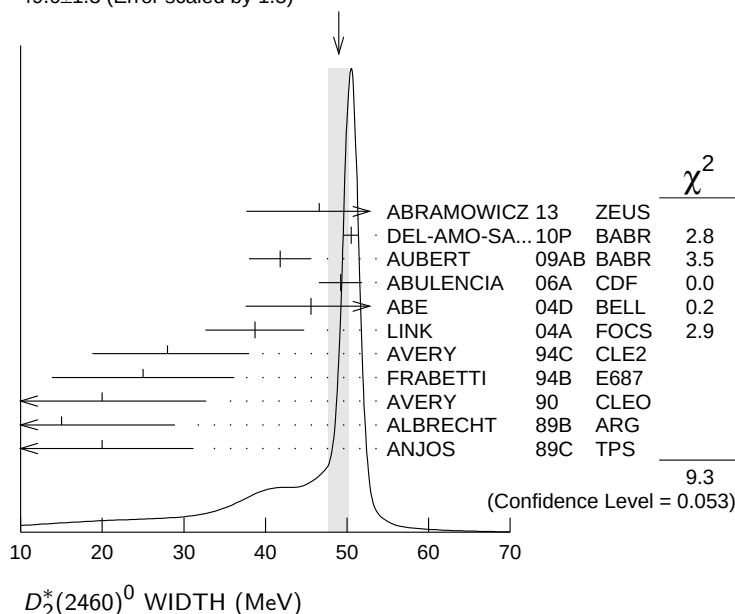
⁵ From the combined fit of the $M(D^+ \pi^-)$ and $M(D^{*+} \pi^-)$ distributions. and A_{D_2} fixed to the theoretical prediction of -1 .

⁶ Fit includes the contribution from $D_0^{*0}(2400)^0$.

NODE=M119W;LINKAGE=AR

NODE=M119W;LINKAGE=LI

WEIGHTED AVERAGE
49.0±1.3 (Error scaled by 1.5)



$D_2^*(2460)^0$ DECAY MODES

$\bar{D}_2^*(2460)^0$ modes are charge conjugates of modes below.

Mode	Fraction (Γ_i/Γ)
Γ_1 $D^+ \pi^-$	seen
Γ_2 $D^{*+}(2010) \pi^-$	seen
Γ_3 $D^0 \pi^+ \pi^-$	not seen
Γ_4 $D^{*0} \pi^+ \pi^-$	not seen

NODE=M119215;NODE=M119

NODE=M119

CLUMP=A;DESIG=1

DESIG=2

DESIG=3;OUR EST;→ UNCHECKED ←

DESIG=4;OUR EST;→ UNCHECKED ←

$D_2^*(2460)^0$ BRANCHING RATIOS

$\Gamma(D^+ \pi^-)/\Gamma_{\text{total}}$	VALUE	EVTs	DOCUMENT ID	TECN	COMMENT	Γ_1/Γ
seen		3.4k	AUBERT	09AB BABR	$B^- \rightarrow D^+ \pi^- \pi^-$	
seen		337	ALBRECHT	89B ARG	$e^+ e^- \rightarrow D^+ \pi^- X$	
seen			ANJOS	89C TPS	$\gamma N \rightarrow D^+ \pi^- X$	

NODE=M119220

NODE=M119R1
NODE=M119R1

$\Gamma(D^{*+}(2010) \pi^-)/\Gamma_{\text{total}}$	VALUE	DOCUMENT ID	TECN	COMMENT	Γ_2/Γ
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	7 ABRAMOWICZ13	ZEUS	$e^\pm p \rightarrow D^{(*)+} \pi^- X$	
1.47±0.03±0.16	379k		DEL-AMO-SA..10P	BABR	$e^+ e^- \rightarrow D^{(*)+} \pi^- X$
2.8 ±0.8 $\begin{smallmatrix} +0.5 \\ -0.6 \end{smallmatrix}$	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	$e^+ e^- \rightarrow D^* \pi^- X$	

NODE=M119R3
NODE=M119R3

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.9 ±0.5 ABE 04D BELL $B^- \rightarrow D^{(*)+} \pi^- \pi^-$

⁷ From the combined fit of the $M(D^+ \pi^-)$ and $M(D^{*+} \pi^-)$ distributions. and A_{D_2} fixed to the theoretical prediction of -1.

NODE=M119R3;LINKAGE=AR

$$\Gamma(D^+\pi^-)/[\Gamma(D^+\pi^-) + \Gamma(D^*(2010)^+\pi^-)] \quad \Gamma_1/(\Gamma_1+\Gamma_2)$$

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.62±0.03±0.02	8414	⁸ AUBERT	09Y BABR	$B^+ \rightarrow D_2^{*0} \ell^+ \nu_\ell$

⁸ Assuming $\Gamma(\Upsilon(4S) \rightarrow B^+ B^-) / \Gamma(\Upsilon(4S) \rightarrow B^0 \bar{B}^0) = 1.065 \pm 0.026$ and equal partial widths for charged and neutral D_2^* mesons.

NODE=M119R01
NODE=M119R01

NODE=M119R01;LINKAGE=AU

$D_2^*(2460)^0$ POLARIZATION AMPLITUDE A_{D_2}

A polarization amplitude A_{D_2} is a parameter that depends on the initial polarization of the D_2 . For $\bar{D}_2$ decays the helicity angle, θ_H , distribution varies like $1 + A_{D_2} \cos^2(\theta_H)$, where θ_H is the angle in the D^* rest frame between the two pions emitted by the $D_2 \rightarrow D^* \pi$ and $D^* \rightarrow D \pi$.

NODE=M119PAM

NODE=M119PAM

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

-1.16±0.35	2.3k	⁹ ABRAMOWICZ13	ZEUS	$e^\pm p \rightarrow D^{(*)+} \pi^- X$
consistent with -1	243k	DEL-AMO-SA...10P	BABR	$e^+ e^- \rightarrow D^+ \pi^- X$
-0.74 ^{+0.49} _{-0.38}		¹⁰ AVERY	94C CLE2	$e^+ e^- \rightarrow D^{*+} \pi^- X$

⁹ From the combined fit of the $M(D^+ \pi^-)$ and $M(D^{*+} \pi^-)$ distributions.

¹⁰ Systematic uncertainties not estimated.

NODE=M119PAM

NODE=M119PAM;LINKAGE=AB

NODE=M119PAM;LINKAGE=AV

$D_2^*(2460)^0$ REFERENCES

ABRAMOWICZ 13	NP B866 229	H. Abramowicz <i>et al.</i>	(ZEUS Collab.)
DEL-AMO-SA... 10P	PR D82 111101	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)
AUBERT 09AB	PR D79 112004	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT 09Y	PRL 103 051803	B. Aubert <i>et al.</i>	(BABAR Collab.)
CHEKANOV 09	EPJ C60 25	S. Chekanov <i>et al.</i>	(ZEUS Collab.)
ABULENCIA 06A	PR D73 051104	A. Abulencia <i>et al.</i>	(CDF Collab.)
ABE 04D	PR D69 112002	K. Abe <i>et al.</i>	(BELLE Collab.)
LINK 04A	PL B586 11	J.M. Link <i>et al.</i>	(FOCUS Collab.)
ABREU 98M	PL B426 231	P. Abreu <i>et al.</i>	(DELPHI Collab.)
ACKERSTAFF 97W	ZPHY C76 425	K. Ackerstaff <i>et al.</i>	(OPAL Collab.)
ASRATYAN 95	ZPHY C68 43	A.E. Asratyan <i>et al.</i>	(BIRM, BELG, CERN+)
AVERY 94C	PL B331 236	P. Avery <i>et al.</i>	(CLEO Collab.)
FRABETTI 94B	PRL 72 324	P.L. Frabetti <i>et al.</i>	(FNAL E687 Collab.)
AVERY 90	PR D41 774	P. Avery, D. Besson	(CLEO Collab.)
ALBRECHT 89B	PL B221 422	H. Albrecht <i>et al.</i>	(ARGUS Collab.) JP
ALBRECHT 89H	PL B232 398	H. Albrecht <i>et al.</i>	(ARGUS Collab.) JP
ANJOS 89C	PRL 62 1717	J.C. Anjos <i>et al.</i>	(FNAL E691 Collab.)

NODE=M119

REFID=54743
REFID=53534
REFID=52941
REFID=52929
REFID=52733
REFID=51054
REFID=50011
REFID=49775
REFID=46315
REFID=45788
REFID=44439
REFID=44096
REFID=43687
REFID=41013
REFID=40736
REFID=41001
REFID=40737

$$D_2^*(2460)^\pm$$

$$I(J^P) = \frac{1}{2}(2^+)$$

$J^P = 2^+$ assignment strongly favored(ALBRECHT 89B).

NODE=M150

NODE=M150

NODE=M150M

NODE=M150M

$D_2^*(2460)^\pm$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2464.3±1.6 OUR AVERAGE		Error includes scale factor of 1.7. See the ideogram below.		
2460.6±4.4 ^{+3.6} _{-0.8}	1371	¹ ABRAMOWICZ13	ZEUS	$e^\pm p \rightarrow D^{(*)0} \pi^+ X$
2465.4±0.2±1.1	111k	² DEL-AMO-SA...10P	BABR	$e^+ e^- \rightarrow D^0 \pi^+ X$
2465.7±1.8 ^{+1.4} _{-4.8}	2909	KUZMIN	07 BELL	$e^+ e^- \rightarrow \text{hadrons}$
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. • • •				
2467.6±1.5±0.8	3.5k	³ LINK	04A FOCS	γA

¹ From the fit of the $M(D^0 \pi^+)$ distribution. The widths of the D_1^+ and D_2^{*+} are fixed to 25 MeV and 37 MeV, and A_{D_1} and A_{D_2} are fixed to the theoretical predictions of 3 and -1, respectively.

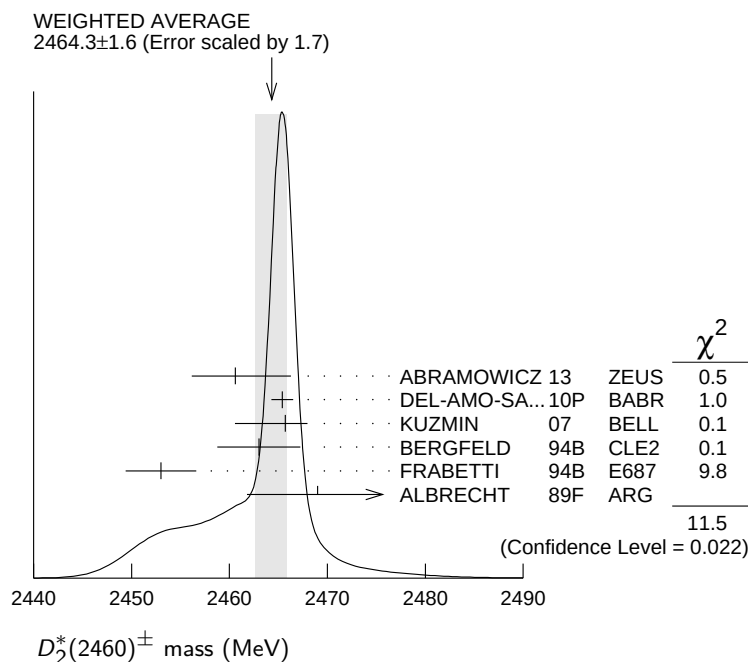
² At a fixed width of 50.5 MeV.

³ Fit includes the contribution from $D_0^*(2400)^\pm$. Not independent of the corresponding mass difference measurement, $(m_{D_2^*(2460)^\pm} - (m_{D_2^*(2460)^0})$.

NODE=M150M;LINKAGE=AB

NODE=M150M;LINKAGE=DE

NODE=M150M;LINKAGE=LI



$$m_{D_2^*(2460)^\pm} - m_{D_2^*(2460)^0}$$

NODE=M150DM

NODE=M150DM

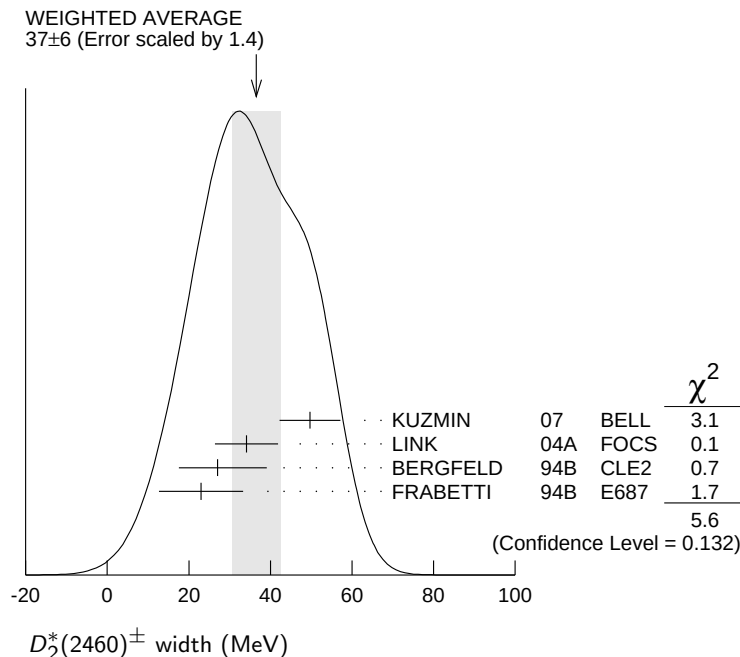
VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
2.4±1.7 OUR AVERAGE			
3.1±1.9±0.9	LINK	04A FOCS	γA
- 2 ±4 ±4	BERGFELD	94B CLE2	$e^+ e^- \rightarrow \text{hadrons}$
0 ±4	FRABETTI	94B E687	$\gamma \text{Be} \rightarrow D \pi X$
14 ±5 ±8	ALBRECHT	89F ARG	$e^+ e^- \rightarrow D^0 \pi^+ X$

$D_2^*(2460)^\pm$ WIDTH

NODE=M150W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
37 ± 6 OUR AVERAGE	Error includes scale factor of 1.4. See the ideogram below.			
49.7 ± 3.8 ± 6.4	2909	KUZMIN	07	BELL $e^+e^- \rightarrow \text{hadrons}$
34.1 ± 6.5 ± 4.2	3.5k	⁴ LINK	04A	FOCS γA
27 $^{+11}_{-8}$ ± 5	310	BERGFELD	94B	CLE2 $e^+e^- \rightarrow D^0\pi^+X$
23 ± 9 ± 5	185	FRABETTI	94B	E687 $\gamma Be \rightarrow D^0\pi^+X$

⁴ Fit includes the contribution from $D_0^*(2400)^\pm$.



$D_2^*(2460)^\pm$ DECAY MODES

$D_2^*(2460)^-$ modes are charge conjugates of modes below.

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

$D_2^*(2460)^\pm$ BRANCHING RATIOS

$\Gamma(D^0\pi^+)/\Gamma_{\text{total}}$	Γ_1/Γ		
VALUE	DOCUMENT ID	TECN	COMMENT
seen	ALBRECHT	89F ARG	$e^+e^- \rightarrow D^0\pi^+X$

$\Gamma(D^0\pi^+)/\Gamma(D^{*0}\pi^+)$				Γ_1/Γ_2
<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
1.2±0.4 OUR AVERAGE				
1.1±0.4 ^{+0.3} _{-0.2}	1371	⁵ ABRAMOWICZ13	ZEUS	$e^\pm p \rightarrow D^{(*)0}\pi^+X$
1.9±1.1±0.3		BERGFELD	94B CLE2	$e^+e^- \rightarrow \text{hadrons}$

⁵ From the fit of the $M(D^0\pi^+)$ distribution. The widths of the D_1^+ and D_2^{*+} are fixed to 25 MeV and 37 MeV, and A_{D_1} and A_{D_2} are fixed to the theoretical predictions of 3 and -1, respectively.

$\Gamma(D^0\pi^+)/[\Gamma(D^0\pi^+)+\Gamma(D^{*0}\pi^+)]$					$\Gamma_1/(\Gamma_1+\Gamma_2)$
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.62 ± 0.03 ± 0.02	3361	⁶ AUBERT	09Y	BABR $\bar{B}^0 \rightarrow D_2^{*+}\ell^- \nu_\ell$

NODE=M150W

NODE=M150W;LINKAGE=LI

NODE=M150215;NODE=M150

NODE=M150

DESIG=1

DESIG=2;OUR EST;→ UNCHECKED ←

DESIG=3;OUR EST;→ UNCHECKED ←

DESIG=4;OUR EST;→ UNCHECKED ←

NODE=M150220

NODE=M150R1
NODE=M150R1

NODE=M150R2
NODE=M150R2

NODE=M150R2;LINKAGE=AB

NODE=M150R01
NODE=M150R01

⁶ Assuming $\Gamma(\Upsilon(4S) \rightarrow B^+ B^-) / \Gamma(\Upsilon(4S) \rightarrow B^0 \bar{B}^0) = 1.065 \pm 0.026$ and equal partial widths for charged and neutral D_2^* mesons.

NODE=M150R01;LINKAGE=AU

$D_2^*(2460)^\pm$ REFERENCES

ABRAMOWICZ 13	NP B866 229	H. Abramowicz <i>et al.</i>	(ZEUS Collab.)
DEL-AMO-SA... 10P	PR D82 111101	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)
AUBERT 09Y	PRL 103 051803	B. Aubert <i>et al.</i>	(BABAR Collab.)
KUZMIN 07	PR D76 012006	A. Kuzmin <i>et al.</i>	(BELLE Collab.)
LINK 04A	PL B586 11	J.M. Link <i>et al.</i>	(FOCUS Collab.)
BERGFELD 94B	PL B340 194	T. Bergfeld <i>et al.</i>	(CLEO Collab.)
FRABETTI 94B	PRL 72 324	P.L. Frabetti <i>et al.</i>	(FNAL E687 Collab.)
ALBRECHT 89B	PL B221 422	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
ALBRECHT 89F	PL B231 208	H. Albrecht <i>et al.</i>	(ARGUS Collab.)

NODE=M150

REFID=54743
REFID=53534
REFID=52929
REFID=51854
REFID=49775
REFID=44099
REFID=43687
REFID=40736
REFID=40931

$D(2550)^0$

$I(J^P) = \frac{1}{2}(0^-)$

OMITTED FROM SUMMARY TABLE
 $J^P = 0^-$ assignment based on the helicity analysis (DEL-AMO-SANCHEZ 10P).

NODE=M198

NODE=M198

$D(2550)^0$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2539.4±4.5±6.8	34k	DEL-AMO-SA...10P	BABR	$e^+ e^- \rightarrow D^{*+} \pi^- X$

NODE=M198M

NODE=M198M

$D(2550)^0$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
130±12±13	34k	DEL-AMO-SA...10P	BABR	$e^+ e^- \rightarrow D^{*+} \pi^- X$

NODE=M198W

NODE=M198W

$D(2550)^0$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad D^{*+} \pi^-$	seen

NODE=M198215;NODE=M198

DESIG=1;OUR EVAL;→ UNCHECKED ←

$D(2550)^0$ REFERENCES

DEL-AMO-SA... 10P	PR D82 111101	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)

NODE=M198

REFID=53534

D(2600)

$I(J^P) = \frac{1}{2}(?)^2$

OMITTED FROM SUMMARY TABLE
 J^P consistent with natural parity (DEL-AMO-SANCHEZ 10P).

D(2600) MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
2612 ±6 OUR AVERAGE		Error includes scale factor of 1.9.			
2608.7±2.4±2.5	26k	DEL-AMO-SA...10P	BABR	0	$e^+e^- \rightarrow D^+\pi^-X$
2621.3±3.7±4.2	13k	¹ DEL-AMO-SA...10P	BABR	+	$e^+e^- \rightarrow D^0\pi^+X$

¹ At a fixed width of 93 MeV.

D(2600) WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
93±6±13	26k	DEL-AMO-SA...10P	BABR	$e^+e^- \rightarrow D^+\pi^-X$

D(2600) DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad D\pi$	seen
$\Gamma_2 \quad D^+\pi^-$	seen
$\Gamma_3 \quad D^0\pi^\pm$	seen
$\Gamma_4 \quad D^*\pi$	seen
$\Gamma_5 \quad D^{*+}\pi^-$	seen

D(2600) BRANCHING RATIOS

$\Gamma(D^+\pi^-)/\Gamma(D^{*+}\pi^-)$				Γ_2/Γ_5	
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
0.32±0.02±0.09	76k	DEL-AMO-SA...10P	BABR	$e^+e^- \rightarrow D^{(*)+}\pi^-X$	

D(2600) REFERENCES

DEL-AMO-SA... 10P PR D82 111101 P. del Amo Sanchez *et al.* (BABAR Collab.)

NODE=M199

NODE=M199

NODE=M199M

NODE=M199M

OCCUR=2

NODE=M199M;LINKAGE=DE

NODE=M199W

NODE=M199W

NODE=M199215;NODE=M199

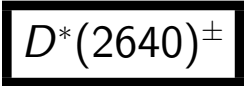
DESIG=1;OUR EVAL;→ UNCHECKED ←
DESIG=2;OUR EVAL;→ UNCHECKED ←
DESIG=3;OUR EVAL;→ UNCHECKED ←
DESIG=4;OUR EVAL;→ UNCHECKED ←
DESIG=5;OUR EVAL;→ UNCHECKED ←

NODE=M199220

NODE=M199R01
NODE=M199R01

NODE=M199

REFID=53534



$$I(J^P) = \frac{1}{2}(??)$$

OMITTED FROM SUMMARY TABLE
Seen in Z decays by ABREU 98M. Not seen by ABBIENDI 01N and
CHEKANOV 09. Needs confirmation.

NODE=M158

NODE=M158

$D^*(2640)^\pm$ MASS

NODE=M158M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2637±2±6	66 ± 14	ABREU	98M DLPH	$e^+e^- \rightarrow D^{*+}\pi^+\pi^-X$

NODE=M158M

$D^*(2640)^\pm$ WIDTH

NODE=M158W

VALUE (MeV)	CL%	DOCUMENT ID	TECN	COMMENT
<15	95	ABREU	98M DLPH	$e^+e^- \rightarrow D^{*+}\pi^+\pi^-X$

NODE=M158W

$D^*(2640)^+$ DECAY MODES

NODE=M158215;NODE=M158

$D^*(2640)^-$ modes are charge conjugates of modes below.

NODE=M158

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad D^*(2010)^+\pi^+\pi^-$	seen

DESIG=1;OUR EST;→ UNCHECKED ←

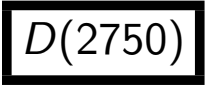
$D^*(2640)^\pm$ REFERENCES

NODE=M158

CHEKANOV 09 EPJ C60 25	S. Chekanov <i>et al.</i>	(ZEUS Collab.)
ABBIENDI 01N EPJ C20 445	G. Abbiendi <i>et al.</i>	(OPAL Collab.)
ABREU 98M PL B426 231	P. Abreu <i>et al.</i>	(DELPHI Collab.)

REFID=52733
REFID=48296
REFID=46315

NODE=M203



$$I(J^P) = \frac{1}{2}(??)$$

OMITTED FROM SUMMARY TABLE

NODE=M203M

NODE=M203M

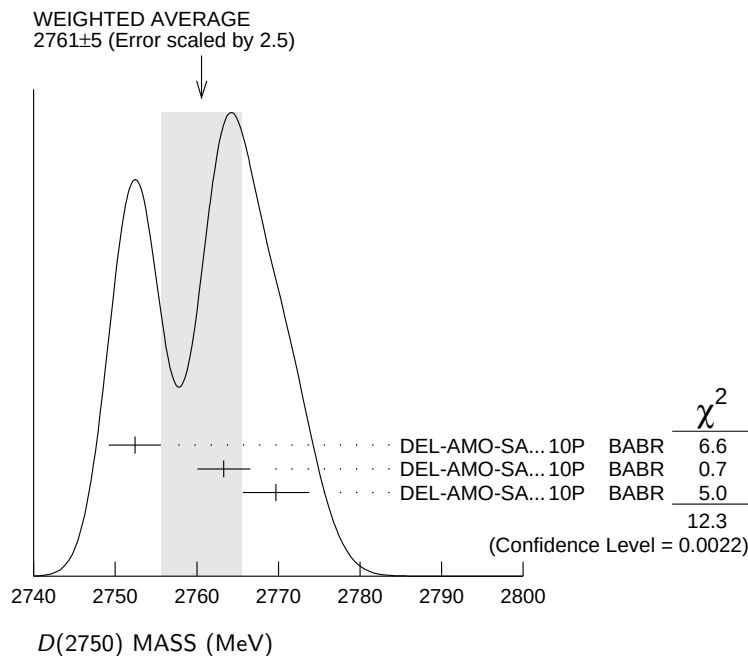
$D(2750)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
2761 ±5 OUR AVERAGE		Error includes scale factor of 2.5. See the ideogram below.			
2752.4±1.7±2.7	23.5k	¹ DEL-AMO-SA..10P	BABR	0	$e^+e^- \rightarrow D^{*+}\pi^-X$
2763.3±2.3±2.3	11.3k	¹ DEL-AMO-SA..10P	BABR	0	$e^+e^- \rightarrow D^+\pi^-X$
2769.7±3.8±1.5	5.7k	^{1,2} DEL-AMO-SA..10P	BABR	+	$e^+e^- \rightarrow D^0\pi^+X$

OCCUR=2
OCCUR=3

¹ The states observed in the $D^*\pi$ and $D\pi$ final states are not necessarily the same.
² At a fixed width of 60.9 MeV.

NODE=M203M;LINKAGE=DE
NODE=M203M;LINKAGE=DA



$D(2750)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
63 ±6 OUR AVERAGE				
71 ±6 ±11	23.5k	³ DEL-AMO-SA...10P	BABR	$e^+e^- \rightarrow D^{*+}\pi^- X$
60.9±5.1± 3.6	11.3k	³ DEL-AMO-SA...10P	BABR	$e^+e^- \rightarrow D^+\pi^- X$

³ The states observed in the $D^*\pi$ and $D\pi$ final states are not necessarily the same.

$D(2750)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $D\pi$	seen
Γ_2 $D^+\pi^-$	seen
Γ_3 $D^0\pi^\pm$	seen
Γ_4 $D^*\pi$	seen
Γ_5 $D^{*+}\pi^-$	seen

$D(2750)$ BRANCHING RATIOS

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_2/Γ_5
0.42±0.05±0.11	34.8k	⁴ DEL-AMO-SA...10P	BABR	$e^+e^- \rightarrow D^{(*)+}\pi^- X$	

⁴ The states observed in the $D^*\pi$ and $D\pi$ final states are not necessarily the same.

$D(2750)$ POLARIZATION AMPLITUDE A_D

A polarization amplitude A_D is a parameter that depends on the initial polarization of the $D(2750)$. For $D(2750)$ decays the helicity angle, θ_H , distribution varies like $1 + A_D \cos(\theta_H)$, where θ_H is the angle in the D^* rest frame between the two pions emitted by the $D(2750) \rightarrow D^*\pi$ and $D^* \rightarrow D\pi$.

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
-0.33±0.28	23.5k	⁵ DEL-AMO-SA...10P	BABR	$e^+e^- \rightarrow D^{*+}\pi^- X$

⁵ Systematic uncertainties not estimated. The states observed in the $D^*\pi$ and $D\pi$ final states are not necessarily the same.

$D(2750)$ REFERENCES

DEL-AMO-SA...10P PR D82 111101 P. del Amo Sanchez *et al.* (BABAR Collab.)

NODE=M203W

NODE=M203W

OCCUR=2

NODE=M203W;LINKAGE=DE

NODE=M203215;NODE=M203

DESIG=1;OUR EVAL;→ UNCHECKED ←
DESIG=2;OUR EVAL;→ UNCHECKED ←
DESIG=3;OUR EVAL;→ UNCHECKED ←
DESIG=4;OUR EVAL;→ UNCHECKED ←
DESIG=5;OUR EVAL;→ UNCHECKED ←

NODE=M203220

NODE=M203R01
NODE=M203R01

NODE=M203R01;LINKAGE=DE

NODE=M203PAM

NODE=M203PAM

NODE=M203PAM

NODE=M203PAM;LINKAGE=DE

NODE=M203

REFID=53534

CHARMED, STRANGE MESONS

($C = S = \pm 1$)

$$D_s^+ = c\bar{s}, D_s^- = \bar{c}s, \text{ similarly for } D_s^{*+}s$$

$$D_s^{*\pm}$$

$$I(J^P) = 0(?^?)$$

J^P is natural, width and decay modes consistent with 1^- .

$D_s^{*\pm}$ MASS

The fit includes $D^\pm, D^0, D_s^\pm, D^{*\pm}, D^{*0}, D_s^{*\pm}, D_1(2420)^0, D_2^*(2460)^0$, and $D_{s1}(2536)^\pm$ mass and mass difference measurements.

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
2112.1 ± 0.4 OUR FIT			
[2112.3 ± 0.5 MeV OUR 2013 FIT Scale factor = 1.1]			
2106.6 ± 2.1 ± 2.7	¹ BLAYLOCK	87	MRK3 $e^+e^- \rightarrow D_s^\pm \gamma X$
¹ Assuming $D_s^\pm$ mass = 1968.7 ± 0.9 MeV.			

$$m_{D_s^{*\pm}} - m_{D_s^\pm}$$

The fit includes $D^\pm, D^0, D_s^\pm, D^{*\pm}, D^{*0}, D_s^{*\pm}, D_1(2420)^0, D_2^*(2460)^0$, 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 ± 0.39 ± 0.40		GRONBERG	95	CLE2 e^+e^-
144.22 ± 0.47 ± 0.37		BROWN	94	CLE2 e^+e^-
142.5 ± 0.8 ± 1.5		² ALBRECHT	88	ARG $e^+e^- \rightarrow D_s^\pm \gamma X$
139.5 ± 8.3 ± 9.7	60	AIHARA	84D	TPC $e^+e^- \rightarrow \text{hadrons}$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
143.0 ± 18.0	8	ASRATYAN	85	HLBC FNAL 15-ft, ν - ² H
110 ± 46		BRANDELIK	79	DASP $e^+e^- \rightarrow D_s^\pm \gamma X$
² Result includes data of ALBRECHT 84B.				

$D_s^{*\pm}$ WIDTH

VALUE (MeV)	CL%	DOCUMENT ID	TECN	COMMENT
< 1.9	90	GRONBERG	95	CLE2 e^+e^-
< 4.5	90	ALBRECHT	88	ARG $E_{\text{cm}}^{ee} = 10.2 \text{ GeV}$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
< 4.9	90	BROWN	94	CLE2 e^+e^-
< 22	90	BLAYLOCK	87	MRK3 $e^+e^- \rightarrow D_s^\pm \gamma X$

D_s^{*+} DECAY MODES

D_s^{*-} modes are charge conjugates of the modes below.

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad D_s^+ \gamma$	(94.2 ± 0.7) %
$\Gamma_2 \quad D_s^+ \pi^0$	(5.8 ± 0.7) %

NODE=MXXX040

NODE=MXXX040

NODE=S074

NODE=S074

NODE=S074M

NODE=S074M

NODE=S074M
NEW

NODE=S074M;LINKAGE=E

NODE=S074DM

NODE=S074DM

NODE=S074DM

NODE=S074DM;LINKAGE=A

NODE=S074W

NODE=S074W

NODE=S074215;NODE=S074

NODE=S074

DESIG=1

DESIG=2

CONSTRAINED FIT INFORMATION

An overall fit to a branching ratio uses 2 measurements and one constraint to determine 2 parameters. The overall fit has a $\chi^2 = 0.0$ for 1 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta x_i \delta x_j \rangle / (\delta x_i \delta x_j)$, in percent, from the fit to the branching fractions, $x_i \equiv \Gamma_i / \Gamma_{\text{total}}$. The fit constrains the x_i whose labels appear in this array to sum to one.

$$x_2 \begin{vmatrix} & -100 \\ & x_1 \end{vmatrix}$$

D_s^{*+} BRANCHING RATIOS

NODE=S074220

$\Gamma(D_s^{*+} \gamma) / \Gamma_{\text{total}}$ Γ_1 / Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

NODE=S074R1
NODE=S074R1

0.942±0.007 OUR FIT

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.942±0.004±0.006	16k	³ AUBERT,BE	05G	BABR	10.6 $e^+ e^- \rightarrow$ hadrons
seen		ASRATYAN	91	HLBC	$\bar{\nu}_\mu \text{Ne}$
seen		ALBRECHT	88	ARG	$e^+ e^- \rightarrow D_s^{*+} \gamma X$
seen		AIHARA	84D		
seen		ALBRECHT	84B		
seen		BRANDELIK	79		

$\Gamma(D_s^{*+} \pi^0) / \Gamma_{\text{total}}$ Γ_2 / Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

NODE=S074R3
NODE=S074R3

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.059±0.004±0.006	560	³ AUBERT,BE	05G	BABR	10.6 $e^+ e^- \rightarrow$ hadrons

$\Gamma(D_s^{*+} \pi^0) / \Gamma(D_s^{*+} \gamma)$ Γ_2 / Γ_1

VALUE	DOCUMENT ID	TECN	COMMENT

NODE=S074R2
NODE=S074R2

0.062±0.008 OUR FIT

0.062±0.008 OUR AVERAGE

0.062±0.005±0.006	AUBERT,BE	05G	BABR	10.6 $e^+ e^- \rightarrow$ hadrons
0.062 $^{+0.020}_{-0.018}$ ±0.022	GRONBERG	95	CLE2	$e^+ e^-$

³Derived from the ratio $\Gamma(D_s^{*+} \pi^0) / \Gamma(D_s^{*+} \gamma)$ assuming that the branching fractions of $D_s^{*+} \rightarrow D_s^{*+} \pi^0$ and $D_s^{*+} \rightarrow D_s^{*+} \gamma$ decays sum to 100%.

NODE=S074R;LINKAGE=AU

$D_s^{*\pm}$ REFERENCES

NODE=S074

AUBERT,BE	05G	PR D72 091101	B. Aubert <i>et al.</i>	(BABAR Collab.)
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.)

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 does 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±0.6 OUR FIT	Error includes scale factor of 1.1.	[2317.8 ± 0.6 MeV OUR 2013 FIT Scale factor = 1.1]		

NODE=M172M

NEW

2318.0±1.0 OUR AVERAGE Error includes scale factor of 1.4.

2319.6±0.2±1.4	3180	AUBERT	06P BABR	10.6 $e^+e^- \rightarrow D_s^+\pi^0 X$
2317.3±0.4±0.8	1022	¹ AUBERT	04E BABR	10.6 e^+e^-

• • • We do not use the following data for averages, fits, limits, etc. • • •

2317.2±1.3	88	² AUBERT,B	04s BABR	$B \rightarrow D_{s0}^{(*)}(2317)^+ \bar{D}^{(*)}$
2317.2±0.5±0.9	761	³ MIKAMI	04 BELL	10.6 e^+e^-
2316.8±0.4±3.0	1267 ± 53	^{3,4} AUBERT	03G BABR	10.6 e^+e^-
2317.6±1.3	273 ± 33	^{3,5} AUBERT	03G BABR	10.6 e^+e^-
2319.8±2.1±2.0	24	³ KROKOVNY	03B BELL	10.6 e^+e^-

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±0.6 OUR FIT	Error includes scale factor of 1.1.	[349.3 ± 0.6 MeV OUR 2013 FIT Scale factor = 1.1]		

NODE=M172DM

NEW

349.2±0.7 OUR AVERAGE

348.7±0.5±0.7	761	MIKAMI	04 BELL	10.6 e^+e^-
350.0±1.2±1.0	135	BESSION	03 CLE2	10.6 e^+e^-
351.3±2.1±1.9	24	⁶ KROKOVNY	03B BELL	10.6 e^+e^-

• • • We do not use the following data for averages, fits, limits, etc. • • •

349.6±0.4±3.0	1267	^{7,8} AUBERT	03G BABR	10.6 e^+e^-
350.2±1.3	273	^{9,10} AUBERT	03G BABR	10.6 e^+e^-

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

$$D_{s0}^*(2317)^\pm$$

NODE=M172W

NODE=M172W

VALUE (MeV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
< 3.8	95	3180	AUBERT	06P BABR	10.6 $e^+e^- \rightarrow D_s^+\pi^0 X$

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 4.6	90	761	MIKAMI	04 BELL	10.6 e^+e^-
< 10			AUBERT	03G BABR	10.6 e^+e^-
< 7	90	135	BESSION	03 CLE2	10.6 e^+e^-

$D_{s0}^*(2317)^\pm$ DECAY MODES $D_{s0}^*(2317)^-$ modes are charge conjugates of modes below.

NODE=M172215;NODE=M172

NODE=M172

Mode	Fraction (Γ_i/Γ)
Γ_1 $D_s^+ \pi^0$	seen
Γ_2 $D_s^+ \gamma$	
Γ_3 $D_s^{*+}(2112) \gamma$	
Γ_4 $D_s^+ \gamma \gamma$	
Γ_5 $D_s^{*+}(2112) \pi^0$	
Γ_6 $D_s^+ \pi^+ \pi^-$	
Γ_7 $D_s^+ \pi^0 \pi^0$	not seen

DESIG=1

DESIG=2

DESIG=3

DESIG=4

DESIG=5

DESIG=6

DESIG=7;OUR EVAL;→ UNCHECKED ←

 $D_{s0}^*(2317)^\pm$ BRANCHING RATIOS

NODE=M172220

$\Gamma(D_s^+ \pi^0)/\Gamma_{\text{total}}$				Γ_1/Γ
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
seen	1540 ± 62	AUBERT	03G BABR	$10.6 e^+ e^-$

NODE=M172R1
NODE=M172R1

$\Gamma(D_s^+ \gamma)/\Gamma(D_s^+ \pi^0)$					Γ_2/Γ_1
<u>VALUE</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
<0.05	90	MIKAMI	04	BELL	10.6 e ⁺ e ⁻
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
<0.14	95	AUBERT	06P	BABR	10.6 e ⁺ e ⁻
<0.052	90	BESSON	03	CLE2	10.6 e ⁺ e ⁻

NODE=M172R5
NODE=M172R5

$\Gamma(D_s^{*}(2112)^+\gamma)/\Gamma(D_s^+\pi^0)$					Γ_3/Γ_1
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
<0.059	90	BESSON	03	CLE2	10.6 e ⁺ e ⁻
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
<0.16	95	AUBERT	06P	BABR	10.6 e ⁺ e ⁻
<0.18	90	MIKAMI	04	BELL	10.6 e ⁺ e ⁻

NODE=M172R6
NODE=M172R6

$\Gamma(D_s^+ \gamma \gamma)/\Gamma(D_s^+ \pi^0)$					Γ_4/Γ_1
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
<0.18	95	AUBERT	06P	BABR	10.6 $e^+ e^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
not seen		AUBERT	03G	BABR	10.6 $e^+ e^-$

NODE=M172R7
NODE=M172R7

$\Gamma(D_s^{*+}(2112)\pi^0)/\Gamma(D_s^+\pi^0)$					Γ_5/Γ_1
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
<0.11	90	BESSON	03	CLE2	10.6 e ⁺ e ⁻

NODE=M172R8
NODE=M172R8

$\Gamma(D_s^+ \pi^+ \pi^-)/\Gamma(D_s^+ \pi^0)$						Γ_6/Γ_1
VALUE	CL%	DOCUMENT ID	TECN	COMMENT		
<0.004	90	MIKAMI	04	BELL	10.6 $e^+ e^-$	
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●						
<0.005	95	AUBERT	06P	BABR	10.6 $e^+ e^-$	
<0.019	90	BESSON	03	CLE2	10.6 $e^+ e^-$	

NODE=M172R9
NODE=M172R9

$\Gamma(D_s^+ \pi^0 \pi^0)/\Gamma(D_s^+ \pi^0)$					Γ_7/Γ_1
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
<0.25	95	AUBERT	06P	BABR	10.6 $e^+ e^-$

NODE=M172R10
NODE=M172R10 **$D_{s0}^*(2317)^\pm$ REFERENCES**

NODE=M172

AUBERT	06P	PR D74 032007	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51144
AUBERT	04E	PR D69 031101	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=49747
AUBERT,B	04S	PRL 93 181801	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=50195
MIKAMI	04	PRL 92 012002	Y. Mikami <i>et al.</i>	(BELLE Collab.)	REFID=49629
AUBERT	03G	PRL 90 242001	B. Aubert <i>et al.</i>	(BaBar Collab.)	REFID=49417
BESSON	03	PR D68 032002	D. Besson <i>et al.</i>	(CLEO Collab.)	REFID=49583
KROKOVNY	03B	PRL 91 262002	P. Krokovny <i>et al.</i>	(BELLE Collab.)	REFID=49615

$$D_{s1}(2460)^{\pm}$$

$$I(J^P) = 0(1^+)$$

NODE=M173

$D_{s1}(2460)^{\pm}$ MASS

NODE=M173M

The fit includes $D^{\pm}$, D^0 , $D_s^{\pm}$, $D^{*\pm}$, D^{*0} , $D_s^{*\pm}$, $D_1(2420)^0$, $D_2^*(2460)^0$, and $D_{s1}(2536)^{\pm}$ mass and mass difference measurements.

NODE=M173M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2459.5±0.6 OUR FIT		Error includes scale factor of 1.1. [2459.6 ± 0.6 MeV OUR 2013 FIT Scale factor = 1.1]		
2459.6±0.9 OUR AVERAGE		Error includes scale factor of 1.3.		
2460.1±0.2±0.8		¹ AUBERT	06P BABR	10.6 e ⁺ e ⁻
2458.0±1.0±1.0	195	AUBERT	04E BABR	10.6 e ⁺ e ⁻
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2459.5±1.2±3.7	920	AUBERT	06P BABR	10.6 e ⁺ e ⁻ → $D_s^+ \gamma X$
2458.6±1.0±2.5	560	AUBERT	06P BABR	10.6 e ⁺ e ⁻ → $D_s^+ \pi^0 \gamma X$
2460.2±0.2±0.8	123	AUBERT	06P BABR	10.6 e ⁺ e ⁻ → $D_s^+ \pi^+ \pi^- X$
2458.9±1.5	112	² AUBERT,B	04S BABR	$B \rightarrow D_{s1}(2460)^+ \bar{D}^{(*)}$
2461.1±1.6	139	³ AUBERT,B	04S BABR	$B \rightarrow D_{s1}(2460)^+ \bar{D}^{(*)}$
2456.5±1.3±1.3	126	^{4,5} MIKAMI	04 BELL	10.6 e ⁺ e ⁻
2459.5±1.3±2.0	152	^{6,7} MIKAMI	04 BELL	10.6 e ⁺ e ⁻
2459.9±0.9±1.6	60	^{6,7} MIKAMI	04 BELL	10.6 e ⁺ e ⁻
2459.2±1.6±2.0	57	KROKOVNY	03B BELL	10.6 e ⁺ e ⁻

NODE=M173M

NEW

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.

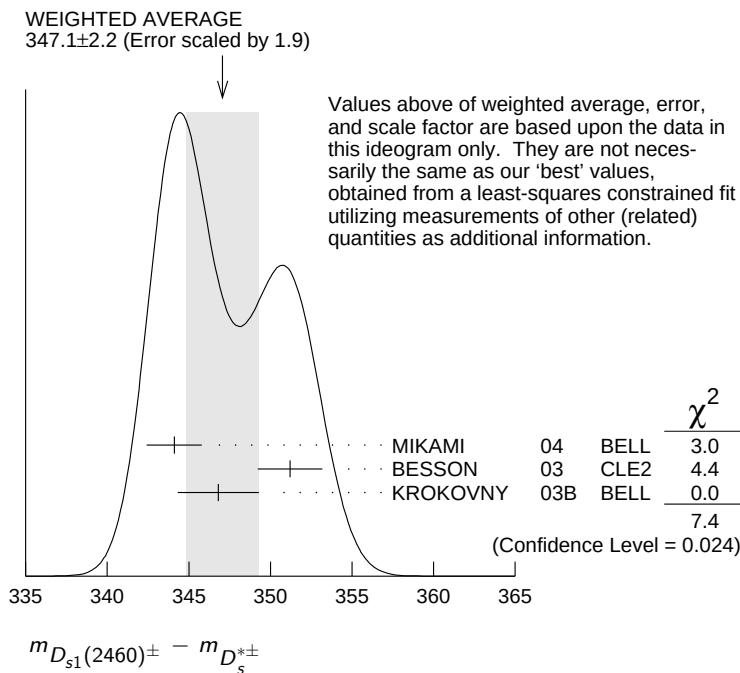
NODE=M173MD

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
347.3±0.7 OUR FIT		Error includes scale factor of 1.2. [347.2 ± 0.7 MeV OUR 2013 FIT Scale factor = 1.2]		
347.1±2.2 OUR AVERAGE		Error includes scale factor of 1.9. See the ideogram below.		
344.1±1.3±1.1	126	MIKAMI	04 BELL	10.6 e ⁺ e ⁻
351.2±1.7±1.0	41	BESSON	03 CLE2	10.6 e ⁺ e ⁻
346.8±1.6±1.9	57	⁸ KROKOVNY	03B BELL	10.6 e ⁺ e ⁻
⁸ Recalculated by us using $m_{D_s^{*+}} = 2112.4 \pm 0.7$ MeV.				

NODE=M173MD

NEW

NODE=M173MD;LINKAGE=K3



$$m_{D_{s1}(2460)^{\pm}} - m_{D_s^{\pm}}$$

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.

NODE=M173DM

NODE=M173DM

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
491.2±0.6 OUR FIT	Error includes scale factor of 1.1. [491.1 ± 0.7 MeV OUR 2013 FIT Scale factor = 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
NEW

OCCUR=2

NODE=M173DM;LINKAGE=M1
NODE=M173DM;LINKAGE=M2

$$D_{s1}(2460)^{\pm} \text{ WIDTH}$$

VALUE (MeV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
< 3.5	95	123	AUBERT	06P BABR	10.6 $e^+e^- \rightarrow D_s^+\pi^+\pi^-X$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 6.3	95	560	AUBERT	06P BABR	10.6 $e^+e^- \rightarrow D_s^+\pi^0\gamma X$
<10		195	AUBERT	04E BABR	10.6 e^+e^-
< 5.5	90	126	MIKAMI	04 BELL	10.6 e^+e^-
< 7	90	41	BESSON	03 CLE2	10.6 e^+e^-

NODE=M173W

NODE=M173W

OCCUR=2

$$D_{s1}(2460)^+ \text{ DECAY MODES}$$

$D_{s1}(2460)^-$ modes are charge conjugates of the modes below.

NODE=M173215;NODE=M173

NODE=M173

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
Γ_1 $D_s^{*+}\pi^0$	(48 ± 11) %	
Γ_2 $D_s^+\gamma$	(18 ± 4) %	
Γ_3 $D_s^+\pi^+\pi^-$	(4.3 ± 1.3) %	S=1.1
Γ_4 $D_s^{*+}\gamma$	< 8 %	CL=90%
Γ_5 $D_{s0}^{*}(2317)^+\gamma$	(3.7 ^{+5.0} _{-2.4}) %	
Γ_6 $D_s^+\pi^0$		
Γ_7 $D_s^+\pi^0\pi^0$		
Γ_8 $D_s^+\gamma\gamma$		

DESIG=1

DESIG=2

DESIG=3

DESIG=4

DESIG=5

DESIG=7

DESIG=8

DESIG=9

CONSTRAINED FIT INFORMATION

An overall fit to 7 branching ratios uses 8 measurements and one constraint to determine 5 parameters. The overall fit has a $\chi^2 = 3.4$ for 4 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta x_i \delta x_j \rangle / (\delta x_i \delta x_j)$, in percent, from the fit to the branching fractions, $x_i \equiv \Gamma_i / \Gamma_{\text{total}}$. The fit constrains the x_i whose labels appear in this array to sum to one.

x_2	80		
x_3	68	62	
x_5	-3	25	26
	x_1	x_2	x_3

$D_{s1}(2460)^\pm$ BRANCHING RATIOS

NODE=M173220

$\Gamma(D_s^{*+} \pi^0) / \Gamma_{\text{total}}$ Γ_1 / Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

0.48 ± 0.11 OUR FIT**0.56 ± 0.13 ± 0.09**¹¹ AUBERT 06N BABR $B \rightarrow D_{s1}(2460)^- \bar{D}^{(*)}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

seen 41 BESSON 03 CLE2 10.6 $e^+ e^-$ ¹¹ Evaluated in AUBERT 06N including measurements from AUBERT,B 04s.NODE=M173R1
NODE=M173R1

$\Gamma(D_s^+ \gamma) / \Gamma_{\text{total}}$ Γ_2 / Γ

VALUE	DOCUMENT ID	TECN	COMMENT

0.18 ± 0.04 OUR FIT**0.16 ± 0.04 ± 0.03**¹² AUBERT 06N BABR $B \rightarrow D_{s1}(2460)^- \bar{D}^{(*)}$ ¹² Evaluated in AUBERT 06N including measurements from AUBERT,B 04s.NODE=M173R6
NODE=M173R6

NODE=M173R6;LINKAGE=AU

$\Gamma(D_s^+ \gamma) / \Gamma(D_s^{*+} \pi^0)$ Γ_2 / Γ_1

VALUE	CL%	EVTS	DOCUMENT ID	TECN	COMMENT

0.38 ± 0.05 OUR FIT**0.44 ± 0.09 OUR AVERAGE**0.55 ± 0.13 ± 0.08 152 MIKAMI 04 BELL 10.6 $e^+ e^-$ 0.38 ± 0.11 ± 0.04 38 KROKOVNY 03B BELL 10.6 $e^+ e^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.274 ± 0.045 ± 0.020 251 ¹³ AUBERT,B 04s BABR $B \rightarrow D_{s1}(2460)^+ \bar{D}^{(*)}$ < 0.49 90 BESSON 03 CLE2 10.6 $e^+ e^-$ ¹³ Used by AUBERT 06N in their measurement of $B(D_s^{*-} \pi^0)$ and $B(D_s^- \gamma)$.NODE=M173R2
NODE=M173R2

NODE=M173R2;LINKAGE=AU

$\Gamma(D_s^+ \pi^+ \pi^-) / \Gamma(D_s^{*+} \pi^0)$ Γ_3 / Γ_1

VALUE	CL%	EVTS	DOCUMENT ID	TECN	COMMENT

0.090 ± 0.020 OUR FIT Error includes scale factor of 1.2.**0.14 ± 0.04 ± 0.02**60 MIKAMI 04 BELL 10.6 $e^+ e^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 0.08 90 BESSON 03 CLE2 10.6 $e^+ e^-$ NODE=M173R3
NODE=M173R3

$\Gamma(D_s^{*+} \gamma) / \Gamma(D_s^{*+} \pi^0)$ Γ_4 / Γ_1

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

< 0.16 90 BESSON 03 CLE2 10.6 $e^+ e^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 0.31 90 MIKAMI 04 BELL 10.6 $e^+ e^-$ NODE=M173R4
NODE=M173R4

$\Gamma(D_{s0}^*(2317)^+ \gamma) / \Gamma(D_s^{*+} \pi^0)$ Γ_5 / Γ_1

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

< 0.22 95 AUBERT 04E BABR 10.6 $e^+ e^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 0.58 90 BESSON 03 CLE2 10.6 $e^+ e^-$ NODE=M173R5
NODE=M173R5

$$\Gamma(D_s^{*+}\pi^0)/[\Gamma(D_s^{*+}\pi^0) + \Gamma(D_{s0}^*(2317)^+\gamma)] \quad \Gamma_1/(\Gamma_1+\Gamma_5)$$

VALUE	DOCUMENT ID	TECN	COMMENT
0.93±0.09 OUR FIT			
0.97±0.09±0.05	AUBERT	06P	BABR 10.6 e ⁺ e ⁻

NODE=M173R7
NODE=M173R7

$$\Gamma(D_s^+\gamma)/[\Gamma(D_s^{*+}\pi^0) + \Gamma(D_{s0}^*(2317)^+\gamma)] \quad \Gamma_2/(\Gamma_1+\Gamma_5)$$

VALUE	DOCUMENT ID	TECN	COMMENT
0.35 ±0.04 OUR FIT			
0.337±0.036±0.038	AUBERT	06P	BABR 10.6 e ⁺ e ⁻

NODE=M173R8
NODE=M173R8

$$\Gamma(D_s^+\pi^+\pi^-)/[\Gamma(D_s^{*+}\pi^0) + \Gamma(D_{s0}^*(2317)^+\gamma)] \quad \Gamma_3/(\Gamma_1+\Gamma_5)$$

VALUE	DOCUMENT ID	TECN	COMMENT
0.083±0.017 OUR FIT			Error includes scale factor of 1.2.
0.077±0.013±0.008	AUBERT	06P	BABR 10.6 e ⁺ e ⁻

NODE=M173R9
NODE=M173R9

$$\Gamma(D_s^{*+}\gamma)/[\Gamma(D_s^{*+}\pi^0) + \Gamma(D_{s0}^*(2317)^+\gamma)] \quad \Gamma_4/(\Gamma_1+\Gamma_5)$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.24	95	AUBERT	06P	BABR 10.6 e ⁺ e ⁻

NODE=M173R10
NODE=M173R10

$$\Gamma(D_{s0}^*(2317)^+\gamma)/[\Gamma(D_s^{*+}\pi^0) + \Gamma(D_{s0}^*(2317)^+\gamma)] \quad \Gamma_5/(\Gamma_1+\Gamma_5)$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.25	95	AUBERT	06P	BABR 10.6 e ⁺ e ⁻

NODE=M173R11
NODE=M173R11

$$\Gamma(D_s^+\pi^0)/[\Gamma(D_s^{*+}\pi^0) + \Gamma(D_{s0}^*(2317)^+\gamma)] \quad \Gamma_6/(\Gamma_1+\Gamma_5)$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.042	95	AUBERT	06P	BABR 10.6 e ⁺ e ⁻

NODE=M173R12
NODE=M173R12

$$\Gamma(D_s^+\pi^0\pi^0)/[\Gamma(D_s^{*+}\pi^0) + \Gamma(D_{s0}^*(2317)^+\gamma)] \quad \Gamma_7/(\Gamma_1+\Gamma_5)$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.68	95	AUBERT	06P	BABR 10.6 e ⁺ e ⁻

NODE=M173R13
NODE=M173R13

$$\Gamma(D_s^+\gamma\gamma)/[\Gamma(D_s^{*+}\pi^0) + \Gamma(D_{s0}^*(2317)^+\gamma)] \quad \Gamma_8/(\Gamma_1+\Gamma_5)$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.33	95	AUBERT	06P	BABR 10.6 e ⁺ e ⁻

NODE=M173R14
NODE=M173R14

$D_{s1}(2460)^\pm$ REFERENCES

NODE=M173

AUBERT	06N	PR D74 031103	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT	06P	PR D74 032007	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT	04E	PR D69 031101	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT,B	04S	PRL 93 181801	B. Aubert <i>et al.</i>	(BABAR Collab.)
MIKAMI	04	PRL 92 012002	Y. Mikami <i>et al.</i>	(BELLE Collab.)
BESSION	03	PR D68 032002	D. Besson <i>et al.</i>	(CLEO Collab.)
KROKOVNY	03B	PRL 91 262002	P. Krokovny <i>et al.</i>	(BELLE Collab.)

REFID=51142
REFID=51144
REFID=49747
REFID=50195
REFID=49629
REFID=49583
REFID=49615

$D_{s1}(2536)^{\pm}$

 $I(J^P) = 0(1^+)$
 J, P need confirmation.

Seen in $D^*(2010)^+ K^0$, $D^*(2007)^0 K^+$, and $D_s^+ \pi^+ \pi^-$. Not seen in $D^+ K^0$ or $D^0 K^+$. $J^P = 1^+$ assignment strongly favored.

NODE=M121

NODE=M121

$D_{s1}(2536)^{\pm}$ MASS

The fit includes $D^{\pm}, D^0, D_s^{\pm}, D^{*\pm}, D^{*0}, D_s^{*\pm}, D_1(2420)^0, D_2^*(2460)^0$, and $D_{s1}(2536)^{\pm}$ mass and mass difference measurements.

NODE=M121M

NODE=M121M

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
2535.10 ± 0.08 OUR FIT	Error includes scale factor of 1.1. [2535.12 ± 0.13 MeV OUR 2013 FIT]			
2535.18 ± 0.24 OUR AVERAGE				

NODE=M121M

NEW

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	$D_{s1}^* \rightarrow D^*(2010) K^0$
• • • 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	$\nu N \rightarrow D_s \gamma \gamma X$

OCCUR=2

- ¹ Using the $D^*(2010)^{\pm}$ mass of 2010.0 ± 0.4 MeV from PDG 06.
² Calculated using $m(D^*(2010)^{\pm}) = 2010.0 \pm 0.5$ MeV, $m(D^*(2007)^0) = 2006.7 \pm 0.5$ MeV, and the mass difference below.
³ Systematic uncertainties not evaluated.
⁴ Calculated using the mass difference $m(D_{s1}^+) - m(D^{*+})_{PDG}$ below and $m(D^{*+})_{PDG} = 2010.25 \pm 0.14$ MeV. Assuming S-wave decay of the $D_{s1}(2536)$ to $D^{*+} K_S^0$, using a Breit-Wigner line shape corresponding to L=0.
⁵ Calculated using the mass difference $m(D_{s1}^+) - m(D^{*+})_{PDG}$ reported below and $m(D^{*+})_{PDG} = 2010.27 \pm 0.17$ MeV.
⁶ Not seen in $D^* K$.

NODE=M121M;LINKAGE=AB

NODE=M121M;LINKAGE=HI

NODE=M121M;LINKAGE=AU

NODE=M121M;LINKAGE=LE

NODE=M121M;LINKAGE=CH

NODE=M121M;LINKAGE=B

$m_{D_{s1}(2536)^{\pm}} - m_{D_s^*(2111)}$

The fit includes $D^{\pm}, D^0, D_s^{\pm}, D^{*\pm}, D^{*0}, D_s^{*\pm}, D_1(2420)^0, D_2^*(2460)^0$, and $D_{s1}(2536)^{\pm}$ mass and mass difference measurements.

NODE=M121DM

NODE=M121DM

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
423.0 ± 0.4 OUR FIT	[422.8 ± 0.5 MeV OUR 2013 FIT Scale factor = 1.1]		
424 ± 28	ASRATYAN	88 HLBC	$D_s^{*\pm} \gamma$

NODE=M121DM

NEW

$m_{D_{s1}(2536)^{\pm}} - m_{D^*(2010)^{\pm}}$

The fit includes $D^{\pm}, D^0, D_s^{\pm}, D^{*\pm}, D^{*0}, D_s^{*\pm}, D_1(2420)^0, D_2^*(2460)^0$, and $D_{s1}(2536)^{\pm}$ mass and mass difference measurements.

NODE=M121DN

NODE=M121DN

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
524.84 ± 0.04 OUR FIT				
[524.84 ± 0.04 MeV OUR 2013 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 $^{+0.44}_{-0.41} \pm 0.10$	236 ± 30	CHEKANOV	09 ZEUS	$e^\pm p \rightarrow D^{*+} K_S^0 X$,
				$D^{*0} K^+ X$
525.3 ± 0.6 ± 0.1	41	HEISTER	02B ALEP	$e^+e^- \rightarrow D^{*+} K^0 X$
⁷ Assuming S -wave decay of the $D_{s1}(2536)$ to $D^{*+} K_S^0$, using a Breit-Wigner line shape corresponding to $L=0$.				

NODE=M121DN
NEW

NODE=M121DN;LINKAGE=LE

$m_{D_{s1}(2536)^\pm} - m_{D^*(2007)^0}$

The fit includes $D^\pm$, D^0 , $D_S^\pm$, $D^{*\pm}$, D^{*0} , $D_S^{*\pm}$, $D_1(2420)^0$, $D_2^*(2460)^0$, and $D_{s1}(2536)^\pm$ mass and mass difference measurements.

NODE=M121DP

NODE=M121DP

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
528.14 ± 0.08 OUR FIT				
528.1 ± 1.5 OUR AVERAGE				
528.7 ± 1.9 ± 0.5	51	HEISTER	02B ALEP	$e^+e^- \rightarrow D^{*0} K^+ X$
527.3 ± 2.2	29	ACKERSTAFF	97W OPAL	$e^+e^- \rightarrow D^{*0} K^+ X$

NODE=M121DP

$D_{s1}(2536)^\pm$ WIDTH

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	$\gamma Be \rightarrow D^{*+} K^0 X$,
				$D^{*0} K^+ X$
< 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

NODE=M121W

NODE=M121W;LINKAGE=LE

NODE=M121W;LINKAGE=AU

$D_{s1}(2536)^+$ DECAY MODES

$D_{s1}(2536)^-$ modes are charge conjugates of the modes below.

NODE=M121215;NODE=M121

NODE=M121

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 $D^*(2010)^+ K^0$	0.85 ± 0.12	
Γ_2 $(D^*(2010)^+ K^0)_{S-wave}$	0.61 ± 0.09	
Γ_3 $(D^*(2010)^+ K^0)_{D-wave}$		
Γ_4 $D^+ \pi^- K^+$	0.028 ± 0.005	
Γ_5 $D^*(2007)^0 K^+$	DEFINED AS 1	
Γ_6 $D^+ K^0$	< 0.34	90%
Γ_7 $D^0 K^+$	< 0.12	90%
Γ_8 $D_S^{*+} \gamma$	possibly seen	
Γ_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

$D_{s2}^*(2573)$

$I(J^P) = 0(?)^?$

J^P is natural, width and decay modes consistent with 2^+ .

$D_{s2}^*(2573)$ MASS

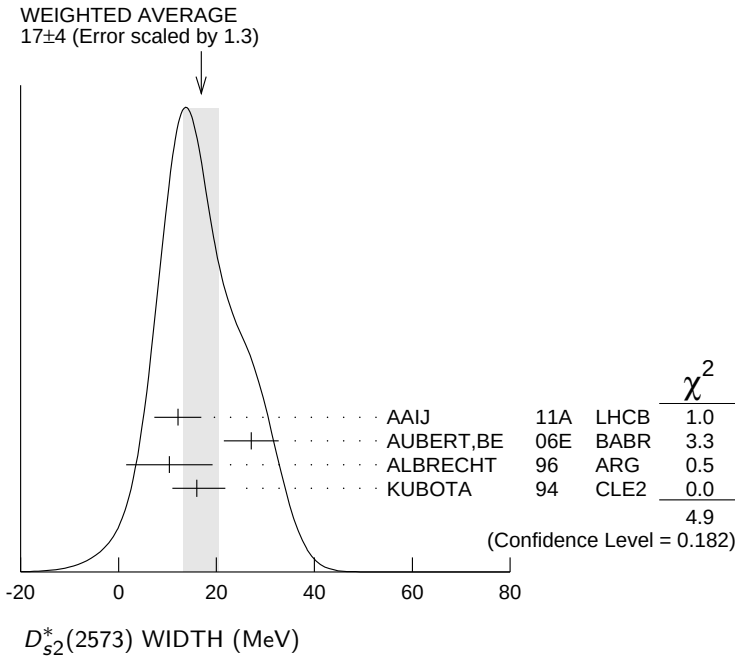
VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2571.9±0.8 OUR AVERAGE				
2569.4±1.6±0.5	82 ± 17	AAIJ	11A LHCb	$B_s \rightarrow D_{s2}^*(2573) \mu \bar{\nu} X$
2572.2±0.3±1.0		AUBERT,BE	06E BABR	$e^+ e^- \rightarrow D K X$
2574.5±3.3±1.6		ALBRECHT	96 ARG	$e^+ e^- \rightarrow D^0 K^+ X$
2573.2 ^{+1.7} _{-1.6} ±0.9	217	KUBOTA	94 CLE2	$e^+ e^- \sim 10.5$ 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 $m_{D^0} = 1864.5 \pm 0.5$ MeV and the mass difference below.				

$m_{D_{s2}^*(2573)} - m_{D^0}$

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
704 ±3 ±1	64	HEISTER	02B ALEP	$e^+ e^- \rightarrow D^0 K^+ X$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
705.4±4.3	25	³ EVDOKIMOV	04 SELX	$600 \Sigma^- A \rightarrow D^0 K^+ X$
³ Systematic errors not estimated.				

$D_{s2}^*(2573)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
17 ±4 OUR AVERAGE	Error includes scale factor of 1.3. See the ideogram below.			
12.1±4.5±1.6	82 ± 17	AAIJ	11A LHCb	$B_s \rightarrow D_{s2}^*(2573) \mu \bar{\nu} X$
27.1±0.6±5.6		AUBERT,BE	06E BABR	$e^+ e^- \rightarrow D K X$
10.4±8.3±3.0		ALBRECHT	96 ARG	$e^+ e^- \rightarrow D^0 K^+ X$
16 ⁺⁵ ₋₄ ±3	217	KUBOTA	94 CLE2	$e^+ e^- \sim 10.5$ GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •				
14 ⁺⁹ ₋₆	25	⁴ EVDOKIMOV	04 SELX	$600 \Sigma^- A \rightarrow D^0 K^+ X$
⁴ Systematic errors not estimated.				



NODE=M148

NODE=M148

NODE=M148M

NODE=M148M

NODE=M148M;LINKAGE=EV
NODE=M148M;LINKAGE=HI

NODE=M148DM

NODE=M148DM

NODE=M148DM;LINKAGE=EV

NODE=M148W

NODE=M148W

NODE=M148W;LINKAGE=EV

$D_{s2}^*(2573)^+$ DECAY MODES

$D_{s2}^*(2573)^-$ modes are charge conjugates of the modes below.

Mode	Fraction (Γ_i/Γ)
Γ_1 $D^0 K^+$	seen
Γ_2 $D^*(2007)^0 K^+$	not seen

NODE=M148215;NODE=M148

NODE=M148

DESIG=1

DESIG=2;OUR EVAL;→ UNCHECKED ←

 $D_{s2}^*(2573)^+$ BRANCHING RATIOS

$\Gamma(D^0 K^+)/\Gamma_{\text{total}}$						Γ_1/Γ
VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT	
seen	217	KUBOTA	94	CLE2	$\pm$	$e^+ e^- \sim 10.5 \text{ GeV}$

$\Gamma(D^*(2007)^0 K^+)/\Gamma(D^0 K^+)$						Γ_2/Γ_1
VALUE	CL%	DOCUMENT ID	TECN	CHG	COMMENT	
<0.33	90	KUBOTA	94	CLE2	+	$e^+ e^- \sim 10.5 \text{ GeV}$

NODE=M148220

NODE=M148R2
NODE=M148R2NODE=M148R1
NODE=M148R1 **$D_{s2}^*(2573)$ REFERENCES**

AAIJ	11A	PL B698 14	R. Aaij <i>et al.</i>	(LHCb Collab.)
AUBERT,BE	06E	PRL 97 222001	B. Aubert <i>et al.</i>	(BABAR Collab.)
EVDOKIMOV	04	PRL 93 242001	A.V. Evdokimov <i>et al.</i>	(SELEX Collab.)
HEISTER	02B	PL B526 34	A. Heister <i>et al.</i>	(ALEPH Collab.)
ALBRECHT	96	ZPHY C69 405	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
KUBOTA	94	PRL 72 1972	Y. Kubota <i>et al.</i>	(CLEO Collab.)

NODE=M148

REFID=16665
REFID=51512
REFID=50337
REFID=48562
REFID=44631
REFID=43781 **$D_{s1}^*(2700)^\pm$**

$$I(J^P) = 0(1^-)$$

NODE=M182

 $D_{s1}^*(2700)^+$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2709 ±4 OUR AVERAGE				
2709.2±1.9± 4.5	52k	¹ AAIJ	12AU LHCb	$pp \rightarrow (DK)^+ X$ at 7 TeV
2710 ±2 $^{+12}_{-7}$	10.4k	² AUBERT	09AR BABR	$e^+ e^- \rightarrow D^{(*)} K X$
2708 ±9 $^{+11}_{-10}$	182	BRODZICKA	08 BELL	$B^+ \rightarrow D^0 \bar{D}^0 K^+$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2688 ±4 ± 3		³ AUBERT,BE	06E BABR	10.6 $e^+ e^- \rightarrow DK X$

NODE=M182M

NODE=M182M

¹ From the combined fit of the $D^+ K_S^0$ and $D^0 K^+$ modes in the model including the $D_{s2}^*(2573)^+$, $D_{s1}^*(2700)^+$ and spin-0 $D_{sJ}^*(2860)^+$.

² From simultaneous fits to the two DK mass spectra and to the total $D^* K$ mass spectrum.

³ Superseded by AUBERT 09AR.

NODE=M182M;LINKAGE=AA

NODE=M182M;LINKAGE=AB

NODE=M182M;LINKAGE=AU

 $D_{s1}^*(2700)^+$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
117 ±13 OUR AVERAGE				
115.8± 7.3±12.1	52k	⁴ AAIJ	12AU LHCb	$pp \rightarrow (DK)^+ X$ at 7 TeV
149 ± 7 $^{+39}_{-52}$	10.4k	⁵ AUBERT	09AR BABR	$e^+ e^- \rightarrow D^{(*)} K X$
108 ±23 $^{+36}_{-31}$	182	BRODZICKA	08 BELL	$B^+ \rightarrow D^0 \bar{D}^0 K^+$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
112 ± 7 ±36		⁶ AUBERT,BE	06E BABR	10.6 $e^+ e^- \rightarrow DK X$

NODE=M182W

NODE=M182W

⁴ From the combined fit of the $D^+ K_S^0$ and $D^0 K^+$ modes in the model including the $D_{s2}^*(2573)^+$, $D_{s1}^*(2700)^+$ and spin-0 $D_{sJ}^*(2860)^+$.

⁵ From simultaneous fits to the two DK mass spectra and to the total $D^* K$ mass spectrum.

⁶ Superseded by AUBERT 09AR.

NODE=M182W;LINKAGE=AA

NODE=M182W;LINKAGE=AB

NODE=M182W;LINKAGE=AU

$D_{s1}^*(2700)^\pm$ DECAY MODES

NODE=M182215;NODE=M182

Mode	
Γ_1	DK
Γ_2	$D^0 K^+$
Γ_3	$D^+ K_S^0$
Γ_4	$D^* K$
Γ_5	$D^{*0} K^+$
Γ_6	$D^{*+} K_S^0$

DESIG=2
DESIG=1
DESIG=3
DESIG=4
DESIG=5
DESIG=6

 $D_{s1}^*(2700)^\pm$ BRANCHING RATIOS

NODE=M182225

$\Gamma(D^* K)/\Gamma(DK)$					Γ_4/Γ_1
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
$0.91 \pm 0.13 \pm 0.12$	10.4k	⁷ AUBERT	09AR BABR	$e^+ e^- \rightarrow D^{(*)} K X$	
⁷ From the average of the corresponding ratios with $D^{(*)0} K^+$ and $D^{(*)+} K_S^0$.					

NODE=M182R01
NODE=M182R01

NODE=M182R01;LINKAGE=AU

$\Gamma(D^{*0} K^+)/\Gamma(D^0 K^+)$					Γ_5/Γ_2
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$0.88 \pm 0.14 \pm 0.14$	7716	⁸ AUBERT	09AR BABR	$e^+ e^- \rightarrow D^{(*)} K X$	
⁸ From the $D^{*0} K^+$ and $D^0 K^+$, where $D^{*0} \rightarrow D^0 \pi^0$.					

NODE=M182R02
NODE=M182R02

NODE=M182R02;LINKAGE=AU

$\Gamma(D^{*+} K_S^0)/\Gamma(D^+ K_S^0)$					Γ_6/Γ_3
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$1.14 \pm 0.39 \pm 0.23$	2700	⁹ AUBERT	09AR BABR	$e^+ e^- \rightarrow D^{(*)} K X$	
⁹ From the $D^{*+} K_S^0$ and $D^+ K_S^0$, where $D^{*+} \rightarrow D^+ \pi^0$.					

NODE=M182R03
NODE=M182R03

NODE=M182R03;LINKAGE=AU

 $D_{s1}^*(2700)^\pm$ REFERENCES

AAIJ	12AU JHEP 1210 151	R. Aaij <i>et al.</i>	(LHCb Collab.)
AUBERT	09AR PR D80 092003	B. Aubert <i>et al.</i>	(BABAR Collab.)
BRODZICKA	08 PRL 100 092001	J. Brodzicka <i>et al.</i>	(BELLE Collab.)
AUBERT,BE	06E PRL 97 222001	B. Aubert <i>et al.</i>	(BABAR Collab.)

NODE=M182

REFID=54735
REFID=53135
REFID=52144
REFID=51512

NODE=M196

$$D_{sJ}^*(2860)^\pm$$

$$I(J^P) = 0(?)^?$$

OMITTED FROM SUMMARY TABLE

Observed by AUBERT,BE 06E and AUBERT 09AR in inclusive production of DK and $D^* K$ in $e^+ e^-$ annihilation. J^P is natural.

NODE=M196

 $D_{sJ}^*(2860)^+$ MASS

NODE=M196M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$2863.2^{+4.0}_{-2.6}$	OUR AVERAGE			
$2866.1 \pm 1.0 \pm 6.3$	36k	¹ AAIJ	12AU LHCb	$pp \rightarrow (DK)^+ X$ at 7 TeV
$2862 \pm 2 \pm 5_{-2}$	3122	² AUBERT	09AR BABR	$e^+ e^- \rightarrow D^{(*)} K X$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$2856.6 \pm 1.5 \pm 5.0$		³ AUBERT,BE	06E BABR	$e^+ e^- \rightarrow DK X$
¹ From the combined fit of the $D^+ K_S^0$ and $D^0 K^+$ modes in the model including the $D_{s2}^*(2573)^+$, $D_{s1}^*(2700)^+$ and spin-0 $D_{sJ}^*(2860)^+$.				
² From simultaneous fits to the two DK mass spectra and to the total $D^* K$ mass spectrum.				
³ Superseded by AUBERT 09AR.				

NODE=M196M

NODE=M196M;LINKAGE=AA

NODE=M196M;LINKAGE=AB

NODE=M196M;LINKAGE=AU

 $D_{sJ}^*(2860)^+$ WIDTH

NODE=M196W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
58 ± 11 OUR AVERAGE		Error includes scale factor of 2.2.		
69.9 ± 3.2 ± 6.6	36k	⁴ AAJ	12AU LHCb	$pp \rightarrow (DK)^+ X$ at 7 TeV
48 ± 3 ± 6	3122	⁵ AUBERT	09AR BABR	$e^+e^- \rightarrow D^{(*)} K X$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
47 ± 7 ± 10		⁶ AUBERT,BE	06E BABR	$e^+e^- \rightarrow DK X$
⁴ From the combined fit of the $D^+ K_S^0$ and $D^0 K^+$ modes in the model including the $D_{s2}^*(2573)^+$, $D_{s1}^*(2700)^+$ and spin-0 $D_{sJ}^*(2860)^+$.				
⁵ From simultaneous fits to the two DK mass spectra and to the total $D^* K$ mass spectrum.				
⁶ Superseded by AUBERT 09AR.				

NODE=M196W

NODE=M196W;LINKAGE=AA

NODE=M196W;LINKAGE=AB

NODE=M196W;LINKAGE=AU

$D_{sJ}^*(2860)^\pm$ 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

$D_{sJ}^*(2860)^\pm$ 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	⁷ AUBERT	09AR BABR	$e^+e^- \rightarrow D^{(*)} K X$	
⁷ From the average of the corresponding ratios with $D^{(*)0} K^+$ and $D^{(*)+} K_S^0$.					

NODE=M196R01
NODE=M196R01

NODE=M196R01;LINKAGE=AU

$\Gamma(D^{*0} K^+)/\Gamma(D^0 K^+)$					Γ_5/Γ_2
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
1.04 ± 0.17 ± 0.20	2241	⁸ AUBERT	09AR BABR	$e^+e^- \rightarrow D^{(*)} K X$	
⁸ From the $D^{*0} K^+$ and $D^0 K^+$, where $D^{*0} \rightarrow D^0 \pi^0$.					

NODE=M196R02
NODE=M196R02

NODE=M196R02;LINKAGE=AU

$\Gamma(D^{*+} K_S^0)/\Gamma(D^+ K_S^0)$					Γ_6/Γ_3
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
1.38 ± 0.35 ± 0.49	881	⁹ AUBERT	09AR BABR	$e^+e^- \rightarrow D^{(*)} K X$	
⁹ From the $D^{*+} K_S^0$ and $D^+ K_S^0$, where $D^{*+} \rightarrow D^+ \pi^0$.					

NODE=M196R03
NODE=M196R03

NODE=M196R03;LINKAGE=AU

$D_{sJ}^*(2860)^\pm$ REFERENCES

NODE=M196

AAJ	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.)

REFID=54735
REFID=53135
REFID=51512

$D_{sJ}(3040)^{\pm}$

$$I(J^P) = 0(?)^?$$

OMITTED FROM SUMMARY TABLE
Observed by AUBERT 09AR in inclusive production of $D^* K$ in $e^+ e^-$ annihilation.

NODE=M197

NODE=M197

$D_{sJ}(3040)^+$ MASS

NODE=M197M

NODE=M197M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$3044 \pm 8^{+30}_{-5}$	AUBERT	09AR BABR	$e^+ e^- \rightarrow D^* K X$

$D_{sJ}(3040)^+$ WIDTH

NODE=M197W

NODE=M197W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$239 \pm 35^{+46}_{-42}$	AUBERT	09AR BABR	$e^+ e^- \rightarrow D^* K X$

$D_{sJ}(3040)^{\pm}$ DECAY MODES

NODE=M197215;NODE=M197

Mode
$\Gamma_1 \quad D^* K$
$\Gamma_2 \quad D^{*0} K^+$
$\Gamma_3 \quad D^{*+} K^0_S$

DESIG=1
DESIG=2
DESIG=3

$D_{sJ}(3040)^{\pm}$ REFERENCES

NODE=M197

REFID=53135

AUBERT 09AR PR D80 092003 B. Aubert *et al.* (BABAR Collb.)

OTHER RELATED PAPERS

REFID=53128

SUN 09 PR D80 074037 Z.-F. Sun, X. Lin

BOTTOM MESONS

$(B = \pm 1)$

NODE=MXXX045

$$B^+ = u\bar{b}, B^0 = d\bar{b}, \bar{B}^0 = \bar{d}b, B^- = \bar{u}b, \quad \text{similarly for } B^{*'}\text{'s}$$

NODE=MXXX045

BOTTOM, STRANGE MESONS

$(B = \pm 1, S = \mp 1)$

NODE=MXXX046

$$B^0_s = s\bar{b}, \bar{B}^0_s = \bar{s}b, \quad \text{similarly for } B^{*'}_s\text{'s}$$

NODE=MXXX046

BOTTOM, CHARMED MESONS

$(B = C = \pm 1)$

NODE=MXXX049

$$B^+_c = c\bar{b}, B^-_c = \bar{c}b, \quad \text{similarly for } B^{*'}_c\text{'s}$$

NODE=MXXX049

$c\bar{c}$ MESONS

NODE=MXXX025

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Reviews

NODE=M826

 $\eta_c(1S)$

$$J^G(J^{PC}) = 0^+(0^-+)$$

NODE=M026

$\eta_c(1S)$ MASS

NODE=M026M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2983.6 ± 0.7 OUR AVERAGE Error includes scale factor of 1.3. See the ideogram below. [2983.7 ± 0.7 MeV OUR 2013 AVERAGE Scale factor = 1.4]				
2984.3 ± 0.6 ± 0.6		^{1,2} ABLIKIM	12F BES3	$\psi(2S) \rightarrow \gamma \eta_c$
2984.49 ± 1.16 ± 0.52	832	³ ABLIKIM	12N BES3	$\psi(2S) \rightarrow \pi^0 \gamma$ hadrons
2982.7 ± 1.8 ± 2.2	486	ZHANG	12A BELL	$e^+ e^- \rightarrow e^+ e^- \eta' \pi^+ \pi^-$
2984.5 ± 0.8 ± 3.1	11k	DEL-AMO-SA...	11M BABR	$\gamma \gamma \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$
2985.4 ± 1.5 $\begin{smallmatrix} + \\ - \end{smallmatrix}$ $\begin{smallmatrix} 0.5 \\ 2.0 \end{smallmatrix}$	920	² VINOKUROVA	11 BELL	$B^\pm \rightarrow K^\pm (K_S^0 K^\pm \pi^\mp)$
2982.2 ± 0.4 ± 1.6	14k	⁴ LEES	10 BABR	$10.6 e^+ e^- \rightarrow e^+ e^- K_S^0 K^\pm \pi^\mp$
2985.8 ± 1.5 ± 3.1	0.9k	AUBERT	08AB BABR	$B \rightarrow \eta_c(1S) K(*) \rightarrow K \bar{K} \pi K(*)$
2986.1 ± 1.0 ± 2.5	7.5k	UEHARA	08 BELL	$\gamma \gamma \rightarrow \eta_c \rightarrow$ hadrons
2970 ± 5 ± 6	501	⁵ ABE	07 BELL	$e^+ e^- \rightarrow J/\psi(c\bar{c})$
2971 ± 3 $\begin{smallmatrix} + \\ - \end{smallmatrix}$ $\begin{smallmatrix} 2 \\ 1 \end{smallmatrix}$	195	WU	06 BELL	$B^+ \rightarrow p \bar{p} K^+$
2974 ± 7 $\begin{smallmatrix} + \\ - \end{smallmatrix}$ $\begin{smallmatrix} 2 \\ 1 \end{smallmatrix}$	20	WU	06 BELL	$B^+ \rightarrow \Lambda \bar{\Lambda} K^+$
2981.8 ± 1.3 ± 1.5	592	ASNER	04 CLEO	$\gamma \gamma \rightarrow \eta_c \rightarrow K_S^0 K^\pm \pi^\mp$
2984.1 ± 2.1 ± 1.0	190	⁶ AMBROGIANI	03 E835	$\bar{p} p \rightarrow \eta_c \rightarrow \gamma \gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2982.5 ± 0.4 ± 1.4	12k	⁷ DEL-AMO-SA...	11M BABR	$\gamma \gamma \rightarrow K_S^0 K^\pm \pi^\mp$
2982.2 ± 0.6		⁸ MITCHELL	09 CLEO	$e^+ e^- \rightarrow \gamma X$
2982 ± 5	270	⁹ AUBERT	06E BABR	$B^\pm \rightarrow K^\pm X_{c\bar{c}}$
2982.5 ± 1.1 ± 0.9	2.5k	¹⁰ AUBERT	04D BABR	$\gamma \gamma \rightarrow \eta_c(1S) \rightarrow K \bar{K} \pi$
2977.5 ± 1.0 ± 1.2		^{8,11} BAI	03 BES	$J/\psi \rightarrow \gamma \eta_c$
2979.6 ± 2.3 ± 1.6	180	¹² FANG	03 BELL	$B \rightarrow \eta_c K$
2976.3 ± 2.3 ± 1.2		^{8,13} BAI	00F BES	$J/\psi, \psi(2S) \rightarrow \gamma \eta_c$
2976.6 ± 2.9 ± 1.3	140	^{8,14} BAI	00F BES	$J/\psi \rightarrow \gamma \eta_c$
2980.4 ± 2.3 ± 0.6		¹⁵ BRANDENB...	00B CLE2	$\gamma \gamma \rightarrow \eta_c \rightarrow K^\pm K_S^0 \pi^\mp$
2975.8 ± 3.9 ± 1.2		¹⁴ BAI	99B BES	Sup. by BAI 00F
2999 ± 8	25	ABREU	980 DLPH	$e^+ e^- \rightarrow e^+ e^- + \text{hadrons}$
2988.3 $\begin{smallmatrix} + \\ - \end{smallmatrix}$ $\begin{smallmatrix} 3.3 \\ 3.1 \end{smallmatrix}$		ARMSTRONG	95F E760	$\bar{p} p \rightarrow \gamma \gamma$
2974.4 ± 1.9		^{8,16} BISELLO	91 DM2	$J/\psi \rightarrow \eta_c \gamma$
2969 ± 4 ± 4	80	⁸ BAI	90B MRK3	$J/\psi \rightarrow \gamma K^+ K^- K^+ K^-$
2956 ± 12 ± 12		⁸ BAI	90B MRK3	$J/\psi \rightarrow \gamma K^+ K^- K_S^0 K_L^0$
2982.6 $\begin{smallmatrix} + \\ - \end{smallmatrix}$ $\begin{smallmatrix} 2.7 \\ 2.3 \end{smallmatrix}$	12	BAGLIN	87B SPEC	$\bar{p} p \rightarrow \gamma \gamma$
2980.2 ± 1.6		^{8,16} BALTRUSAIT...	86 MRK3	$J/\psi \rightarrow \eta_c \gamma$
2984 ± 2.3 ± 4.0		⁸ GAISER	86 CBAL	$J/\psi \rightarrow \gamma X, \psi(2S) \rightarrow \gamma X$
2976 ± 8		^{8,17} BALTRUSAIT...	84 MRK3	$J/\psi \rightarrow 2\phi \gamma$
2982 ± 8	18	¹⁸ HIMEL	80B MRK2	$e^+ e^-$
2980 ± 9		¹⁸ PARTRIDGE	80B CBAL	$e^+ e^-$

NODE=M026M

NEW

OCCUR=2

OCCUR=2

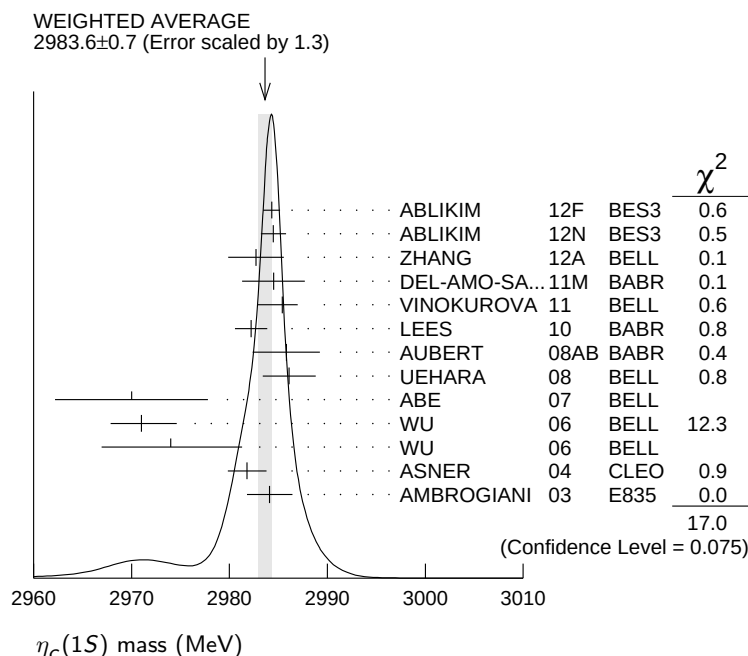
OCCUR=2

OCCUR=3

- ¹ From a simultaneous fit to six decay modes of the η_c .
- ² Accounts for interference with non-resonant continuum.
- ³ With floating width.
- ⁴ Taking into account interference with the non-resonant $J^P = 0^-$ amplitude.
- ⁵ From a fit of the J/ψ recoil mass spectrum. Supersedes ABE,K 02 and ABE 04G.
- ⁶ Using mass of $\psi(2S) = 3686.00$ MeV.
- ⁷ Not independent from the measurements reported by LEES 10.
- ⁸ MITCHELL 09 observes a significant asymmetry in the lineshapes of $\psi(2S) \rightarrow \gamma \eta_c$ and $J/\psi \rightarrow \gamma \eta_c$ transitions. If ignored, this asymmetry could lead to significant bias whenever the mass and width are measured in $\psi(2S)$ or J/ψ radiative decays.
- ⁹ From the fit of the kaon momentum spectrum. Systematic errors not evaluated.
- ¹⁰ Superseded by LEES 10.
- ¹¹ From a simultaneous fit of five decay modes of the η_c .
- ¹² Superseded by VINOKUROVA 11.
- ¹³ Weighted average of the $\psi(2S)$ and $J/\psi(1S)$ samples. Using an η_c width of 13.2 MeV.
- ¹⁴ Average of several decay modes. Using an η_c width of 13.2 MeV.
- ¹⁵ Superseded by ASNER 04.
- ¹⁶ Average of several decay modes.
- ¹⁷ $\eta_c \rightarrow \phi \phi$.
- ¹⁸ Mass adjusted by us to correspond to $J/\psi(1S)$ mass = 3097 MeV.

NODE=M026M;LINKAGE=BL
 NODE=M026M;LINKAGE=VA
 NODE=M026M;LINKAGE=AL
 NODE=M026M;LINKAGE=LE
 NODE=M026M;LINKAGE=EB
 NODE=M026M;LINKAGE=BG
 NODE=M026M;LINKAGE=DE
 NODE=M026M;LINKAGE=MI

NODE=M026M;LINKAGE=AU
 NODE=M026M;LINKAGE=UB
 NODE=M026M;LINKAGE=AK
 NODE=M026M;LINKAGE=FA
 NODE=M026M;LINKAGE=KZ
 NODE=M026M;LINKAGE=C1
 NODE=M026M;LINKAGE=NN
 NODE=M026M;LINKAGE=A
 NODE=M026M;LINKAGE=B
 NODE=M026M;LINKAGE=M



$\eta_c(1S)$ WIDTH

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
32.2 ± 0.9 OUR FIT				
[32.0 ± 0.9 MeV OUR 2013 FIT]				
32.3 ± 1.0 OUR AVERAGE				
Error includes scale factor of 1.2. [32.2 ± 1.0 MeV OUR 2013 AVERAGE Scale factor = 1.2]				
32.0 ± 1.2 ± 1.0		^{1,2} ABLIKIM	12F BES3	$\psi(2S) \rightarrow \gamma \eta_c$
36.4 ± 3.2 ± 1.7	832	³ ABLIKIM	12N BES3	$\psi(2S) \rightarrow \pi^0 \gamma$ hadrons
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	² VINOKUROVA	11 BELL	$B^\pm \rightarrow K^\pm (K_S^0 K^\pm \pi^\mp)$
31.7 ± 1.2 ± 0.8	14k	⁴ LEES	10 BABR	$10.6 e^+ e^- \rightarrow e^+ e^- K_S^0 K^\pm \pi^\mp$
36.3 ^{+3.7} _{-3.6} ± 4.4	0.9k	AUBERT	08AB BABR	$B \rightarrow \eta_c(1S) K^{(*)} \rightarrow K \bar{K} \pi K^{(*)}$
28.1 ± 3.2 ± 2.2	7.5k	UEHARA	08 BELL	$\gamma \gamma \rightarrow \eta_c \rightarrow$ hadrons
48 ⁺⁸ ₋₇ ± 5	195	WU	06 BELL	$B^+ \rightarrow p \bar{p} K^+$
40 ± 19 ± 5	20	WU	06 BELL	$B^+ \rightarrow \Lambda \bar{\Lambda} K^+$
24.8 ± 3.4 ± 3.5	592	ASNER	04 CLEO	$\gamma \gamma \rightarrow \eta_c \rightarrow K_S^0 K^\pm \pi^\mp$
20.4 ^{+7.7} _{-6.7} ± 2.0	190	AMBROGIANI	03 E835	$\bar{p} p \rightarrow \eta_c \rightarrow \gamma \gamma$
23.9 ^{+12.6} _{-7.1}		ARMSTRONG	95F E760	$\bar{p} p \rightarrow \gamma \gamma$

NODE=M026W

NODE=M026W
 NEW

NEW

OCCUR=2

• • • We do not use the following data for averages, fits, limits, etc. • • •

32.1 ± 1.1 ± 1.3	12k	⁵ DEL-AMO-SA..11M	BABR	$\gamma\gamma \rightarrow K_S^0 K^\pm \pi^\mp$
34.3 ± 2.3 ± 0.9	2.5k	⁶ AUBERT	04D BABR	$\gamma\gamma \rightarrow \eta_c(1S) \rightarrow K \bar{K} \pi$
17.0 ± 3.7 ± 7.4		⁷ BAI	03 BES	$J/\psi \rightarrow \gamma \eta_c$
29 ± 8 ± 6	180	⁸ FANG	03 BELL	$B \rightarrow \eta_c K$
11.0 ± 8.1 ± 4.1		⁹ BAI	00F BES	$J/\psi \rightarrow \gamma \eta_c$ and $\psi(2S) \rightarrow \gamma \eta_c$
27.0 ± 5.8 ± 1.4		¹⁰ BRANDENB...	00B CLE2	$\gamma\gamma \rightarrow \eta_c \rightarrow K^\pm K_S^0 \pi^\mp$
7.0 ⁺ 7.5 _{-7.0}	12	BAGLIN	87B SPEC	$\bar{p}p \rightarrow \gamma\gamma$
10.1 ⁺ 33.0 _{-8.2}	23	¹¹ BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \gamma p \bar{p}$
11.5 ± 4.5		GAISER	86 CBAL	$J/\psi \rightarrow \gamma X, \psi(2S) \rightarrow \gamma X$
< 40 90% CL	18	HIMEL	80B MRK2	$e^+ e^-$
< 20 90% CL		PARTRIDGE	80B CBAL	$e^+ e^-$

¹ From a simultaneous fit to six decay modes of the η_c .

² Accounts for interference with non-resonant continuum.

³ With floating mass.

⁴ Taking into account interference with the non-resonant $J^P = 0^-$ amplitude.

⁵ Not independent from the measurements reported by LEES 10.

⁶ Superseded by LEES 10.

⁷ From a simultaneous fit of five decay modes of the η_c .

⁸ Superseded by VINOKUROVA 11.

⁹ From a fit to the 4-prong invariant mass in $\psi(2S) \rightarrow \gamma \eta_c$ and $J/\psi(1S) \rightarrow \gamma \eta_c$ decays.

¹⁰ Superseded by ASNER 04.

¹¹ Positive and negative errors correspond to 90% confidence level.

OCCUR=2

NODE=M026W;LINKAGE=BL
 NODE=M026W;LINKAGE=VA
 NODE=M026W;LINKAGE=AL
 NODE=M026W;LINKAGE=LE
 NODE=M026W;LINKAGE=DE
 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

Γ_1	$\eta'(958) \pi \pi$	(4.1 ± 1.7) %	
Γ_2	$\rho \rho$	(1.8 ± 0.5) %	
Γ_3	$K^*(892)^0 K^- \pi^+ + \text{c.c.}$	(2.0 ± 0.7) %	
Γ_4	$K^*(892) \bar{K}^*(892)$	(7.0 ± 1.3) × 10 ⁻³	
Γ_5	$K^* \bar{K}^* \pi^+ \pi^-$	(1.1 ± 0.5) %	
Γ_6	$\phi K^+ K^-$	(2.9 ± 1.4) × 10 ⁻³	
Γ_7	$\phi \phi$	(1.76 ± 0.20) × 10 ⁻³	
Γ_8	$\phi 2(\pi^+ \pi^-)$	< 4 × 10 ⁻³	90%
Γ_9	$a_0(980) \pi$	< 2 %	90%
Γ_{10}	$a_2(1320) \pi$	< 2 %	90%
Γ_{11}	$K^*(892) \bar{K} + \text{c.c.}$	< 1.28 %	90%
Γ_{12}	$f_2(1270) \eta$	< 1.1 %	90%
Γ_{13}	$\omega \omega$	< 3.1 × 10 ⁻³	90%
Γ_{14}	$\omega \phi$	< 1.7 × 10 ⁻³	90%
Γ_{15}	$f_2(1270) f_2(1270)$	(9.8 ± 2.5) × 10 ⁻³	
Γ_{16}	$f_2(1270) f_2'(1525)$	(9.7 ± 3.2) × 10 ⁻³	

NODE=M026;CLUMP=A
 DESIG=24
 DESIG=19
 DESIG=26
 DESIG=18
 DESIG=57
 DESIG=28
 DESIG=17
 DESIG=58
 DESIG=21
 DESIG=22
 DESIG=40
 DESIG=23
 DESIG=20
 DESIG=47
 DESIG=46
 DESIG=59

Decays into stable hadrons

Γ_{17}	$K \bar{K} \pi$	(7.3 ± 0.5) %	
Γ_{18}	$\eta \pi^+ \pi^-$	(1.7 ± 0.5) %	
Γ_{19}	$\eta 2(\pi^+ \pi^-)$	(4.4 ± 1.3) %	
Γ_{20}	$K^+ K^- \pi^+ \pi^-$	(6.9 ± 1.1) × 10 ⁻³	
Γ_{21}	$K^+ K^- \pi^+ \pi^- \pi^0$	(3.5 ± 0.6) %	
Γ_{22}	$K^0 K^- \pi^+ \pi^- \pi^+ + \text{c.c.}$	(5.6 ± 1.5) %	
Γ_{23}	$K^+ K^- 2(\pi^+ \pi^-)$	(7.5 ± 2.4) × 10 ⁻³	
Γ_{24}	$2(K^+ K^-)$	(1.47 ± 0.31) × 10 ⁻³	
Γ_{25}	$\pi^+ \pi^- \pi^0 \pi^0$	(4.7 ± 1.0) %	
Γ_{26}	$2(\pi^+ \pi^-)$	(9.7 ± 1.2) × 10 ⁻³	
Γ_{27}	$2(\pi^+ \pi^- \pi^0)$	(17.4 ± 3.3) %	
Γ_{28}	$3(\pi^+ \pi^-)$	(1.8 ± 0.4) %	
Γ_{29}	$\rho \bar{\rho}$	(1.52 ± 0.16) × 10 ⁻³	
Γ_{30}	$\rho \bar{\rho} \pi^0$	(3.6 ± 1.3) × 10 ⁻³	
Γ_{31}	$\Lambda \bar{\Lambda}$	(1.09 ± 0.24) × 10 ⁻³	
Γ_{32}	$\Sigma^+ \bar{\Sigma}^-$	(2.1 ± 0.6) × 10 ⁻³	
Γ_{33}	$\Xi^- \bar{\Xi}^+$	(8.9 ± 2.7) × 10 ⁻⁴	
Γ_{34}	$K \bar{K} \eta$	(10 ± 5) × 10 ⁻³	
Γ_{35}	$\pi^+ \pi^- p \bar{p}$	(5.3 ± 1.8) × 10 ⁻³	

NODE=M026;CLUMP=B
 DESIG=14
 DESIG=16
 DESIG=61
 DESIG=15
 DESIG=60
 DESIG=62
 DESIG=55
 DESIG=27
 DESIG=63
 DESIG=11
 DESIG=64
 DESIG=56
 DESIG=12
 DESIG=65
 DESIG=45
 DESIG=66
 DESIG=67
 DESIG=25
 DESIG=13

Radiative decays

$$\Gamma_{36} \quad \gamma\gamma \quad (1.57 \pm 0.12) \times 10^{-4}$$

 NODE=M026;CLUMP=C
 DESIG=31

**Charge conjugation (C), Parity (P),
 Lepton family number (LF) violating modes**

NODE=M026;CLUMP=D

Γ_{37}	$\pi^+ \pi^-$	P, CP	< 1.1	$\times 10^{-4}$	90%
Γ_{38}	$\pi^0 \pi^0$	P, CP	< 3.5	$\times 10^{-5}$	90%
Γ_{39}	$K^+ K^-$	P, CP	< 6	$\times 10^{-4}$	90%
Γ_{40}	$K_S^0 K_S^0$	P, CP	< 3.1	$\times 10^{-4}$	90%

DESIG=51

DESIG=52

DESIG=53

DESIG=54

CONSTRAINED FIT INFORMATION

An overall fit to the total width, 8 combinations of partial widths obtained from integrated cross section, and 17 branching ratios uses 80 measurements and one constraint to determine 12 parameters. The overall fit has a $\chi^2 = 113.0$ for 69 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta p_i \delta p_j \rangle / (\delta p_i \delta p_j)$, in percent, from the fit to parameters p_i , including the branching fractions, $x_i \equiv \Gamma_i / \Gamma_{\text{total}}$. The fit constrains the x_i whose labels appear in this array to sum to one.

x_7	18									
x_{15}	3	6								
x_{17}	22	42	7							
x_{20}	11	21	4	25						
x_{24}	9	16	3	25	10					
x_{26}	14	25	5	31	16	12				
x_{29}	14	26	5	36	16	13	20			
x_{31}	3	6	1	9	4	3	5	25		
x_{36}	-29	-54	-10	-66	-34	-27	-41	-45	-11	
Γ	-2	-3	-1	-4	-2	-2	-2	7	2	-29
	x_4	x_7	x_{15}	x_{17}	x_{20}	x_{24}	x_{26}	x_{29}	x_{31}	x_{36}

Mode	Rate (MeV)	
$\Gamma_4 \quad K^*(892) \bar{K}^*(892)$	0.23 $\pm$ 0.04	DESIG=18
$\Gamma_7 \quad \phi \phi$	0.057 $\pm$ 0.007	DESIG=17
$\Gamma_{15} \quad f_2(1270) f_2(1270)$	0.32 $\pm$ 0.08	DESIG=46
$\Gamma_{17} \quad K \bar{K} \pi$	2.36 $\pm$ 0.17	DESIG=14
$\Gamma_{20} \quad K^+ K^- \pi^+ \pi^-$	0.223 $\pm$ 0.035	DESIG=15
$\Gamma_{24} \quad 2(K^+ K^-)$	0.047 $\pm$ 0.010	DESIG=27
$\Gamma_{26} \quad 2(\pi^+ \pi^-)$	0.31 $\pm$ 0.04	DESIG=11
$\Gamma_{29} \quad \rho \bar{\rho}$	0.049 $\pm$ 0.005	DESIG=12
$\Gamma_{31} \quad \Lambda \bar{\Lambda}$	0.035 $\pm$ 0.008	DESIG=45
$\Gamma_{36} \quad \gamma\gamma$	0.0050 $\pm$ 0.0004	DESIG=31

 $\eta_c(1S)$ PARTIAL WIDTHS

NODE=M026217

 $\Gamma(\gamma\gamma)$ **Γ_{36}**

VALUE (keV) EVTS DOCUMENT ID TECN COMMENT

5.0 $\pm$ 0.4 OUR FIT
 NODE=M026W1
 NODE=M026W1

• • • 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 $e^+ e^-$
$6.7^{+2.4}_{-1.7} \pm 2.3$		⁴ ARMSTRONG	95F	E760	$\bar{p}p \rightarrow \gamma\gamma$
11.3 ± 4.2		¹⁰ ALBRECHT	94H	ARG	$e^+ e^- \rightarrow e^+ e^- \eta_c$
8.0 $\pm 2.3 \pm 2.4$	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

$\eta_c(1S) \Gamma(i) \Gamma(\gamma\gamma) / \Gamma(\text{total})$

$\Gamma(\eta'(958)\pi\pi) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$					$\Gamma_1 \Gamma_{36} / \Gamma$
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

$\Gamma(\rho\rho) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$					$\Gamma_2 \Gamma_{36} / \Gamma$
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

$\Gamma(K^*(892)\bar{K}^*(892)) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$					$\Gamma_4 \Gamma_{36} / \Gamma$
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

$\Gamma(\phi\phi) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$					$\Gamma_7 \Gamma_{36} / \Gamma$
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

$\Gamma(\omega\omega) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$					$\Gamma_{13} \Gamma_{36} / \Gamma$
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

$\Gamma(\omega\phi) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$					$\Gamma_{14} \Gamma_{36} / \Gamma$
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

$$\Gamma(f_2(1270)f_2(1270)) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{15}\Gamma_{36}/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
49±13 OUR FIT				
69±17±12	3182 ± 766	UEHARA	08 BELL	$\gamma\gamma \rightarrow 2(\pi^+\pi^-)$

NODE=M026G19
NODE=M026G19

$$\Gamma(f_2(1270)f_2'(1525)) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{16}\Gamma_{36}/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
49±9±13	1128 ± 206	UEHARA	08 BELL	$\gamma\gamma \rightarrow \pi^+\pi^-K^+K^-$

NODE=M026G20
NODE=M026G20

$$\Gamma(K\bar{K}\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{17}\Gamma_{36}/\Gamma$$

VALUE (keV)	CL% EVTS	DOCUMENT ID	TECN	COMMENT
0.369±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

$$\Gamma(K^+K^-\pi^+\pi^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{20}\Gamma_{36}/\Gamma$$

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

$$\Gamma(K^+K^-\pi^+\pi^-\pi^0) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{21}\Gamma_{36}/\Gamma$$

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

$$\Gamma(2(K^+K^-)) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{24}\Gamma_{36}/\Gamma$$

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

$$\Gamma(2(\pi^+\pi^-)) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$$

$$\Gamma_{26}\Gamma_{36}/\Gamma$$

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

$$\Gamma(p\bar{p}) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$$

$$\Gamma_{29}\Gamma_{36}/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
7.6 ± 0.8 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

$$\Gamma(K_S^0 K_S^0) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$$

$$\Gamma_{40}\Gamma_{36}/\Gamma$$

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	$J/\psi \rightarrow \gamma\rho^+\rho^-$	

NODE=M026R9
NODE=M026R9

• • • We do not use the following data for averages, fits, limits, etc. • • •

<14	90	¹ BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \eta_c \gamma$

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

NEW

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

$\Gamma(K^{*0}\bar{K}^{*0}\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
113±47±25	45	¹ ABLIKIM	06A BES2	$J/\psi \rightarrow K^{*0}\bar{K}^{*0}\pi^+\pi^-\gamma$

NODE=M026R25
 NODE=M026R25

¹ ABLIKIM 06A reports $[\Gamma(\eta_c(1S) \rightarrow K^{*0}\bar{K}^{*0}\pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta_c(1S))] = (1.91 \pm 0.64 \pm 0.48) \times 10^{-4}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = (1.7 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R25;LINKAGE=AB

 $\Gamma(\phi K^+ K^-)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
2.9^{+0.9}_{-0.8}±1.1	14.1 ^{+4.4} _{-3.7}	¹ HUANG	03 BELL	$B^+ \rightarrow (\phi K^+ K^-) K^+$

NODE=M026R21
 NODE=M026R21

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=M026R;LINKAGE=BB

 $\Gamma(\phi\phi)/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
17.6± 2.0 OUR FIT				
30 ± 5 OUR AVERAGE				

NODE=M026R7
 NODE=M026R7

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	$J/\psi \rightarrow \gamma K^+ K^- K_S^0 K_L^0$

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.

NODE=M026R;LINKAGE=E

² Using $B(B^+ \rightarrow \eta_c K^+) = (1.25 \pm 0.12^{+0.10}_{-0.12}) \times 10^{-3}$ from FANG 03 and $B(\eta_c \rightarrow K\bar{K}\pi) = (5.5 \pm 1.7) \times 10^{-2}$.

NODE=M026R7;LINKAGE=BB

 $\Gamma(\phi\phi)/\Gamma(K\bar{K}\pi)$ Γ_7/Γ_{17}

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
0.0240±0.0026 OUR FIT				

NODE=M026R39
 NODE=M026R39

0.044^{+0.012}_{-0.010} OUR AVERAGE

0.055 ± 0.014 ± 0.005		AUBERT,B	04B BABR	$B^\pm \rightarrow K^\pm \eta_c$
0.032 ^{+0.014} _{-0.010} ± 0.009	7	¹ HUANG	03 BELL	$B^\pm \rightarrow K^\pm \phi\phi$

¹ Using $B(B^+ \rightarrow \eta_c K^+) = (1.25 \pm 0.12^{+0.10}_{-0.12}) \times 10^{-3}$ from FANG 03 and $B(\eta_c \rightarrow K\bar{K}\pi) = (5.5 \pm 1.7) \times 10^{-2}$.

NODE=M026R39;LINKAGE=BB

 $\Gamma(\phi 2(\pi^+\pi^-))/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<40 (CL = 90%)	[<35 × 10⁻⁴ (CL = 90%) OUR 2013 BEST LIMIT]			
<40	90	¹ ABLIKIM	06A BES2	$J/\psi \rightarrow \phi 2(\pi^+\pi^-)\gamma$

NODE=M026R26
 NODE=M026R26

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;LINKAGE=AB

 $\Gamma(a_0(980)\pi)/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.02	90	^{1,2} BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \eta_c \gamma$

NODE=M026R11
 NODE=M026R11

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;LINKAGE=E

NODE=M026R11;LINKAGE=F

 $\Gamma(a_2(1320)\pi)/\Gamma_{\text{total}}$ Γ_{10}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.02	90	¹ BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \eta_c \gamma$

NODE=M026R12
 NODE=M026R12

¹ The quoted branching ratios use $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = 0.0127 \pm 0.0036$.

NODE=M026R12;LINKAGE=E

$\Gamma(K^*(892)\bar{K} + c.c.)/\Gamma_{\text{total}}$ Γ_{11}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.0128	90	BISELLO	91 DM2	$J/\psi \rightarrow \gamma K_S^0 K^\pm \pi^\mp$
<0.0132	90	¹ BISELLO	91 DM2	$J/\psi \rightarrow \gamma K^\mp K^\mp \pi^0$

¹ The quoted branching ratios use $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = 0.0127 \pm 0.0036$.

NODE=M026R17
NODE=M026R17

OCCUR=2

NODE=M026R17;LINKAGE=E

 $\Gamma(f_2(1270)\eta)/\Gamma_{\text{total}}$ Γ_{12}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.011	90	¹ BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \eta_c \gamma$

¹ The quoted branching ratios use $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = 0.0127 \pm 0.0036$.

NODE=M026R13
NODE=M026R13

NODE=M026R13;LINKAGE=E

 $\Gamma(\omega\omega)/\Gamma_{\text{total}}$ Γ_{13}/Γ

VALUE	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

 $\Gamma(\omega\phi)/\Gamma_{\text{total}}$ Γ_{14}/Γ

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

 $\Gamma(f_2(1270)f_2(1270))/\Gamma_{\text{total}}$ Γ_{15}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
0.98 ± 0.25 OUR FIT				
$0.77^{+0.25}_{-0.30} \pm 0.17$	91.2 ± 19.8	¹ ABLIKIM 04M BES		$J/\psi \rightarrow \gamma 2\pi^+ 2\pi^-$

¹ ABLIKIM 04M reports $[\Gamma(\eta_c(1S) \rightarrow f_2(1270)f_2(1270))/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma \eta_c(1S))] = (1.3 \pm 0.3^{+0.3}_{-0.4}) \times 10^{-4}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = (1.7 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R19
NODE=M026R19

NODE=M026R19;LINKAGE=AB

 $\Gamma(K\bar{K}\pi)/\Gamma_{\text{total}}$ Γ_{17}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
7.3 ± 0.5 OUR FIT				
6.5 ± 0.6 OUR AVERAGE				
$6.3 \pm 1.3 \pm 0.6$	55	^{1,2} ABLIKIM 12N BES3		$\psi(2S) \rightarrow \pi^0 \gamma K^+ K^- \pi^0$
$7.9 \pm 1.4 \pm 0.7$	107	^{3,4} ABLIKIM 12N BES3		$\psi(2S) \rightarrow \pi^0 \gamma K_S^0 K^\mp \pi^\pm$
8.5 ± 1.8		⁵ AUBERT 06E BABR		$B^\pm \rightarrow K^\pm X_{c\bar{c}}$
5.1 ± 2.1	0.6k	⁶ BAI 04 BES		$J/\psi \rightarrow \gamma K^\pm \pi^\mp K_S^0$
$6.90 \pm 1.42 \pm 1.32$	33	⁶ BISELLO 91 DM2		$J/\psi \rightarrow \gamma K^+ K^- \pi^0$
$5.43 \pm 0.94 \pm 0.94$	68	⁶ BISELLO 91 DM2		$J/\psi \rightarrow \gamma K^\pm \pi^\mp K_S^0$
4.8 ± 1.7	95	^{6,7} BALTRUSAIT..86 MRK3		$J/\psi \rightarrow \eta_c \gamma$
$16.1^{+9.2}_{-7.3}$		^{8,9} HIMEL 80B MRK2		$\psi(2S) \rightarrow \eta_c \gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 10.7 90% CL ^{6,10} PARTRIDGE 80B CBAL $J/\psi \rightarrow \eta_c \gamma$

¹ ABLIKIM 12N quotes $B(\psi(2S) \rightarrow \pi^0 h_c) \cdot B(h_c \rightarrow \gamma \eta_c) \cdot B(\eta_c \rightarrow K^+ K^- \pi^0) = (4.54 \pm 0.76 \pm 0.48) \times 10^{-6}$ which we multiply by 6 to account for isospin symmetry.

² ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow K\bar{K}\pi)/\Gamma_{\text{total}}] \times [\Gamma(h_c(1P) \rightarrow \eta_c(1S)\gamma)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}}] = (27.24 \pm 4.56 \pm 2.88) \times 10^{-6}$ which we divide by our best value $\Gamma(h_c(1P) \rightarrow \eta_c(1S)\gamma)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}} = (4.3 \pm 0.4) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

³ ABLIKIM 12N quotes $B(\psi(2S) \rightarrow \pi^0 h_c) \cdot B(h_c \rightarrow \gamma \eta_c) \cdot B(\eta_c \rightarrow K_S^0 K^\pm \pi^\mp) = (11.35 \pm 1.25 \pm 1.50) \times 10^{-6}$ which we multiply by 3 to account for isospin symmetry.

⁴ ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow K\bar{K}\pi)/\Gamma_{\text{total}}] \times [\Gamma(h_c(1P) \rightarrow \eta_c(1S)\gamma)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}}] = (34.05 \pm 3.75 \pm 4.50) \times 10^{-6}$ which we divide by our best value $\Gamma(h_c(1P) \rightarrow \eta_c(1S)\gamma)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}}$

NODE=M026R4
NODE=M026R4

OCCUR=2

OCCUR=2

NODE=M026R4;LINKAGE=BK

NODE=M026R4;LINKAGE=CK

NODE=M026R4;LINKAGE=BL

NODE=M026R4;LINKAGE=CL

$\Gamma_{\text{total}} = (4.3 \pm 0.4) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

⁵ Determined from the ratio of $B(B^\pm \rightarrow K^\pm \eta_c) B(\eta_c \rightarrow K \bar{K} \pi) = (7.4 \pm 0.5 \pm 0.7) \times 10^{-5}$ reported in AUBERT, B 04B and $B(B^\pm \rightarrow K^\pm \eta_c) = (8.7 \pm 1.5) \times 10^{-3}$ reported in AUBERT 06E.

⁶ The quoted branching ratios use $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = 0.0127 \pm 0.0036$. Where relevant, the error in this branching ratio is treated as a common systematic in computing averages.

⁷ Average from $K^+ K^- \pi^0$ and $K^\pm K_S^0 \pi^\mp$ decay channels.

⁸ $K^\pm K_S^0 \pi^\mp$ corrected to $K \bar{K} \pi$ by factor 3. KS, MR.

⁹ Estimated using $B(\psi(2S) \rightarrow \gamma \eta_c(1S)) = 0.0028 \pm 0.0006$.

¹⁰ $K^+ K^- \pi^0$ corrected to $K \bar{K} \pi$ by factor 6. KS, MR

NODE=M026R4;LINKAGE=AB

NODE=M026R4;LINKAGE=E

NODE=M026R4;LINKAGE=D

NODE=M026R4;LINKAGE=01

NODE=M026R4;LINKAGE=A

NODE=M026R4;LINKAGE=02

$\Gamma(\phi K^+ K^-)/\Gamma(K \bar{K} \pi)$

Γ_6/Γ_{17}

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
$0.052^{+0.016}_{-0.014} \pm 0.014$	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

$\Gamma(\eta \pi^+ \pi^-)/\Gamma_{\text{total}}$

Γ_{18}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.7 \pm 0.4 \pm 0.1$	33	¹ ABLIKIM	12N	BES3 $\psi(2S) \rightarrow \pi^0 \gamma \eta \pi^+ \pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
5.4 ± 2.0	75	² BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \eta_c \gamma$
$3.7 \pm 1.3 \pm 2.0$	18	² PARTRIDGE	80B	CBAL $J/\psi \rightarrow \eta \pi^+ \pi^- \gamma$

NODE=M026R6
NODE=M026R6

¹ ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow \eta \pi^+ \pi^-)/\Gamma_{\text{total}}] \times [\Gamma(h_c(1P) \rightarrow \eta_c(1S) \gamma)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}}] = (7.22 \pm 1.47 \pm 1.11) \times 10^{-6}$ which we divide by our best value $\Gamma(h_c(1P) \rightarrow \eta_c(1S) \gamma)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}} = (4.3 \pm 0.4) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R6;LINKAGE=AB

² The quoted branching ratios use $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = 0.0127 \pm 0.0036$. Where relevant, the error in this branching ratio is treated as a common systematic in computing averages.

NODE=M026R6;LINKAGE=E

$\Gamma(\eta 2(\pi^+ \pi^-))/\Gamma_{\text{total}}$

Γ_{19}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
$4.4 \pm 1.2 \pm 0.4$	39	¹ ABLIKIM	12N	BES3 $\psi(2S) \rightarrow \pi^0 \gamma \eta 2(\pi^+ \pi^-)$

NODE=M026R05
NODE=M026R05

¹ ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow \eta 2(\pi^+ \pi^-))/\Gamma_{\text{total}}] \times [\Gamma(h_c(1P) \rightarrow \eta_c(1S) \gamma)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}}] = (19.17 \pm 3.77 \pm 3.72) \times 10^{-6}$ which we divide by our best value $\Gamma(h_c(1P) \rightarrow \eta_c(1S) \gamma)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}} = (4.3 \pm 0.4) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R05;LINKAGE=AB

$\Gamma(K^+ K^- \pi^+ \pi^-)/\Gamma_{\text{total}}$

Γ_{20}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
6.9 ± 1.1 OUR FIT				
11.2 ± 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 ± 4	0.4k	² BAI	04	BES $J/\psi \rightarrow \gamma K^+ K^- \pi^+ \pi^-$
21 ± 7	110	² BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \eta_c \gamma$
14^{+22}_{-9}		³ HIMEL	80B	MRK2 $\psi(2S) \rightarrow \eta_c \gamma$

NODE=M026R5
NODE=M026R5

¹ ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow K^+ K^- \pi^+ \pi^-)/\Gamma_{\text{total}}] \times [\Gamma(h_c(1P) \rightarrow \eta_c(1S) \gamma)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}}] = (4.16 \pm 0.76 \pm 0.59) \times 10^{-6}$ which we divide by our best value $\Gamma(h_c(1P) \rightarrow \eta_c(1S) \gamma)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}} = (4.3 \pm 0.4) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R5;LINKAGE=AB

² The quoted branching ratios use $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = 0.0127 \pm 0.0036$. Where relevant, the error in this branching ratio is treated as a common systematic in computing averages.

NODE=M026R5;LINKAGE=E

³ Estimated using $B(\psi(2S) \rightarrow \gamma \eta_c(1S)) = 0.0028 \pm 0.0006$.

NODE=M026R5;LINKAGE=A

$\Gamma(K^+ K^- \pi^+ \pi^- \pi^0)/\Gamma(K \bar{K} \pi)$ Γ_{21}/Γ_{17}

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.477$\pm$0.017$\pm$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

 $\Gamma(K^0 K^- \pi^+ \pi^- \pi^+ + c.c.)/\Gamma_{\text{total}}$ Γ_{22}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
5.6$\pm$1.4$\pm$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.

NODE=M026R06;LINKAGE=AA

² ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow K^0 K^- \pi^+ \pi^- \pi^+ + c.c.)/\Gamma_{\text{total}}] \times [\Gamma(h_c(1P) \rightarrow \eta_c(1S)\gamma)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}}] = (24.02 \pm 4.44 \pm 4.08) \times 10^{-6}$ which we divide by our best value $\Gamma(h_c(1P) \rightarrow \eta_c(1S)\gamma)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}} = (4.3 \pm 0.4) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R06;LINKAGE=AB

 $\Gamma(K^+ K^- 2(\pi^+ \pi^-))/\Gamma_{\text{total}}$ Γ_{23}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
7.5$\pm$2.4 OUR AVERAGE				

NODE=M026R23
NODE=M026R23

8 $\pm$ 4 $\pm$ 1	10	¹ ABLIKIM	12N BES3	$\psi(2S) \rightarrow \pi^0 \gamma K^+ K^- 2(\pi^+ \pi^-)$
7.2 $\pm$ 2.4 $\pm$ 1.6	100	² ABLIKIM	06A BES2	$J/\psi \rightarrow K^+ K^- 2(\pi^+ \pi^-) \gamma$

¹ ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow K^+ K^- 2(\pi^+ \pi^-))/\Gamma_{\text{total}}] \times [\Gamma(h_c(1P) \rightarrow \eta_c(1S)\gamma)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}}] = (3.60 \pm 1.71 \pm 0.64) \times 10^{-6}$ which we divide by our best value $\Gamma(h_c(1P) \rightarrow \eta_c(1S)\gamma)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}} = (4.3 \pm 0.4) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R23;LINKAGE=AL

² ABLIKIM 06A reports $[\Gamma(\eta_c(1S) \rightarrow K^+ K^- 2(\pi^+ \pi^-))/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma \eta_c(1S))] = (1.21 \pm 0.32 \pm 0.24) \times 10^{-4}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = (1.7 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R23;LINKAGE=AB

 $\Gamma(2(K^+ K^-))/\Gamma_{\text{total}}$ Γ_{24}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.47$\pm$ 0.31 OUR FIT				

NODE=M026R20
NODE=M026R20

2.2 $\pm$ 0.9 $\pm$ 0.2	7	¹ ABLIKIM	12N BES3	$\psi(2S) \rightarrow \pi^0 \gamma 2(K^+ K^-)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.4 $\pm$ 0.5 $\pm$ 0.6	14.5 $\pm$ 4.6 $\pm$ 3.0	² HUANG	03 BELL	$B^+ \rightarrow 2(K^+ K^-) K^+$
21 $\pm$ 10 $\pm$ 6		³ ALBRECHT	94H ARG	$\gamma\gamma \rightarrow K^+ K^- K^+ K^-$

¹ ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow 2(K^+ K^-))/\Gamma_{\text{total}}] \times [\Gamma(h_c(1P) \rightarrow \eta_c(1S)\gamma)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}}] = (0.94 \pm 0.37 \pm 0.14) \times 10^{-6}$ which we divide by our best value $\Gamma(h_c(1P) \rightarrow \eta_c(1S)\gamma)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}} = (4.3 \pm 0.4) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R20;LINKAGE=AB

² Using $B(B^+ \rightarrow \eta_c K^+) = (1.25 \pm 0.12^{+0.10}_{-0.12}) \times 10^{-3}$ from FANG 03 and $B(\eta_c \rightarrow K \bar{K} \pi) = (5.5 \pm 1.7) \times 10^{-2}$.

NODE=M026R20;LINKAGE=BB

³ Normalized to the sum of $B(\eta_c \rightarrow K^\pm K_S^0 \pi^\mp)$, $B(\eta_c \rightarrow \phi\phi)$, $B(\eta_c \rightarrow K^+ K^- \pi^+ \pi^-)$, and $B(\eta_c \rightarrow 2\pi^+ 2\pi^-)$.

NODE=M026R20;LINKAGE=AL

 $\Gamma(2(K^+ K^-))/\Gamma(K \bar{K} \pi)$ Γ_{24}/Γ_{17}

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.020$\pm$0.004 OUR FIT				

NODE=M026R38
NODE=M026R38

0.024 $\pm$ 0.007 OUR AVERAGE

0.023 $\pm$ 0.007 $\pm$ 0.006		AUBERT,B	04B BABR	$B^\pm \rightarrow K^\pm \eta_c$
0.026 $\pm$ 0.009 $\pm$ 0.007	15	¹ HUANG	03 BELL	$B^\pm \rightarrow K^\pm (2K^+ 2K^-)$

¹ Using $B(B^+ \rightarrow \eta_c K^+) = (1.25 \pm 0.12^{+0.10}_{-0.12}) \times 10^{-3}$ from FANG 03 and $B(\eta_c \rightarrow K \bar{K} \pi) = (5.5 \pm 1.7) \times 10^{-2}$.

NODE=M026R38;LINKAGE=BB

$\Gamma(\pi^+\pi^-\pi^0\pi^0)/\Gamma_{\text{total}}$ Γ_{25}/Γ VALUE (units 10^{-2}) EVTS

DOCUMENT ID TECN COMMENT

4.7±0.9±0.4 118 1 ABLIKIM 12N BES3 $\psi(2S) \rightarrow \pi^0\gamma\pi^+\pi^-2\pi^0$

1 ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow \pi^+\pi^-\pi^0\pi^0)/\Gamma_{\text{total}}] \times [\Gamma(h_c(1P) \rightarrow \eta_c(1S)\gamma)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}}] = (20.31 \pm 2.20 \pm 3.33) \times 10^{-6}$ which we divide by our best value $\Gamma(h_c(1P) \rightarrow \eta_c(1S)\gamma)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}} = (4.3 \pm 0.4) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R07
NODE=M026R07

NODE=M026R07;LINKAGE=AB

 $\Gamma(2(\pi^+\pi^-))/\Gamma_{\text{total}}$ Γ_{26}/Γ VALUE (units 10^{-2}) EVTS

DOCUMENT ID TECN COMMENT

0.97±0.12 OUR FIT

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 $\begin{smallmatrix} +1.5 \\ -1.0 \end{smallmatrix}$ 3 HIMEL 80B MRK2 $\psi(2S) \rightarrow \eta_c\gamma$

1 ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow 2(\pi^+\pi^-))/\Gamma_{\text{total}}] \times [\Gamma(h_c(1P) \rightarrow \eta_c(1S)\gamma)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}}] = (7.51 \pm 0.85 \pm 1.11) \times 10^{-6}$ which we divide by our best value $\Gamma(h_c(1P) \rightarrow \eta_c(1S)\gamma)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}} = (4.3 \pm 0.4) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

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_{27}/Γ VALUE (units 10^{-2}) EVTS

DOCUMENT ID TECN COMMENT

17.4±2.9±1.5 175 1 ABLIKIM 12N BES3 $\psi(2S) \rightarrow \pi^0\gamma 2(\pi^+\pi^-\pi^0)$

1 ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow 2(\pi^+\pi^-\pi^0))/\Gamma_{\text{total}}] \times [\Gamma(h_c(1P) \rightarrow \eta_c(1S)\gamma)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}}] = (75.13 \pm 7.42 \pm 9.99) \times 10^{-6}$ which we divide by our best value $\Gamma(h_c(1P) \rightarrow \eta_c(1S)\gamma)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}} = (4.3 \pm 0.4) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R08
NODE=M026R08

NODE=M026R08;LINKAGE=AB

 $\Gamma(3(\pi^+\pi^-))/\Gamma_{\text{total}}$ Γ_{28}/Γ VALUE (units 10^{-3}) EVTS

DOCUMENT ID TECN COMMENT

18 ±4 OUR AVERAGE

[(17 ± 4) × 10⁻³ OUR 2013 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 $[\Gamma(\eta_c(1S) \rightarrow 3(\pi^+\pi^-))/\Gamma_{\text{total}}] \times [\Gamma(h_c(1P) \rightarrow \eta_c(1S)\gamma)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}}] = (8.82 \pm 1.57 \pm 1.59) \times 10^{-6}$ which we divide by our best value $\Gamma(h_c(1P) \rightarrow \eta_c(1S)\gamma)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}} = (4.3 \pm 0.4) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

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

NEW

NODE=M026R24;LINKAGE=AL

NODE=M026R24;LINKAGE=AB

 $\Gamma(p\bar{p})/\Gamma_{\text{total}}$ Γ_{29}/Γ VALUE (units 10^{-4}) EVTS

DOCUMENT ID TECN COMMENT

15.2± 1.6 OUR FIT

[(15.1 ± 1.6) × 10⁻⁴ OUR 2013 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 $\begin{smallmatrix} +29 \\ -15 \end{smallmatrix}$ 3 HIMEL 80B MRK2 $\psi(2S) \rightarrow \eta_c\gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

14.8 $\begin{smallmatrix} + \\ - \end{smallmatrix}$ $\begin{smallmatrix} 2.0+1.7 \\ 2.4-1.8 \end{smallmatrix}$ 195 4 WU 06 BELL $B^+ \rightarrow p\bar{p}K^+$ NODE=M026R2
NODE=M026R2

NEW

¹ ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow p\bar{p})/\Gamma_{\text{total}}] \times [\Gamma(h_c(1P) \rightarrow \eta_c(1S)\gamma)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}}] = (0.65 \pm 0.19 \pm 0.10) \times 10^{-6}$ which we divide by our best value $\Gamma(h_c(1P) \rightarrow \eta_c(1S)\gamma)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}} = (4.3 \pm 0.4) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² The quoted branching ratios use $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = 0.0127 \pm 0.0036$. Where relevant, the error in this branching ratio is treated as a common systematic in computing averages.

³ Estimated using $B(\psi(2S) \rightarrow \gamma\eta_c(1S)) = 0.0028 \pm 0.0006$.

⁴ WU 06 reports $[\Gamma(\eta_c(1S) \rightarrow p\bar{p})/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \eta_c K^+)] = (1.42 \pm 0.11^{+0.16}_{-0.20}) \times 10^{-6}$ 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;LINKAGE=AB

NODE=M026R2;LINKAGE=E

NODE=M026R2;LINKAGE=A

NODE=M026R2;LINKAGE=WU

$\Gamma(p\bar{p})/\Gamma(K\bar{K}\pi)$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_{29}/Γ_{17}
0.0207 ± 0.0021 OUR FIT					
[0.0206 ± 0.0021 OUR 2013 FIT]					

NODE=M026R03
NODE=M026R03
NEW

0.021 ± 0.002	+0.004 -0.006	195	¹ WU	06	BELL	$B^\pm \rightarrow K^\pm p\bar{p}$

¹ Using $B(B^+ \rightarrow \eta_c K^+) = (1.25 \pm 0.12^{+0.10}_{-0.12}) \times 10^{-3}$ from FANG 03 and $B(\eta_c \rightarrow K\bar{K}\pi) = (5.5 \pm 1.7) \times 10^{-2}$.

NODE=M026R03;LINKAGE=BB

$\Gamma(p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\phi\phi)/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT	$\Gamma_{29}/\Gamma \times \Gamma_7/\Gamma$
0.27 ± 0.05 OUR FIT				

NODE=M026R33
NODE=M026R33

4.0	+3.5 -3.2	BAGLIN	89	SPEC	$\bar{p}p \rightarrow K^+ K^- K^+ K^-$

$\Gamma(p\bar{p}\pi^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_{30}/Γ
0.36 ± 0.13 ± 0.03	14	¹ ABLIKIM	12N	BES3	$\psi(2S) \rightarrow \pi^0 \gamma p\bar{p}\pi^0$

NODE=M026R09
NODE=M026R09

¹ ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow p\bar{p}\pi^0)/\Gamma_{\text{total}}] \times [\Gamma(h_c(1P) \rightarrow \eta_c(1S)\gamma)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}}] = (1.53 \pm 0.49 \pm 0.23) \times 10^{-6}$ which we divide by our best value $\Gamma(h_c(1P) \rightarrow \eta_c(1S)\gamma)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}} = (4.3 \pm 0.4) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R09;LINKAGE=AB

$\Gamma(\Lambda\bar{\Lambda})/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_{31}/Γ
10.9 ± 2.4 OUR FIT						

NODE=M026R18
NODE=M026R18

11.7 ± 3.4 OUR AVERAGE [(11.7 ± 3.5) × 10⁻⁴ OUR 2013 AVERAGE]

11.7 ± 2.3 ± 2.6 ¹ ABLIKIM 12B BES3

NEW

• • • 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.

NODE=M026R18;LINKAGE=AB

² WU 06 reports $[\Gamma(\eta_c(1S) \rightarrow \Lambda\bar{\Lambda})/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \eta_c K^+)] = (0.95^{+0.25+0.08}_{-0.22-0.11}) \times 10^{-6}$ which we divide by our best value $B(B^+ \rightarrow \eta_c K^+) = (9.6 \pm 1.1) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R18;LINKAGE=WU

³ The quoted branching ratios use $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = 0.0127 \pm 0.0036$.

NODE=M026R18;LINKAGE=E

$\Gamma(\Lambda\bar{\Lambda})/\Gamma(p\bar{p})$

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_{31}/Γ_{29}
0.72 ± 0.16 OUR FIT				

NODE=M026R27
NODE=M026R27

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;LINKAGE=WU

$\Gamma(\Sigma^+ \bar{\Sigma}^-)/\Gamma_{\text{total}}$ Γ_{32}/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_{33}/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

 $\Gamma(K \bar{K} \eta)/\Gamma_{\text{total}}$ Γ_{34}/Γ

VALUE (units 10^{-2})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
1.0±0.5±0.1		7	^{1,2} ABLIKIM	12N BES3	$\psi(2S) \rightarrow \pi^0 \gamma \eta K^+ K^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<3.1	90		³ BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \eta_c \gamma$
¹ ABLIKIM 12N quotes $B(\psi(2S) \rightarrow \pi^0 h_c) \cdot B(h_c \rightarrow \gamma \eta_c) \cdot B(\eta_c \rightarrow K^+ K^- \eta) = (12.01 \pm 2.22 \pm 2.04) \times 10^{-6}$ which we multiply by 2 to account for isospin symmetry.					
² ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow K \bar{K} \eta)/\Gamma_{\text{total}}] \times [\Gamma(h_c(1P) \rightarrow \eta_c(1S) \gamma)/\Gamma_{\text{total}}] \times [\Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}}] = (4.22 \pm 2.02 \pm 0.64) \times 10^{-6}$ which we divide by our best value $\Gamma(h_c(1P) \rightarrow \eta_c(1S) \gamma)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}} = (4.3 \pm 0.4) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.					
³ The quoted branching ratios use $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = 0.0127 \pm 0.0036$.					

NODE=M026R15
 NODE=M026R15

NODE=M026R15;LINKAGE=AK

NODE=M026R15;LINKAGE=AL

NODE=M026R15;LINKAGE=E

 $\Gamma(\pi^+ \pi^- \rho \bar{\rho})/\Gamma_{\text{total}}$ Γ_{35}/Γ

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
5.3±1.7±0.5		19	¹ ABLIKIM	12N BES3	$\psi(2S) \rightarrow \pi^0 \gamma \rho \bar{\rho} \pi^+ \pi^-$
• • • 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 $[\Gamma(\eta_c(1S) \rightarrow \pi^+ \pi^- \rho \bar{\rho})/\Gamma_{\text{total}}] \times [\Gamma(h_c(1P) \rightarrow \eta_c(1S) \gamma)/\Gamma_{\text{total}}] \times [\Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}}] = (2.30 \pm 0.65 \pm 0.36) \times 10^{-6}$ which we divide by our best value $\Gamma(h_c(1P) \rightarrow \eta_c(1S) \gamma)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}} = (4.3 \pm 0.4) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.					

NODE=M026R3
 NODE=M026R3

NODE=M026R3;LINKAGE=AB

RADIATIVE DECAYS

NODE=M026310

 $\Gamma(\gamma \gamma)/\Gamma_{\text{total}}$ Γ_{36}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
1.57±0.12 OUR FIT					
1.9 $^{+0.7}_{-0.6}$ OUR AVERAGE					
2.7 $^{+0.8}_{-0.5}$ ±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	$J/\psi \rightarrow \eta_c \gamma$

NODE=M026R31
 NODE=M026R31

¹ ABLIKIM 13I reports $[\Gamma(\eta_c(1S) \rightarrow \gamma\gamma)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta_c(1S))] = (4.5 \pm 1.2 \pm 0.6) \times 10^{-6}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = (1.7 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² ADAMS 08 reports $[\Gamma(\eta_c(1S) \rightarrow \gamma\gamma)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta_c(1S))] = (2.4^{+1.1}_{-0.8} \pm 0.3) \times 10^{-6}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = (1.7 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

³ WICHT 08 reports $[\Gamma(\eta_c(1S) \rightarrow \gamma\gamma)/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \eta_c K^+)] = (2.2^{+0.9+0.4}_{-0.7-0.2}) \times 10^{-7}$ which we divide by our best value $B(B^+ \rightarrow \eta_c K^+) = (9.6 \pm 1.1) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

⁴ Not independent from the values of the total and two-photon width quoted by the same experiment.

⁵ The quoted branching ratios use $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = 0.0127 \pm 0.0036$.

⁶ Using $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = 0.0127 \pm 0.0036$.

NODE=M026R31;LINKAGE=AL

NODE=M026R31;LINKAGE=AD

NODE=M026R31;LINKAGE=WI

NODE=M026R31;LINKAGE=AB

NODE=M026R31;LINKAGE=E

NODE=M026R31;LINKAGE=C

$\Gamma(\gamma\gamma)/\Gamma(K\bar{K}\pi)$

Γ_{36}/Γ_{17}

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
2.13±0.29 OUR FIT				
[(2.14 ± 0.29) × 10 ⁻³ OUR 2013 FIT]				

NODE=M026R04

NODE=M026R04

NEW

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;LINKAGE=BB

$\Gamma(p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$

$\Gamma_{29}/\Gamma \times \Gamma_{36}/\Gamma$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
0.237±0.024 OUR FIT				
[(0.238 ± 0.024) × 10 ⁻⁶ OUR 2013 FIT]				

NODE=M026R32

NODE=M026R32

NEW

0.26 ± 0.05 OUR AVERAGE Error includes scale factor of 1.4.

0.224 $^{+0.038}_{-0.037}$ ± 0.020	190	AMBROGIANI 03	E835	$\bar{p}p \rightarrow \eta_c \rightarrow \gamma\gamma$
0.336 $^{+0.080}_{-0.070}$		ARMSTRONG 95F	E760	$\bar{p}p \rightarrow \gamma\gamma$
0.68 $^{+0.42}_{-0.31}$	12	BAGLIN	87B SPEC	$\bar{p}p \rightarrow \gamma\gamma$

———— Charge conjugation (C), Parity (P), ————
 ———— Lepton family number (LF) violating modes ————

NODE=M026320

$\Gamma(\pi^+\pi^-)/\Gamma_{\text{total}}$

Γ_{37}/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 $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = 1.7 \times 10^{-2}$.

NODE=M026R34;LINKAGE=AL

² ABLIKIM 06B reports $[\Gamma(\eta_c(1S) \rightarrow \pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta_c(1S))] < 1.1 \times 10^{-5}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = 1.7 \times 10^{-2}$.

NODE=M026R34;LINKAGE=AB

$\Gamma(\pi^0\pi^0)/\Gamma_{\text{total}}$

Γ_{38}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT

< 3.5 90 ¹ ABLIKIM 11G BES3 $J/\psi \rightarrow \gamma\pi^0\pi^0$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<40 90 ² ABLIKIM 06B BES2 $J/\psi \rightarrow \pi^0\pi^0\gamma$

¹ ABLIKIM 11G reports $[\Gamma(\eta_c(1S) \rightarrow \pi^0\pi^0)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta_c(1S))] < 6.0 \times 10^{-7}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = 1.7 \times 10^{-2}$.

NODE=M026R35;LINKAGE=AL

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;LINKAGE=AB

$\Gamma(K^+K^-)/\Gamma_{\text{total}}$

Γ_{39}/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

$\Gamma(K_S^0 K_S^0)/\Gamma_{\text{total}}$

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

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 B17B 120	C. Berger <i>et al.</i>	(PLUTO Collab.)	REFID=22010
GAISER	86	PR D34 711	J. Gaiser <i>et al.</i>	(Crystal Ball Collab.)	REFID=22012
ALTHOFF	85B	ZPHY C29 189	M. Althoff <i>et al.</i>	(TASSO Collab.)	REFID=21349
BALTRUSAIT...	84	PRL 52 2126	R.M. Baltrusaitis <i>et al.</i>	(CIT, UCSC+) ^{JP}	REFID=22006
BLOOM	83	ARNS 33 143	E.D. Bloom, C. Peck	(SLAC, CIT)	REFID=21682
HIMEL	80B	PRL 45 1146	T.M. Himel <i>et al.</i>	(SLAC, LBL, UCB)	REFID=22003
PARTRIDGE	80B	PRL 45 1150	R. Partridge <i>et al.</i>	(CIT, HARV, PRIN+)	REFID=22004

$J/\psi(1S)$

$$I^G(J^{PC}) = 0^-(1^{--})$$

NODE=M070

 $J/\psi(1S)$ MASS

NODE=M070M

NODE=M070M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
3096.916±0.011 OUR AVERAGE				
3096.917±0.010±0.007		AULCHENKO 03	KEDR	$e^+e^- \rightarrow \text{hadrons}$
3096.89 ±0.09	502	¹ ARTAMONOV 00	OLYA	$e^+e^- \rightarrow \text{hadrons}$
3096.91 ±0.03 ±0.01		² ARMSTRONG 93B	E760	$\bar{p}p \rightarrow e^+e^-$
3096.95 ±0.1 ±0.3	193	BAGLIN 87	SPEC	$\bar{p}p \rightarrow e^+e^- X$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
3097.5 ±0.3		GRIBUSHIN 96	FMPS	$515 \pi^- \text{Be} \rightarrow 2\mu X$
3098.4 ±2.0	38k	LEMOIGNE 82	GOLI	$185 \pi^- \text{Be} \rightarrow \gamma \mu^+ \mu^- A$
3096.93 ±0.09	502	³ ZHOLENTZ 80	REDE	e^+e^-
3097.0 ±1		⁴ BRANDELIK 79C	DASP	e^+e^-
¹ Reanalysis of ZHOLENTZ 80 using new electron mass (COHEN 87) and radiative corrections (KURAEV 85).				
² Mass central value and systematic error recalculated by us according to Eq.(16) in ARMSTRONG 93B, using the value for the $\psi(2S)$ mass from AULCHENKO 03.				
³ Superseded by ARTAMONOV 00.				
⁴ From a simultaneous fit to e^+e^- , $\mu^+\mu^-$ and hadronic channels assuming $\Gamma(e^+e^-) = \Gamma(\mu^+\mu^-)$.				

NODE=M070M;LINKAGE=AR

NODE=M070M;LINKAGE=NW

NODE=M070M;LINKAGE=RZ

NODE=M070M;LINKAGE=F

 $J/\psi(1S)$ WIDTH

NODE=M070W

NODE=M070W

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
92.9± 2.8 OUR AVERAGE Error includes scale factor of 1.1.				
96.1± 3.2	13k	¹ ADAMS 06A	CLEO	$e^+e^- \rightarrow \mu^+\mu^-\gamma$
84.4± 8.9		BAI 95B	BES	e^+e^-
91 ±11 ±6		² ARMSTRONG 93B	E760	$\bar{p}p \rightarrow e^+e^-$
85.5 ⁺ _{-6.1} 5.8		³ HSUEH 92	RVUE	See Υ mini-review
• • • We do not use the following data for averages, fits, limits, etc. • • •				
94.1± 2.7		⁴ ANASHIN 10	KEDR	$3.097 e^+e^- \rightarrow e^+e^-, \mu^+\mu^-$
93.7± 3.5	7.8k	¹ AUBERT 04	BABR	$e^+e^- \rightarrow \mu^+\mu^-\gamma$
¹ Calculated by us from the reported values of $\Gamma(e^+e^-) \times B(\mu^+\mu^-)$ using $B(e^+e^-) = (5.94 \pm 0.06)\%$ and $B(\mu^+\mu^-) = (5.93 \pm 0.06)\%$.				
² The initial-state radiation correction reevaluated by ANDREOTTI 07 in its Ref. [4].				
³ Using data from COFFMAN 92, BALDINI-CELIO 75, BOYARSKI 75, ESPOSITO 75B, BRANDELIK 79C.				
⁴ Assuming $\Gamma(e^+e^-) = \Gamma(\mu^+\mu^-)$ and using $\Gamma(e^+e^-)/\Gamma_{\text{total}} = (5.94 \pm 0.06)\%$.				

NODE=M070W;LINKAGE=AA

NODE=M070W;LINKAGE=AN

NODE=M070W;LINKAGE=A

NODE=M070W;LINKAGE=AS

 $J/\psi(1S)$ DECAY MODES

NODE=M070215;NODE=M070

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
Γ_1 hadrons	(87.7 ±0.5) %	DESIG=3
Γ_2 virtual $\gamma \rightarrow \text{hadrons}$	(13.50 ±0.30) %	DESIG=4
Γ_3 ggg	(64.1 ±1.0) %	DESIG=249
Γ_4 γgg	(8.8 ±1.1) %	DESIG=250
Γ_5 e^+e^-	(5.971±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

Γ ₈	$\rho\pi$	(1.69 ± 0.15) %	S=2.4	DESIG=20
Γ ₉	$\rho^0\pi^0$	(5.6 ± 0.7) × 10 ⁻³		DESIG=21
Γ ₁₀	$a_2(1320)\rho$	(1.09 ± 0.22) %		DESIG=43
Γ ₁₁	$\omega\pi^+\pi^+\pi^-\pi^-$	(8.5 ± 3.4) × 10 ⁻³		DESIG=26
Γ ₁₂	$\omega\pi^+\pi^-\pi^0$	(4.0 ± 0.7) × 10 ⁻³		DESIG=211
Γ ₁₃	$\omega\pi^+\pi^-$	(8.6 ± 0.7) × 10 ⁻³	S=1.1	DESIG=24
Γ ₁₄	$\omega f_2(1270)$	(4.3 ± 0.6) × 10 ⁻³		DESIG=28
Γ ₁₅	$K^*(892)^0\bar{K}^*(892)^0$	(2.3 ± 0.7) × 10 ⁻⁴		DESIG=46
Γ ₁₆	$K^*(892)^\pm K^*(892)^\mp$	(1.00 ± 0.22) × 10 ⁻³		DESIG=256
Γ ₁₇	$K^*(892)^\pm K^*(800)^\mp$	(1.1 ± 1.0) × 10 ⁻³		DESIG=257
Γ ₁₈	$\eta K^*(892)^0\bar{K}^*(892)^0$	(1.15 ± 0.26) × 10 ⁻³		DESIG=252
Γ ₁₉	$K^*(892)^0\bar{K}_2^*(1430)^0 + \text{c.c.}$	(6.0 ± 0.6) × 10 ⁻³		DESIG=48
Γ ₂₀	$K^*(892)^0\bar{K}_2^*(1770)^0 + \text{c.c.} \rightarrow K^*(892)^0 K^- \pi^+ + \text{c.c.}$	(6.9 ± 0.9) × 10 ⁻⁴		DESIG=235
Γ ₂₁	$\omega K^*(892)\bar{K} + \text{c.c.}$	(6.1 ± 0.9) × 10 ⁻³		DESIG=102
Γ ₂₂	$K^+ K^*(892)^- + \text{c.c.}$	(5.12 ± 0.30) × 10 ⁻³		DESIG=121
Γ ₂₃	$K^+ K^*(892)^- + \text{c.c.} \rightarrow K^+ K^- \pi^0$	(1.97 ± 0.20) × 10 ⁻³		DESIG=231
Γ ₂₄	$K^+ K^*(892)^- + \text{c.c.} \rightarrow K^0 K^\pm \pi^\mp + \text{c.c.}$	(3.0 ± 0.4) × 10 ⁻³		DESIG=232
Γ ₂₅	$K^0\bar{K}^*(892)^0 + \text{c.c.}$	(4.39 ± 0.31) × 10 ⁻³		DESIG=122
Γ ₂₆	$K^0\bar{K}^*(892)^0 + \text{c.c.} \rightarrow K^0 K^\pm \pi^\mp + \text{c.c.}$	(3.2 ± 0.4) × 10 ⁻³		DESIG=233
Γ ₂₇	$K_1(1400)^\pm K^\mp$	(3.8 ± 1.4) × 10 ⁻³		DESIG=132
Γ ₂₈	$\bar{K}^*(892)^0 K^+ \pi^- + \text{c.c.}$	seen		DESIG=214
Γ ₂₉	$\omega\pi^0\pi^0$	(3.4 ± 0.8) × 10 ⁻³		DESIG=140
Γ ₃₀	$b_1(1235)^\pm \pi^\mp$	[b] (3.0 ± 0.5) × 10 ⁻³		DESIG=49
Γ ₃₁	$\omega K^\pm K_S^0 \pi^\mp$	[b] (3.4 ± 0.5) × 10 ⁻³		DESIG=101
Γ ₃₂	$b_1(1235)^0 \pi^0$	(2.3 ± 0.6) × 10 ⁻³		DESIG=160
Γ ₃₃	$\eta K^\pm K_S^0 \pi^\mp$	[b] (2.2 ± 0.4) × 10 ⁻³		DESIG=230
Γ ₃₄	$\phi K^*(892)\bar{K} + \text{c.c.}$	(2.18 ± 0.23) × 10 ⁻³		DESIG=104
Γ ₃₅	$\omega K\bar{K}$	(1.70 ± 0.32) × 10 ⁻³		DESIG=27
Γ ₃₆	$\omega f_0(1710) \rightarrow \omega K\bar{K}$	(4.8 ± 1.1) × 10 ⁻⁴		DESIG=130
Γ ₃₇	$\phi 2(\pi^+\pi^-)$	(1.66 ± 0.23) × 10 ⁻³		DESIG=35
Γ ₃₈	$\Delta(1232)^{++} \bar{p}\pi^-$	(1.6 ± 0.5) × 10 ⁻³		DESIG=70
Γ ₃₉	$\omega\eta$	(1.74 ± 0.20) × 10 ⁻³	S=1.6	DESIG=30
Γ ₄₀	$\phi K\bar{K}$	(1.83 ± 0.24) × 10 ⁻³	S=1.5	DESIG=36
Γ ₄₁	$\phi f_0(1710) \rightarrow \phi K\bar{K}$	(3.6 ± 0.6) × 10 ⁻⁴		DESIG=129
Γ ₄₂	$\phi f_2(1270)$	(7.2 ± 1.3) × 10 ⁻⁴		DESIG=39
Γ ₄₃	$\Delta(1232)^{++} \bar{\Delta}(1232)^{--}$	(1.10 ± 0.29) × 10 ⁻³		DESIG=66
Γ ₄₄	$\Sigma(1385)^- \bar{\Sigma}(1385)^+ (\text{or c.c.})$	[b] (1.10 ± 0.12) × 10 ⁻³		DESIG=67
Γ ₄₅	$\phi f_2'(1525)$	(8 ± 4) × 10 ⁻⁴	S=2.7	DESIG=40
Γ ₄₆	$\phi\pi^+\pi^-$	(9.4 ± 0.9) × 10 ⁻⁴	S=1.2	DESIG=34
Γ ₄₇	$\phi\pi^0\pi^0$	(5.6 ± 1.6) × 10 ⁻⁴		DESIG=76
Γ ₄₈	$\phi K^\pm K_S^0 \pi^\mp$	[b] (7.2 ± 0.8) × 10 ⁻⁴		DESIG=103
Γ ₄₉	$\omega f_1(1420)$	(6.8 ± 2.4) × 10 ⁻⁴		DESIG=105
Γ ₅₀	$\phi\eta$	(7.5 ± 0.8) × 10 ⁻⁴	S=1.5	DESIG=37
Γ ₅₁	$\Xi^0\Xi^0$	(1.20 ± 0.24) × 10 ⁻³		DESIG=248
Γ ₅₂	$\Xi(1530)^- \Xi^+$	(5.9 ± 1.5) × 10 ⁻⁴		DESIG=107
Γ ₅₃	$\rho K^- \bar{\Sigma}(1385)^0$	(5.1 ± 3.2) × 10 ⁻⁴		DESIG=74
Γ ₅₄	$\omega\pi^0$	(4.5 ± 0.5) × 10 ⁻⁴	S=1.4	DESIG=32
Γ ₅₅	$\phi\eta'(958)$	(4.0 ± 0.7) × 10 ⁻⁴	S=2.1	DESIG=38
Γ ₅₆	$\phi f_0(980)$	(3.2 ± 0.9) × 10 ⁻⁴	S=1.9	DESIG=41
Γ ₅₇	$\phi f_0(980) \rightarrow \phi\pi^+\pi^-$	(1.8 ± 0.4) × 10 ⁻⁴		DESIG=236
Γ ₅₈	$\phi f_0(980) \rightarrow \phi\pi^0\pi^0$	(1.7 ± 0.7) × 10 ⁻⁴		DESIG=237

Г ₅₉	$\eta\phi f_0(980) \rightarrow \eta\phi\pi^+\pi^-$	(3.2 ±1.0) × 10 ⁻⁴		DESIG=229
Г ₆₀	$\phi a_0(980)^0 \rightarrow \phi\eta\pi^0$	(5 ±4) × 10 ⁻⁶		DESIG=258
Г ₆₁	$\Xi(1530)^0 \Xi^0$	(3.2 ±1.4) × 10 ⁻⁴		DESIG=108
Г ₆₂	$\Sigma(1385)^- \bar{\Sigma}^+ \text{ (or c.c.)}$	[b] (3.1 ±0.5) × 10 ⁻⁴		DESIG=68
Г ₆₃	$\phi f_1(1285)$	(2.6 ±0.5) × 10 ⁻⁴	S=1.1	DESIG=106
Г ₆₄	$\eta\pi^+\pi^-$	(4.0 ±1.7) × 10 ⁻⁴		DESIG=239
Г ₆₅	$\rho\eta$	(1.93 ±0.23) × 10 ⁻⁴		DESIG=22
Г ₆₆	$\omega\eta'(958)$	(1.82 ±0.21) × 10 ⁻⁴		DESIG=31
Г ₆₇	$\omega f_0(980)$	(1.4 ±0.5) × 10 ⁻⁴		DESIG=150
Г ₆₈	$\rho\eta'(958)$	(1.05 ±0.18) × 10 ⁻⁴		DESIG=23
Г ₆₉	$a_2(1320)^\pm \pi^\mp$	[b] < 4.3 × 10 ⁻³	CL=90%	DESIG=42
Г ₇₀	$K K_2^*(1430) + \text{c.c.}$	< 4.0 × 10 ⁻³	CL=90%	DESIG=45
Г ₇₁	$K_1(1270)^\pm K^\mp$	< 3.0 × 10 ⁻³	CL=90%	DESIG=131
Г ₇₂	$K_2^*(1430)^0 \bar{K}_2^*(1430)^0$	< 2.9 × 10 ⁻³	CL=90%	DESIG=47
Г ₇₃	$\phi\pi^0$	< 6.4 × 10 ⁻⁶	CL=90%	DESIG=33
Г ₇₄	$\phi\eta(1405) \rightarrow \phi\eta\pi\pi$	< 2.5 × 10 ⁻⁴	CL=90%	DESIG=128
Г ₇₅	$\omega f_2'(1525)$	< 2.2 × 10 ⁻⁴	CL=90%	DESIG=29
Г ₇₆	$\omega X(1835) \rightarrow \omega p \bar{p}$	< 3.9 × 10 ⁻⁶	CL=95%	DESIG=263
Г ₇₇	$\eta\phi(2170) \rightarrow$ $\eta K^*(892)^0 \bar{K}^*(892)^0$	< 2.52 × 10 ⁻⁴	CL=90%	DESIG=253
Г ₇₈	$\Sigma(1385)^0 \bar{\Lambda} + \text{c.c.}$	< 8.2 × 10 ⁻⁶	CL=90%	DESIG=111
Г ₇₉	$\Delta(1232)^+ \bar{p}$	< 1 × 10 ⁻⁴	CL=90%	DESIG=112
Г ₈₀	$\Lambda(1520) \bar{\Lambda} + \text{c.c.} \rightarrow \gamma \Lambda \bar{\Lambda}$	< 4.1 × 10 ⁻⁶	CL=90%	DESIG=260
Г ₈₁	$\Theta(1540) \bar{\Theta}(1540) \rightarrow$ $K_S^0 p K^- \bar{n} + \text{c.c.}$	< 1.1 × 10 ⁻⁵	CL=90%	DESIG=205
Г ₈₂	$\Theta(1540) K^- \bar{n} \rightarrow K_S^0 p K^- \bar{n}$	< 2.1 × 10 ⁻⁵	CL=90%	DESIG=206
Г ₈₃	$\Theta(1540) K_S^0 \bar{p} \rightarrow K_S^0 \bar{p} K^+ n$	< 1.6 × 10 ⁻⁵	CL=90%	DESIG=207
Г ₈₄	$\bar{\Theta}(1540) K^+ n \rightarrow K_S^0 \bar{p} K^+ n$	< 5.6 × 10 ⁻⁵	CL=90%	DESIG=208
Г ₈₅	$\bar{\Theta}(1540) K_S^0 p \rightarrow K_S^0 p K^- \bar{n}$	< 1.1 × 10 ⁻⁵	CL=90%	DESIG=209
Г ₈₆	$\Sigma^0 \bar{\Lambda}$	< 9 × 10 ⁻⁵	CL=90%	DESIG=110

Decays into stable hadrons

Г ₈₇	$2(\pi^+\pi^-)\pi^0$	(4.1 ±0.5) %	S=2.4	DESIG=9
Г ₈₈	$3(\pi^+\pi^-)\pi^0$	(2.9 ±0.6) %		DESIG=11
Г ₈₉	$\pi^+\pi^-\pi^0$	(2.11 ±0.07) %	S=1.5	DESIG=7
Г ₉₀	$\pi^+\pi^-\pi^0 K^+ K^-$	(1.79 ±0.29) %	S=2.2	DESIG=18
Г ₉₁	$4(\pi^+\pi^-)\pi^0$	(9.0 ±3.0) × 10 ⁻³		DESIG=12
Г ₉₂	$\pi^+\pi^- K^+ K^-$	(6.6 ±0.5) × 10 ⁻³		DESIG=16
Г ₉₃	$\pi^+\pi^- K^+ K^- \eta$	(1.84 ±0.28) × 10 ⁻³		DESIG=238
Г ₉₄	$\pi^0\pi^0 K^+ K^-$	(2.45 ±0.31) × 10 ⁻³		DESIG=234
Г ₉₅	$K \bar{K} \pi$	(6.1 ±1.0) × 10 ⁻³		DESIG=15
Г ₉₆	$2(\pi^+\pi^-)$	(3.57 ±0.30) × 10 ⁻³		DESIG=8
Г ₉₇	$3(\pi^+\pi^-)$	(4.3 ±0.4) × 10 ⁻³		DESIG=10
Г ₉₈	$2(\pi^+\pi^-\pi^0)$	(1.62 ±0.21) %		DESIG=210
Г ₉₉	$2(\pi^+\pi^-)\eta$	(2.29 ±0.24) × 10 ⁻³		DESIG=201
Г ₁₀₀	$3(\pi^+\pi^-)\eta$	(7.2 ±1.5) × 10 ⁻⁴		DESIG=202
Г ₁₀₁	$\rho \bar{p}$	(2.120 ±0.029) × 10 ⁻³		DESIG=50
Г ₁₀₂	$\rho \bar{p} \pi^0$	(1.19 ±0.08) × 10 ⁻³	S=1.1	DESIG=52
Г ₁₀₃	$\rho \bar{p} \pi^+ \pi^-$	(6.0 ±0.5) × 10 ⁻³	S=1.3	DESIG=54
Г ₁₀₄	$\rho \bar{p} \pi^+ \pi^- \pi^0$	[c] (2.3 ±0.9) × 10 ⁻³	S=1.9	DESIG=55
Г ₁₀₅	$\rho \bar{p} \eta$	(2.00 ±0.12) × 10 ⁻³		DESIG=56
Г ₁₀₆	$\rho \bar{p} \rho$	< 3.1 × 10 ⁻⁴	CL=90%	DESIG=57
Г ₁₀₇	$\rho \bar{p} \omega$	(9.8 ±1.0) × 10 ⁻⁴	S=1.3	DESIG=58
Г ₁₀₈	$\rho \bar{p} \eta'(958)$	(2.1 ±0.4) × 10 ⁻⁴		DESIG=59
Г ₁₀₉	$\rho \bar{p} \phi$	(4.5 ±1.5) × 10 ⁻⁵		DESIG=127
Г ₁₁₀	$n \bar{n}$	(2.09 ±0.16) × 10 ⁻³		DESIG=64

NODE=M070;CLUMP=B

┌ ₁₁₁	$n\bar{n}\pi^+\pi^-$	$(4 \pm 4) \times 10^{-3}$		DESIG=65
┌ ₁₁₂	$\Sigma^+\bar{\Sigma}^-$	$(1.50 \pm 0.24) \times 10^{-3}$		DESIG=247
┌ ₁₁₃	$\Sigma^0\bar{\Sigma}^0$	$(1.29 \pm 0.09) \times 10^{-3}$		DESIG=63
┌ ₁₁₄	$2(\pi^+\pi^-)K^+K^-$	$(4.7 \pm 0.7) \times 10^{-3}$	S=1.3	DESIG=17
┌ ₁₁₅	$p\bar{n}\pi^-$	$(2.12 \pm 0.09) \times 10^{-3}$		DESIG=53
┌ ₁₁₆	$nN(1440)$	seen		DESIG=215;OUR EST;→ UNCHECKED ←
┌ ₁₁₇	$nN(1520)$	seen		DESIG=216;OUR EST;→ UNCHECKED ←
┌ ₁₁₈	$nN(1535)$	seen		DESIG=217;OUR EST;→ UNCHECKED ←
┌ ₁₁₉	$\Xi^-\bar{\Xi}^+$	$(8.6 \pm 1.1) \times 10^{-4}$	S=1.2	DESIG=62
┌ ₁₂₀	$\Lambda\bar{\Lambda}$	$(1.61 \pm 0.15) \times 10^{-3}$	S=1.9	DESIG=60
┌ ₁₂₁	$\Lambda\bar{\Sigma}^-\pi^+$ (or c.c.)	[b] $(8.3 \pm 0.7) \times 10^{-4}$	S=1.2	DESIG=71
┌ ₁₂₂	$pK^-\bar{\Lambda}$	$(8.9 \pm 1.6) \times 10^{-4}$		DESIG=72
┌ ₁₂₃	$2(K^+K^-)$	$(7.6 \pm 0.9) \times 10^{-4}$		DESIG=19
┌ ₁₂₄	$pK^-\bar{\Sigma}^0$	$(2.9 \pm 0.8) \times 10^{-4}$		DESIG=73
┌ ₁₂₅	K^+K^-	$(2.70 \pm 0.17) \times 10^{-4}$		DESIG=13
┌ ₁₂₆	$K_S^0 K_L^0$	$(2.1 \pm 0.4) \times 10^{-4}$	S=3.2	DESIG=75
┌ ₁₂₇	$\Lambda\bar{\Lambda}\pi^+\pi^-$	$(4.3 \pm 1.0) \times 10^{-3}$		DESIG=261
┌ ₁₂₈	$\Lambda\bar{\Lambda}\eta$	$(1.62 \pm 0.17) \times 10^{-4}$		DESIG=228
┌ ₁₂₉	$\Lambda\bar{\Lambda}\pi^0$	$(3.8 \pm 0.4) \times 10^{-5}$		DESIG=109
┌ ₁₃₀	$\bar{\Lambda}nK_S^0 + \text{c.c.}$	$(6.5 \pm 1.1) \times 10^{-4}$		DESIG=225
┌ ₁₃₁	$\pi^+\pi^-$	$(1.47 \pm 0.14) \times 10^{-4}$		DESIG=6
┌ ₁₃₂	$\Lambda\bar{\Sigma} + \text{c.c.}$	$(2.83 \pm 0.23) \times 10^{-5}$		DESIG=61
┌ ₁₃₃	$K_S^0 K_S^0$	$< 1 \times 10^{-6}$	CL=95%	DESIG=14

Radiative decays

┌ ₁₃₄	3γ	$(1.16 \pm 0.22) \times 10^{-5}$		NODE=M070;CLUMP=C DESIG=81
┌ ₁₃₅	4γ	$< 9 \times 10^{-6}$	CL=90%	DESIG=244
┌ ₁₃₆	5γ	$< 1.5 \times 10^{-5}$	CL=90%	DESIG=245
┌ ₁₃₇	$\gamma\eta_c(1S)$	$(1.7 \pm 0.4) \%$	S=1.6	DESIG=85
┌ ₁₃₈	$\gamma\eta_c(1S) \rightarrow 3\gamma$	$(3.8 \pm 1.3_{-1.0}) \times 10^{-6}$	S=1.1	DESIG=246
┌ ₁₃₉	$\gamma\pi^+\pi^-2\pi^0$	$(8.3 \pm 3.1) \times 10^{-3}$		DESIG=99
┌ ₁₄₀	$\gamma\eta\pi\pi$	$(6.1 \pm 1.0) \times 10^{-3}$		DESIG=96
┌ ₁₄₁	$\gamma\eta_2(1870) \rightarrow \gamma\eta\pi^+\pi^-$	$(6.2 \pm 2.4) \times 10^{-4}$		DESIG=142
┌ ₁₄₂	$\gamma\eta(1405/1475) \rightarrow \gamma K\bar{K}\pi$	[d] $(2.8 \pm 0.6) \times 10^{-3}$	S=1.6	DESIG=89
┌ ₁₄₃	$\gamma\eta(1405/1475) \rightarrow \gamma\gamma\rho^0$	$(7.8 \pm 2.0) \times 10^{-5}$	S=1.8	DESIG=171
┌ ₁₄₄	$\gamma\eta(1405/1475) \rightarrow \gamma\eta\pi^+\pi^-$	$(3.0 \pm 0.5) \times 10^{-4}$		DESIG=170
┌ ₁₄₅	$\gamma\eta(1405/1475) \rightarrow \gamma\gamma\phi$	$< 8.2 \times 10^{-5}$	CL=95%	DESIG=212
┌ ₁₄₆	$\gamma\rho\rho$	$(4.5 \pm 0.8) \times 10^{-3}$		DESIG=94
┌ ₁₄₇	$\gamma\rho\omega$	$< 5.4 \times 10^{-4}$	CL=90%	DESIG=226
┌ ₁₄₈	$\gamma\rho\phi$	$< 8.8 \times 10^{-5}$	CL=90%	DESIG=227
┌ ₁₄₉	$\gamma\eta'(958)$	$(5.15 \pm 0.16) \times 10^{-3}$	S=1.2	DESIG=84
┌ ₁₅₀	$\gamma 2\pi^+ 2\pi^-$	$(2.8 \pm 0.5) \times 10^{-3}$	S=1.9	DESIG=95
┌ ₁₅₁	$\gamma f_2(1270) f_2(1270)$	$(9.5 \pm 1.7) \times 10^{-4}$		DESIG=203
┌ ₁₅₂	$\gamma f_2(1270) f_2(1270)$ (non resonant)	$(8.2 \pm 1.9) \times 10^{-4}$		DESIG=204
┌ ₁₅₃	$\gamma K^+ K^- \pi^+ \pi^-$	$(2.1 \pm 0.6) \times 10^{-3}$		DESIG=143
┌ ₁₅₄	$\gamma f_4(2050)$	$(2.7 \pm 0.7) \times 10^{-3}$		DESIG=100
┌ ₁₅₅	$\gamma\omega\omega$	$(1.61 \pm 0.33) \times 10^{-3}$		DESIG=97
┌ ₁₅₆	$\gamma\eta(1405/1475) \rightarrow \gamma\rho^0\rho^0$	$(1.7 \pm 0.4) \times 10^{-3}$	S=1.3	DESIG=124
┌ ₁₅₇	$\gamma f_2(1270)$	$(1.43 \pm 0.11) \times 10^{-3}$		DESIG=86
┌ ₁₅₈	$\gamma f_0(1710) \rightarrow \gamma K\bar{K}$	$(8.5 \pm 1.2_{-0.9}) \times 10^{-4}$	S=1.2	DESIG=91
┌ ₁₅₉	$\gamma f_0(1710) \rightarrow \gamma\pi\pi$	$(4.0 \pm 1.0) \times 10^{-4}$		DESIG=135
┌ ₁₆₀	$\gamma f_0(1710) \rightarrow \gamma\omega\omega$	$(3.1 \pm 1.0) \times 10^{-4}$		DESIG=221
┌ ₁₆₁	$\gamma\eta$	$(1.104 \pm 0.034) \times 10^{-3}$		DESIG=83
┌ ₁₆₂	$\gamma f_1(1420) \rightarrow \gamma K\bar{K}\pi$	$(7.9 \pm 1.3) \times 10^{-4}$		DESIG=175
┌ ₁₆₃	$\gamma f_1(1285)$	$(6.1 \pm 0.8) \times 10^{-4}$		DESIG=88
┌ ₁₆₄	$\gamma f_1(1510) \rightarrow \gamma\eta\pi^+\pi^-$	$(4.5 \pm 1.2) \times 10^{-4}$		DESIG=141

Γ_{165}	$\gamma f'_2(1525)$	$(4.5 \pm^{+0.7}_{-0.4}) \times 10^{-4}$		DESIG=87
Γ_{166}	$\gamma f_2(1640) \rightarrow \gamma \omega \omega$	$(2.8 \pm 1.8) \times 10^{-4}$		DESIG=222
Γ_{167}	$\gamma f_2(1910) \rightarrow \gamma \omega \omega$	$(2.0 \pm 1.4) \times 10^{-4}$		DESIG=223
Γ_{168}	$\gamma f_0(1800) \rightarrow \gamma \omega \phi$	$(2.5 \pm 0.6) \times 10^{-4}$		DESIG=262
Γ_{169}	$\gamma f_2(1950) \rightarrow \gamma K^*(892) \bar{K}^*(892)$	$(7.0 \pm 2.2) \times 10^{-4}$		DESIG=144
Γ_{170}	$\gamma K^*(892) \bar{K}^*(892)$	$(4.0 \pm 1.3) \times 10^{-3}$		DESIG=145
Γ_{171}	$\gamma \phi \phi$	$(4.0 \pm 1.2) \times 10^{-4}$	S=2.1	DESIG=98
Γ_{172}	$\gamma p \bar{p}$	$(3.8 \pm 1.0) \times 10^{-4}$		DESIG=90
Γ_{173}	$\gamma \eta(2225)$	$(3.3 \pm 0.5) \times 10^{-4}$		DESIG=126
Γ_{174}	$\gamma \eta(1760) \rightarrow \gamma \rho^0 \rho^0$	$(1.3 \pm 0.9) \times 10^{-4}$		DESIG=125
Γ_{175}	$\gamma \eta(1760) \rightarrow \gamma \omega \omega$	$(1.98 \pm 0.33) \times 10^{-3}$		DESIG=224
Γ_{176}	$\gamma X(1835) \rightarrow \gamma \pi^+ \pi^- \eta'$	$(2.6 \pm 0.4) \times 10^{-4}$		DESIG=213
Γ_{177}	$\gamma X(1835) \rightarrow \gamma p \bar{p}$	$(7.7 \pm^{+1.5}_{-0.9}) \times 10^{-5}$		DESIG=254
Γ_{178}	$\gamma X(1840) \rightarrow \gamma 3(\pi^+ \pi^-)$	$(2.4 \pm^{+0.7}_{-0.8}) \times 10^{-5}$		DESIG=264
Γ_{179}	$\gamma (K \bar{K} \pi) [J^{PC} = 0^{-+}]$	$(7 \pm 4) \times 10^{-4}$	S=2.1	DESIG=176
Γ_{180}	$\gamma \pi^0$	$(3.49 \pm^{+0.33}_{-0.30}) \times 10^{-5}$		DESIG=82
Γ_{181}	$\gamma p \bar{p} \pi^+ \pi^-$	$< 7.9 \times 10^{-4}$	CL=90%	DESIG=93
Γ_{182}	$\gamma \Lambda \bar{\Lambda}$	$< 1.3 \times 10^{-4}$	CL=90%	DESIG=200
Γ_{183}	$\gamma f_0(2200)$			DESIG=123
Γ_{184}	$\gamma f_J(2220)$	$> 2.50 \times 10^{-3}$	CL=99.9%	DESIG=92
Γ_{185}	$\gamma f_J(2220) \rightarrow \gamma \pi \pi$	$(8 \pm 4) \times 10^{-5}$		DESIG=136
Γ_{186}	$\gamma f_J(2220) \rightarrow \gamma K \bar{K}$	$< 3.6 \times 10^{-5}$		DESIG=137
Γ_{187}	$\gamma f_J(2220) \rightarrow \gamma p \bar{p}$	$(1.5 \pm 0.8) \times 10^{-5}$		DESIG=138
Γ_{188}	$\gamma f_0(1500)$	$(1.01 \pm 0.32) \times 10^{-4}$		DESIG=172
Γ_{189}	$\gamma A \rightarrow \gamma \text{invisible}$	$[e] < 6.3 \times 10^{-6}$	CL=90%	DESIG=251
Γ_{190}	$\gamma A^0 \rightarrow \gamma \mu^+ \mu^-$	$[f] < 2.1 \times 10^{-5}$	CL=90%	DESIG=259
Weak decays				
Γ_{191}	$D^- e^+ \nu_e + \text{c.c.}$	$< 1.2 \times 10^{-5}$	CL=90%	DESIG=218
Γ_{192}	$\bar{D}^0 e^+ e^- + \text{c.c.}$	$< 1.1 \times 10^{-5}$	CL=90%	DESIG=219
Γ_{193}	$D_s^- e^+ \nu_e + \text{c.c.}$	$< 3.6 \times 10^{-5}$	CL=90%	DESIG=220
Γ_{194}	$D^- \pi^+ + \text{c.c.}$	$< 7.5 \times 10^{-5}$	CL=90%	DESIG=241
Γ_{195}	$\bar{D}^0 K^0 + \text{c.c.}$	$< 1.7 \times 10^{-4}$	CL=90%	DESIG=242
Γ_{196}	$D_s^- \pi^+ + \text{c.c.}$	$< 1.3 \times 10^{-4}$	CL=90%	DESIG=243
Charge conjugation (C), Parity (P), Lepton Family number (LF) violating modes				
Γ_{197}	$\gamma \gamma$	C	$< 5 \times 10^{-6}$	CL=90% DESIG=80
Γ_{198}	$e^\pm \mu^\mp$	LF	$< 1.6 \times 10^{-7}$	CL=90% DESIG=177
Γ_{199}	$e^\pm \tau^\mp$	LF	$< 8.3 \times 10^{-6}$	CL=90% DESIG=178
Γ_{200}	$\mu^\pm \tau^\mp$	LF	$< 2.0 \times 10^{-6}$	CL=90% DESIG=179
Other decays				
Γ_{201}	invisible	$< 7 \times 10^{-4}$	CL=90%	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)	EVS	DOCUMENT ID	TECN	COMMENT
5.55 ± 0.14 ± 0.02 OUR EVALUATION				
• • • We do not use the following data for averages, fits, limits, etc. • • •				
5.71 ± 0.16	13k	¹ ADAMS	06A CLEO	$e^+e^- \rightarrow \mu^+\mu^-\gamma$
5.57 ± 0.19	7.8k	¹ AUBERT	04 BABR	$e^+e^- \rightarrow \mu^+\mu^-\gamma$
5.14 ± 0.39		BAI	95B BES	e^+e^-
5.36 ^{+0.29} _{-0.28}		² HSUEH	92 RVUE	See $\mathcal{T}$ mini-review
4.72 ± 0.35		ALEXANDER	89 RVUE	See $\mathcal{T}$ mini-review
4.4 ± 0.6		² BRANDELIK	79C DASP	e^+e^-
4.6 ± 0.8		³ BALDINI-...	75 FRAG	e^+e^-
4.8 ± 0.6		BOYARSKI	75 MRK1	e^+e^-
4.6 ± 1.0		ESPOSITO	75B FRAM	e^+e^-

NODE=M070W1
NODE=M070W1
→ UNCHECKED ←¹ Calculated by us from the reported values of $\Gamma(e^+e^-) \times B(\mu^+\mu^-)$ using $B(\mu^+\mu^-) = (5.93 \pm 0.06)\%$.² From a simultaneous fit to e^+e^- , $\mu^+\mu^-$, and hadronic channels assuming $\Gamma(e^+e^-) = \Gamma(\mu^+\mu^-)$.³ Assuming equal partial widths for e^+e^- and $\mu^+\mu^-$.

NODE=M070W1;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_{197}**

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	3.097 $e^+e^- \rightarrow e^+e^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
350 ± 20	BRANDELIK	79C DASP	e^+e^-
320 ± 70	¹ BALDINI-...	75 FRAG	e^+e^-
340 ± 90	¹ ESPOSITO	75B FRAM	e^+e^-
360 ± 100	¹ FORD	75 SPEC	e^+e^-

¹ Data redundant with branching ratios or partial widths above.NODE=M070G1
NODE=M070G1

NODE=M070G1;LINKAGE=S

$$\Gamma(\mu^+\mu^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$$

$$\Gamma_7\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
334 ± 5 OUR AVERAGE				
331.8 ± 5.2 ± 6.3		ANASHIN	10 KEDR	3.097 e ⁺ e ⁻ → μ ⁺ μ ⁻
338.4 ± 5.8 ± 7.1	13k	ADAMS	06A CLEO	e ⁺ e ⁻ → μ ⁺ μ ⁻ γ
330.1 ± 7.7 ± 7.3	7.8k	AUBERT	04 BABR	e ⁺ e ⁻ → μ ⁺ μ ⁻ γ
• • • We do not use the following data for averages, fits, limits, etc. • • •				
510 ± 90		DASP	75 DASP	e ⁺ e ⁻
380 ± 50		¹ ESPOSITO	75B FRAM	e ⁺ e ⁻

¹ Data redundant with branching ratios or partial widths above.

NODE=M070G2
NODE=M070G2

NODE=M070G2;LINKAGE=S

$$\Gamma(\omega\pi^+\pi^-\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$$

$$\Gamma_{12}\Gamma_5/\Gamma$$

VALUE (10 ⁻² keV)	EVTS	DOCUMENT ID	TECN	COMMENT
2.2 ± 0.3 ± 0.2	170	AUBERT	06D BABR	10.6 e ⁺ e ⁻ → ωπ ⁺ π ⁻ π ⁰ γ

NODE=M070G8
NODE=M070G8

$$\Gamma(\omega\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$$

$$\Gamma_{13}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
53.6 ± 5.0 ± 0.4	788	¹ AUBERT	07AU BABR	10.6 e ⁺ e ⁻ → ωπ ⁺ π ⁻ γ

NODE=M070G24
NODE=M070G24

¹ AUBERT 07AU reports [Γ(J/ψ(1S) → ωπ⁺π⁻) × Γ(J/ψ(1S) → e⁺e⁻)/Γ_{total}] × [B(ω(782) → π⁺π⁻π⁰)] = 47.8 ± 3.1 ± 3.2 eV which we divide by our best value B(ω(782) → π⁺π⁻π⁰) = (89.2 ± 0.7) × 10⁻². Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070G24;LINKAGE=AU

$$\Gamma(K^*(892)^0\bar{K}_2^*(1430)^0 + \text{c.c.}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$$

$$\Gamma_{19}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
33 ± 4 ± 1	317 ± 23	^{1,2} AUBERT	07AK BABR	10.6 e ⁺ e ⁻ → π ⁺ π ⁻ K ⁺ K ⁻ γ

NODE=M070G02
NODE=M070G02

¹ Dividing by 2/3 to take into account that B(K^{*0} → K⁺π⁻) = 2/3.

² AUBERT 07AK reports [Γ(J/ψ(1S) → K^{*}(892)⁰ $\bar{K}_2^*(1430)^0$ + c.c.) × Γ(J/ψ(1S) → e⁺e⁻)/Γ_{total}] × [B(K₂^{*}(1430) → Kπ)] = 16.4 ± 1.1 ± 1.4 eV which we divide by our best value B(K₂^{*}(1430) → Kπ) = (49.9 ± 1.2) × 10⁻². Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070G02;LINKAGE=AE
NODE=M070G02;LINKAGE=UB

$$\Gamma(K^*(892)^0\bar{K}_2(1770)^0 + \text{c.c.} \rightarrow K^*(892)^0 K^- \pi^+ + \text{c.c.}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$$

$$\Gamma_{20}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
3.8 ± 0.4 ± 0.3	110 ± 14	¹ AUBERT	07AK BABR	10.6 e ⁺ e ⁻ → π ⁺ π ⁻ K ⁺ K ⁻ γ

NODE=M070G03
NODE=M070G03

¹ Dividing by 2/3 to take into account that B(K^{*0} → K⁺π⁻) = 2/3.

NODE=M070G03;LINKAGE=AE

$$\Gamma(K^+ K^*(892)^- + \text{c.c.}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$$

$$\Gamma_{22}\Gamma_5/\Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
29.0 ± 1.7 ± 1.3	AUBERT	08S BABR	10.6 e ⁺ e ⁻ → K ⁺ K [*] (892) ⁻ γ

NODE=M070G18
NODE=M070G18

$$\Gamma(K^+ K^*(892)^- + \text{c.c.} \rightarrow K^+ K^- \pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$$

$$\Gamma_{23}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
10.96 ± 0.85 ± 0.70	155	AUBERT	08S BABR	10.6 e ⁺ e ⁻ → K ⁺ K ⁻ π ⁰ γ

NODE=M070G20
NODE=M070G20

$$\Gamma(K^+ K^*(892)^- + \text{c.c.} \rightarrow K^0 K^\pm \pi^\mp + \text{c.c.}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$$

$$\Gamma_{24}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
16.76 ± 1.70 ± 1.00	89	AUBERT	08S BABR	10.6 e ⁺ e ⁻ → K _S ⁰ K [±] π [∓] γ

NODE=M070G21
NODE=M070G21

$$\Gamma(K^0\bar{K}^*(892)^0 + \text{c.c.}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$$

$$\Gamma_{25}\Gamma_5/\Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
26.6 ± 2.5 ± 1.5	AUBERT	08S BABR	10.6 e ⁺ e ⁻ → K ⁰ $\bar{K}^*(892)^0$ γ

NODE=M070G19
NODE=M070G19

$$\Gamma(K^0\bar{K}^*(892)^0 + \text{c.c.} \rightarrow K^0 K^\pm \pi^\mp + \text{c.c.}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$$

$$\Gamma_{26}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
17.70 ± 1.70 ± 1.00	94	AUBERT	08S BABR	10.6 e ⁺ e ⁻ → K _S ⁰ K [±] π [∓] γ

NODE=M070G22
NODE=M070G22

$$\Gamma(\omega K\bar{K}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$$

$$\Gamma_{35}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
3.70 ± 1.98 ± 0.03	24	¹ AUBERT	07AU BABR	10.6 e ⁺ e ⁻ → ωK ⁺ K ⁻ γ

NODE=M070G29
NODE=M070G29

¹ AUBERT 07AU reports [Γ(J/ψ(1S) → ωK $\bar{K}$) × Γ(J/ψ(1S) → e⁺e⁻)/Γ_{total}] × [B(ω(782) → π⁺π⁻π⁰)] = 3.3 ± 1.3 ± 1.2 eV which we divide by our best value B(ω(782) → π⁺π⁻π⁰) = (89.2 ± 0.7) × 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

$$\Gamma(\phi 2(\pi^+ \pi^-)) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}}$$

$$\Gamma_{37} \Gamma_5 / \Gamma$$

VALUE (10 ⁻² keV)	EVTS	DOCUMENT ID	TECN	COMMENT
0.96±0.19±0.01	35	¹ AUBERT	06D BABR	10.6 e ⁺ e ⁻ → $\phi 2(\pi^+ \pi^-) \gamma$
¹ AUBERT 06D reports $[\Gamma(J/\psi(1S) \rightarrow \phi 2(\pi^+ \pi^-)) \times \Gamma(J/\psi(1S) \rightarrow e^+ e^-)/\Gamma_{\text{total}}] \times [B(\phi(1020) \rightarrow K^+ K^-)] = (0.47 \pm 0.09 \pm 0.03) \times 10^{-2}$ keV which we divide by our best value $B(\phi(1020) \rightarrow K^+ K^-) = (48.9 \pm 0.5) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M070G10
NODE=M070G10

NODE=M070G10;LINKAGE=AU

$$\Gamma(\phi \pi^+ \pi^-) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}}$$

$$\Gamma_{46} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
4.8 ±0.4 OUR AVERAGE				
4.52±0.48±0.04	254 ± 23	¹ SHEN	09 BELL	10.6 e ⁺ e ⁻ → $K^+ K^- \pi^+ \pi^- \gamma$
5.33±0.71±0.05	103	² AUBERT,BE	06D BABR	10.6 e ⁺ e ⁻ → $K^+ K^- \pi^+ \pi^- \gamma$

NODE=M070G14
NODE=M070G14

NODE=M070G14;LINKAGE=SH

- ¹ SHEN 09 reports $4.50 \pm 0.41 \pm 0.26$ eV from a measurement of $[\Gamma(J/\psi(1S) \rightarrow \phi \pi^+ \pi^-) \times \Gamma(J/\psi(1S) \rightarrow e^+ e^-)/\Gamma_{\text{total}}] \times [B(\phi(1020) \rightarrow K^+ K^-)]$ assuming $B(\phi(1020) \rightarrow K^+ K^-) = (49.2 \pm 0.6) \times 10^{-2}$, which we rescale to our best value $B(\phi(1020) \rightarrow K^+ K^-) = (48.9 \pm 0.5) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.
- ² AUBERT,BE 06D reports $[\Gamma(J/\psi(1S) \rightarrow \phi \pi^+ \pi^-) \times \Gamma(J/\psi(1S) \rightarrow e^+ e^-)/\Gamma_{\text{total}}] \times [B(\phi(1020) \rightarrow K^+ K^-)] = 2.61 \pm 0.30 \pm 0.18$ eV which we divide by our best value $B(\phi(1020) \rightarrow K^+ K^-) = (48.9 \pm 0.5) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070G14;LINKAGE=AU

$$\Gamma(\phi \pi^0 \pi^0) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}}$$

$$\Gamma_{47} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
3.15±0.88±0.03	23	¹ AUBERT,BE	06D BABR	10.6 e ⁺ e ⁻ → $K^+ K^- \pi^0 \pi^0 \gamma$
¹ AUBERT,BE 06D reports $[\Gamma(J/\psi(1S) \rightarrow \phi \pi^0 \pi^0) \times \Gamma(J/\psi(1S) \rightarrow e^+ e^-)/\Gamma_{\text{total}}] \times [B(\phi(1020) \rightarrow K^+ K^-)] = 1.54 \pm 0.40 \pm 0.16$ eV which we divide by our best value $B(\phi(1020) \rightarrow K^+ K^-) = (48.9 \pm 0.5) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M070G15
NODE=M070G15

NODE=M070G15;LINKAGE=AU

$$\Gamma(\phi \eta) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}}$$

$$\Gamma_{50} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
6.1±2.7±0.4	6	¹ AUBERT	07AU BABR	10.6 e ⁺ e ⁻ → $\phi \eta \gamma$
¹ AUBERT 07AU quotes $\Gamma_{ee}^{J/\psi} \cdot B(J/\psi \rightarrow \phi \eta) \cdot B(\phi \rightarrow K^+ K^-) \cdot B(\eta \rightarrow 3\pi) = 0.84 \pm 0.37 \pm 0.05$ eV.				

NODE=M070G28
NODE=M070G28

NODE=M070G28;LINKAGE=AU

$$\Gamma(\phi f_0(980) \rightarrow \phi \pi^+ \pi^-) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}}$$

$$\Gamma_{57} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
1.21±0.23 OUR AVERAGE		Error includes scale factor of 1.2.		
1.48±0.27±0.09	60 ± 11	¹ SHEN	09 BELL	10.6 e ⁺ e ⁻ → $K^+ K^- \pi^+ \pi^- \gamma$
1.02±0.24±0.01	20 ± 5	² AUBERT	07AK BABR	10.6 e ⁺ e ⁻ → $\pi^+ \pi^- K^+ K^- \gamma$
¹ Multiplied by 2/3 to take into account the $\phi \pi^+ \pi^-$ mode only. Using $B(\phi \rightarrow K^+ K^-) = (49.2 \pm 0.6)\%$.				
² AUBERT 07AK reports $[\Gamma(J/\psi(1S) \rightarrow \phi f_0(980) \rightarrow \phi \pi^+ \pi^-) \times \Gamma(J/\psi(1S) \rightarrow e^+ e^-)/\Gamma_{\text{total}}] \times [B(\phi(1020) \rightarrow K^+ K^-)] = 0.50 \pm 0.11 \pm 0.04$ eV which we divide by our best value $B(\phi(1020) \rightarrow K^+ K^-) = (48.9 \pm 0.5) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M070G05
NODE=M070G05

NODE=M070G05;LINKAGE=SH

NODE=M070G05;LINKAGE=UB

$$\Gamma(\phi f_0(980) \rightarrow \phi \pi^0 \pi^0) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}}$$

$$\Gamma_{58} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
0.96±0.40±0.01	7.0 ± 2.8	¹ AUBERT	07AK BABR	10.6 e ⁺ e ⁻ → $\pi^0 \pi^0 K^+ K^- \gamma$
¹ AUBERT 07AK reports $[\Gamma(J/\psi(1S) \rightarrow \phi f_0(980) \rightarrow \phi \pi^0 \pi^0) \times \Gamma(J/\psi(1S) \rightarrow e^+ e^-)/\Gamma_{\text{total}}] \times [B(\phi(1020) \rightarrow K^+ K^-)] = 0.47 \pm 0.19 \pm 0.05$ eV which we divide by our best value $B(\phi(1020) \rightarrow K^+ K^-) = (48.9 \pm 0.5) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M070G06
NODE=M070G06

NODE=M070G06;LINKAGE=UB

$$\Gamma(\eta \pi^+ \pi^-) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}}$$

$$\Gamma_{64} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
2.23±0.97±0.03	9	¹ AUBERT	07AU BABR	10.6 e ⁺ e ⁻ → $\eta \pi^+ \pi^- \gamma$
¹ AUBERT 07AU reports $[\Gamma(J/\psi(1S) \rightarrow \eta \pi^+ \pi^-) \times \Gamma(J/\psi(1S) \rightarrow e^+ e^-)/\Gamma_{\text{total}}] \times [B(\eta \rightarrow \pi^+ \pi^- \pi^0)] = 0.51 \pm 0.22 \pm 0.03$ eV which we divide by our best value $B(\eta \rightarrow \pi^+ \pi^- \pi^0) = (22.92 \pm 0.28) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M070G25
NODE=M070G25

NODE=M070G25;LINKAGE=AU

$$\Gamma(K^*(892)^0 \bar{K}^*(892)^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{15} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
1.28±0.40±0.11	25 ± 8	¹ AUBERT 07AK	BABR	10.6 e ⁺ e ⁻ → π ⁺ π ⁻ K ⁺ K ⁻ γ

¹ Dividing by (2/3)² to take twice into account that B(K*⁰ → K⁺π⁻) = 2/3.

NODE=M070G01
NODE=M070G01

NODE=M070G01;LINKAGE=AE

$$\Gamma(\phi f_2(1270)) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{42} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
4.0±0.7±0.1	44 ± 7	^{1,2} AUBERT 07AK	BABR	10.6 e ⁺ e ⁻ → π ⁺ π ⁻ K ⁺ K ⁻ γ

¹ Using B(φ → (K⁺K⁻)) = (49.3 ± 0.6)%.

² AUBERT 07AK reports [Γ(J/ψ(1S) → φ f₂(1270)) × Γ(J/ψ(1S) → e⁺e⁻)/Γ_{total}] × [B(f₂(1270) → ππ)] = 3.41 ± 0.55 ± 0.28 eV which we divide by our best value B(f₂(1270) → ππ) = (84.8^{+2.4}_{-1.2}) × 10⁻². Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070G07
NODE=M070G07

NODE=M070G07;LINKAGE=AE

NODE=M070G07;LINKAGE=UB

$$\Gamma(2(\pi^+ \pi^-) \pi^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{87} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
303±5±18	4990	AUBERT	07AU	BABR 10.6 e ⁺ e ⁻ → 2(π ⁺ π ⁻)π ⁰ γ

NODE=M070G23
NODE=M070G23

$$\Gamma(\pi^+ \pi^- \pi^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{89} \Gamma_5 / \Gamma$$

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
0.122±0.005±0.008	AUBERT,B	04N	BABR 10.6 e ⁺ e ⁻ → π ⁺ π ⁻ π ⁰ γ

NODE=M070G5
NODE=M070G5

$$\Gamma(\pi^+ \pi^- \pi^0 K^+ K^-) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{90} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
107.0±4.3±6.4	768	AUBERT	07AU	BABR 10.6 e ⁺ e ⁻ → K ⁺ K ⁻ π ⁺ π ⁻ π ⁰ γ

NODE=M070G27
NODE=M070G27

$$\Gamma(\pi^+ \pi^- K^+ K^-) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{92} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
36.3±1.3±2.1	1586 ± 58	AUBERT 07AK	BABR	10.6 e ⁺ e ⁻ → π ⁺ π ⁻ K ⁺ K ⁻ γ

• • • We do not use the following data for averages, fits, limits, etc. • • •

33.6±2.7±2.7	233	¹ AUBERT 05D	BABR	10.6 e ⁺ e ⁻ → K ⁺ K ⁻ π ⁺ π ⁻ γ

¹ Superseded by AUBERT 07AK.

NODE=M070G12
NODE=M070G12

NODE=M070G12;LINKAGE=AU

$$\Gamma(\pi^+ \pi^- K^+ K^- \eta) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{93} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
25.9±3.9±0.1	73	¹ AUBERT 07AU	BABR	10.6 e ⁺ e ⁻ → K ⁺ K ⁻ π ⁺ π ⁻ ηγ

¹ AUBERT 07AU reports [Γ(J/ψ(1S) → π⁺π⁻K⁺K⁻η) × Γ(J/ψ(1S) → e⁺e⁻)/Γ_{total}] × [B(η → 2γ)] = 10.2 ± 1.3 ± 0.8 eV which we divide by our best value B(η → 2γ) = (39.41 ± 0.20) × 10⁻². Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070G30
NODE=M070G30

NODE=M070G30;LINKAGE=AU

$$\Gamma(\pi^0 \pi^0 K^+ K^-) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{94} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
13.6±1.1±1.3	203 ± 16	AUBERT 07AK	BABR	10.6 e ⁺ e ⁻ → π ⁰ π ⁰ K ⁺ K ⁻ γ

NODE=M070G04
NODE=M070G04

$$\Gamma(2(\pi^+ \pi^-)) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{96} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
20.4±0.9±0.4		LEES	12E	BABR 10.6 e ⁺ e ⁻ → 2π ⁺ 2π ⁻ γ

• • • 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 ⁻ → 2(π ⁺ π ⁻)γ

¹ Superseded by LEES 12E.

NODE=M070G11
NODE=M070G11

NODE=M070G11;LINKAGE=AU

$$\Gamma(3(\pi^+ \pi^-)) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{97} \Gamma_5 / \Gamma$$

VALUE (10 ⁻² keV)	EVTS	DOCUMENT ID	TECN	COMMENT
2.37±0.16±0.14	496	AUBERT	06D	BABR 10.6 e ⁺ e ⁻ → 3(π ⁺ π ⁻)γ

NODE=M070G6
NODE=M070G6

$$\Gamma(2(\pi^+ \pi^- \pi^0)) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{98} \Gamma_5 / \Gamma$$

VALUE (10 ⁻² keV)	EVTS	DOCUMENT ID	TECN	COMMENT
8.9±0.5±1.0	761	AUBERT	06D	BABR 10.6 e ⁺ e ⁻ → 2(π ⁺ π ⁻ π ⁰)γ

NODE=M070G7
NODE=M070G7

$$\Gamma(2(\pi^+\pi^-\eta)) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{99}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

13.1±2.4±0.1 85 ¹ AUBERT 07AU BABR 10.6 e⁺e⁻ → 2(π⁺π⁻)ηγ

¹ AUBERT 07AU reports $[\Gamma(J/\psi(1S) \rightarrow 2(\pi^+\pi^-\eta)) \times \Gamma(J/\psi(1S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\eta \rightarrow 2\gamma)] = 5.16 \pm 0.85 \pm 0.39$ 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
NODE=M070G26

NODE=M070G26;LINKAGE=AU

$$\Gamma(p\bar{p}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{101}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

11.9±0.5 OUR AVERAGE Error includes scale factor of 1.4. See the ideogram below.
[11.6 ± 0.9 eV OUR 2013 AVERAGE Scale factor = 1.2]

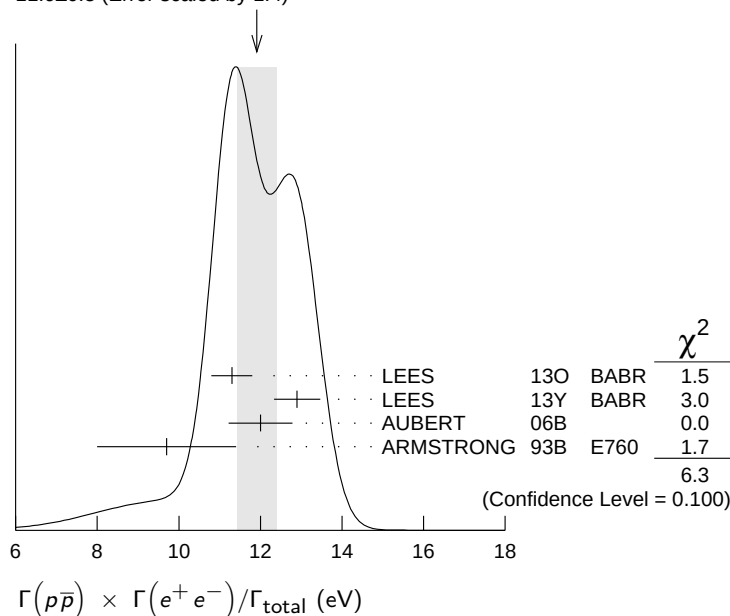
11.3±0.4±0.3	821	LEES	13O	BABR	e ⁺ e ⁻ → p $\bar{p}$ γ
12.9±0.4±0.4	918	LEES	13Y	BABR	e ⁺ e ⁻ → p $\bar{p}$ γ
12.0±0.6±0.5	438	AUBERT	06B		e ⁺ e ⁻ → p $\bar{p}$ γ
9.7±1.7		¹ ARMSTRONG	93B	E760	p $\bar{p}$ → e ⁺ e ⁻

¹ Using $\Gamma_{\text{total}} = 85.5^{+6.1}_{-5.8}$ MeV.

NODE=M070G4
NODE=M070G4
NEW

NODE=M070G;LINKAGE=A

WEIGHTED AVERAGE
11.9±0.5 (Error scaled by 1.4)



$$\Gamma(\Sigma^0\bar{\Sigma}^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{113}\Gamma_5/\Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT

6.4±1.2±0.6 AUBERT 07BD BABR 10.6 e⁺e⁻ → Σ⁰Σ⁰γ

NODE=M070G17
NODE=M070G17

$$\Gamma(2(\pi^+\pi^-)K^+K^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{114}\Gamma_5/\Gamma$$

VALUE (10 ⁻² keV)	EVTS	DOCUMENT ID	TECN	COMMENT

2.75±0.23±0.17 205 AUBERT 06D BABR 10.6 e⁺e⁻ → K⁺K⁻2(π⁺π⁻)γ

NODE=M070G9
NODE=M070G9

$$\Gamma(\Lambda\bar{\Lambda}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{120}\Gamma_5/\Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT

10.7±0.9±0.7 AUBERT 07BD BABR 10.6 e⁺e⁻ → ΛΛ̄γ

NODE=M070G16
NODE=M070G16

$$\Gamma(2(K^+K^-)) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{123}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

4.11±0.39±0.30 156 ± 15 AUBERT 07AK BABR 10.6 e⁺e⁻ → 2(K⁺K⁻)γ

• • • We do not use the following data for averages, fits, limits, etc. • • •

4.0 ± 0.7 ± 0.6 38 ¹ AUBERT 05D BABR 10.6 e⁺e⁻ → 2(K⁺K⁻)γ

¹ Superseded by AUBERT 07AK.

NODE=M070G13
NODE=M070G13

NODE=M070G13;LINKAGE=AU

$$\Gamma(K^+K^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{125}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

1.42±0.23±0.08 51 LEES 13Q BABR e⁺e⁻ → K⁺K⁻γ

NODE=M070G08
NODE=M070G08

$J/\psi(1S)$ BRANCHING RATIOS

NODE=M070230

For the first four branching ratios, see also the partial widths, and (partial widths) $\times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ above.

NODE=M070300

 $\Gamma(\text{hadrons})/\Gamma_{\text{total}}$ **Γ_1/Γ** VALUEDOCUMENT IDTECNCOMMENT**0.877 $\pm$ 0.005 OUR AVERAGE**0.878 $\pm$ 0.005

BAI

95B

BES

 e^+e^- 0.86 $\pm$ 0.02

BOYARSKI

75

MRK1

 e^+e^-

NODE=M070R3

NODE=M070R3

 $\Gamma(\text{virtual } \gamma \rightarrow \text{hadrons})/\Gamma_{\text{total}}$ **Γ_2/Γ** VALUEDOCUMENT IDTECNCOMMENT**0.135 $\pm$ 0.003**

1,2 SETH

04

RVUE

 e^+e^-

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.17 $\pm$ 0.02

1 BOYARSKI

75

MRK1

 e^+e^-

NODE=M070R4

NODE=M070R4

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;LINKAGE=C

NODE=M070R4;LINKAGE=SE

 $\Gamma(ggg)/\Gamma_{\text{total}}$ **Γ_3/Γ** VALUE (units 10^{-2})EVTSDOCUMENT IDTECNCOMMENT**64.1 $\pm$ 1.0**

6 M

1 BESSON

08

CLEO

 $\psi(2S) \rightarrow \pi^+\pi^- + \text{hadrons}$

¹ Calculated using the value $\Gamma(\gamma gg)/\Gamma(ggg) = 0.137 \pm 0.001 \pm 0.016 \pm 0.004$ from BESSON 08 and the PDG 08 values of $B(\ell^+\ell^-)$, $B(\text{virtual } \gamma \rightarrow \text{hadrons})$, and $B(\gamma\eta_c)$. The statistical error is negligible and the systematic error is partially correlated with that of $\Gamma(\gamma gg)/\Gamma_{\text{total}}$ measurement of BESSON 08.

NODE=M070S65

NODE=M070S65

NODE=M070S65;LINKAGE=BE

 $\Gamma(\gamma gg)/\Gamma_{\text{total}}$ **Γ_4/Γ** VALUE (units 10^{-2})EVTSDOCUMENT IDTECNCOMMENT**8.79 $\pm$ 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

 $\Gamma(\gamma gg)/\Gamma(ggg)$ **Γ_4/Γ_3** VALUE (units 10^{-2})EVTSDOCUMENT IDTECNCOMMENT**13.7 $\pm$ 0.1 $\pm$ 0.7**

6 M

BESSON

08

CLEO

 $\psi(2S) \rightarrow \pi^+\pi^- J/\psi$

NODE=M070S67

NODE=M070S67

 $\Gamma(e^+e^-)/\Gamma_{\text{total}}$ **Γ_5/Γ** VALUE (units 10^{-2})EVTSDOCUMENT IDTECNCOMMENT**5.971 $\pm$ 0.032 OUR AVERAGE**[(5.94 $\pm$ 0.06) $\times 10^{-2}$ OUR 2013 AVERAGE]5.983 $\pm$ 0.007 $\pm$ 0.037

720k

ABLIKIM

13R

BES3

 $\psi(2S) \rightarrow J/\psi \pi^+\pi^-$ 5.945 $\pm$ 0.067 $\pm$ 0.042

15k

LI

05C

CLEO

 $\psi(2S) \rightarrow J/\psi \pi^+\pi^-$ 5.90 $\pm$ 0.05 $\pm$ 0.10

BAI

98D

BES

 $\psi(2S) \rightarrow J/\psi \pi^+\pi^-$ 6.09 $\pm$ 0.33

BAI

95B

BES

 e^+e^- 5.92 $\pm$ 0.15 $\pm$ 0.20

COFFMAN

92

MRK3

 $\psi(2S) \rightarrow J/\psi \pi^+\pi^-$ 6.9 $\pm$ 0.9

BOYARSKI

75

MRK1

 e^+e^-

NODE=M070R1

NODE=M070R1

NEW

 $\Gamma(e^+e^-\gamma)/\Gamma_{\text{total}}$ **Γ_6/Γ** VALUE (units 10^{-3})DOCUMENT IDTECNCOMMENT**8.8 $\pm$ 1.3 $\pm$ 0.4**

1 ARMSTRONG

96

E760

 $\bar{p}p \rightarrow e^+e^-\gamma$ ¹ For $E_\gamma > 100$ MeV.

NODE=M070S33

NODE=M070S33

NODE=M070S33;LINKAGE=A

 $\Gamma(\mu^+\mu^-)/\Gamma_{\text{total}}$ **Γ_7/Γ** VALUE (units 10^{-2})EVTSDOCUMENT IDTECNCOMMENT**5.961 $\pm$ 0.033 OUR AVERAGE**[(5.93 $\pm$ 0.06) $\times 10^{-2}$ OUR 2013 AVERAGE]5.973 $\pm$ 0.007 $\pm$ 0.038

770k

ABLIKIM

13R

BES3

 $\psi(2S) \rightarrow J/\psi \pi^+\pi^-$ 5.960 $\pm$ 0.065 $\pm$ 0.050

17k

LI

05C

CLEO

 $\psi(2S) \rightarrow J/\psi \pi^+\pi^-$ 5.84 $\pm$ 0.06 $\pm$ 0.10

BAI

98D

BES

 $\psi(2S) \rightarrow J/\psi \pi^+\pi^-$ 6.08 $\pm$ 0.33

BAI

95B

BES

 e^+e^- 5.90 $\pm$ 0.15 $\pm$ 0.19

COFFMAN

92

MRK3

 $\psi(2S) \rightarrow J/\psi \pi^+\pi^-$ 6.9 $\pm$ 0.9

BOYARSKI

75

MRK1

 e^+e^-

NODE=M070R2

NODE=M070R2

NEW

$\Gamma(e^+e^-)/\Gamma(\mu^+\mu^-)$ Γ_5/Γ_7

VALUE	DOCUMENT ID	TECN	COMMENT
1.0016 ± 0.0031 OUR AVERAGE			
[0.998 ± 0.012 OUR 2013 AVERAGE]			
1.0022 ± 0.0044 ± 0.0048	¹ AULCHENKO 14	KEDR	3.097 $e^+e^- \rightarrow e^+e^-, \mu^+\mu^-$
1.0017 ± 0.0017 ± 0.0033	2 ABLIKIM 13R	BES3	$\psi(2S) \rightarrow J/\psi \pi^+\pi^-$
1.002 ± 0.021 ± 0.013	³ ANASHIN 10	KEDR	3.097 $e^+e^- \rightarrow e^+e^-, \mu^+\mu^-$
0.997 ± 0.012 ± 0.006	LI	05C CLEO	$\psi(2S) \rightarrow J/\psi \pi^+\pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
1.011 ± 0.013 ± 0.016	BAI	98D BES	$\psi(2S) \rightarrow J/\psi \pi^+\pi^-$
1.00 ± 0.07	BAI	95B BES	e^+e^-
1.00 ± 0.05	BOYARSKI 75	MRK1	e^+e^-
0.91 ± 0.15	ESPOSITO 75B	FRAM	e^+e^-
0.93 ± 0.10	FORD 75	SPEC	e^+e^-

¹ From 235.3k $J/\psi \rightarrow e^+e^-$ and 156.6k $J/\psi \rightarrow \mu^+\mu^-$ observed events.² Not independent of the corresponding measurements of $\Gamma(e^+e^-)/\Gamma_{\text{total}}$ and $\Gamma(\mu^+\mu^-)/\Gamma_{\text{total}}$.³ Not independent of the corresponding measurements of $\Gamma(e^+e^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ and $\Gamma(\mu^+\mu^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$.

NODE=M070R5
 NODE=M070R5
 NEW

NODE=M070R5;LINKAGE=A
 NODE=M070R5;LINKAGE=AB

NODE=M070R5;LINKAGE=AN

NODE=M070305

HADRONIC DECAYS

 $\Gamma(\rho\pi)/\Gamma_{\text{total}}$ Γ_8/Γ

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^-

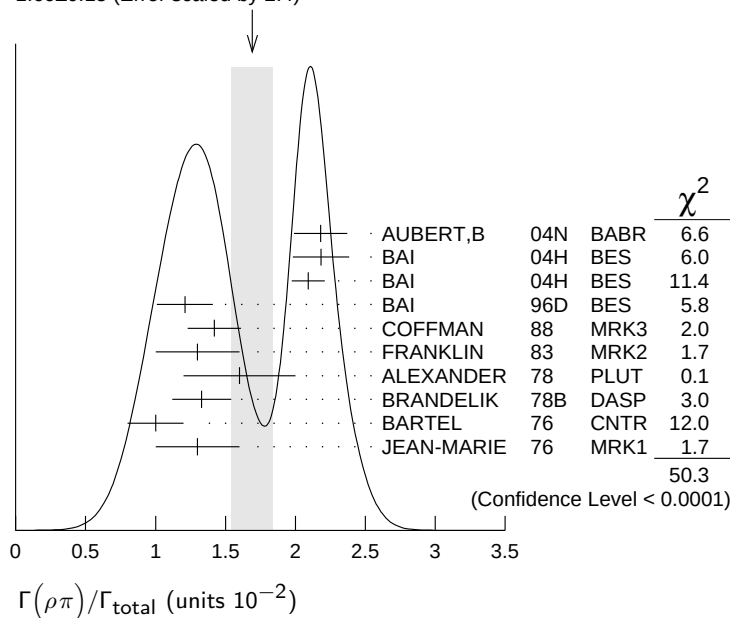
¹ From the ratio of $\Gamma(e^+e^-) B(\pi^+\pi^-\pi^0)$ and $\Gamma(e^+e^-) B(\mu^+\mu^-)$ (AUBERT 04).² Not independent of their $B(\pi^+\pi^-\pi^0)$.³ From $J/\psi \rightarrow \pi^+\pi^-\pi^0$ events directly.⁴ Obtained comparing the rates for $\pi^+\pi^-\pi^0$ and $\mu^+\mu^-$, using J/ψ events produced via $\psi(2S) \rightarrow \pi^+\pi^- J/\psi$ and with $B(J/\psi \rightarrow \mu^+\mu^-) = 5.88 \pm 0.10\%$.

NODE=M070R20
 NODE=M070R20

OCCUR=2

NODE=M070R20;LINKAGE=AU
 NODE=M070R20;LINKAGE=BU
 NODE=M070R20;LINKAGE=BA
 NODE=M070R20;LINKAGE=BI

WEIGHTED AVERAGE
 1.69 ± 0.15 (Error scaled by 2.4)



$\Gamma(\rho^0\pi^0)/\Gamma(\rho\pi)$

VALUE	DOCUMENT ID	TECN	COMMENT
0.328±0.005±0.027	COFFMAN	88	MRK3 e^+e^-
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.35 ±0.08	ALEXANDER	78	PLUT e^+e^-
0.32 ±0.08	BRANDELIK	78B	DASP e^+e^-
0.39 ±0.11	BARTEL	76	CNTR e^+e^-
0.37 ±0.09	JEAN-MARIE	76	MRK1 e^+e^-

 Γ_9/Γ_8

NODE=M070R21
 NODE=M070R21

 $\Gamma(a_2(1320)\rho)/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
10.9±2.2 OUR AVERAGE				
11.7±0.7±2.5	7584	AUGUSTIN	89	DM2 $J/\psi \rightarrow \rho^0\rho^\pm\pi^\mp$
8.4±4.5	36	VANNUCCI	77	MRK1 $e^+e^- \rightarrow 2(\pi^+\pi^-)\pi^0$

 Γ_{10}/Γ

NODE=M070R43
 NODE=M070R43

 $\Gamma(\omega\pi^+\pi^+\pi^-\pi^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
85±34	140	VANNUCCI	77	MRK1 $e^+e^- \rightarrow 3(\pi^+\pi^-)\pi^0$

 Γ_{11}/Γ

NODE=M070R26
 NODE=M070R26

 $\Gamma(\omega\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
0.40±0.06±0.04	170	¹ AUBERT	06D BABR	10.6 $e^+e^- \rightarrow \omega\pi^+\pi^-\pi^0\gamma$

 Γ_{12}/Γ

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
8.6±0.7 OUR AVERAGE				Error includes scale factor of 1.1.
9.7±0.6±0.6	788	¹ AUBERT	07AU BABR	10.6 $e^+e^- \rightarrow \omega\pi^+\pi^-\gamma$
7.0±1.6	18058	AUGUSTIN	89 DM2	$J/\psi \rightarrow 2(\pi^+\pi^-)\pi^0$
7.8±1.6	215	BURMESTER	77D PLUT	e^+e^-
6.8±1.9	348	VANNUCCI	77 MRK1	$e^+e^- \rightarrow 2(\pi^+\pi^-)\pi^0$

 Γ_{13}/Γ

NODE=M070R24
 NODE=M070R24

¹ AUBERT 07AU quotes $\Gamma_{ee}^{J/\psi} \cdot B(J/\psi \rightarrow \omega\pi^+\pi^-) \cdot B(\omega \rightarrow 3\pi) = 47.8 \pm 3.1 \pm 3.2$ eV.

NODE=M070R24;LINKAGE=AU

 $\Gamma(\omega f_2(1270))/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
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	$e^+e^- \rightarrow 2(\pi^+\pi^-)\pi^0$

 Γ_{14}/Γ

NODE=M070R28
 NODE=M070R28

 $\Gamma(K^*(892)^0\bar{K}^*(892)^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
2.3±0.7±0.1	25 ± 8	¹ AUBERT	07AK BABR	10.6	$e^+e^- \rightarrow \pi^+\pi^-\pi^+K^-\gamma$

 Γ_{15}/Γ

NODE=M070R46
 NODE=M070R46

• • • We do not use the following data for averages, fits, limits, etc. • • •

<5 90 VANNUCCI 77 MRK1 $e^+e^- \rightarrow \pi^+\pi^-\pi^+K^-$

¹ AUBERT 07AK reports $[\Gamma(J/\psi(1S) \rightarrow K^*(892)^0\bar{K}^*(892)^0)/\Gamma_{\text{total}}] \times [\Gamma(J/\psi(1S) \rightarrow e^+e^-)] = (1.28 \pm 0.40 \pm 0.11) \times 10^{-3}$ keV which we divide by our best value $\Gamma(J/\psi(1S) \rightarrow e^+e^-) = 5.55 \pm 0.14 \pm 0.02$ keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070R46;LINKAGE=BE

 $\Gamma(K^*(892)^\pm K^*(892)^\mp)/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.00±0.19^{+0.11}_{-0.32}	323	ABLIKIM	10E BES2	$J/\psi \rightarrow K^\pm K_S^0 \pi^\mp \pi^0$

 Γ_{16}/Γ

NODE=M070S73
 NODE=M070S73

 $\Gamma(K^*(892)^\pm K^*(800)^\mp)/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.09±0.18^{+0.94}_{-0.54}	655	ABLIKIM	10E BES2	$J/\psi \rightarrow K^\pm K_S^0 \pi^\mp \pi^0$

 Γ_{17}/Γ

NODE=M070S74
 NODE=M070S74

$\Gamma(\eta K^*(892)^0 \bar{K}^*(892)^0)/\Gamma_{\text{total}}$ Γ_{18}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.15±0.13±0.22	209	ABLIKIM	10C BES2	$J/\psi \rightarrow \eta K^+ \pi^- K^- \pi^+$

NODE=M070S69
 NODE=M070S69

 $\Gamma(K^*(892)^0 \bar{K}_2^*(1430)^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{19}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
6.0±0.6 OUR AVERAGE				
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 AUBERT 07AK reports $[\Gamma(J/\psi(1S) \rightarrow K^*(892)^0 \bar{K}_2^*(1430)^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [\Gamma(J/\psi(1S) \rightarrow e^+ e^-)] = (32.9 \pm 2.3 \pm 2.7) \times 10^{-3}$ keV which we divide by our best value $\Gamma(J/\psi(1S) \rightarrow e^+ e^-) = 5.55 \pm 0.14 \pm 0.02$ keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070R48;LINKAGE=AU
 NODE=M070R48;LINKAGE=BE

 $\Gamma(\omega K^*(892) \bar{K} + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{21}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
61 ± 9 OUR AVERAGE				
62.0± 6.8±10.6	899 ± 98	ABLIKIM	08E BES2	$J/\psi \rightarrow \omega K_S^0 K^\pm \pi^\mp$
65.3±10.2±13.5	176 ± 28	ABLIKIM	08E BES2	$J/\psi \rightarrow \omega K^\mp K^- \pi^0$
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_{22}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
5.12±0.30 OUR AVERAGE				
5.2 ±0.4 ±0.1		¹ AUBERT	08S BABR	$10.6 e^+ e^- \rightarrow K^+ K^*(892)^- \gamma$
4.57±0.17±0.70	2285	JOUSSET	90 DM2	$J/\psi \rightarrow \text{hadrons}$
5.26±0.13±0.53		COFFMAN	88 MRK3	$J/\psi \rightarrow K^\pm K_S^0 \pi^\mp, K^+ K^- \pi^0$

NODE=M070S15
 NODE=M070S15

• • • We do not use the following data for averages, fits, limits, etc. • • •

2.6 ±0.6	24	FRANKLIN	83 MRK2	$J/\psi \rightarrow K^+ K^- \pi^0$
3.2 ±0.6	48	VANNUCCI	77 MRK1	$J/\psi \rightarrow K^\pm K_S^0 \pi^\mp$
4.1 ±1.2	39	BRAUNSCH...	76 DASP	$J/\psi \rightarrow K^\pm X$

¹ AUBERT 08S reports $[\Gamma(J/\psi(1S) \rightarrow K^+ K^*(892)^- + \text{c.c.})/\Gamma_{\text{total}}] \times [\Gamma(J/\psi(1S) \rightarrow e^+ e^-)] = (29.0 \pm 1.7 \pm 1.3) \times 10^{-3}$ 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_{23}/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_{24}/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

 $\Gamma(K^0 \bar{K}^*(892)^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{25}/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	$J/\psi \rightarrow K^\pm K_S^0 \pi^\mp$

NODE=M070S16
 NODE=M070S16

• • • 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;LINKAGE=AU

$\Gamma(K^0 \bar{K}^*(892)^0 + \text{c.c.})/\Gamma(K^+ K^*(892)^- + \text{c.c.})$		Γ_{25}/Γ_{22}		
VALUE	DOCUMENT ID	TECN	COMMENT	
0.82±0.05±0.09	COFFMAN	88	MRK3 $J/\psi \rightarrow K \bar{K}^*(892) + \text{c.c.}$	

NODE=M070S17
NODE=M070S17

$\Gamma(K^0 \bar{K}^*(892)^0 + \text{c.c.} \rightarrow K^0 K^\pm \pi^\mp + \text{c.c.})/\Gamma_{\text{total}}$		Γ_{26}/Γ		
VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
3.2±0.4±0.1	94	¹ AUBERT	08S	BABR $10.6 e^+ e^- \rightarrow K_S^0 K^\pm \pi^\mp \gamma$

NODE=M070S59
NODE=M070S59

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;LINKAGE=AU

$\Gamma(K_1(1400)^\pm K^\mp)/\Gamma_{\text{total}}$		Γ_{27}/Γ		
VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT	
3.8±0.8±1.2	¹ BAI	99C	BES $e^+ e^-$	

NODE=M070S35
NODE=M070S35

¹ Assuming $B(K_1(1400) \rightarrow K^* \pi) = 0.94 \pm 0.06$

NODE=M070S35;LINKAGE=M3

$\Gamma(\bar{K}^*(892)^0 K^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}}$		Γ_{28}/Γ		
VALUE	DOCUMENT ID	TECN	COMMENT	
seen	¹ ABLIKIM	06C	BES2 $J/\psi \rightarrow \bar{K}^*(892)^0 K^+ \pi^-$	

NODE=M070S52
NODE=M070S52

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;LINKAGE=AB

$\Gamma(\omega \pi^0 \pi^0)/\Gamma_{\text{total}}$		Γ_{29}/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_{30}/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_{31}/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_{32}/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_{33}/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_{34}/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_{35}/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^-

¹ AUBERT 07AU quotes $\Gamma_{ee}^{J/\psi} \cdot B(J/\psi \rightarrow \omega K^+ K^-) \cdot B(\eta \rightarrow 3\pi) = 3.3 \pm 1.3 \pm 0.2 \text{ eV}$.

² Addition of $\omega K^+ K^-$ and $\omega K^0 \bar{K}^0$ branching ratios.

NODE=M070R27
NODE=M070R27

NODE=M070R27;LINKAGE=AU
NODE=M070R27;LINKAGE=B

 $\Gamma(\omega f_0(1710) \rightarrow \omega K \bar{K})/\Gamma_{\text{total}}$ Γ_{36}/Γ VALUE (units 10^{-4})

DOCUMENT ID

TECN

COMMENT

4.8 ± 1.1 ± 0.31,2 FALVARD 88 DM2 $J/\psi \rightarrow \text{hadrons}$

¹ Includes unknown branching fraction $f_0(1710) \rightarrow K \bar{K}$.

² Addition of $f_0(1710) \rightarrow K^+ K^-$ and $f_0(1710) \rightarrow K^0 \bar{K}^0$ branching ratios.

NODE=M070S25
NODE=M070S25

NODE=M070S25;LINKAGE=F
NODE=M070S25;LINKAGE=G

 $\Gamma(\phi 2(\pi^+ \pi^-))/\Gamma_{\text{total}}$ Γ_{37}/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	$J/\psi \rightarrow \text{hadrons}$

¹ Using $\Gamma(J/\psi \rightarrow e^+ e^-) = 5.52 \pm 0.14 \pm 0.04 \text{ keV}$.

NODE=M070R35
NODE=M070R35

NODE=M070R35;LINKAGE=EE

 $\Gamma(\Delta(1232)^{++} \bar{p} \pi^-)/\Gamma_{\text{total}}$ Γ_{38}/Γ VALUE (units 10^{-3})

EVTS

DOCUMENT ID

TECN

COMMENT

1.58 ± 0.23 ± 0.40332 EATON 84 MRK2 e^+e^-

NODE=M070R70
NODE=M070R70

 $\Gamma(\omega \eta)/\Gamma_{\text{total}}$ Γ_{39}/Γ VALUE (units 10^{-3})

EVTS

DOCUMENT ID

TECN

COMMENT

1.74 ± 0.20 OUR AVERAGE

Error includes scale factor of 1.6. See the ideogram below.

2.352 ± 0.273	5k	¹ ABLIKIM	06F	BES2	$J/\psi \rightarrow \omega \eta$
1.44 ± 0.40 ± 0.14	13	² AUBERT	06D	BABR	10.6 $e^+e^- \rightarrow \omega \eta \gamma$
1.43 ± 0.10 ± 0.21	378	JOUSSET	90	DM2	$J/\psi \rightarrow \text{hadrons}$
1.71 ± 0.08 ± 0.20		COFFMAN	88	MRK3	$e^+e^- \rightarrow 3\pi \eta$

¹ Using $B(\eta \rightarrow 2\gamma) = (39.43 \pm 0.26)\%$, $B(\eta \rightarrow \pi^+ \pi^- \pi^0) = 22.6 \pm 0.4\%$, $B(\eta \rightarrow \pi^+ \pi^- \gamma) = 4.68 \pm 0.11\%$, and $B(\omega \rightarrow \pi^+ \pi^- \pi^0) = (89.1 \pm 0.7)\%$.

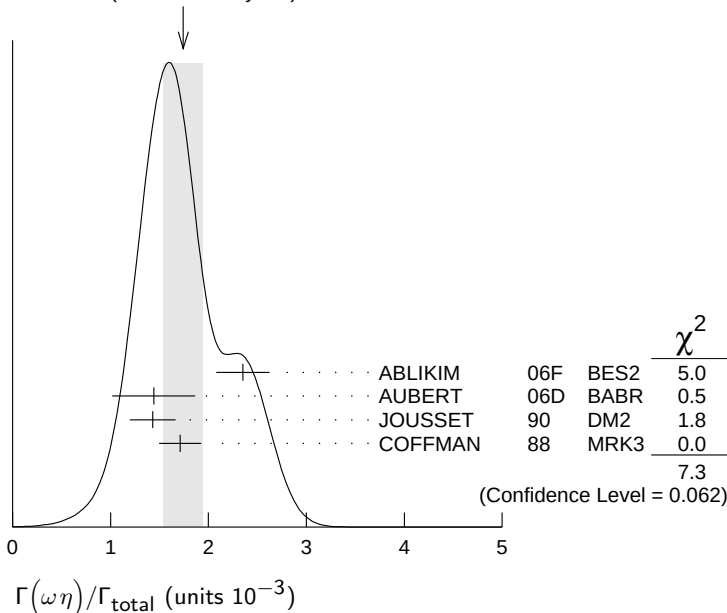
² Using $\Gamma(J/\psi \rightarrow e^+ e^-) = 5.52 \pm 0.14 \pm 0.04 \text{ keV}$.

NODE=M070R30
NODE=M070R30

NODE=M070R30;LINKAGE=BL

NODE=M070R30;LINKAGE=EE

WEIGHTED AVERAGE
1.74 ± 0.20 (Error scaled by 1.6)



$\Gamma(\phi K \bar{K})/\Gamma_{\text{total}}$ Γ_{40}/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
18.3 ± 2.4 OUR AVERAGE		Error includes scale factor of 1.5. See the ideogram below.		
21.4 ± 0.4 ± 2.2		ABLIKIM	05 BES2	$J/\psi \rightarrow \phi \pi^+ \pi^-$
48 $^{+20}_{-16}$ ± 6	9.0 $^{+3.7}_{-3.0}$	1,2 HUANG	03 BELL	$B^+ \rightarrow (\phi K^+ K^-) K^+$
14.6 ± 0.8 ± 2.1		3 FALVARD	88 DM2	$J/\psi \rightarrow \text{hadrons}$
18 ± 8	14	FELDMAN	77 MRK1	$e^+ e^-$

¹ We have multiplied $K^+ K^-$ measurement by 2 to obtain $K \bar{K}$.

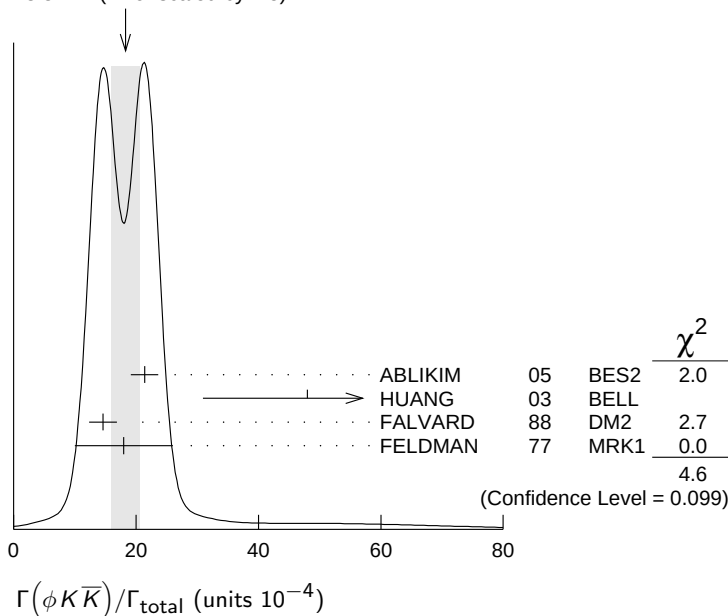
² Using $B(B^+ \rightarrow J/\psi K^+) = (1.01 \pm 0.05) \times 10^{-3}$.

³ Addition of $\phi K^+ K^-$ and $\phi K^0 \bar{K}^0$ branching ratios.

NODE=M070R36
NODE=M070R36

NODE=M070R36;LINKAGE=AA
NODE=M070R36;LINKAGE=CC
NODE=M070R36;LINKAGE=A

WEIGHTED AVERAGE
18.3 ± 2.4 (Error scaled by 1.5)

 $\Gamma(\phi f_0(1710) \rightarrow \phi K \bar{K})/\Gamma_{\text{total}}$ Γ_{41}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
3.6 ± 0.2 ± 0.6	1,2 FALVARD	88 DM2	$J/\psi \rightarrow \text{hadrons}$

¹ Including interference with $f'_2(1525)$.

² Includes unknown branching fraction $f_0(1710) \rightarrow K \bar{K}$.

NODE=M070S24
NODE=M070S24

NODE=M070S24;LINKAGE=D
NODE=M070S24;LINKAGE=E

 $\Gamma(\phi f_2(1270))/\Gamma_{\text{total}}$ Γ_{42}/Γ

VALUE (units 10^{-3})	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
0.72 ± 0.13 ± 0.02	44 ± 7		1,2 AUBERT	07AK BABR	10.6 $e^+ e^- \rightarrow \pi^+ \pi^- K^+ K^- \gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 0.45	90	FALVARD	88 DM2	$J/\psi \rightarrow \text{hadrons}$
< 0.37	90	VANNUCCI	77 MRK1	$e^+ e^- \rightarrow \pi^+ \pi^- K^+ K^-$

¹ Using $B(f_2(1270) \rightarrow \pi \pi) = (84.8^{+2.4}_{-1.2})\%$

² AUBERT 07AK reports $[\Gamma(J/\psi(1S) \rightarrow \phi f_2(1270))/\Gamma_{\text{total}}] \times [\Gamma(J/\psi(1S) \rightarrow e^+ e^-)] = (4.02 \pm 0.65 \pm 0.33) \times 10^{-3}$ keV which we divide by our best value $\Gamma(J/\psi(1S) \rightarrow e^+ e^-) = 5.55 \pm 0.14 \pm 0.02$ keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070R39
NODE=M070R39

NODE=M070R39;LINKAGE=AU
NODE=M070R39;LINKAGE=BE

 $\Gamma(\Delta(1232)^{++} \bar{\Delta}(1232)^{--})/\Gamma_{\text{total}}$ Γ_{43}/Γ

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
1.10 ± 0.09 ± 0.28	233	EATON	84 MRK2	$e^+ e^-$

NODE=M070R66
NODE=M070R66

$\Gamma(\Sigma(1385)^- \bar{\Sigma}(1385)^+ (\text{or c.c.}))/\Gamma_{\text{total}}$ Γ_{44}/Γ VALUE (units 10^{-3}) EVTS

DOCUMENT ID

TECN

COMMENT

1.10±0.12 OUR AVERAGE

1.23±0.07±0.30	0.8k	ABLIKIM	12P	BES2	$J/\psi \rightarrow \Sigma(1385)^- \bar{\Sigma}(1385)^+$
1.50±0.08±0.38	1k	ABLIKIM	12P	BES2	$J/\psi \rightarrow \Sigma(1385)^+ \bar{\Sigma}(1385)^-$
1.00±0.04±0.21	0.6k	HENRARD	87	DM2	$e^+ e^- \rightarrow \Sigma^{*-}$
1.19±0.04±0.25	0.7k	HENRARD	87	DM2	$e^+ e^- \rightarrow \Sigma^{*+}$
0.86±0.18±0.22	56	EATON	84	MRK2	$e^+ e^- \rightarrow \Sigma^{*-}$
1.03±0.24±0.25	68	EATON	84	MRK2	$e^+ e^- \rightarrow \Sigma^{*+}$

NODE=M070R67
NODE=M070R67

OCCUR=2

OCCUR=2

OCCUR=2

 $\Gamma(\phi f'_2(1525))/\Gamma_{\text{total}}$ Γ_{45}/Γ VALUE (units 10^{-4}) EVTS

DOCUMENT ID

TECN

COMMENT

8 ±4 OUR AVERAGE Error includes scale factor of 2.7.

12.3±0.6±2.0		^{1,2} FALVARD	88	DM2	$J/\psi \rightarrow \text{hadrons}$
4.8±1.8	46	¹ GIDAL	81	MRK2	$J/\psi \rightarrow K^+ K^- K^+ K^-$

¹ Re-evaluated using $B(f'_2(1525) \rightarrow K \bar{K}) = 0.713$.² Including interference with $f_0(1710)$.NODE=M070R40
NODE=M070R40NODE=M070R40;LINKAGE=B
NODE=M070R40;LINKAGE=C $\Gamma(\phi \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{46}/Γ VALUE (units 10^{-3}) EVTS

DOCUMENT ID

TECN

COMMENT

0.94±0.09 OUR AVERAGE Error includes scale factor of 1.2.

0.96±0.13	103	¹ AUBERT,BE	06D	BABR	$10.6 e^+ e^- \rightarrow K^+ K^- \pi^+ \pi^- \gamma$
1.09±0.02±0.13		ABLIKIM	05	BES2	$J/\psi \rightarrow \phi \pi^+ \pi^-$
0.78±0.03±0.12		FALVARD	88	DM2	$J/\psi \rightarrow \text{hadrons}$
2.1 ±0.9	23	FELDMAN	77	MRK1	$e^+ e^-$

¹ Derived by us. AUBERT,BE 06D measures $\Gamma(J/\psi \rightarrow e^+ e^-) \times B(J/\psi \rightarrow \phi \pi^+ \pi^-) \times B(\phi \rightarrow K^+ K^-) = (2.61 \pm 0.30 \pm 0.18) \text{ eV}$ NODE=M070R34
NODE=M070R34

NODE=M070R34;LINKAGE=AU

 $\Gamma(\phi \pi^0 \pi^0)/\Gamma_{\text{total}}$ Γ_{47}/Γ VALUE (units 10^{-3}) EVTS

DOCUMENT ID

TECN

COMMENT

0.56±0.16 23 ¹ AUBERT,BE 06D BABR 10.6 $e^+ e^- \rightarrow K^+ K^- \pi^0 \pi^0 \gamma$ ¹ Derived by us. AUBERT,BE 06D measures $\Gamma(J/\psi \rightarrow e^+ e^-) \times B(J/\psi \rightarrow \phi \pi^0 \pi^0) \times B(\phi \rightarrow K^+ K^-) = (1.54 \pm 0.40 \pm 0.16) \text{ eV}$ NODE=M070S44
NODE=M070S44

NODE=M070S44;LINKAGE=AU

 $\Gamma(\phi K^\pm K_S^0 \pi^\mp)/\Gamma_{\text{total}}$ Γ_{48}/Γ VALUE (units 10^{-4}) EVTS

DOCUMENT ID

TECN

COMMENT

7.2±0.8 OUR AVERAGE

7.4±0.6±1.4	227 ± 19	ABLIKIM	08E	BES2	$e^+ e^- \rightarrow J/\psi$
7.4±0.9±1.1		FALVARD	88	DM2	$J/\psi \rightarrow \text{hadrons}$
7 ±0.6±1.0	163 ± 15	BECKER	87	MRK3	$e^+ e^- \rightarrow \text{hadrons}$

NODE=M070S3
NODE=M070S3 $\Gamma(\omega f_1(1420))/\Gamma_{\text{total}}$ Γ_{49}/Γ VALUE (units 10^{-4}) EVTS

DOCUMENT ID

TECN

COMMENT

6.8^{+1.9}_{-1.6}±1.7	111 ⁺³¹ ₋₂₆	BECKER	87	MRK3	$e^+ e^- \rightarrow \text{hadrons}$

NODE=M070S5
NODE=M070S5 $\Gamma(\phi \eta)/\Gamma_{\text{total}}$ Γ_{50}/Γ VALUE (units 10^{-3}) EVTS

DOCUMENT ID

TECN

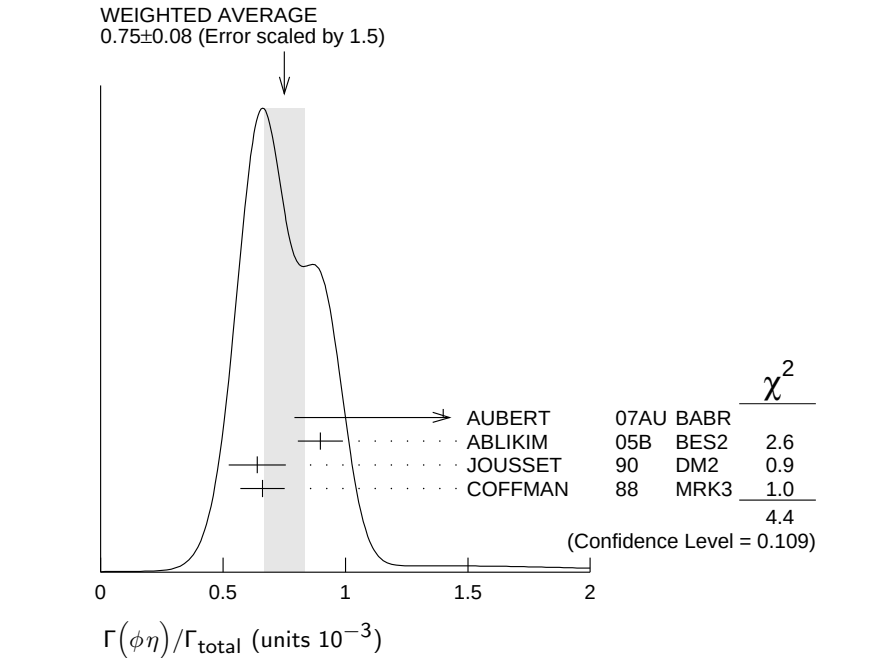
COMMENT

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	346	JOUSSET	90	DM2	$J/\psi \rightarrow \text{hadrons}$
0.661±0.045±0.078		COFFMAN	88	MRK3	$e^+ e^- \rightarrow K^+ K^- \eta$

¹ AUBERT 07AU quotes $\Gamma_{ee}^{J/\psi} \cdot B(J/\psi \rightarrow \phi \eta) \cdot B(\phi \rightarrow K^+ K^-) \cdot B(\eta \rightarrow \gamma \gamma) = 0.84 \pm 0.37 \pm 0.05 \text{ eV}$.NODE=M070R37
NODE=M070R37

NODE=M070R37;LINKAGE=AU

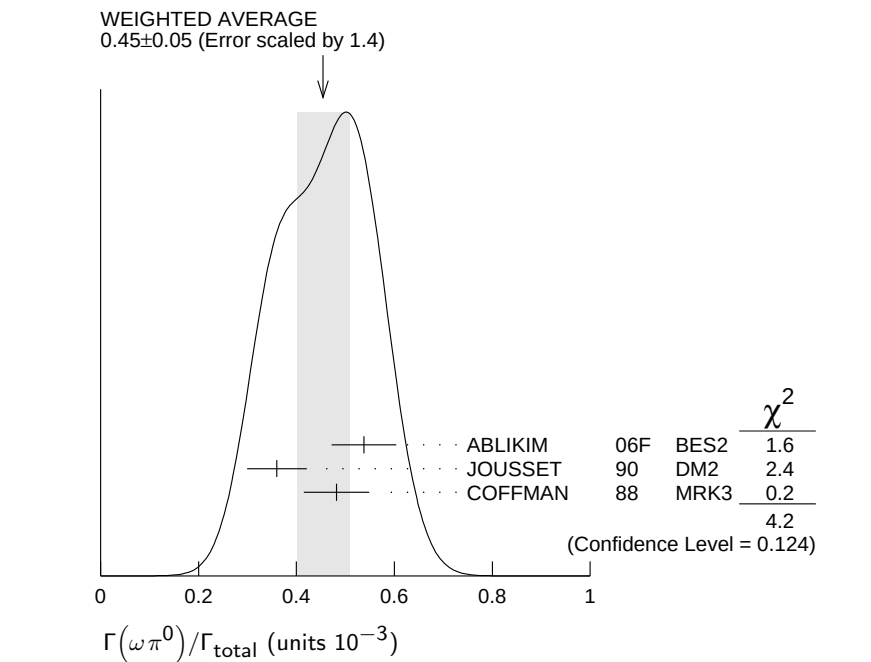


$\Gamma(\Xi^0\Xi^0)/\Gamma_{\text{total}}$					Γ_{51}/Γ
VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT	NODE=M070S64 NODE=M070S64
1.20±0.12±0.21	206	ABLIKIM	080	BES2 $e^+e^- \rightarrow J/\psi$	

$\Gamma(\Xi(1530)^-\Xi^+)/\Gamma_{\text{total}}$					Γ_{52}/Γ
VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT	NODE=M070S9 NODE=M070S9
0.59±0.09±0.12	75 ± 11	HENRARD	87	DM2 e^+e^-	

$\Gamma(pK^-\bar{\Sigma}(1385)^0)/\Gamma_{\text{total}}$					Γ_{53}/Γ
VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT	NODE=M070R74 NODE=M070R74
0.51±0.26±0.18	89	EATON	84	MRK2 e^+e^-	

$\Gamma(\omega\pi^0)/\Gamma_{\text{total}}$					Γ_{54}/Γ
VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT	NODE=M070R32 NODE=M070R32
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 $J/\psi \rightarrow \omega\pi^0$	NODE=M070R32;LINKAGE=BL
0.360±0.028±0.054	222	JOUSSET	90	DM2 $J/\psi \rightarrow \text{hadrons}$	
0.482±0.019±0.064		COFFMAN	88	MRK3 $e^+e^- \rightarrow \pi^0\pi^+\pi^-\pi^0$	
¹ Using $B(\omega \rightarrow \pi^+\pi^-\pi^0) = (89.1 \pm 0.7)\%$.					

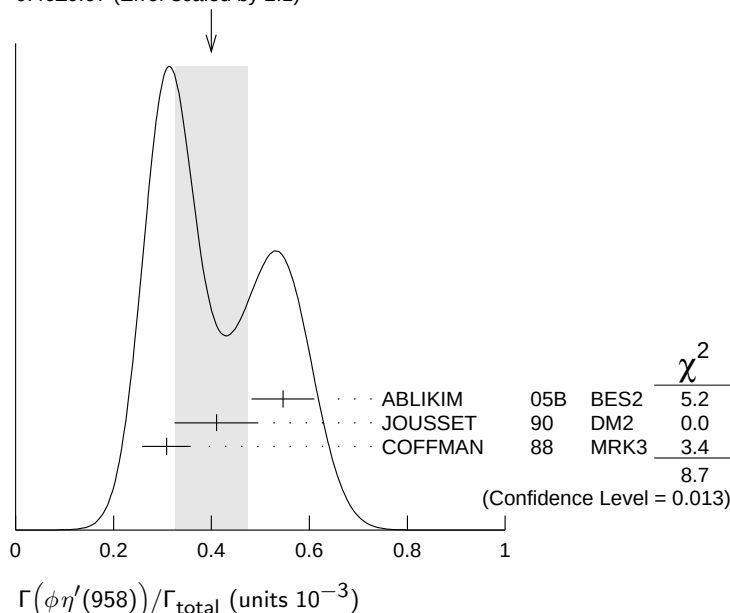


$\Gamma(\phi\eta'(958))/\Gamma_{\text{total}}$ Γ_{55}/Γ

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
0.40 $\pm$ 0.07					OUR AVERAGE Error includes scale factor of 2.1. See the ideogram below.
0.546 $\pm$ 0.031 $\pm$ 0.056			ABLIKIM	05B BES2	$e^+e^- \rightarrow J/\psi \rightarrow \text{hadr}$
0.41 $\pm$ 0.03 $\pm$ 0.08		167	JOUSSET	90 DM2	$J/\psi \rightarrow \text{hadrons}$
0.308 $\pm$ 0.034 $\pm$ 0.036			COFFMAN	88 MRK3	$e^+e^- \rightarrow K^+K^-\eta'$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 1.3		90	VANNUCCI	77 MRK1	e^+e^-

NODE=M070R38
 NODE=M070R38

WEIGHTED AVERAGE
 0.40 $\pm$ 0.07 (Error scaled by 2.1)

 $\Gamma(\phi f_0(980))/\Gamma_{\text{total}}$ Γ_{56}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
3.2 $\pm$ 0.9				OUR AVERAGE Error includes scale factor of 1.9.
4.6 $\pm$ 0.4 $\pm$ 0.8		¹ FALVARD	88 DM2	$J/\psi \rightarrow \text{hadrons}$
2.6 $\pm$ 0.6	50	¹ GIDAL	81 MRK2	$J/\psi \rightarrow K^+K^-K^+K^-$

¹ Assuming $B(f_0(980) \rightarrow \pi\pi) = 0.78$.

NODE=M070R41
 NODE=M070R41

NODE=M070R41;LINKAGE=A

 $\Gamma(\phi f_0(980) \rightarrow \phi\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{57}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
0.182 $\pm$ 0.042 $\pm$ 0.005	19.5 $\pm$ 4.5	^{1,2} AUBERT	07AK BABR	10.6 $e^+e^- \rightarrow \pi^+\pi^-K^+K^-\gamma$

¹ Using $B(\phi \rightarrow K^+K^-) = (49.3 \pm 0.6)\%$.

² AUBERT 07AK reports $[\Gamma(J/\psi(1S) \rightarrow \phi f_0(980) \rightarrow \phi\pi^+\pi^-)/\Gamma_{\text{total}}] \times [\Gamma(J/\psi(1S) \rightarrow e^+e^-)] = (1.01 \pm 0.22 \pm 0.08) \times 10^{-3}$ keV which we divide by our best value $\Gamma(J/\psi(1S) \rightarrow e^+e^-) = 5.55 \pm 0.14 \pm 0.02$ keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070S02
 NODE=M070S02

NODE=M070S02;LINKAGE=AU
 NODE=M070S02;LINKAGE=BE

 $\Gamma(\phi f_0(980) \rightarrow \phi\pi^0\pi^0)/\Gamma_{\text{total}}$ Γ_{58}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
0.171 $\pm$ 0.073 $\pm$ 0.004	7.0 $\pm$ 2.8	^{1,2} AUBERT	07AK BABR	10.6 $e^+e^- \rightarrow \pi^0\pi^0K^+K^-\gamma$

¹ Using $B(\phi \rightarrow K^+K^-) = (49.3 \pm 0.6)\%$.

² AUBERT 07AK reports $[\Gamma(J/\psi(1S) \rightarrow \phi f_0(980) \rightarrow \phi\pi^0\pi^0)/\Gamma_{\text{total}}] \times [\Gamma(J/\psi(1S) \rightarrow e^+e^-)] = (0.95 \pm 0.39 \pm 0.10) \times 10^{-3}$ keV which we divide by our best value $\Gamma(J/\psi(1S) \rightarrow e^+e^-) = 5.55 \pm 0.14 \pm 0.02$ keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070S03
 NODE=M070S03

NODE=M070S03;LINKAGE=AU
 NODE=M070S03;LINKAGE=BE

 $\Gamma(\eta\phi f_0(980) \rightarrow \eta\phi\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{59}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
3.23 $\pm$ 0.75 $\pm$ 0.73	52	ABLIKIM	08F BES	$J/\psi \rightarrow \eta\phi f_0(980)$

NODE=M070R08
 NODE=M070R08

$\Gamma(\phi a_0(980)^0 \rightarrow \phi \eta \pi^0)/\Gamma_{\text{total}}$ Γ_{60}/Γ VALUE (units 10^{-6})

DOCUMENT ID

TECN

COMMENT

5.0±2.7±2.5¹

ABLIKIM

11D

BES3

 $J/\psi \rightarrow \phi \eta \pi^0$ ¹ Assuming $a_0(980) - f_0(980)$ mixing and isospin breaking via γ^* and $K^* K$ loops.NODE=M070S75
NODE=M070S75

NODE=M070S75;LINKAGE=AB

 $\Gamma(\Xi(1530)^0 \Xi^0)/\Gamma_{\text{total}}$ Γ_{61}/Γ VALUE (units 10^{-3})

EVTS

DOCUMENT ID

TECN

COMMENT

0.32±0.12±0.07

24 ± 9

HENRARD

87

DM2

 $e^+ e^-$ NODE=M070S10
NODE=M070S10 $\Gamma(\Sigma(1385)^- \bar{\Sigma}^+ (\text{or c.c.}))/\Gamma_{\text{total}}$ Γ_{62}/Γ VALUE (units 10^{-3})

EVTS

DOCUMENT ID

TECN

COMMENT

0.31±0.05 OUR AVERAGE

0.30±0.03±0.07 74 ± 8

HENRARD

87

DM2

 $e^+ e^- \rightarrow \Sigma^{*-}$

0.34±0.04±0.07 77 ± 9

HENRARD

87

DM2

 $e^+ e^- \rightarrow \Sigma^{*+}$

0.29±0.11±0.10 26

EATON

84

MRK2

 $e^+ e^- \rightarrow \Sigma^{*-}$

0.31±0.11±0.11 28

EATON

84

MRK2

 $e^+ e^- \rightarrow \Sigma^{*+}$ NODE=M070R68
NODE=M070R68

OCCUR=2

OCCUR=2

 $\Gamma(\phi f_1(1285))/\Gamma_{\text{total}}$ Γ_{63}/Γ VALUE (units 10^{-4})

EVTS

DOCUMENT ID

TECN

COMMENT

2.6±0.5 OUR AVERAGE Error includes scale factor of 1.1.

3.2±0.6±0.4

JOUSSET

90

DM2

 $J/\psi \rightarrow \phi 2(\pi^+ \pi^-)$

2.1±0.5±0.4 25

¹

JOUSSET

90

DM2

 $J/\psi \rightarrow \phi \eta \pi^+ \pi^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.6±0.2±0.1 16 ± 6

BECKER

87

MRK3

 $J/\psi \rightarrow \phi K \bar{K} \pi$ ¹ We attribute to the $f_1(1285)$ the signal observed in the $\pi^+ \pi^- \eta$ invariant mass distribution at 1297 MeV.NODE=M070S6
NODE=M070S6

OCCUR=2

NODE=M070S6;LINKAGE=Q

 $\Gamma(\eta \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{64}/Γ VALUE (units 10^{-3})

EVTS

DOCUMENT ID

TECN

COMMENT

0.40±0.17±0.03

9

¹

AUBERT

07AU

BABR

10.6 $e^+ e^- \rightarrow \eta \pi^+ \pi^- \gamma$ ¹ AUBERT 07AU quotes $\Gamma_{ee}^{J/\psi} \cdot B(J/\psi \rightarrow \eta \pi^+ \pi^-) \cdot B(\eta \rightarrow 3\pi) = 0.51 \pm 0.22 \pm 0.03 \text{ eV}$.NODE=M070S05
NODE=M070S05

NODE=M070S05;LINKAGE=AU

 $\Gamma(\rho \eta)/\Gamma_{\text{total}}$ Γ_{65}/Γ VALUE (units 10^{-3})

EVTS

DOCUMENT ID

TECN

COMMENT

0.193±0.023 OUR AVERAGE

0.194±0.017±0.029 299

JOUSSET

90

DM2

 $J/\psi \rightarrow \text{hadrons}$

0.193±0.013±0.029

COFFMAN

88

MRK3

 $e^+ e^- \rightarrow \pi^+ \pi^- \eta$ NODE=M070R22
NODE=M070R22 $\Gamma(\omega \eta'(958))/\Gamma_{\text{total}}$ Γ_{66}/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

 $e^+ e^- \rightarrow 3\pi \eta'$ ¹ Using $B(\eta' \rightarrow \pi^+ \pi^- \eta) = (44.3 \pm 1.5)\%$, $B(\eta' \rightarrow \pi^+ \pi^- \gamma) = 29.5 \pm 1.0\%$, $B(\eta \rightarrow 2\gamma) = 39.43 \pm 0.26\%$, and $B(\omega \rightarrow \pi^+ \pi^- \pi^0) = (89.1 \pm 0.7)\%$.NODE=M070R31
NODE=M070R31

NODE=M070R31;LINKAGE=BL

 $\Gamma(\omega f_0(980))/\Gamma_{\text{total}}$ Γ_{67}/Γ VALUE (units 10^{-4})

DOCUMENT ID

TECN

COMMENT

1.41±0.27±0.47¹

AUGUSTIN

89

DM2

 $J/\psi \rightarrow 2(\pi^+ \pi^-) \pi^0$ ¹ Assuming $B(f_0(980) \rightarrow \pi \pi) = 0.78$.NODE=M070S27
NODE=M070S27

NODE=M070S27;LINKAGE=K

 $\Gamma(\rho \eta'(958))/\Gamma_{\text{total}}$ Γ_{68}/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_{69}/Γ VALUE (units 10^{-4})

CL%

DOCUMENT ID

TECN

COMMENT

<43

90

BRAUNSCH...

76

DASP

 $e^+ e^-$ NODE=M070R42
NODE=M070R42

$\Gamma(K\bar{K}_2^*(1430) + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{70}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<40	90	VANNUCCI 77	MRK1	$e^+e^- \rightarrow K^0\bar{K}_2^{*0}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<66	90	BRAUNSCH... 76	DASP	$e^+e^- \rightarrow K^\pm\bar{K}_2^{*\mp}$

NODE=M070R45
 NODE=M070R45

 $\Gamma(K_1(1270)^\pm K^\mp)/\Gamma_{\text{total}}$ Γ_{71}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<3.0	90	¹ BAI 99C	BES	e^+e^-

¹ Assuming $B(K_1(1270) \rightarrow K\rho) = 0.42 \pm 0.06$

NODE=M070S34
 NODE=M070S34

NODE=M070S34;LINKAGE=M2

 $\Gamma(K_2^*(1430)^0\bar{K}_2^*(1430)^0)/\Gamma_{\text{total}}$ Γ_{72}/Γ

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

 $\Gamma(\phi\pi^0)/\Gamma_{\text{total}}$ Γ_{73}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<6.4	90	ABLIKIM 05B	BES2	$e^+e^- \rightarrow J/\psi \rightarrow \phi\gamma\gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<6.8	90	COFFMAN 88	MRK3	$e^+e^- \rightarrow K^+K^-\pi^0$

NODE=M070R33
 NODE=M070R33

 $\Gamma(\phi\eta(1405) \rightarrow \phi\eta\pi\pi)/\Gamma_{\text{total}}$ Γ_{74}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<2.5	90	¹ FALVARD 88	DM2	$J/\psi \rightarrow \text{hadrons}$

¹ Includes unknown branching fraction $\eta(1405) \rightarrow \eta\pi\pi$.

NODE=M070S23
 NODE=M070S23

NODE=M070S23;LINKAGE=A

 $\Gamma(\omega f'_2(1525))/\Gamma_{\text{total}}$ Γ_{75}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<2.2	90	¹ VANNUCCI 77	MRK1	$e^+e^- \rightarrow \pi^+\pi^-\pi^0 K^+K^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<2.8	90	¹ FALVARD 88	DM2	$J/\psi \rightarrow \text{hadrons}$

¹ Re-evaluated assuming $B(f'_2(1525) \rightarrow K\bar{K}) = 0.713$.

NODE=M070R29
 NODE=M070R29

NODE=M070R29;LINKAGE=C

 $\Gamma(\omega X(1835) \rightarrow \omega p\bar{p})/\Gamma_{\text{total}}$ Γ_{76}/Γ

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

 $\Gamma(\eta\phi(2170) \rightarrow \eta K^*(892)^0\bar{K}^*(892)^0)/\Gamma_{\text{total}}$ Γ_{77}/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_{78}/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_{79}/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_{80}/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_{81}/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_{82} / 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_{83} / 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_{84} / 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_{85} / 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_{86} / Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<0.9	90	HENRARD	87 DM2	$e^+ e^-$

NODE=M070S12
NODE=M070S12

STABLE HADRONS

 $\Gamma(2(\pi^+ \pi^-) \pi^0) / \Gamma_{\text{total}}$ Γ_{87} / 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	$e^+ e^-$

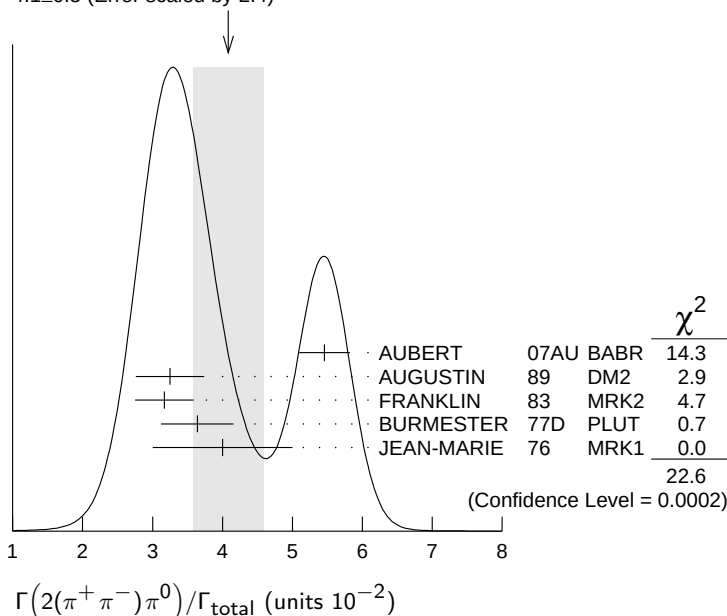
NODE=M070307

NODE=M070R9
NODE=M070R9

¹ AUBERT 07AU reports $[\Gamma(J/\psi(1S) \rightarrow 2(\pi^+ \pi^-) \pi^0) / \Gamma_{\text{total}}] \times [\Gamma(J/\psi(1S) \rightarrow e^+ e^-)] = 0.303 \pm 0.005 \pm 0.018 \text{ keV}$ which we divide by our best value $\Gamma(J/\psi(1S) \rightarrow e^+ e^-) = 5.55 \pm 0.14 \pm 0.02 \text{ keV}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070R9;LINKAGE=AU

WEIGHTED AVERAGE
4.1 ± 0.5 (Error scaled by 2.4)


 $\Gamma(\omega \pi^+ \pi^-) / \Gamma(2(\pi^+ \pi^-) \pi^0)$ $\Gamma_{13} / \Gamma_{87}$

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

$\Gamma(3(\pi^+\pi^-\pi^0))/\Gamma_{\text{total}}$

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT	Γ_{88}/Γ
0.029±0.006 OUR AVERAGE					
0.028±0.009	11	FRANKLIN	83	MRK2 $e^+e^- \rightarrow \text{hadrons}$	
0.029±0.007	181	JEAN-MARIE	76	MRK1 e^+e^-	

NODE=M070R11
NODE=M070R11

 $\Gamma(\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT	Γ_{89}/Γ
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	$e^+e^- \rightarrow J/\psi$	
22.9 ±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 $\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) \times \Gamma(\psi(2S) \rightarrow e^+e^-)/\Gamma_{\text{total}} = 0.813 \pm 0.013$ 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.

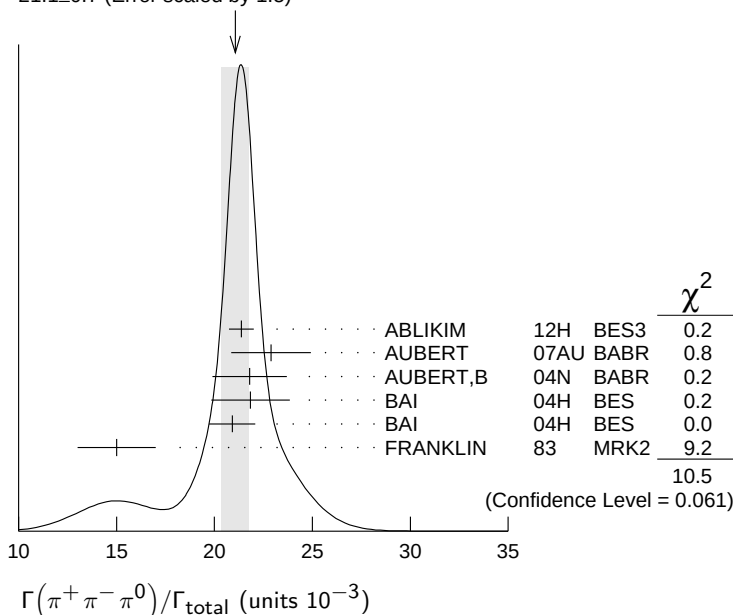
⁶ Obtained comparing the rates for $\pi^+\pi^-\pi^0$ and $\mu^+\mu^-$, using J/ψ events produced via $\psi(2S) \rightarrow \pi^+\pi^-J/\psi$ and with $B(J/\psi \rightarrow \mu^+\mu^-) = 5.88 \pm 0.10\%$.

NODE=M070R;LINKAGE=BA
NODE=M070R7;LINKAGE=AB

NODE=M070R7;LINKAGE=AU

NODE=M070R;LINKAGE=AU
NODE=M070R;LINKAGE=BU
NODE=M070R;LINKAGE=BI

WEIGHTED AVERAGE
21.1±0.7 (Error scaled by 1.5)

 $\Gamma(\pi^+\pi^-\pi^0 K^+K^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-2})	EVTs	DOCUMENT ID	TECN	COMMENT	Γ_{90}/Γ
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

 $\Gamma(4(\pi^+\pi^-\pi^0))/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT	Γ_{91}/Γ
90±30	13	JEAN-MARIE	76	MRK1 e^+e^-	

NODE=M070R12
NODE=M070R12

$\Gamma(\pi^+\pi^-K^+K^-)/\Gamma_{\text{total}}$ Γ_{92}/Γ VALUE (units 10^{-3}) EVTS

DOCUMENT ID TECN COMMENT

6.6±0.5 OUR AVERAGE

6.5±0.4±0.2 1.6k ¹ AUBERT 07AK BABR 10.6 $e^+e^- \rightarrow \pi^+\pi^-K^+K^-\gamma$
 7.2±2.3 205 VANNUCCI 77 MRK1 e^+e^-

• • • We do not use the following data for averages, fits, limits, etc. • • •

6.1±0.7±0.2 233 ² AUBERT 05D BABR 10.6 $e^+e^- \rightarrow K^+K^-\pi^+\pi^-\gamma$

¹ AUBERT 07AK reports $[\Gamma(J/\psi(1S) \rightarrow \pi^+\pi^-K^+K^-)/\Gamma_{\text{total}}] \times [\Gamma(J/\psi(1S) \rightarrow e^+e^-)] = (36.3 \pm 1.3 \pm 2.1) \times 10^{-3}$ keV which we divide by our best value $\Gamma(J/\psi(1S) \rightarrow e^+e^-) = 5.55 \pm 0.14 \pm 0.02$ keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² Superseded by AUBERT 07AK. AUBERT 05D reports $[\Gamma(J/\psi(1S) \rightarrow \pi^+\pi^-K^+K^-)/\Gamma_{\text{total}}] \times [\Gamma(J/\psi(1S) \rightarrow e^+e^-)] = (33.6 \pm 2.7 \pm 2.7) \times 10^{-3}$ keV which we divide by our best value $\Gamma(J/\psi(1S) \rightarrow e^+e^-) = 5.55 \pm 0.14 \pm 0.02$ keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070R16
 NODE=M070R16

NODE=M070R16;LINKAGE=BE

NODE=M070R16;LINKAGE=AU

 $\Gamma(\pi^+\pi^-K^+K^-\eta)/\Gamma_{\text{total}}$ Γ_{93}/Γ VALUE (units 10^{-3}) EVTS

DOCUMENT ID TECN COMMENT

1.84±0.28±0.05

73 ¹ AUBERT 07AU BABR 10.6 $e^+e^- \rightarrow K^+K^-\pi^+\pi^-\eta\gamma$

¹ AUBERT 07AU reports $[\Gamma(J/\psi(1S) \rightarrow \pi^+\pi^-K^+K^-\eta)/\Gamma_{\text{total}}] \times [\Gamma(J/\psi(1S) \rightarrow e^+e^-)] = (10.2 \pm 1.3 \pm 0.8) \times 10^{-3}$ keV which we divide by our best value $\Gamma(J/\psi(1S) \rightarrow e^+e^-) = 5.55 \pm 0.14 \pm 0.02$ keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070S04
 NODE=M070S04

NODE=M070S04;LINKAGE=AU

 $\Gamma(\pi^0\pi^0K^+K^-)/\Gamma_{\text{total}}$ Γ_{94}/Γ VALUE (units 10^{-3}) EVTS

DOCUMENT ID TECN COMMENT

2.45±0.31±0.06

203 ± 16 ¹ AUBERT 07AK BABR 10.6 $e^+e^- \rightarrow \pi^0\pi^0K^+K^-\gamma$

¹ 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

 $\Gamma(K\bar{K}\pi)/\Gamma_{\text{total}}$ Γ_{95}/Γ VALUE (units 10^{-4}) EVTS

DOCUMENT ID TECN COMMENT

61 ±10 OUR AVERAGE

55.2±12.0 25 FRANKLIN 83 MRK2 $e^+e^- \rightarrow K^+K^-\pi^0$
 78.0±21.0 126 VANNUCCI 77 MRK1 $e^+e^- \rightarrow K_S^0K^\pm\pi^\mp$

NODE=M070R15
 NODE=M070R15

 $\Gamma(2(\pi^+\pi^-))/\Gamma_{\text{total}}$ Γ_{96}/Γ 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_{97}/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_{98}/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_{99}/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_{100}/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_{101}/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 $B(B^+ \rightarrow J/\psi(1S)K^+) = (1.027 \pm 0.031) \times 10^{-3}$. 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_{102}/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^-

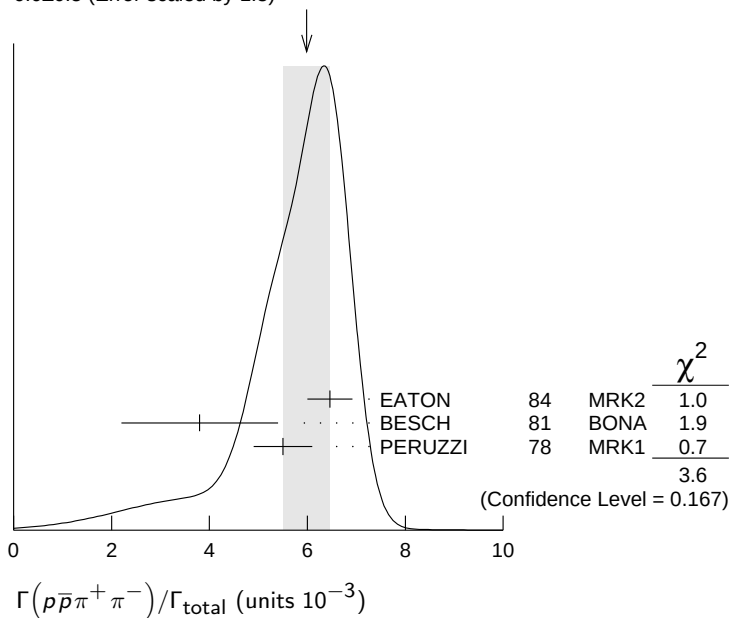
NODE=M070R52
NODE=M070R52

 $\Gamma(p\bar{p}\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{103}/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)



$\Gamma(p\bar{\rho}\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$

Γ_{104}/Γ

Including $p\bar{\rho}\pi^+\pi^-\gamma$ 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^-

NODE=M070R55
 NODE=M070R55
 NODE=M070R55

$\Gamma(p\bar{\rho}\eta)/\Gamma_{\text{total}}$

Γ_{105}/Γ

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^-

NODE=M070R56
 NODE=M070R56

¹ From the combination of $p\bar{\rho}\eta \rightarrow p\bar{\rho}\gamma\gamma$ and $p\bar{\rho}\eta \rightarrow p\bar{\rho}\pi^+\pi^-\pi^0$ channels.

NODE=M070R56;LINKAGE=AB

$\Gamma(p\bar{\rho}\rho)/\Gamma_{\text{total}}$

Γ_{106}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<0.31	90	EATON	84	MRK2 $e^+e^- \rightarrow \text{hadrons}\gamma$

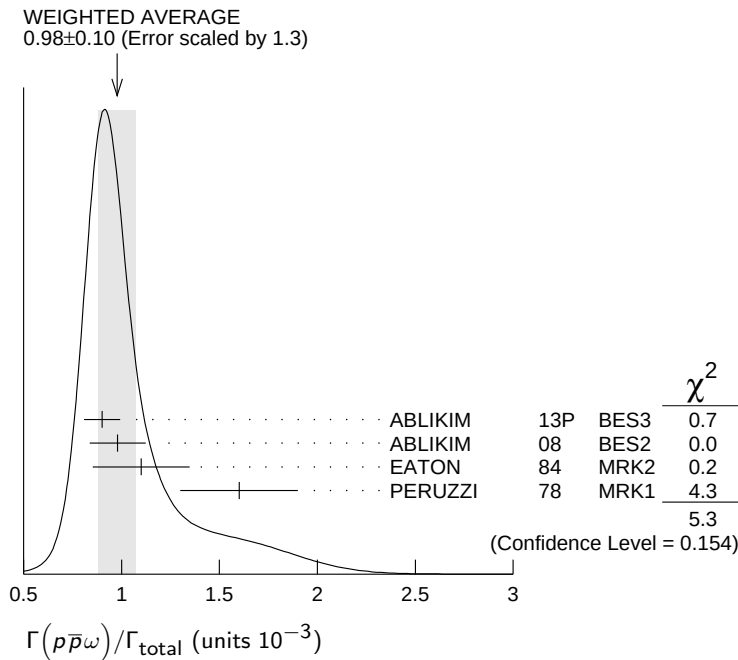
NODE=M070R57
 NODE=M070R57

$\Gamma(p\bar{\rho}\omega)/\Gamma_{\text{total}}$

Γ_{107}/Γ

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. $[(1.10 \pm 0.15) \times 10^{-3}]$ OUR 2013 AVERAGE Scale factor = 1.3]		
$0.90 \pm 0.02 \pm 0.09$	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^-

NODE=M070R58
 NODE=M070R58
 NEW



$\Gamma(p\bar{\rho}\eta'(958))/\Gamma_{\text{total}}$

Γ_{108}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
0.21 ± 0.04 OUR AVERAGE				
0.200 ± 0.023 ± 0.028	265 ± 31	¹ ABLIKIM	09	BES2 e^+e^-
0.68 ± 0.23 ± 0.17	19	EATON	84	MRK2 e^+e^-
1.8 ± 0.6	19	PERUZZI	78	MRK1 e^+e^-

NODE=M070R59
NODE=M070R59

¹ From the combination of $p\bar{p}\eta' \rightarrow p\bar{p}\pi^+\pi^-\eta$ and $p\bar{p}\eta' \rightarrow p\bar{p}\gamma\rho^0$ channels.

NODE=M070R59;LINKAGE=AB

$\Gamma(p\bar{\rho}\phi)/\Gamma_{\text{total}}$

Γ_{109}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
0.45 ± 0.13 ± 0.07	FALVARD	88	DM2 $J/\psi \rightarrow$ hadrons

NODE=M070S22
NODE=M070S22

$\Gamma(n\bar{n})/\Gamma_{\text{total}}$

Γ_{110}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
2.09 ± 0.16 OUR AVERAGE				
2.07 ± 0.01 ± 0.17	36k	ABLIKIM	12C	BES3 e^+e^-
2.31 ± 0.49	79	BALDINI	98	FENI e^+e^-
1.8 ± 0.9		BESCH	78	BONA e^+e^-
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1.90 ± 0.55	40	ANTONELLI	93	SPEC e^+e^-

NODE=M070R64
NODE=M070R64

$\Gamma(n\bar{n}\pi^+\pi^-)/\Gamma_{\text{total}}$

Γ_{111}/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_{112}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.50 ± 0.10 ± 0.22	399	ABLIKIM	080	BES2 $e^+e^- \rightarrow J/\psi$

NODE=M070S09
NODE=M070S09

$\Gamma(\Sigma^0\bar{\Sigma}^0)/\Gamma_{\text{total}}$

Γ_{113}/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 $e^+e^- \rightarrow \Sigma^0\bar{\Sigma}^0$

NODE=M070R63
NODE=M070R63

• • • 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;LINKAGE=AU

$\Gamma(2(\pi^+\pi^-)K^+K^-)/\Gamma_{\text{total}}$ Γ_{114}/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_{115}/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

 $\Gamma(\Xi^-\Xi^+)/\Gamma_{\text{total}}$ Γ_{119}/Γ

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
0.86 ± 0.11 OUR AVERAGE		Error includes scale factor of 1.2.		
0.90 ± 0.03 ± 0.18	961 ± 35	ABLIKIM	12P BES2	$J/\psi \rightarrow \Xi^-\Xi^+$
0.70 ± 0.06 ± 0.12	132 ± 11	HENRARD	87 DM2	$e^+e^- \rightarrow \Xi^-\Xi^+$
1.14 ± 0.08 ± 0.20	194	EATON	84 MRK2	$e^+e^- \rightarrow \Xi^-\Xi^+$
1.4 ± 0.5	51	PERUZZI	78 MRK1	$e^+e^- \rightarrow \Xi^-\Xi^+$

NODE=M070R62
 NODE=M070R62

 $\Gamma(\Lambda\bar{\Lambda})/\Gamma_{\text{total}}$ Γ_{120}/Γ

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
1.61 ± 0.15 OUR AVERAGE		Error includes scale factor of 1.9. See the ideogram below.		
1.93 ± 0.21 ± 0.05		¹ AUBERT	07BD BABR	10.6 $e^+e^- \rightarrow \Lambda\bar{\Lambda}\gamma$
2.03 ± 0.03 ± 0.15	8887	ABLIKIM	06 BES2	$J/\psi \rightarrow \Lambda\bar{\Lambda}$
1.9 $^{+0.5}_{-0.4}$ ± 0.1	46	² WU	06 BELL	$B^+ \rightarrow \Lambda\bar{\Lambda}K^+$
1.08 ± 0.06 ± 0.24	631	BAI	98G BES	e^+e^-
1.38 ± 0.05 ± 0.20	1847	PALLIN	87 DM2	e^+e^-
1.58 ± 0.08 ± 0.19	365	EATON	84 MRK2	e^+e^-
2.6 ± 1.6	5	BESCH	81 BONA	e^+e^-
1.1 ± 0.2	196	PERUZZI	78 MRK1	e^+e^-

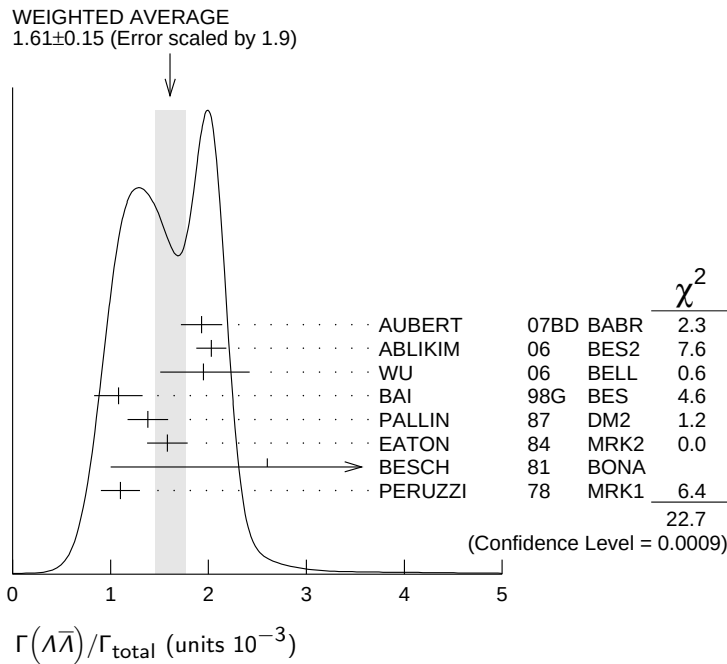
NODE=M070R60
 NODE=M070R60

¹ AUBERT 07BD reports $[\Gamma(J/\psi(1S) \rightarrow \Lambda\bar{\Lambda})/\Gamma_{\text{total}}] \times [\Gamma(J/\psi(1S) \rightarrow e^+e^-)] = (10.7 \pm 0.9 \pm 0.7) \times 10^{-3}$ keV which we divide by our best value $\Gamma(J/\psi(1S) \rightarrow e^+e^-) = 5.55 \pm 0.14 \pm 0.02$ keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070R60;LINKAGE=AU

² WU 06 reports $[\Gamma(J/\psi(1S) \rightarrow \Lambda\bar{\Lambda})/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow J/\psi(1S)K^+)] = (2.00 $^{+0.34}_{-0.29}$ ± 0.34) $\times 10^{-6}$ which we divide by our best value $B(B^+ \rightarrow J/\psi(1S)K^+) = (1.027 \pm 0.031) \times 10^{-3}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.$

NODE=M070R60;LINKAGE=WU



$\Gamma(\Lambda\bar{\Lambda})/\Gamma(p\bar{p})$

$\Gamma_{120}/\Gamma_{101}$

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_{121}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
0.83 ± 0.07 OUR AVERAGE		Error includes scale factor of 1.2.		
0.770 ± 0.051 ± 0.083	335	¹ ABLIKIM	07H BES2	$e^+e^- \rightarrow \Lambda\bar{\Sigma}^+\pi^-$
0.747 ± 0.056 ± 0.076	254	¹ ABLIKIM	07H BES2	$e^+e^- \rightarrow \Lambda\bar{\Sigma}^-\pi^+$
0.90 ± 0.06 ± 0.16	225 ± 15	HENRARD	87 DM2	$e^+e^- \rightarrow \Lambda\bar{\Sigma}^+\pi^-$
1.11 ± 0.06 ± 0.20	342 ± 18	HENRARD	87 DM2	$e^+e^- \rightarrow \Lambda\bar{\Sigma}^-\pi^+$
1.53 ± 0.17 ± 0.38	135	EATON	84 MRK2	$e^+e^- \rightarrow \Lambda\bar{\Sigma}^+\pi^-$
1.38 ± 0.21 ± 0.35	118	EATON	84 MRK2	$e^+e^- \rightarrow \Lambda\bar{\Sigma}^-\pi^+$

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_{122}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
0.89 ± 0.07 ± 0.14	307	EATON	84 MRK2	e^+e^-

NODE=M070R72
NODE=M070R72

$\Gamma(2(K^+K^-))/\Gamma_{\text{total}}$

Γ_{123}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
0.76 ± 0.09 OUR AVERAGE				
0.74 ± 0.09 ± 0.02	156 ± 15	¹ AUBERT	07AK BABR	10.6 $e^+e^- \rightarrow 2(K^+K^-)\gamma$
1.4 $^{+0.5}_{-0.4} \pm 0.2$	11.0 $^{+4.3}_{-3.5}$	² HUANG	03 BELL	$B^+ \rightarrow 2(K^+K^-)K^+$
0.7 ± 0.3		VANNUCCI	77 MRK1	e^+e^-

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.72 ± 0.17 ± 0.02	38	³ AUBERT	05D BABR	10.6 $e^+e^- \rightarrow 2(K^+K^-)\gamma$

¹ AUBERT 07AK reports $[\Gamma(J/\psi(1S) \rightarrow 2(K^+K^-))/\Gamma_{\text{total}}] \times [\Gamma(J/\psi(1S) \rightarrow e^+e^-)] = (4.11 \pm 0.39 \pm 0.30) \times 10^{-3}$ keV which we divide by our best value $\Gamma(J/\psi(1S) \rightarrow e^+e^-) = 5.55 \pm 0.14 \pm 0.02$ keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² Using $B(B^+ \rightarrow J/\psi K^+) = (1.01 \pm 0.05) \times 10^{-3}$.

³ Superseded by AUBERT 07AK. AUBERT 05D reports $[\Gamma(J/\psi(1S) \rightarrow 2(K^+K^-))/\Gamma_{\text{total}}] \times [\Gamma(J/\psi(1S) \rightarrow e^+e^-)] = (4.0 \pm 0.7 \pm 0.6) \times 10^{-3}$ keV which we divide by our best value $\Gamma(J/\psi(1S) \rightarrow e^+e^-) = 5.55 \pm 0.14 \pm 0.02$ keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070R19
NODE=M070R19

NODE=M070R19;LINKAGE=BE

NODE=M070R19;LINKAGE=CC
NODE=M070R19;LINKAGE=AU

$\Gamma(pK-\bar{\Sigma}^0)/\Gamma_{\text{total}}$ Γ_{124}/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_{125}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.70±0.17 OUR AVERAGE				

2.86±0.09±0.19	1k	¹ METREVELI	12	$\psi(2S) \rightarrow \pi^+\pi^-K^+K^-$
2.39±0.24±0.22	107	BALTRUSAIT..85D	MRK3	e^+e^-
2.2 ±0.9	6	BRANDELIK	79C	DASP e^+e^-

¹ Obtained by analyzing CLEO-c data but not authored by the CLEO Collaboration.

NODE=M070R13
 NODE=M070R13

NODE=M070R13;LINKAGE=ME

 $\Gamma(K_S^0 K_L^0)/\Gamma_{\text{total}}$ Γ_{126}/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_{127}/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_{128}/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_{129}/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

 $\Gamma(\bar{\Lambda}nK_S^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{130}/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_{131}/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_{132}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT

2.83±0.23 OUR AVERAGE[(2.83 ± 0.23) × 10⁻³ OUR 2013 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

NEW

OCCUR=2

NODE=M070R61;LINKAGE=AB

NODE=M070R61;LINKAGE=AC

 $\Gamma(K_S^0 K_S^0)/\Gamma_{\text{total}}$ Γ_{133}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT

<0.01 95 ¹ BAI 04D BES e^+e^-

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.052 90 ¹ BALTRUSAIT..85C MRK3 e^+e^- ¹ Forbidden by CP.

NODE=M070R14

NODE=M070R14

NODE=M070R14;LINKAGE=C

NODE=M070310

RADIATIVE DECAYS

 $\Gamma(3\gamma)/\Gamma_{\text{total}}$ Γ_{134}/Γ

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT

11.6±2.2 OUR AVERAGE11.3±1.8±2.0 113 ± 18 ABLIKIM 13I BES3 $\psi(2S) \rightarrow \pi^+\pi^- J/\psi$ 12 ± 3 ± 2 24.2^{+7.2}_{-6.0} ADAMS 08 CLEO $\psi(2S) \rightarrow \pi^+\pi^- J/\psi$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<55 90 PARTRIDGE 80 CBAL e^+e^-

NODE=M070R81

NODE=M070R81

 $\Gamma(4\gamma)/\Gamma_{\text{total}}$ Γ_{135}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT

<9 90 ADAMS 08 CLEO $\psi(2S) \rightarrow \pi^+\pi^- J/\psi$

NODE=M070S06

NODE=M070S06

 $\Gamma(5\gamma)/\Gamma_{\text{total}}$ Γ_{136}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT

<15 90 ADAMS 08 CLEO $\psi(2S) \rightarrow \pi^+\pi^- J/\psi$

NODE=M070S07

NODE=M070S07

 $\Gamma(\gamma\eta_c(1S))/\Gamma_{\text{total}}$ Γ_{137}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT

1.7 ± 0.4 OUR AVERAGE Error includes scale factor of 1.6. [(1.7 ± 0.4) × 10⁻² OUR 2013 AVERAGE Scale factor = 1.6]2.01±0.32±0.02 ¹ MITCHELL 09 CLEO $e^+e^- \rightarrow \gamma X$ 1.27±0.36 GAISER 86 CBAL $J/\psi \rightarrow \gamma X$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.79±0.20 273 ± 43 ² AUBERT 06E BABR $B^\pm \rightarrow K^\pm X_{c\bar{c}}$ seen 16 BALTRUSAIT..84 MRK3 $J/\psi \rightarrow 2\phi\gamma$

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 $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (34.45 \pm 0.30) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² Calculated by the authors using an average of $B(J/\psi \rightarrow \gamma\eta_c) \times B(\eta_c \rightarrow K\bar{K}\pi)$ from BALTRUSAITIS 86, BISELLO 91, BAI 04 and $B(\eta_c \rightarrow K\bar{K}\pi) = (8.5 \pm 1.8)\%$ from AUBERT 06E.

NODE=M070R85

NODE=M070R85

NEW

NODE=M070R85;LINKAGE=MI

NODE=M070R85;LINKAGE=AU

 $\Gamma(\gamma\eta_c(1S) \rightarrow 3\gamma)/\Gamma_{\text{total}}$ Γ_{138}/Γ

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT

3.8^{+1.3}_{-1.0} OUR AVERAGE Error includes scale factor of 1.1.4.5±1.2±0.6 33 ± 9 ABLIKIM 13I BES3 $\psi(2S) \rightarrow \pi^+\pi^- J/\psi$ 1.2^{+2.7}_{-1.1} ± 0.3 1.2^{+2.8}_{-1.1} ADAMS 08 CLEO $\psi(2S) \rightarrow \pi^+\pi^- J/\psi$

NODE=M070S08

NODE=M070S08

$\Gamma(\gamma\pi^+\pi^-2\pi^0)/\Gamma_{\text{total}}$ VALUE (units 10^{-3}) **$8.3 \pm 0.2 \pm 3.1$** ¹ 4π mass less than 2.0 GeV.

DOCUMENT ID TECN COMMENT

¹ BALTRUSAIT...86B MRK3 $J/\psi \rightarrow 4\pi\gamma$ Γ_{139}/Γ NODE=M070R99
NODE=M070R99

NODE=M070R99;LINKAGE=M

 $\Gamma(\gamma\eta\pi\pi)/\Gamma_{\text{total}}$ VALUE (units 10^{-3}) **6.1 ± 1.0 OUR AVERAGE** $5.85 \pm 0.3 \pm 1.05$ $7.8 \pm 1.2 \pm 2.4$ ¹ Broad enhancement at 1700 MeV.¹ EDWARDS 83B CBAL $J/\psi \rightarrow \eta\pi^+\pi^-$ ¹ EDWARDS 83B CBAL $J/\psi \rightarrow \eta 2\pi^0$ Γ_{140}/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_{141}/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.

 $1.66 \pm 0.1 \pm 0.58$ ^{1,2} BAI 00D BES $J/\psi \rightarrow \gamma K^\pm K_S^0 \pi^\mp$ $3.8 \pm 0.3 \pm 0.6$ ³ AUGUSTIN 90 DM2 $J/\psi \rightarrow \gamma K \bar{K} \pi$ $4.0 \pm 0.7 \pm 1.0$ ³ EDWARDS 82E CBAL $J/\psi \rightarrow K^+ K^- \pi^0 \gamma$ 4.3 ± 1.7 ^{3,4} SCHARRE 80 MRK2 e^+e^-

• • • We do not use the following data for averages, fits, limits, etc. • • •

 $1.78 \pm 0.21 \pm 0.33$ ^{3,5,6} AUGUSTIN 92 DM2 $J/\psi \rightarrow \gamma K \bar{K} \pi$ $0.83 \pm 0.13 \pm 0.18$ ^{3,7,8} AUGUSTIN 92 DM2 $J/\psi \rightarrow \gamma K \bar{K} \pi$ $0.66^{+0.17+0.24}_{-0.16-0.15}$ ^{3,6,9} BAI 90C MRK3 $J/\psi \rightarrow \gamma K_S^0 K^\pm \pi^\mp$ $1.03^{+0.21+0.26}_{-0.18-0.19}$ ^{3,8,10} BAI 90C MRK3 $J/\psi \rightarrow \gamma K_S^0 K^\pm \pi^\mp$ 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.

OCCUR=2

OCCUR=2

NODE=M070R89;LINKAGE=BD

NODE=M070R89;LINKAGE=BE

NODE=M070R89;LINKAGE=B

NODE=M070R89;LINKAGE=C

NODE=M070R89;LINKAGE=H

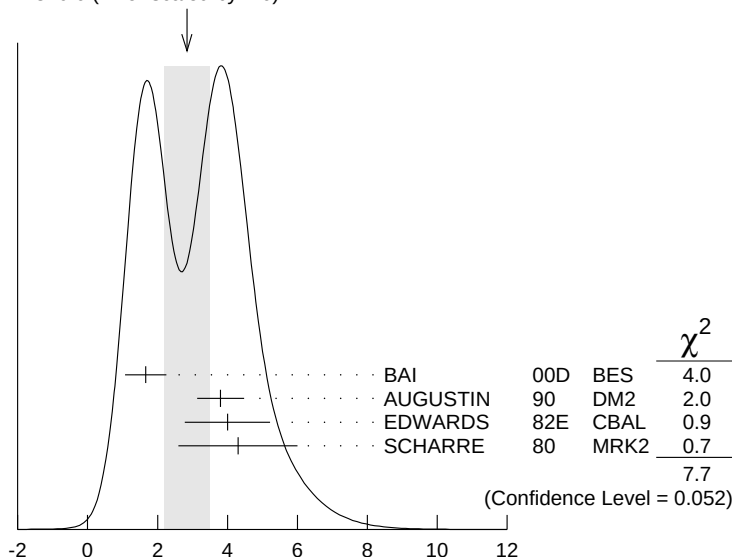
NODE=M070R89;LINKAGE=K9

NODE=M070R89;LINKAGE=J

NODE=M070R89;LINKAGE=K8

NODE=M070R89;LINKAGE=D

NODE=M070R89;LINKAGE=E

WEIGHTED AVERAGE
 2.8 ± 0.6 (Error scaled by 1.6) $\Gamma(\gamma\eta(1405/1475) \rightarrow \gamma K \bar{K} \pi)/\Gamma_{\text{total}}$ (units 10^{-3})

$\Gamma(\gamma\eta(1405/1475) \rightarrow \gamma\gamma\rho^0)/\Gamma_{\text{total}}$ Γ_{143}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
0.78±0.20 OUR AVERAGE	Error includes scale factor of 1.8.		
1.07±0.17±0.11	¹ BAI	04J BES2	$J/\psi \rightarrow \gamma\gamma\pi^+\pi^-$
0.64±0.12±0.07	¹ COFFMAN	90 MRK3	$J/\psi \rightarrow \gamma\gamma\pi^+\pi^-$

¹ Includes unknown branching fraction $\eta(1405) \rightarrow \gamma\rho^0$.NODE=M070S30
NODE=M070S30

NODE=M070S30;LINKAGE=C

 $\Gamma(\gamma\eta(1405/1475) \rightarrow \gamma\eta\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{144}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
3.0 ±0.5 OUR AVERAGE				
2.6 ±0.7 ±0.4		BAI	99 BES	$J/\psi \rightarrow \gamma\eta\pi^+\pi^-$
3.38±0.33±0.64		¹ BOLTON	92B MRK3	$J/\psi \rightarrow \gamma\eta\pi^+\pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
7.0 ±0.6 ±1.1	261	² AUGUSTIN	90 DM2	$J/\psi \rightarrow \gamma\eta\pi^+\pi^-$

¹ Via $a_0(980)\pi$.² Includes unknown branching fraction to $\eta\pi^+\pi^-$.NODE=M070S29
NODE=M070S29NODE=M070S29;LINKAGE=RR
NODE=M070S29;LINKAGE=R $\Gamma(\gamma\eta(1405/1475) \rightarrow \gamma\gamma\phi)/\Gamma_{\text{total}}$ Γ_{145}/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_{146}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
4.5 ±0.8 OUR AVERAGE				
4.7 ±0.3 ±0.9		¹ BALTRUSAIT..86B	MRK3	$J/\psi \rightarrow 4\pi\gamma$
3.75±1.05±1.20		² BURKE	82 MRK2	$J/\psi \rightarrow 4\pi\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.09	90	³ BISELLO	89B	$J/\psi \rightarrow 4\pi\gamma$

¹ 4π mass less than 2.0 GeV.² 4π mass less than 2.0 GeV. We have multiplied $2\rho^0$ measurement by 3 to obtain 2ρ .³ 4π mass in the range 2.0–25 GeV.NODE=M070R94
NODE=M070R94NODE=M070R94;LINKAGE=N
NODE=M070R94;LINKAGE=M
NODE=M070R94;LINKAGE=A $\Gamma(\gamma\rho\omega)/\Gamma_{\text{total}}$ Γ_{147}/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_{148}/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_{149}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
5.15±0.16 OUR AVERAGE		Error includes scale factor of 1.2.		
4.82±0.23±0.08		¹ ABLIKIM	11 BES3	$J/\psi \rightarrow \eta'\gamma$
5.24±0.12±0.11		PEDLAR	09 CLE3	$J/\psi \rightarrow \eta'\gamma$
5.55±0.44	35k	ABLIKIM	06E BES2	$J/\psi \rightarrow \eta'\gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

4.50±0.14±0.53		BOLTON	92B MRK3	$J/\psi \rightarrow \gamma\pi^+\pi^-\eta, \eta \rightarrow \gamma\gamma$
4.30±0.31±0.71		BOLTON	92B MRK3	$J/\psi \rightarrow \gamma\pi^+\pi^-\eta, \eta \rightarrow \pi^+\pi^-\pi^0$
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 $B(\eta'(958) \rightarrow \pi^+\pi^-\eta) = (42.9 \pm 0.7) \times 10^{-2}$, $B(\eta \rightarrow 2\gamma) = (39.41 \pm 0.20) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best values.

NODE=M070R84
NODE=M070R84

OCCUR=2

OCCUR=2

NODE=M070R84;LINKAGE=AB

$\Gamma(\gamma 2\pi^+ 2\pi^-)/\Gamma_{\text{total}}$
VALUE (units 10^{-3})

DOCUMENT ID

TECN

COMMENT

2.8 ± 0.5 OUR AVERAGE Error includes scale factor of 1.9. See the ideogram below.

4.32 ± 0.14 ± 0.73

¹ BISELLO 89B DM2 $J/\psi \rightarrow 4\pi\gamma$

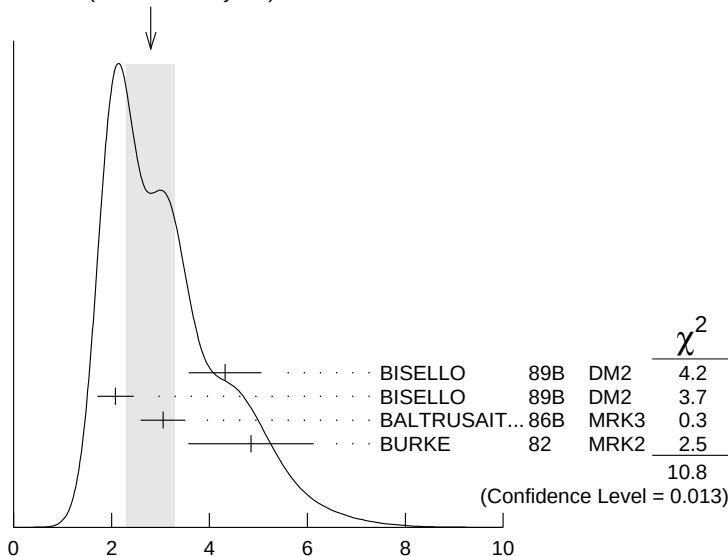
2.08 ± 0.13 ± 0.35

² BISELLO 89B DM2 $J/\psi \rightarrow 4\pi\gamma$

3.05 ± 0.08 ± 0.45

² BALTRUSAIT...86B MRK3 $J/\psi \rightarrow 4\pi\gamma$

4.85 ± 0.45 ± 1.20

³ BURKE 82 MRK2 e^+e^- ¹ 4π mass less than 3.0 GeV.² 4π mass less than 2.0 GeV.³ 4π mass less than 2.5 GeV.WEIGHTED AVERAGE
2.8 ± 0.5 (Error scaled by 1.9)
 $\Gamma(\gamma 2\pi^+ 2\pi^-)/\Gamma_{\text{total}}$ (units 10^{-3})

 $\Gamma(\gamma f_2(1270) f_2(1270))/\Gamma_{\text{total}}$
VALUE (units 10^{-4})

EVTS

DOCUMENT ID

TECN

COMMENT

9.5 ± 0.7 ± 1.6 646 ± 45 ABLIKIM 04M BES $J/\psi \rightarrow \gamma 2\pi^+ 2\pi^-$
 $\Gamma(\gamma f_2(1270) f_2(1270) (\text{non resonant}))/\Gamma_{\text{total}}$
VALUE (units 10^{-4})

DOCUMENT ID

TECN

COMMENT

8.2 ± 0.8 ± 1.7 ¹ ABLIKIM 04M BES $J/\psi \rightarrow \gamma 2\pi^+ 2\pi^-$
¹ Subtracting contribution from intermediate $\eta_c(1S)$ decays.
 $\Gamma(\gamma K^+ K^- \pi^+ \pi^-)/\Gamma_{\text{total}}$
VALUE (units 10^{-3})

EVTS

DOCUMENT ID

TECN

COMMENT

2.1 ± 0.1 ± 0.6 1516 BAI 00B BES $J/\psi \rightarrow \gamma K^+ K^0 \pi^+ \pi^-$
 $\Gamma(\gamma f_4(2050))/\Gamma_{\text{total}}$
VALUE (units 10^{-3})

DOCUMENT ID

TECN

COMMENT

2.7 ± 0.5 ± 0.5 ¹ BALTRUSAIT...87 MRK3 $J/\psi \rightarrow \gamma \pi^+ \pi^-$
¹ Assuming branching fraction $f_4(2050) \rightarrow \pi\pi/\text{total} = 0.167$.
 $\Gamma(\gamma \omega \omega)/\Gamma_{\text{total}}$
VALUE (units 10^{-3})

EVTS

DOCUMENT ID

TECN

COMMENT

1.61 ± 0.33 OUR AVERAGE

6.0 ± 4.8 ± 1.8

ABLIKIM 08A BES2 $J/\psi \rightarrow \gamma \omega \pi^+ \pi^-$

1.41 ± 0.2 ± 0.42 120 ± 17

BISELLO 87 SPEC e^+e^- , hadrons γ

1.76 ± 0.09 ± 0.45

BALTRUSAIT...85C MRK3 $e^+e^- \rightarrow \text{hadrons } \gamma$
 Γ_{150}/Γ

 NODE=M070R95
 NODE=M070R95

OCCUR=2

 NODE=M070R95;LINKAGE=A
 NODE=M070R95;LINKAGE=B
 NODE=M070R95;LINKAGE=M

 Γ_{151}/Γ

 NODE=M070S45
 NODE=M070S45

 Γ_{152}/Γ

 NODE=M070S46
 NODE=M070S46

NODE=M070S46;LINKAGE=AB

 Γ_{153}/Γ

 NODE=M070B05
 NODE=M070B05

 Γ_{154}/Γ

 NODE=M070S7
 NODE=M070S7

NODE=M070S7;LINKAGE=V

 Γ_{155}/Γ

 NODE=M070R97
 NODE=M070R97

$\Gamma(\gamma\eta(1405/1475) \rightarrow \gamma\rho^0\rho^0)/\Gamma_{\text{total}}$ Γ_{156}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
1.7 $\pm$ 0.4 OUR AVERAGE	Error includes scale factor of 1.3.		
2.1 $\pm$ 0.4	BUGG	95 MRK3	$J/\psi \rightarrow \gamma\pi^+\pi^-\pi^+\pi^-$
1.36 $\pm$ 0.38	1,2 BISELLO	89B DM2	$J/\psi \rightarrow 4\pi\gamma$

¹ Estimated by us from various fits.² Includes unknown branching fraction to $\rho^0\rho^0$.

NODE=M070S19
 NODE=M070S19

NODE=M070S19;LINKAGE=A
 NODE=M070S19;LINKAGE=B

 $\Gamma(\gamma f_2(1270))/\Gamma_{\text{total}}$ Γ_{157}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.43 $\pm$ 0.11 OUR AVERAGE				
1.62 $\pm$ 0.26 $^{+0.02}_{-0.05}$		1 ABLIKIM	06V BES2	$e^+e^- \rightarrow J/\psi \rightarrow \gamma\pi^+\pi^-$
1.42 $\pm$ 0.21 $^{+0.02}_{-0.04}$		2 ABLIKIM	06V BES2	$e^+e^- \rightarrow J/\psi \rightarrow \gamma\pi^0\pi^0$
1.33 $\pm$ 0.05 $\pm$ 0.20		3 AUGUSTIN	87 DM2	$J/\psi \rightarrow \gamma\pi^+\pi^-$
1.36 $\pm$ 0.09 $\pm$ 0.23		3 BALTRUSAIT..87	MRK3	$J/\psi \rightarrow \gamma\pi^+\pi^-$
1.48 $\pm$ 0.25 $\pm$ 0.30	178	EDWARDS	82B CBAL	$e^+e^- \rightarrow 2\pi^0\gamma$
2.0 $\pm$ 0.7	35	ALEXANDER	78 PLUT	e^+e^-
1.2 $\pm$ 0.6	30	4 BRANDELIK	78B DASP	$e^+e^- \rightarrow \pi^+\pi^-\gamma$

NODE=M070R86
 NODE=M070R86

OCCUR=2

¹ ABLIKIM 06V reports $[\Gamma(J/\psi(1S) \rightarrow \gamma f_2(1270))/\Gamma_{\text{total}}] \times [B(f_2(1270) \rightarrow \pi\pi)] = (1.371 \pm 0.010 \pm 0.222) \times 10^{-3}$ which we divide by our best value $B(f_2(1270) \rightarrow \pi\pi) = (84.8^{+2.4}_{-1.2}) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² ABLIKIM 06V reports $[\Gamma(J/\psi(1S) \rightarrow \gamma f_2(1270))/\Gamma_{\text{total}}] \times [B(f_2(1270) \rightarrow \pi\pi)] = (1.200 \pm 0.027 \pm 0.174) \times 10^{-3}$ which we divide by our best value $B(f_2(1270) \rightarrow \pi\pi) = (84.8^{+2.4}_{-1.2}) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

³ Estimated using $B(f_2(1270) \rightarrow \pi\pi) = 0.843 \pm 0.012$. The errors do not contain the uncertainty in the $f_2(1270)$ decay.

⁴ Restated by us to take account of spread of E1, M2, E3 transitions.

NODE=M070R86;LINKAGE=AI

NODE=M070R86;LINKAGE=AL

NODE=M070R86;LINKAGE=X

NODE=M070R86;LINKAGE=T

 $\Gamma(\gamma f_0(1710) \rightarrow \gamma K\bar{K})/\Gamma_{\text{total}}$ Γ_{158}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
8.5 $\pm$ 1.2 OUR AVERAGE		Error includes scale factor of 1.2.		
9.62 $\pm$ 0.29 $^{+3.51}_{-1.86}$		1 BAI	03G BES	$J/\psi \rightarrow \gamma K\bar{K}$
5.0 $\pm$ 0.8 $^{+1.8}_{-0.4}$		2,3 BAI	96C BES	$J/\psi \rightarrow \gamma K^+K^-$
9.2 $\pm$ 1.4 $\pm$ 1.4		3 AUGUSTIN	88 DM2	$J/\psi \rightarrow \gamma K^+K^-$
10.4 $\pm$ 1.2 $\pm$ 1.6		3 AUGUSTIN	88 DM2	$J/\psi \rightarrow \gamma K_S^0 K_S^0$
9.6 $\pm$ 1.2 $\pm$ 1.8		3 BALTRUSAIT..87	MRK3	$J/\psi \rightarrow \gamma K^+K^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1.6 $\pm$ 0.2 $^{+0.6}_{-0.2}$		3,4 BAI	96C BES	$J/\psi \rightarrow \gamma K^+K^-$
< 0.8	90	5 BISELLO	89B	$J/\psi \rightarrow 4\pi\gamma$
1.6 $\pm$ 0.4 $\pm$ 0.3		6 BALTRUSAIT..87	MRK3	$J/\psi \rightarrow \gamma\pi^+\pi^-$
3.8 $\pm$ 1.6		7 EDWARDS	82D CBAL	$e^+e^- \rightarrow \eta\eta\gamma$

¹ Includes unknown branching ratio to K^+K^- or $K_S^0 K_S^0$.

² Assuming $J^P = 2^+$ for $f_0(1710)$.

³ Includes unknown branching fraction to K^+K^- or $K_S^0 K_S^0$. We have multiplied K^+K^- measurement by 2, and $K_S^0 K_S^0$ by 4 to obtain $K\bar{K}$ result.

⁴ Assuming $J^P = 0^+$ for $f_0(1710)$.

⁵ Includes unknown branching fraction to $\rho^0\rho^0$.

⁶ Includes unknown branching fraction to $\pi^+\pi^-$.

⁷ Includes unknown branching fraction to $\eta\eta$.

NODE=M070R91
 NODE=M070R91

OCCUR=2

OCCUR=2

OCCUR=2

NODE=M070R91;LINKAGE=K9
 NODE=M070R91;LINKAGE=A1
 NODE=M070R91;LINKAGE=B

NODE=M070R91;LINKAGE=A2
 NODE=M070R91;LINKAGE=C
 NODE=M070R91;LINKAGE=Z
 NODE=M070R91;LINKAGE=A

 $\Gamma(\gamma f_0(1710) \rightarrow \gamma\pi\pi)/\Gamma_{\text{total}}$ Γ_{159}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
4.0 $\pm$ 1.0 OUR AVERAGE			
3.96 $\pm$ 0.06 $\pm$ 1.12	1 ABLIKIM	06V BES2	$e^+e^- \rightarrow J/\psi \rightarrow \gamma\pi^+\pi^-$
3.99 $\pm$ 0.15 $\pm$ 2.64	1 ABLIKIM	06V BES2	$e^+e^- \rightarrow J/\psi \rightarrow \gamma\pi^0\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
2.5 $\pm$ 1.6 $\pm$ 0.8	BAI	98H BES	$J/\psi \rightarrow \gamma\pi^0\pi^0$

¹ Including unknown branching fraction to $\pi\pi$.

NODE=M070B01
 NODE=M070B01

OCCUR=2

NODE=M070B01;LINKAGE=AB

$\Gamma(\gamma f_0(1710) \rightarrow \gamma \omega \omega) / \Gamma_{\text{total}}$ Γ_{160} / Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$0.31 \pm 0.06 \pm 0.08$	180	ABLIKIM	06H BES	$J/\psi \rightarrow \gamma \omega \omega$

NODE=M070R01
 NODE=M070R01

 $\Gamma(\gamma \eta) / \Gamma_{\text{total}}$ Γ_{161} / Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.104 ± 0.034 OUR AVERAGE				
$1.101 \pm 0.029 \pm 0.022$		PEDLAR	09 CLE3	$J/\psi \rightarrow \eta \gamma$
1.123 ± 0.089	11k	ABLIKIM	06E BES2	$J/\psi \rightarrow \eta \gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$0.88 \pm 0.08 \pm 0.11$		BLOOM	83 CBAL	$e^+ e^-$
0.82 ± 0.10		BRANDELIK	79C DASP	$e^+ e^-$
1.3 ± 0.4	21	BARTEL	77 CNTR	$e^+ e^-$

NODE=M070R83
 NODE=M070R83

 $\Gamma(\gamma f_1(1420) \rightarrow \gamma K \bar{K} \pi) / \Gamma_{\text{total}}$ Γ_{162} / Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
0.79 ± 0.13 OUR AVERAGE			
$0.68 \pm 0.04 \pm 0.24$	BAI	00D BES	$J/\psi \rightarrow \gamma K^\pm K_S^0 \pi^\mp$
$0.76 \pm 0.15 \pm 0.21$	^{1,2} AUGUSTIN	92 DM2	$J/\psi \rightarrow \gamma K \bar{K} \pi$
$0.87 \pm 0.14^{+0.14}_{-0.11}$	¹ BAI	90C MRK3	$J/\psi \rightarrow \gamma K_S^0 K^\pm \pi^\mp$

NODE=M070S31
 NODE=M070S31

OCCUR=2

¹ Included unknown branching fraction $f_1(1420) \rightarrow K \bar{K} \pi$.

² From fit to the $K^*(892) K 1^{++}$ partial wave.

NODE=M070S31;LINKAGE=A
 NODE=M070S31;LINKAGE=D

 $\Gamma(\gamma f_1(1285)) / \Gamma_{\text{total}}$ Γ_{163} / Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
0.61 ± 0.08 OUR AVERAGE			
$0.69 \pm 0.16 \pm 0.20$	¹ BAI	04J BES2	$J/\psi \rightarrow \gamma \gamma \rho^0$
$0.61 \pm 0.04 \pm 0.21$	² BAI	00D BES	$J/\psi \rightarrow \gamma K^\pm K_S^0 \pi^\mp$
$0.45 \pm 0.09 \pm 0.17$	³ BAI	99 BES	$J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$
$0.625 \pm 0.063 \pm 0.103$	⁴ BOLTON	92 MRK3	$J/\psi \rightarrow \gamma f_1(1285)$
$0.70 \pm 0.08 \pm 0.16$	⁵ BOLTON	92B MRK3	$J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$

NODE=M070R88
 NODE=M070R88

¹ Assuming $B(f_1(1285) \rightarrow \rho^0 \gamma) = 0.055 \pm 0.013$.

² Assuming $\Gamma(f_1(1285) \rightarrow K \bar{K} \pi) / \Gamma_{\text{total}} = 0.090 \pm 0.004$.

³ Assuming $\Gamma(f_1(1285) \rightarrow \eta \pi \pi) / \Gamma_{\text{total}} = 0.5 \pm 0.18$.

⁴ Obtained summing the sequential decay channels

$B(J/\psi \rightarrow \gamma f_1(1285), f_1(1285) \rightarrow \pi \pi \pi \pi) = (1.44 \pm 0.39 \pm 0.27) \times 10^{-4}$;
 $B(J/\psi \rightarrow \gamma f_1(1285), f_1(1285) \rightarrow a_0(980) \pi, a_0(980) \rightarrow \eta \pi) = (3.90 \pm 0.42 \pm 0.87) \times 10^{-4}$;

$B(J/\psi \rightarrow \gamma f_1(1285), f_1(1285) \rightarrow a_0(980) \pi, a_0(980) \rightarrow K \bar{K}) = (0.66 \pm 0.26 \pm 0.29) \times 10^{-4}$;

$B(J/\psi \rightarrow \gamma f_1(1285), f_1(1285) \rightarrow \gamma \rho^0) = (0.25 \pm 0.07 \pm 0.03) \times 10^{-4}$.

⁵ Using $B(f_1(1285) \rightarrow a_0(980) \pi) = 0.37$, and including unknown branching ratio for $a_0(980) \rightarrow \eta \pi$.

NODE=M070R88;LINKAGE=BI
 NODE=M070R88;LINKAGE=BD
 NODE=M070R88;LINKAGE=BA
 NODE=M070R88;LINKAGE=B

NODE=M070R88;LINKAGE=A

 $\Gamma(\gamma f_1(1510) \rightarrow \gamma \eta \pi^+ \pi^-) / \Gamma_{\text{total}}$ Γ_{164} / Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
$4.5 \pm 1.0 \pm 0.7$	BAI	99 BES	$J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$

NODE=M070S36
 NODE=M070S36

 $\Gamma(\gamma f'_2(1525)) / \Gamma_{\text{total}}$ Γ_{165} / Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$4.5^{+0.7}_{-0.4}$ OUR AVERAGE					
$3.85 \pm 0.17^{+1.91}_{-0.73}$			¹ BAI	03G BES	$J/\psi \rightarrow \gamma K \bar{K}$
$3.6 \pm 0.4^{+1.4}_{-0.4}$			¹ BAI	96C BES	$J/\psi \rightarrow \gamma K^+ K^-$
$5.6 \pm 1.4 \pm 0.9$			¹ AUGUSTIN	88 DM2	$J/\psi \rightarrow \gamma K^+ K^-$
$4.5 \pm 0.4 \pm 0.9$			¹ AUGUSTIN	88 DM2	$J/\psi \rightarrow \gamma K_S^0 K_S^0$
$6.8 \pm 1.6 \pm 1.4$			¹ BALTRUSAIT..87	MRK3	$J/\psi \rightarrow \gamma K^+ K^-$

NODE=M070R87
 NODE=M070R87

OCCUR=3

OCCUR=4

OCCUR=2

• • • We do not use the following data for averages, fits, limits, etc. • • •

<3.4 90 4 ² BRANDELIK 79C DASP $e^+ e^- \rightarrow \pi^+ \pi^- \gamma$

<2.3 90 3 ALEXANDER 78 PLUT $e^+ e^- \rightarrow K^+ K^- \gamma$

¹ Using $B(f'_2(1525) \rightarrow K \bar{K}) = 0.888$.

² Assuming isotropic production and decay of the $f'_2(1525)$ and isospin.

NODE=M070R87;LINKAGE=A1
 NODE=M070R87;LINKAGE=I

$\Gamma(\gamma f_2(1640) \rightarrow \gamma \omega \omega) / \Gamma_{\text{total}}$ Γ_{166} / 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_{167} / 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_{168} / Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.5 ± 0.6 OUR AVERAGE				
$2.00 \pm 0.08^{+1.38}_{-1.64}$	1.3k	ABLIKIM	13J BES3	$J/\psi \rightarrow \gamma \omega \phi$
$2.61 \pm 0.27 \pm 0.65$	95	ABLIKIM	06J BES2	$J/\psi \rightarrow \gamma \omega \phi$

NODE=M070S79
 NODE=M070S79

 $\Gamma(\gamma f_2(1950) \rightarrow \gamma K^*(892) \bar{K}^*(892)) / \Gamma_{\text{total}}$ Γ_{169} / 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_{170} / Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$4.0 \pm 0.3 \pm 1.3$	320	¹ BAI	00B BES	$J/\psi \rightarrow \gamma K^+ K^0 \pi^+ \pi^-$

¹ Summed over all charges.

NODE=M070B07
 NODE=M070B07

NODE=M070R;LINKAGE=B7

 $\Gamma(\gamma \phi \phi) / \Gamma_{\text{total}}$ Γ_{171} / Γ

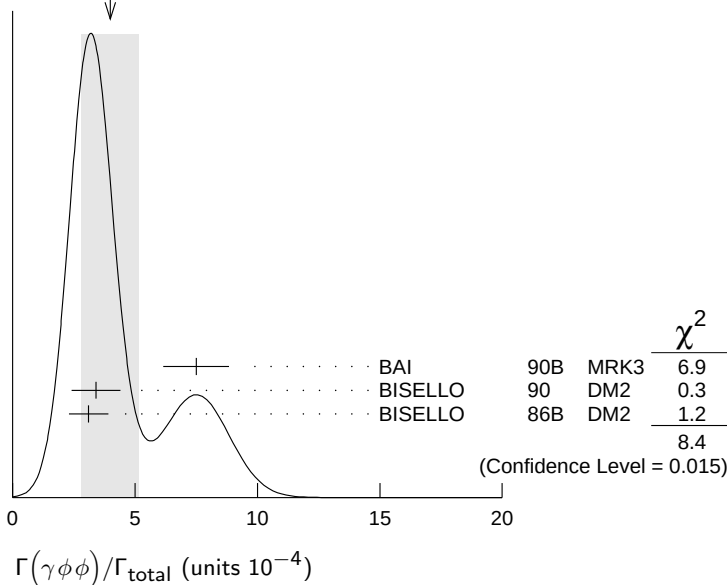
VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
4.0 ± 1.2 OUR AVERAGE				Error includes scale factor of 2.1. See the ideogram below.
$7.5 \pm 0.6 \pm 1.2$	168	BAI	90B MRK3	$J/\psi \rightarrow \gamma 4K$
$3.4 \pm 0.8 \pm 0.6$	33 ± 7	¹ BISELLO	90 DM2	$J/\psi \rightarrow \gamma K^+ K^- K_S^0 K_L^0$
$3.1 \pm 0.7 \pm 0.4$		¹ BISELLO	86B DM2	$J/\psi \rightarrow \gamma K^+ K^- K^+ K^-$

¹ $\phi \phi$ mass less than 2.9 GeV, η_c excluded.

NODE=M070R98
 NODE=M070R98

NODE=M070R98;LINKAGE=C

WEIGHTED AVERAGE
 4.0 ± 1.2 (Error scaled by 2.1)

 $\Gamma(\gamma \rho \rho) / \Gamma_{\text{total}}$ Γ_{172} / Γ

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$0.38 \pm 0.07 \pm 0.07$		49	EATON	84 MRK2	$e^+ e^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 0.11	90	PERUZZI	78 MRK1	$e^+ e^-$

NODE=M070R90
 NODE=M070R90

$\Gamma(\gamma\eta(2225))/\Gamma_{\text{total}}$ Γ_{173}/Γ VALUE (units 10^{-3}) EVTS**0.33±0.05 OUR AVERAGE**

0.44±0.04±0.08 196 ± 19

0.33±0.08±0.05

0.27±0.06±0.06

0.24^{+0.15}_{-0.10}

DOCUMENT ID TECN COMMENT

1 ABLIKIM 08I BES $J/\psi \rightarrow \gamma K^+ K^- K_S^0 K_L^0$ 1 BAI 90B MRK3 $J/\psi \rightarrow \gamma K^+ K^- K^+ K^-$ 1 BAI 90B MRK3 $J/\psi \rightarrow \gamma K^+ K^- K_S^0 K_L^0$ 2,3 BISELLO 89B DM2 $J/\psi \rightarrow 4\pi\gamma$ ¹ Includes unknown branching fraction to $\phi\phi$.² Estimated by us from various fits.³ Includes unknown branching fraction to $\rho^0\rho^0$.NODE=M070S21
NODE=M070S21

OCCUR=2

NODE=M070S21;LINKAGE=U
NODE=M070S21;LINKAGE=A
NODE=M070S21;LINKAGE=B $\Gamma(\gamma\eta(1760) \rightarrow \gamma\rho^0\rho^0)/\Gamma_{\text{total}}$ Γ_{174}/Γ VALUE (units 10^{-3})**0.13±0.09**DOCUMENT ID TECN COMMENT
1,2 BISELLO 89B DM2 $J/\psi \rightarrow 4\pi\gamma$ ¹ Estimated by us from various fits.² Includes unknown branching fraction to $\rho^0\rho^0$.NODE=M070S20
NODE=M070S20NODE=M070S20;LINKAGE=A
NODE=M070S20;LINKAGE=B $\Gamma(\gamma\eta(1760) \rightarrow \gamma\omega\omega)/\Gamma_{\text{total}}$ Γ_{175}/Γ VALUE (units 10^{-3})**1.98±0.08±0.32**EVTS DOCUMENT ID TECN COMMENT
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_{176}/Γ VALUE (units 10^{-4}) EVTS**2.6 ±0.4 OUR AVERAGE**2.87±0.09^{+0.49}_{-0.52} 4265 1 ABLIKIM 11C BES3 $J/\psi \rightarrow \gamma\pi^+\pi^-\eta'$ 2.2 ±0.4 ±0.4 264 ABLIKIM 05R BES2 $J/\psi \rightarrow \gamma\pi^+\pi^-\eta'$ ¹ From a fit of the $\pi^+\pi^-\eta'$ mass distribution to a combination of $\gamma f_1(1510)$, $\gamma X(1835)$, and two unconfirmed states $\gamma X(2120)$, and $\gamma X(2370)$, for $M(p\bar{p}) < 2.8$ GeV, and accounting for backgrounds from non- η' events and $J/\psi \rightarrow \pi^0\pi^+\pi^-\eta'$.NODE=M070R78
NODE=M070R78

NODE=M070R78;LINKAGE=AI

 $\Gamma(\gamma X(1835) \rightarrow \gamma p\bar{p})/\Gamma_{\text{total}}$ Γ_{177}/Γ VALUE (units 10^{-4})**0.77^{+0.15}_{-0.09} OUR AVERAGE**0.90^{+0.04+0.27}_{-0.11-0.55} 1 ABLIKIM 12D BES3 $J/\psi \rightarrow \gamma p\bar{p}$ 1.14^{+0.43+0.42}_{-0.30-0.26} 231 2 ALEXANDER 10 CLEO $J/\psi \rightarrow \gamma p\bar{p}$ 0.70±0.04^{+0.19}_{-0.08} BAI 03F BES2 $J/\psi \rightarrow \gamma p\bar{p}$ ¹ From the fit including final state interaction effects in isospin 0 S-wave according to SIBIRTSEV 05A.² From a fit of the $p\bar{p}$ mass distribution to a combination of $\gamma X(1835)$, γR with $M(R) = 2100$ MeV and $\Gamma(R) = 160$ MeV, and $\gamma p\bar{p}$ phase space, for $M(p\bar{p}) < 2.85$ GeV.NODE=M070S71
NODE=M070S71

NODE=M070S71;LINKAGE=AK

NODE=M070S71;LINKAGE=AL

 $\Gamma(\gamma X(1840) \rightarrow \gamma 3(\pi^+\pi^-))/\Gamma_{\text{total}}$ Γ_{178}/Γ VALUE (units 10^{-5})**2.44±0.36^{+0.60}_{-0.74}**EVTS DOCUMENT ID TECN COMMENT
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_{179}/Γ VALUE (units 10^{-3})**0.7 ±0.4 OUR AVERAGE** Error includes scale factor of 2.1.0.58±0.03±0.20 1 BAI 00D BES $J/\psi \rightarrow \gamma K^\pm K_S^0 \pi^\mp$ 2.1 ±0.1 ±0.7 2 BAI 00D BES $J/\psi \rightarrow \gamma K^\pm K_S^0 \pi^\mp$ ¹ For a broad structure around 1800 MeV.² For a broad structure around 2040 MeV.NODE=M070S38
NODE=M070S38

OCCUR=2

NODE=M070S38;LINKAGE=BD
NODE=M070S38;LINKAGE=BE $\Gamma(\gamma\pi^0)/\Gamma_{\text{total}}$ Γ_{180}/Γ VALUE (units 10^{-5})**3.49^{+0.33}_{-0.30} OUR AVERAGE**3.63±0.36±0.13 PEDLAR 09 CLE3 $J/\psi \rightarrow \pi^0\gamma$ 3.13^{+0.65}_{-0.47} 586 ABLIKIM 06E BES2 $J/\psi \rightarrow \pi^0\gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

3.6 ±1.1 ±0.7 BLOOM 83 CBAL e^+e^- 7.3 ±4.7 10 BRANDELIK 79C DASP e^+e^- NODE=M070R82
NODE=M070R82

$\Gamma(\gamma p \bar{p} \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{181}/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_{182}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<0.13	90	HENRARD	87	DM2 $e^+ e^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.16	90	BAI	98G	BES $e^+ e^-$

NODE=M070S8
 NODE=M070S8

 $\Gamma(\gamma f_0(2200))/\Gamma_{\text{total}}$ Γ_{183}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
1.5	¹ AUGUSTIN	88	DM2 $J/\psi \rightarrow \gamma K_S^0 K_S^0$
¹ Includes unknown branching fraction to $K_S^0 K_S^0$.			

NODE=M070S18
 NODE=M070S18

NODE=M070S18;LINKAGE=A

 $\Gamma(\gamma f_J(2220))/\Gamma_{\text{total}}$ Γ_{184}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
>250	99.9		¹ HASAN	96	SPEC $\bar{p} p \rightarrow \pi^+ \pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
>300			² BAI	96B	BES $e^+ e^- \rightarrow \gamma \bar{p} p, K \bar{K}$
< 2.3	95		³ AUGUSTIN	88	DM2 $J/\psi \rightarrow \gamma K^+ K^-$
< 1.6	95		³ AUGUSTIN	88	DM2 $J/\psi \rightarrow \gamma K_S^0 K_S^0$
$12.4^{+6.4}_{-5.2} \pm 2.8$		23	³ BALTRUSAIT...86D	MRK3	$J/\psi \rightarrow \gamma K_S^0 K_S^0$
$8.4^{+3.4}_{-2.8} \pm 1.6$		93	³ BALTRUSAIT...86D	MRK3	$J/\psi \rightarrow \gamma K^+ K^-$
¹ Using BAI 96B.					
² Using BARNES 93.					
³ Includes unknown branching fraction to $K^+ K^-$ or $K_S^0 K_S^0$.					

NODE=M070R92
 NODE=M070R92

OCCUR=2

OCCUR=2

NODE=M070R92;LINKAGE=M
 NODE=M070R92;LINKAGE=A
 NODE=M070R92;LINKAGE=W

 $\Gamma(\gamma f_J(2220) \rightarrow \gamma \pi \pi)/\Gamma_{\text{total}}$ Γ_{185}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
$0.84 \pm 0.26 \pm 0.30$	BAI	96B	BES $e^+ e^- \rightarrow J/\psi \rightarrow \gamma \pi^+ \pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$1.4 \pm 0.8 \pm 0.4$	BAI	98H	BES $J/\psi \rightarrow \gamma \pi^0 \pi^0$

NODE=M070B02
 NODE=M070B02

 $\Gamma(\gamma f_J(2220) \rightarrow \gamma K \bar{K})/\Gamma_{\text{total}}$ Γ_{186}/Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
< 3.6	¹ DEL-AMO-SA..100	BABR	$e^+ e^- \rightarrow J/\psi \rightarrow \gamma K^+ K^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
< 2.9	¹ DEL-AMO-SA..100	BABR	$e^+ e^- \rightarrow J/\psi \rightarrow \gamma K_S^0 K_S^0$
$6.6 \pm 2.9 \pm 2.4$	BAI	96B	BES $e^+ e^- \rightarrow J/\psi \rightarrow \gamma K^+ K^-$
$10.8 \pm 4.0 \pm 3.2$	BAI	96B	BES $e^+ e^- \rightarrow J/\psi \rightarrow \gamma K_S^0 K_S^0$
¹ For spin 2 and helicity 0; other combinations lead to more stringent upper limits.			

NODE=M070B03
 NODE=M070B03

OCCUR=2

OCCUR=2

NODE=M070B03;LINKAGE=DE

 $\Gamma(\gamma f_J(2220) \rightarrow \gamma p \bar{p})/\Gamma_{\text{total}}$ Γ_{187}/Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
$1.5 \pm 0.6 \pm 0.5$	BAI	96B	BES $e^+ e^- \rightarrow J/\psi \rightarrow \gamma p \bar{p}$

NODE=M070B04
 NODE=M070B04

 $\Gamma(\gamma f_0(1500))/\Gamma_{\text{total}}$ Γ_{188}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
1.01 ± 0.32 OUR AVERAGE			
$1.00 \pm 0.03 \pm 0.45$	¹ ABLIKIM	06v	BES2 $e^+ e^- \rightarrow J/\psi \rightarrow \gamma \pi^+ \pi^-$
$1.02 \pm 0.09 \pm 0.45$	¹ ABLIKIM	06v	BES2 $e^+ e^- \rightarrow J/\psi \rightarrow \gamma \pi^0 \pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$>5.7 \pm 0.8$	^{2,3} BUGG	95	MRK3 $J/\psi \rightarrow \gamma \pi^+ \pi^- \pi^+ \pi^-$
¹ Including unknown branching fraction to $\pi \pi$.			
² Including unknown branching ratio for $f_0(1500) \rightarrow \pi^+ \pi^- \pi^+ \pi^-$.			
³ Assuming that $f_0(1500)$ decays only to two S-wave dipions.			

NODE=M070S32
 NODE=M070S32

OCCUR=2

NODE=M070S32;LINKAGE=AB
 NODE=M070S32;LINKAGE=A
 NODE=M070S32;LINKAGE=B

$\Gamma(\gamma A \rightarrow \gamma \text{invisible})/\Gamma_{\text{total}}$
(narrow state A with $m_A < 960$ MeV)

 Γ_{189}/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_{190}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<2.1	90	¹ ABLIKIM	12	BES3 $J/\psi \rightarrow \gamma \mu^+ \mu^-$

¹ For a narrow scalar or pseudoscalar, A^0 , with a mass in the range 0.21–3.00 GeV. The measured 90% CL limit as a function of m_{A^0} ranges from 4×10^{-7} to 2.1×10^{-5} .

NODE=M070S76
NODE=M070S76

NODE=M070S76;LINKAGE=AB

WEAK DECAYS

$\Gamma(D^- e^+ \nu_e + \text{c.c.})/\Gamma_{\text{total}}$

 Γ_{191}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<1.2	90	ABLIKIM	06M	BES2 $e^+e^- \rightarrow J/\psi$

NODE=M070S53
NODE=M070S53

$\Gamma(\bar{D}^0 e^+ e^- + \text{c.c.})/\Gamma_{\text{total}}$

 Γ_{192}/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_{193}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<3.6	90	¹ ABLIKIM	06M	BES2 $e^+e^- \rightarrow J/\psi$

¹ Using $B(D_s^- \rightarrow \phi \pi^-) = 4.4 \pm 0.5 \%$.

NODE=M070S55
NODE=M070S55

NODE=M070S55;LINKAGE=AB

$\Gamma(D^- \pi^+ + \text{c.c.})/\Gamma_{\text{total}}$

 Γ_{194}/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_{195}/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

$\Gamma(D_s^- \pi^+ + \text{c.c.})/\Gamma_{\text{total}}$

 Γ_{196}/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

$\Gamma(\gamma\gamma)/\Gamma_{\text{total}}$

 Γ_{197}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
< 0.5	90	ADAMS	08	CLEO $\psi(2S) \rightarrow \pi^+\pi^- J/\psi$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<16	90	¹ WICHT	08	BELL $B^\pm \rightarrow K^\pm \gamma\gamma$
< 2.2	90	ABLIKIM	07J	BES2 $\psi(2S) \rightarrow J/\psi \pi^+ \pi^-$
<50	90	BARTEL	77	CNTR e^+e^-

¹ WICHT 08 reports $[\Gamma(J/\psi(1S) \rightarrow \gamma\gamma)/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow J/\psi(1S) K^+)] < 0.16 \times 10^{-6}$ which we divide by our best value $B(B^+ \rightarrow J/\psi(1S) K^+) = 1.027 \times 10^{-3}$.

NODE=M070R80
NODE=M070R80

NODE=M070R80;LINKAGE=WI

LEPTON FAMILY NUMBER (LF) VIOLATING MODES

$\Gamma(e^\pm \mu^\mp)/\Gamma_{\text{total}}$

 Γ_{198}/Γ

VALUE (units 10^{-7})	CL%	DOCUMENT ID	TECN	COMMENT
< 1.6 (CL = 90%) [$< 1.1 \times 10^{-6}$ (CL = 90%) OUR 2013 BEST LIMIT]				
< 1.6	90	ABLIKIM	13L	BES3 $e^+e^- \rightarrow J/\psi$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<11	90	BAI	03D	BES $e^+e^- \rightarrow J/\psi$

NODE=M070315

NODE=M070S39
NODE=M070S39

$\Gamma(e^{\pm}\tau^{\mp})/\Gamma_{\text{total}}$

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<8.3	90	ABLIKIM	04	BES $e^+e^- \rightarrow J/\psi$

 Γ_{199}/Γ

NODE=M070S40
 NODE=M070S40

 $\Gamma(\mu^{\pm}\tau^{\mp})/\Gamma_{\text{total}}$

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<2.0	90	ABLIKIM	04	BES $e^+e^- \rightarrow J/\psi$

 Γ_{200}/Γ

NODE=M070S41
 NODE=M070S41

OTHER DECAYS

NODE=M070325

 $\Gamma(\text{invisible})/\Gamma(e^+e^-)$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<6.6 $\times 10^{-2}$	90	LEES	13I	BABR $B \rightarrow K^{(*)} J/\psi$

 Γ_{201}/Γ_5

NODE=M070S80
 NODE=M070S80

 $\Gamma(\text{invisible})/\Gamma(\mu^+\mu^-)$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<1.2 $\times 10^{-2}$	90	ABLIKIM	08G	BES2 $\psi(2S) \rightarrow \pi^+\pi^- J/\psi$

 Γ_{201}/Γ_7

NODE=M070S60
 NODE=M070S60

 $J/\psi(1S)$ REFERENCES

NODE=M070

AULCHENKO	14	PL B731 227	V.M. Aulchenko <i>et al.</i>	(KEDR Collab.)	REFID=55655
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	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
METREVELI	12	PR D85 092007	Z. Metreveli <i>et al.</i>	(NWES, FLOR, WAYN+)	REFID=54304
ABLIKIM	11	PR D83 012003	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=53646
ABLIKIM	11C	PRL 106 072002	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=53684
ABLIKIM	11D	PR D83 032003	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=16715
ABLIKIM	10C	PL B685 27	M. Ablikim <i>et al.</i>	(BES II Collab.)	REFID=53349
ABLIKIM	10E	PL B693 88	M. Ablikim <i>et al.</i>	(BES II Collab.)	REFID=53361
ALEXANDER	10	PR D82 092002	J.P. Alexander <i>et al.</i>	(CLEO Collab.)	REFID=53525
ANASHIN	10	PL B685 134	V.V. Anashin <i>et al.</i>	(KEDR Collab.)	REFID=53220
DEL-AMO-SA...	100	PRL 105 172001	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)	REFID=53533
INSLER	10	PR D81 091101	J. Insler <i>et al.</i>	(CLEO Collab.)	REFID=53359
ABLIKIM	09	PL B676 25	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52718
ABLIKIM	09B	PR D80 052004	M. Ablikim <i>et al.</i>	(BES II Collab.)	REFID=53099
MITCHELL	09	PRL 102 011801	R.E. Mitchell <i>et al.</i>	(CLEO Collab.)	REFID=52676
PEDLAR	09	PR D79 111101	T.K. Pedlar <i>et al.</i>	(CLEO Collab.)	REFID=52998
SHEN	09	PR D80 031101	C.P. Shen <i>et al.</i>	(BELLE Collab.)	REFID=53000
ABLIKIM	08	EPJ C53 15	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52047
ABLIKIM	08A	PR D77 012001	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52128
ABLIKIM	08C	PL B659 789	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52130
ABLIKIM	08E	PR D77 032005	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52143
ABLIKIM	08F	PRL 100 102003	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52154
ABLIKIM	08G	PRL 100 192001	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52253
ABLIKIM	08I	PL B662 330	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52255
ABLIKIM	08J	PL B663 297	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52256
ABLIKIM	08O	PR D78 092005	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52571
ADAMS	08	PRL 101 101801	G.S. Adams <i>et al.</i>	(CLEO Collab.)	REFID=52261
AUBERT	08S	PR D77 092002	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52242
BESSION	08	PR D78 032012	D. Besson <i>et al.</i>	(CLEO Collab.)	REFID=52685
PDG	08	PL B667 1	C. Amsler <i>et al.</i>	(PDG Collab.)	REFID=52166
WICHT	08	PL B662 323	J. Wicht <i>et al.</i>	(BELLE Collab.)	REFID=52204
ABLIKIM	07H	PR D76 092003	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52046
ABLIKIM	07J	PR D76 117101	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52072
ANDREOTTI	07	PL B654 74	M. Andreotti <i>et al.</i>	(Femilab E835 Collab.)	REFID=51944
AUBERT	07AK	PR D76 012008	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51908
AUBERT	07AU	PR D76 092005	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52049
Also		PR D77 119902E (err.)	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52266
AUBERT	07BD	PR D76 092006	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52050
ABLIKIM	06	PL B632 181	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50986
ABLIKIM	06C	PL B633 681	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51037
ABLIKIM	06E	PR D73 052008	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51057
ABLIKIM	06F	PR D73 052007	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51058
ABLIKIM	06H	PR D73 112007	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51125
ABLIKIM	06J	PRL 96 162002	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51127
ABLIKIM	06K	PRL 97 062001	M. Ablikim <i>et al.</i>	(BES II Collab.)	REFID=51128
ABLIKIM	06M	PL B639 418	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51130
ABLIKIM	06V	PL B642 441	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51507
ADAMS	06A	PR D73 051103	G.S. Adams <i>et al.</i>	(CLEO Collab.)	REFID=51036
AUBERT	06B	PR D73 012005	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51026
AUBERT	06D	PR D73 052003	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51047
AUBERT	06E	PRL 96 052002	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51059
AUBERT,BE	06D	PR D74 091103	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51511
WU	06	PRL 97 162003	C.-H. Wu <i>et al.</i>	(BELLE Collab.)	REFID=51472

ABLIKIM	05	PL B607 243	M. Ablikim <i>et al.</i>	(BES Collab.)	REF ID=50450
ABLIKIM	05B	PR D71 032003	M. Ablikim <i>et al.</i>	(BES Collab.)	REF ID=50450
ABLIKIM	05C	PL B610 192	M. Ablikim <i>et al.</i>	(BES Collab.)	REF ID=50450
ABLIKIM	05H	PR D72 012002	M. Ablikim <i>et al.</i>	(BES Collab.)	REF ID=50450
ABLIKIM	05R	PRL 95 262001	M. Ablikim <i>et al.</i>	(BES Collab.)	REF ID=50450
AUBERT	05D	PR D71 052001	B. Aubert <i>et al.</i>	(BABAR Collab.)	REF ID=50450
LI	05C	PR D71 111103	Z. Li <i>et al.</i>	(CLEO Collab.)	REF ID=50450
SIBIRTSSEV	05A	PR D71 054010	A. Sibirtsev, J. Haidenbauer		REF ID=50450
ABLIKIM	04	PL B598 172	M. Ablikim <i>et al.</i>	(BES Collab.)	REF ID=50450
ABLIKIM	04M	PR D70 112008	M. Ablikim <i>et al.</i>	(BES Collab.)	REF ID=50450
AUBERT	04	PR D69 011103	B. Aubert <i>et al.</i>	(BaBar Collab.)	REF ID=50450
AUBERT,B	04N	PR D70 072004	B. Aubert <i>et al.</i>	(BABAR Collab.)	REF ID=50450
BAI	04	PL B578 16	J.Z. Bai <i>et al.</i>	(BES Collab.)	REF ID=50450
BAI	04A	PR D69 012003	J.Z. Bai <i>et al.</i>	(BES Collab.)	REF ID=50450
BAI	04D	PL B589 7	J.Z. Bai <i>et al.</i>	(BES Collab.)	REF ID=50450
BAI	04E	PL B591 42	J.Z. Bai <i>et al.</i>	(BES Collab.)	REF ID=50450
BAI	04G	PR D70 012004	J.Z. Bai <i>et al.</i>	(BES Collab.)	REF ID=50450
BAI	04H	PR D70 012005	J.Z. Bai <i>et al.</i>	(BES Collab.)	REF ID=50450
BAI	04J	PL B594 47	J.Z. Bai <i>et al.</i>	(BES Collab.)	REF ID=50450
SETH	04	PR D69 097503	K.K. Seth		REF ID=50450
AULCHENKO	03	PL B573 63	V.M. Aulchenko <i>et al.</i>	(KEDR Collab.)	REF ID=50450
BAI	03D	PL B561 49	J.Z. Bai <i>et al.</i>	(BES Collab.)	REF ID=50450
BAI	03F	PRL 91 022001	J.Z. Bai <i>et al.</i>	(BES II Collab.)	REF ID=50450
BAI	03G	PR D68 052003	J.Z. Bai <i>et al.</i>	(BES Collab.)	REF ID=50450
HUANG	03	PRL 91 241802	H.-C. Huang <i>et al.</i>	(BELLE Collab.)	REF ID=50450
BAI	02C	PRL 88 101802	J.Z. Bai <i>et al.</i>	(BES Collab.)	REF ID=50450
ARTAMONOV	00	PL B474 427	A.S. Artamonov <i>et al.</i>		REF ID=50450
BAI	00	PRL 84 594	J.Z. Bai <i>et al.</i>	(BES Collab.)	REF ID=50450
BAI	00B	PL B472 200	J.Z. Bai <i>et al.</i>	(BES Collab.)	REF ID=50450
BAI	00D	PL B476 25	J.Z. Bai <i>et al.</i>	(BES Collab.)	REF ID=50450
BAI	99	PL B446 356	J.Z. Bai <i>et al.</i>	(BES Collab.)	REF ID=50450
BAI	99C	PRL 83 1918	J.Z. Bai <i>et al.</i>	(BES Collab.)	REF ID=50450
BAI	98D	PR D58 092006	J.Z. Bai <i>et al.</i>	(BES Collab.)	REF ID=50450
BAI	98G	PL B424 213	J.Z. Bai <i>et al.</i>	(BES Collab.)	REF ID=50450
BAI	98H	PRL 81 1179	J.Z. Bai <i>et al.</i>	(BES Collab.)	REF ID=50450
BALDINI	98	PL B444 111	R. Baldini <i>et al.</i>	(FENICE Collab.)	REF ID=50450
ARMSTRONG	96	PR D54 7067	T.A. Armstrong <i>et al.</i>	(E760 Collab.)	REF ID=50450
BAI	96B	PRL 76 3502	J.Z. Bai <i>et al.</i>	(BES Collab.)	REF ID=50450
BAI	96C	PRL 77 3959	J.Z. Bai <i>et al.</i>	(BES Collab.)	REF ID=50450
BAI	96D	PR D54 1221	J.Z. Bai <i>et al.</i>	(BES Collab.)	REF ID=50450
GRIBUSHIN	96	PR D53 4723	A. Gribushin <i>et al.</i>	(E672 Collab.)	REF ID=50450
HASAN	96	PL B388 376	A. Hasan, D.V. Bugg	(BRUN, LOQM)	REF ID=50450
BAI	95B	PL B355 374	J.Z. Bai <i>et al.</i>	(BES Collab.)	REF ID=50450
BUGG	95	PL B353 378	D.V. Bugg <i>et al.</i>	(LOQM, PNPI, WASH)	REF ID=50450
ANTONELLI	93	PL B301 317	A. Antonelli <i>et al.</i>	(FENICE Collab.)	REF ID=50450
ARMSTRONG	93B	PR D47 772	T.A. Armstrong <i>et al.</i>	(FNAL E760 Collab.)	REF ID=50450
BARNES	93	PL B309 469	P.D. Barnes <i>et al.</i>	(PS185 Collab.)	REF ID=50450
AUGUSTIN	92	PR D46 1951	J.E. Augustin, G. Cosme	(DM2 Collab.)	REF ID=50450
BOLTON	92	PL B278 495	T. Bolton <i>et al.</i>	(Mark III Collab.)	REF ID=50450
BOLTON	92B	PRL 69 1328	T. Bolton <i>et al.</i>	(Mark III Collab.)	REF ID=50450
COFFMAN	92	PRL 68 282	D.M. Coffman <i>et al.</i>	(Mark III Collab.)	REF ID=50450
HSUEH	92	PR D45 R2181	S. Hsueh, S. Palestini	(FNAL, TORI)	REF ID=50450
BISELLO	91	NP B350 1	D. Bisello <i>et al.</i>	(DM2 Collab.)	REF ID=50450
AUGUSTIN	90	PR D42 10	J.E. Augustin <i>et al.</i>	(DM2 Collab.)	REF ID=50450
BAI	90B	PRL 65 1309	Z. Bai <i>et al.</i>	(Mark III Collab.)	REF ID=50450
BAI	90C	PRL 65 2507	Z. Bai <i>et al.</i>	(Mark III Collab.)	REF ID=50450
BISELLO	90	PL B241 617	D. Bisello <i>et al.</i>	(DM2 Collab.)	REF ID=50450
COFFMAN	90	PR D41 1410	D.M. Coffman <i>et al.</i>	(Mark III Collab.)	REF ID=50450
JOUSSET	90	PR D41 1389	J. Jousset <i>et al.</i>	(DM2 Collab.)	REF ID=50450
ALEXANDER	89	NP B320 45	J.P. Alexander <i>et al.</i>	(LBL, MICH, SLAC)	REF ID=50450
AUGUSTIN	89	NP B320 1	J.E. Augustin, G. Cosme	(DM2 Collab.)	REF ID=50450
BISELLO	89B	PR D39 701	G. Busetto <i>et al.</i>	(DM2 Collab.)	REF ID=50450
AUGUSTIN	88	PRL 60 2238	J.E. Augustin <i>et al.</i>	(DM2 Collab.)	REF ID=50450
COFFMAN	88	PR D38 2695	D.M. Coffman <i>et al.</i>	(Mark III Collab.)	REF ID=50450
FALVARD	88	PR D38 2706	A. Falvard <i>et al.</i>	(CLER, FRAS, LALO+)	REF ID=50450
AUGUSTIN	87	ZPHY C36 369	J.E. Augustin <i>et al.</i>	(LALO, CLER, FRAS+)	REF ID=50450
BAGLIN	87	NP B286 592	C. Baglin <i>et al.</i>	(LAPP, CERN, GENO, LYON+)	REF ID=50450
BALTRUSAIT...	87	PR D35 2077	R.M. Baltrusaitis <i>et al.</i>	(Mark III Collab.)	REF ID=50450
BECKER	87	PRL 59 186	J.J. Becker <i>et al.</i>	(Mark III Collab.)	REF ID=50450
BISELLO	87	PL B192 239	D. Bisello <i>et al.</i>	(PADO, CLER, FRAS+)	REF ID=50450
COHEN	87	RMP 59 1121	E.R. Cohen, B.N. Taylor	(RISC, NBS)	REF ID=50450
HENRARD	87	NP B292 670	P. Henrard <i>et al.</i>	(CLER, FRAS, LALO+)	REF ID=50450
PALLIN	87	NP B292 653	D. Pallin <i>et al.</i>	(CLER, FRAS, LALO, PADO)	REF ID=50450
BALTRUSAIT...	86	PR D33 629	R.M. Baltrusaitis <i>et al.</i>	(Mark III Collab.)	REF ID=50450
BALTRUSAIT...	86B	PR D33 1222	R.M. Baltrusaitis <i>et al.</i>	(Mark III Collab.)	REF ID=50450
BALTRUSAIT...	86D	PRL 56 107	R.M. Baltrusaitis <i>et al.</i>	(CIT, UCSC, ILL, SLAC+)	REF ID=50450
BISELLO	86B	PL B179 294	D. Bisello <i>et al.</i>	(DM2 Collab.)	REF ID=50450
GAISER	86	PR D34 711	J. Gaiser <i>et al.</i>	(Crystal Ball Collab.)	REF ID=50450
BALTRUSAIT...	85C	PRL 55 1723	R.M. Baltrusaitis <i>et al.</i>	(CIT, UCSC+)	REF ID=50450
BALTRUSAIT...	85D	PR D32 566	R.M. Baltrusaitis <i>et al.</i>	(CIT, UCSC+)	REF ID=50450
KURAEV	85	SJNP 41 466	E.A. Kuraev, V.S. Fadin	(NOVO)	REF ID=50450
Translated from YAF 41 733					
BALTRUSAIT...	84	PRL 52 2126	R.M. Baltrusaitis <i>et al.</i>	(CIT, UCSC+)	REF ID=22006
EATON	84	PR D29 804	M.W. Eaton <i>et al.</i>	(LBL, SLAC)	REF ID=22006
BLOOM	83	ARNS 33 143	E.D. Bloom, C. Peck	(SLAC, CIT)	REF ID=22006
EDWARDS	83B	PRL 51 859	C. Edwards <i>et al.</i>	(CIT, HARV, PRIN+)	REF ID=22006
FRANKLIN	83	PRL 51 963	M.E.B. Franklin <i>et al.</i>	(LBL, SLAC)	REF ID=22006
BURKE	82	PRL 49 632	D.L. Burke <i>et al.</i>	(LBL, SLAC)	REF ID=22006
EDWARDS	82B	PR D25 3065	C. Edwards <i>et al.</i>	(CIT, HARV, PRIN+)	REF ID=22006
EDWARDS	82D	PRL 48 458	C. Edwards <i>et al.</i>	(CIT, HARV, PRIN+)	REF ID=22006
Also					
EDWARDS	82E	ARNS 33 143	E.D. Bloom, C. Peck	(SLAC, CIT)	REF ID=22006
LEMOIGNE	82	PRL 49 259	C. Edwards <i>et al.</i>	(CIT, HARV, PRIN+)	REF ID=22006
BESCH	81	PL 113B 509	Y. Lemoigne <i>et al.</i>	(SACL, LOIC, SHMP+)	REF ID=22006
GIDAL	81	ZPHY C8 1	H.J. Besch <i>et al.</i>	(BONN, DESY, MANZ)	REF ID=22006
PARTRIDGE	81	PL 107B 153	G. Gidal <i>et al.</i>	(SLAC, LBL)	REF ID=22006
SCHARRE	80	PRL 44 712	R. Partridge <i>et al.</i>	(CIT, HARV, PRIN+)	REF ID=22006
ZHOLENTZ	80	PL 97B 329	D.L. Scharre <i>et al.</i>	(SLAC, LBL)	REF ID=22006
Also					
BRANDELIK	79C	SJNP 34 814	A.A. Zholents <i>et al.</i>	(NOVO)	REF ID=22006
Translated from YAF 34 1471					
BRANDELIK	78	ZPHY C1 233	R. Brandelik <i>et al.</i>	(DASP Collab.)	REF ID=22114
ALEXANDER	78	PL 72B 493	G. Alexander <i>et al.</i>	(DESY, HAMB, SIEG+)	REF ID=22065
BESCH	78	PL 78B 347	H.J. Besch <i>et al.</i>	(BONN, DESY, MANZ)	REF ID=22066
BRANDELIK	78B	PL 74B 292	R. Brandelik <i>et al.</i>	(DASP Collab.)	REF ID=22067
PERUZZI	78	PR D17 2901	I. Peruzzi <i>et al.</i>	(SLAC, LBL)	REF ID=22068
BARTEL	77	PL 66B 489	W. Bartel <i>et al.</i>	(DESY, HEIDP)	REF ID=22058
BURMESTER	77D	PL 72B 135	J. Burmester <i>et al.</i>	(DESY, HAMB, SIEG+)	REF ID=22060
FELDMAN	77	PRPL 33C 285	G.J. Feldman, M.L. Perl	(DESY, HAMB, SIEG+)	REF ID=22062
VANNUCCI	77	PR D15 1814	F. Vannucci <i>et al.</i>	(LBL, SLAC)	REF ID=22063
BARTEL	76	PL 64B 483	W. Bartel <i>et al.</i>	(DESY, HEIDP)	REF ID=22192
BRAUNSCH...	76	PL 63B 487	W. Braunschweig <i>et al.</i>	(DASP Collab.)	REF ID=22054
JEAN-MARIE	76	PRL 36 291	B. Jean-Marie <i>et al.</i>	(SLAC, LBL, IG)	REF ID=22056
BALDINI...	75	PL 58B 471	R. Baldini-Celio <i>et al.</i>	(FRAS, ROMA)	REF ID=22026
BOYARSKI	75	PRL 34 1357	A.M. Boyarski <i>et al.</i>	(SLAC, LBL) JPC	REF ID=22030
DASP	75	PL 56B 491	W. Braunschweig <i>et al.</i>	(DASP Collab.)	REF ID=22036
ESPOSITO	75B	LNC 14 73	B. Esposito <i>et al.</i>	(FRAS, NAPL, PADO+)	REF ID=22038
FORD	75	PRL 34 604	R.L. Ford <i>et al.</i>	(SLAC, PENN)	REF ID=22039

A REVIEW GOES HERE – Check our WWW List of Reviews

 $\chi_{c0}(1P)$

$$I^G(J^{PC}) = 0^+(0^{++})$$

NODE=M870

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 $\begin{smallmatrix} +0.7 \\ -0.6 \end{smallmatrix}$ ± 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 $\begin{smallmatrix} +1.8 \\ -1.9 \end{smallmatrix}$ ± 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
 NEW

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
10.5 ± 0.6 OUR FIT				
[10.3 ± 0.6 MeV OUR 2013 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 $\begin{smallmatrix} +1.7 \\ -1.3 \end{smallmatrix}$ ± 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 $\begin{smallmatrix} +5.2 \\ -3.7 \end{smallmatrix}$ ± 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

NODE=M056;CLUMP=A

Γ_1	$2(\pi^+\pi^-)$	$(2.24 \pm 0.18) \%$		DESIG=3
Γ_2	$\rho^0 \pi^+\pi^-$	$(8.7 \pm 2.8) \times 10^{-3}$		DESIG=9
Γ_3	$\rho^0 \rho^0$			DESIG=54
Γ_4	$f_0(980) f_0(980)$	$(6.5 \pm 2.1) \times 10^{-4}$		DESIG=20
Γ_5	$\pi^+\pi^-\pi^0\pi^0$	$(3.3 \pm 0.4) \%$		DESIG=61
Γ_6	$\rho^+\pi^-\pi^0 + \text{c.c.}$	$(2.8 \pm 0.4) \%$		DESIG=62
Γ_7	$4\pi^0$	$(3.2 \pm 0.4) \times 10^{-3}$		DESIG=70
Γ_8	$\pi^+\pi^-K^+K^-$	$(1.75 \pm 0.14) \%$		DESIG=5
Γ_9	$K_0^*(1430)^0 \bar{K}_0^*(1430)^0 \rightarrow \pi^+\pi^-K^+K^-$	$(9.6 \pm 3.5) \times 10^{-4}$		DESIG=31
Γ_{10}	$K_0^*(1430)^0 \bar{K}_2^*(1430)^0 + \text{c.c.} \rightarrow \pi^+\pi^-K^+K^-$	$(7.8 \pm 1.9) \times 10^{-4}$		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}	$f_0(980) f_0(980)$	$(1.6 \pm 1.0) \times 10^{-4}$		DESIG=23
Γ_{14}	$f_0(980) f_0(2200)$	$(7.8 \pm 2.0) \times 10^{-4}$		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}	$f_0(1370) f_0(1710)$	$(6.6 \pm 3.5) \times 10^{-4}$		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}	$K^+K^-\pi^+\pi^-\pi^0$	$(1.11 \pm 0.26) \%$		DESIG=75
Γ_{22}	$K^+K^-\pi^0\pi^0$	$(5.4 \pm 0.9) \times 10^{-3}$		DESIG=63
Γ_{23}	$K^+\pi^-\bar{K}^0\pi^0 + \text{c.c.}$	$(2.44 \pm 0.33) \%$		DESIG=65
Γ_{24}	$\rho^+K^-K^0 + \text{c.c.}$	$(1.18 \pm 0.21) \%$		DESIG=66
Γ_{25}	$K^*(892)^-K^+\pi^0 \rightarrow K^+\pi^-\bar{K}^0\pi^0 + \text{c.c.}$	$(4.5 \pm 1.1) \times 10^{-3}$		DESIG=67
Γ_{26}	$K_S^0 K_S^0 \pi^+\pi^-$	$(5.6 \pm 1.0) \times 10^{-3}$		DESIG=41
Γ_{27}	$K^+K^-\eta\pi^0$	$(3.0 \pm 0.7) \times 10^{-3}$		DESIG=68
Γ_{28}	$3(\pi^+\pi^-)$	$(1.20 \pm 0.18) \%$		DESIG=4
Γ_{29}	$K^+\bar{K}^*(892)^0\pi^- + \text{c.c.}$	$(7.2 \pm 1.6) \times 10^{-3}$		DESIG=10
Γ_{30}	$K^*(892)^0 \bar{K}^*(892)^0$	$(1.7 \pm 0.6) \times 10^{-3}$		DESIG=21
Γ_{31}	$\pi\pi$	$(8.33 \pm 0.35) \times 10^{-3}$		DESIG=18
Γ_{32}	$\pi^0\eta$	$< 1.8 \times 10^{-4}$		DESIG=35
Γ_{33}	$\pi^0\eta'$	$< 1.1 \times 10^{-3}$		DESIG=36
Γ_{34}	$\eta\eta$	$(2.95 \pm 0.19) \times 10^{-3}$		DESIG=13
Γ_{35}	$\eta\eta'$	$< 2.3 \times 10^{-4}$	CL=90%	DESIG=37
Γ_{36}	$\eta'\eta'$	$(1.96 \pm 0.21) \times 10^{-3}$		DESIG=46
Γ_{37}	$\omega\omega$	$(9.5 \pm 1.1) \times 10^{-4}$		DESIG=22
Γ_{38}	$\omega\phi$	$(1.16 \pm 0.21) \times 10^{-4}$		DESIG=76
Γ_{39}	K^+K^-	$(5.91 \pm 0.32) \times 10^{-3}$		DESIG=2
Γ_{40}	$K_S^0 K_S^0$	$(3.10 \pm 0.18) \times 10^{-3}$		DESIG=15
Γ_{41}	$\pi^+\pi^-\eta$	$< 1.9 \times 10^{-4}$	CL=90%	DESIG=50
Γ_{42}	$\pi^+\pi^-\eta'$	$< 3.5 \times 10^{-4}$	CL=90%	DESIG=53
Γ_{43}	$\bar{K}^0 K^+\pi^- + \text{c.c.}$	$< 9 \times 10^{-5}$	CL=90%	DESIG=17
Γ_{44}	$K^+K^-\pi^0$	$< 6 \times 10^{-5}$	CL=90%	DESIG=47
Γ_{45}	$K^+K^-\eta$	$< 2.2 \times 10^{-4}$	CL=90%	DESIG=51
Γ_{46}	$K^+K^-K_S^0 K_S^0$	$(1.4 \pm 0.5) \times 10^{-3}$		DESIG=42
Γ_{47}	$K^+K^-K^+K^-$	$(2.75 \pm 0.28) \times 10^{-3}$		DESIG=14
Γ_{48}	$K^+K^-\phi$	$(9.5 \pm 2.4) \times 10^{-4}$		DESIG=44
Γ_{49}	$\phi\phi$	$(7.7 \pm 0.7) \times 10^{-4}$		DESIG=16
Γ_{50}	$p\bar{p}$	$(2.25 \pm 0.09) \times 10^{-4}$		DESIG=11
Γ_{51}	$p\bar{p}\pi^0$	$(6.8 \pm 0.7) \times 10^{-4}$	S=1.3	DESIG=48

Γ ₅₂	$p\bar{p}\eta$	$(3.5 \pm 0.4) \times 10^{-4}$		DESIG=52
Γ ₅₃	$p\bar{p}\omega$	$(5.1 \pm 0.6) \times 10^{-4}$		DESIG=69
Γ ₅₄	$p\bar{p}\phi$	$(5.9 \pm 1.4) \times 10^{-5}$		DESIG=74
Γ ₅₅	$p\bar{p}\pi^+\pi^-$	$(2.1 \pm 0.7) \times 10^{-3}$	S=1.4	DESIG=8
Γ ₅₆	$p\bar{p}\pi^0\pi^0$	$(1.02 \pm 0.27) \times 10^{-3}$		DESIG=64
Γ ₅₇	$p\bar{p}K^+K^-$ (non-resonant)	$(1.19 \pm 0.26) \times 10^{-4}$		DESIG=71
Γ ₅₈	$p\bar{p}K_S^0 K_S^0$	$< 8.8 \times 10^{-4}$	CL=90%	DESIG=40
Γ ₅₉	$p\bar{n}\pi^-$	$(1.24 \pm 0.11) \times 10^{-3}$		DESIG=43
Γ ₆₀	$\bar{p}n\pi^+$	$(1.34 \pm 0.12) \times 10^{-3}$		DESIG=82
Γ ₆₁	$p\bar{n}\pi^-\pi^0$	$(2.29 \pm 0.21) \times 10^{-3}$		DESIG=83
Γ ₆₂	$\bar{p}n\pi^+\pi^0$	$(2.16 \pm 0.18) \times 10^{-3}$		DESIG=84
Γ ₆₃	$\Lambda\bar{\Lambda}$	$(3.21 \pm 0.25) \times 10^{-4}$		DESIG=19
Γ ₆₄	$\Lambda\bar{\Lambda}\pi^+\pi^-$	$(1.15 \pm 0.13) \times 10^{-3}$		DESIG=38
Γ ₆₅	$\Lambda\bar{\Lambda}\pi^+\pi^-$ (non-resonant)	$< 5 \times 10^{-4}$	CL=90%	DESIG=77
Γ ₆₆	$\Sigma(1385)^+\bar{\Lambda}\pi^- + \text{c.c.}$	$< 5 \times 10^{-4}$	CL=90%	DESIG=78
Γ ₆₇	$\Sigma(1385)^-\bar{\Lambda}\pi^+ + \text{c.c.}$	$< 5 \times 10^{-4}$	CL=90%	DESIG=79
Γ ₆₈	$K^+\bar{p}\Lambda + \text{c.c.}$	$(1.22 \pm 0.12) \times 10^{-3}$	S=1.3	DESIG=49
Γ ₆₉	$K^+\bar{p}\Lambda(1520) + \text{c.c.}$	$(2.9 \pm 0.7) \times 10^{-4}$		DESIG=72
Γ ₇₀	$\Lambda(1520)\bar{\Lambda}(1520)$	$(3.1 \pm 1.2) \times 10^{-4}$		DESIG=73
Γ ₇₁	$\Sigma^0\bar{\Sigma}^0$	$(4.4 \pm 0.4) \times 10^{-4}$		DESIG=58
Γ ₇₂	$\Sigma^+\bar{\Sigma}^-$	$(3.9 \pm 0.7) \times 10^{-4}$	S=1.7	DESIG=59
Γ ₇₃	$\Sigma(1385)^+\bar{\Sigma}(1385)^-$	$(1.6 \pm 0.6) \times 10^{-4}$		DESIG=80
Γ ₇₄	$\Sigma(1385)^-\bar{\Sigma}(1385)^+$	$(2.3 \pm 0.6) \times 10^{-4}$		DESIG=81
Γ ₇₅	$\Xi^0\bar{\Xi}^0$	$(3.1 \pm 0.8) \times 10^{-4}$		DESIG=60
Γ ₇₆	$\Xi^-\bar{\Xi}^+$	$(4.7 \pm 0.7) \times 10^{-4}$		DESIG=39

Radiative decays

Γ ₇₇	$\gamma J/\psi(1S)$	$(1.27 \pm 0.06) \%$		NODE=M056;CLUMP=B DESIG=6
Γ ₇₈	$\gamma\rho^0$	$< 9 \times 10^{-6}$	CL=90%	DESIG=55
Γ ₇₉	$\gamma\omega$	$< 8 \times 10^{-6}$	CL=90%	DESIG=56
Γ ₈₀	$\gamma\phi$	$< 6 \times 10^{-6}$	CL=90%	DESIG=57
Γ ₈₁	$\gamma\gamma$	$(2.23 \pm 0.13) \times 10^{-4}$		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 238 measurements to determine 49 parameters. The overall fit has a $\chi^2 = 339.7$ for 189 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta p_i \delta p_j \rangle / (\delta p_i \delta p_j)$, in percent, from the fit to parameters p_i , including the branching fractions, $x_i \equiv \Gamma_i / \Gamma_{\text{total}}$.

x_2	25									
x_8	14	4								
x_{29}	7	2	29							
x_{31}	15	4	16	5						
x_{34}	8	2	9	3	21					
x_{39}	13	3	14	5	28	17				
x_{40}	12	3	13	4	27	16	22			
x_{47}	9	2	8	3	14	8	12	11		
x_{49}	10	3	10	4	14	9	12	12	7	
x_{50}	7	2	9	3	13	6	15	15	8	8
x_{63}	8	2	9	3	20	12	17	16	8	9
x_{77}	4	1	5	1	14	9	10	10	5	5
x_{81}	-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_{29}	x_{31}	x_{34}	x_{39}	x_{40}	x_{47}	x_{49}

χ_{63}	11			
χ_{77}	-21	8		
χ_{81}	2	4	9	
Γ	-7	-9	-8	-48
	χ_{50}	χ_{63}	χ_{77}	χ_{81}

$\chi_{c0}(1P)$ PARTIAL WIDTHS

$\chi_{c0}(1P) \Gamma(i) \Gamma(\gamma J/\psi(1S))/\Gamma(\text{total})$

NODE=M056217

NODE=M056223

$\Gamma(p\bar{p}) \times \Gamma(\gamma J/\psi(1S))/\Gamma_{\text{total}}$

$\Gamma_{50}\Gamma_{77}/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

NODE=M056G1

NODE=M056G1

NEW

30.0 ± 2.3 OUR FIT

[28.6 ± 2.4 eV OUR 2013 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

$\Gamma(2(\pi^+\pi^-)) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$

$\Gamma_1\Gamma_{81}/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

NODE=M056G2

NODE=M056G2

52 ± 4 OUR FIT**49 ± 10 OUR AVERAGE** Error includes scale factor of 1.8.44.7 ± 3.6 ± 4.9 3.6k UEHARA 08 BELL $\gamma\gamma \rightarrow \chi_{c0} \rightarrow 2(\pi^+\pi^-)$ 75 ± 13 ± 8 EISENSTEIN 01 CLE2 $e^+e^- \rightarrow e^+e^- \chi_{c0}$

$\Gamma(\rho^0\rho^0) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$

$\Gamma_3\Gamma_{81}/\Gamma$

VALUE (eV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT

NODE=M056G07

NODE=M056G07

• • • We do not use the following data for averages, fits, limits, etc. • • •

<12 90 <252 UEHARA 08 BELL $\gamma\gamma \rightarrow \chi_{c0} \rightarrow 2(\pi^+\pi^-)$

$\Gamma(\pi^+\pi^-K^+K^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$

$\Gamma_8\Gamma_{81}/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

NODE=M056G08

NODE=M056G08

41 ± 4 OUR FIT**38.8 ± 3.7 ± 4.7** 1.7k UEHARA 08 BELL $\gamma\gamma \rightarrow \chi_{c0} \rightarrow K^+K^-\pi^+\pi^-$

$\Gamma(K^+K^-\pi^+\pi^-\pi^0) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$

$\Gamma_{21}\Gamma_{81}/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

NODE=M056G01

NODE=M056G01

26 ± 4 ± 4 1094 DEL-AMO-SA..11M BABR $\gamma\gamma \rightarrow K^+K^-\pi^+\pi^-\pi^0$

$\Gamma(K^+\bar{K}^*(892)^0\pi^- + \text{c.c.}) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$

$\Gamma_{29}\Gamma_{81}/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

NODE=M056G09

NODE=M056G09

17 ± 4 OUR FIT**16.7 ± 6.1 ± 3.0** 495 ± 182 UEHARA 08 BELL $\gamma\gamma \rightarrow \chi_{c0} \rightarrow K^+K^-\pi^+\pi^-$

$\Gamma(K^*(892)^0\bar{K}^*(892)^0) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$

$\Gamma_{30}\Gamma_{81}/\Gamma$

VALUE (eV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT

NODE=M056G10

NODE=M056G10

• • • We do not use the following data for averages, fits, limits, etc. • • •

<6 90 <148 UEHARA 08 BELL $\gamma\gamma \rightarrow \chi_{c0} \rightarrow K^+K^-\pi^+\pi^-$

$\Gamma(\pi\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$

$\Gamma_{31}\Gamma_{81}/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

NODE=M056G3

NODE=M056G3

19.5 ± 1.4 OUR FIT

[19.6 ± 1.4 eV OUR 2013 FIT]

23 ± 5 OUR AVERAGE29.7^{+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

$\Gamma(\eta\eta) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$		$\Gamma_{34}\Gamma_{81}/\Gamma$		
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

$\Gamma(\omega\omega) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$		$\Gamma_{37}\Gamma_{81}/\Gamma$		
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

$\Gamma(\omega\phi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$		$\Gamma_{38}\Gamma_{81}/\Gamma$		
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

$\Gamma(K^+K^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$		$\Gamma_{39}\Gamma_{81}/\Gamma$		
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

$\Gamma(K_S^0 K_S^0) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$		$\Gamma_{40}\Gamma_{81}/\Gamma$		
VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

7.3 ±0.6 OUR FIT

[7.2 ± 0.5 eV OUR 2013 FIT]

8.7 ±1.9 OUR AVERAGE [7.0 ± 1.0 eV OUR 2013 AVERAGE]

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
NEW

NEW

NODE=M056G5;LINKAGE=UE

$\Gamma(K^+K^-K^+K^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$		$\Gamma_{47}\Gamma_{81}/\Gamma$		
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

$\Gamma(\rho\phi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$		$\Gamma_{49}\Gamma_{81}/\Gamma$		
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	TECN	COMMENT	

0.0224±0.0018 OUR FIT

[0.0225 ± 0.0019 OUR 2013 FIT]

NODE=M056R2
NODE=M056R2
NEW

$\Gamma(\rho^0\pi^+\pi^-)/\Gamma(2(\pi^+\pi^-))$		Γ_2/Γ_1		
VALUE	DOCUMENT ID	TECN	COMMENT	

0.39±0.12 OUR FIT

0.39±0.12

TANENBAUM 78 MRK1 $\psi(2S) \rightarrow \gamma\chi_{c0}$

NODE=M056R54
NODE=M056R54

$\Gamma(\rho^0\pi^+\pi^-)/\Gamma_{\text{total}}$		Γ_2/Γ		
VALUE	DOCUMENT ID	TECN	COMMENT	

0.0087±0.0028 OUR FIT

[0.0088 ± 0.0028 OUR 2013 FIT]

NODE=M056R9
NODE=M056R9
NEW

$\Gamma(f_0(980)f_0(980))/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT

6.5±2.1 OUR AVERAGE $[(6.6 \pm 2.1) \times 10^{-4}]$ OUR 2013 AVERAGE]**6.5±2.1±0.2** 36 ± 9 ¹ ABLIKIM 04G BES $\psi(2S) \rightarrow \gamma 2\pi^+ 2\pi^-$

¹ ABLIKIM 04G reports $[\Gamma(\chi_{c0}(1P) \rightarrow f_0(980)f_0(980))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))] = (6.5 \pm 1.6 \pm 1.3) \times 10^{-5}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.99 \pm 0.27) \times 10^{-2}$. 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

NEW

NODE=M056R24;LINKAGE=AB

 $\Gamma(\pi^+ \pi^- \pi^0 \pi^0)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT

3.3±0.4±0.1 1751.4 ¹ HE 08B CLEO $e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$

¹ HE 08B reports $3.54 \pm 0.10 \pm 0.43 \pm 0.18$ % from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \pi^+ \pi^- \pi^0 \pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.99 \pm 0.27) \times 10^{-2}$. 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

 $\Gamma(\rho^+ \pi^- \pi^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT

2.8±0.4±0.1 1358.5 ^{1,2} HE 08B CLEO $e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$

¹ HE 08B reports $3.04 \pm 0.18 \pm 0.42 \pm 0.16$ % from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \rho^+ \pi^- \pi^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.99 \pm 0.27) \times 10^{-2}$. 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

 $\Gamma(4\pi^0)/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT

3.2±0.4 OUR AVERAGE $[(3.3 \pm 0.4) \times 10^{-3}]$ OUR 2013 AVERAGE]**3.2±0.4±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

NEW

NODE=M056R71;LINKAGE=AB

 $\Gamma(\pi^+ \pi^- K^+ K^-)/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE (units 10^{-3})	DOCUMENT ID

17.5±1.4 OUR FIT $[(17.7 \pm 1.5) \times 10^{-3}]$ OUR 2013 FIT]NODE=M056R3
NODE=M056R3

NEW

 $\Gamma(K^+ \bar{K}^*(892)^0 \pi^- + \text{c.c.})/\Gamma(\pi^+ \pi^- K^+ K^-)$ Γ_{29}/Γ_8

VALUE	DOCUMENT ID	TECN	COMMENT

0.41±0.09 OUR FIT**0.41±0.10** TANENBAUM 78 MRK1 $\psi(2S) \rightarrow \gamma \chi_{c0}$ NODE=M056R55
NODE=M056R55 $\Gamma(K_0^*(1430)^0 \bar{K}_0^*(1430)^0 \rightarrow \pi^+ \pi^- K^+ K^-)/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT

9.6^{+3.5}_{-2.8} OUR AVERAGE $[(9.8^{+4.0}_{-2.8}) \times 10^{-4}]$ OUR 2013 AVERAGE]**9.6^{+3.5}_{-2.8}±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

NEW

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

$7.8^{+1.9}_{-2.4}$ OUR AVERAGE $[(8.0^{+2.0}_{-2.4}) \times 10^{-4}]$ OUR 2013 AVERAGE]

NODE=M056R37
NODE=M056R37

NEW

$7.8^{+1.9}_{-2.4} \pm 0.2$ 62 ¹ ABLIKIM 05Q BES2 $\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$

¹ ABLIKIM 05Q reports $(8.49 \pm 1.66^{+1.32}_{-1.99}) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow K_0^*(1430)^0 \bar{K}_2^*(1430)^0 + \text{c.c.} \rightarrow \pi^+ \pi^- K^+ K^-) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.99 \pm 0.27) \times 10^{-2}$. 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

$$\Gamma(K_1(1270)^+ K^- + \text{c.c.} \rightarrow \pi^+ \pi^- K^+ K^-) / \Gamma_{\text{total}} \quad \Gamma_{11}/\Gamma$$

VALUE (units 10^{-3}) EVTS DOCUMENT ID TECN COMMENT

6.1 ± 1.9 OUR AVERAGE $[(6.2 \pm 1.9) \times 10^{-3}]$ OUR 2013 AVERAGE]

NODE=M056R38
NODE=M056R38

NEW

$6.1^{+1.9}_{-1.8} \pm 0.2$ 68 ¹ ABLIKIM 05Q BES2 $\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$

¹ ABLIKIM 05Q reports $(6.66 \pm 1.31^{+1.60}_{-1.51}) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow K_1(1270)^+ K^- + \text{c.c.} \rightarrow \pi^+ \pi^- K^+ K^-) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.99 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value. The measurement assumes $B(K_1(1270) \rightarrow K \rho(770)) = 42 \pm 6\%$.

NODE=M056R38;LINKAGE=AB

$$\Gamma(K_1(1400)^+ K^- + \text{c.c.} \rightarrow \pi^+ \pi^- K^+ K^-) / \Gamma_{\text{total}} \quad \Gamma_{12}/\Gamma$$

VALUE (units 10^{-3}) CL% DOCUMENT ID TECN COMMENT

< 2.6 (CL = 90%) $[< 2.7 \times 10^{-3} \text{ (CL = 90\%)}]$ OUR 2013 BEST LIMIT]

NODE=M056R39
NODE=M056R39

< 2.6 90 ¹ ABLIKIM 05Q BES2 $\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$

¹ ABLIKIM 05Q reports $< 2.85 \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow K_1(1400)^+ K^- + \text{c.c.} \rightarrow \pi^+ \pi^- K^+ K^-) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = 9.99 \times 10^{-2}$. The measurement assumes $B(K_1(1400) \rightarrow K^*(892)\pi) = 94 \pm 6\%$.

NODE=M056R39;LINKAGE=AB

$$\Gamma(f_0(980) f_0(980)) / \Gamma_{\text{total}} \quad \Gamma_{13}/\Gamma$$

VALUE (units 10^{-5}) EVTS DOCUMENT ID TECN COMMENT

$15.9^{+10.2}_{-8.8} \pm 0.4$ 28 ¹ ABLIKIM 05Q BES2 $\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$

¹ ABLIKIM 05Q reports $[\Gamma(\chi_{c0}(1P) \rightarrow f_0(980) f_0(980)) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))] = (1.59 \pm 0.50^{+0.89}_{-0.72}) \times 10^{-5}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.99 \pm 0.27) \times 10^{-2}$. 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
NODE=M056R28

NODE=M056R28;LINKAGE=AB

$$\Gamma(f_0(980) f_0(2200)) / \Gamma_{\text{total}} \quad \Gamma_{14}/\Gamma$$

VALUE (units 10^{-4}) EVTS DOCUMENT ID TECN COMMENT

$7.8^{+2.0}_{-2.5}$ OUR AVERAGE $[(7.9^{+2.0}_{-2.5}) \times 10^{-4}]$ OUR 2013 AVERAGE]

NODE=M056R29
NODE=M056R29

NEW

$7.8^{+2.0}_{-2.5} \pm 0.2$ 77 ¹ ABLIKIM 05Q BES2 $\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$

¹ ABLIKIM 05Q reports $(8.42 \pm 1.42^{+1.65}_{-2.29}) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow f_0(980) f_0(2200)) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.99 \pm 0.27) \times 10^{-2}$. 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

$$\Gamma(f_0(1370) f_0(1370)) / \Gamma_{\text{total}} \quad \Gamma_{15}/\Gamma$$

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

¹ABLIKIM 05Q reports $< 2.9 \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow f_0(1370)f_0(1370))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = 9.99 \times 10^{-2}$. 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})	EVS	DOCUMENT ID	TECN	COMMENT

$6.6^{+3.5}_{-2.3}$ OUR AVERAGE		[($6.7^{+3.5}_{-2.3}$) $\times 10^{-4}$ OUR 2013 AVERAGE]		

NODE=M056R32
NODE=M056R32

NEW

$6.6^{+3.5}_{-2.3} \pm 0.2$	61	¹ ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma\pi^+\pi^-K^+K^-$

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	$\psi(2S) \rightarrow \gamma\pi^+\pi^-K^+K^-$

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
NODE=M056R33

NODE=M056R33;LINKAGE=AB

$\Gamma(f_0(1500)f_0(1500))/\Gamma_{\text{total}}$ Γ_{19}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT

<0.5	90	¹ ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma\pi^+\pi^-K^+K^-$

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
NODE=M056R34

NODE=M056R34;LINKAGE=AB

$\Gamma(f_0(1500)f_0(1710))/\Gamma_{\text{total}}$ Γ_{20}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT

<0.7	90	¹ ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma\pi^+\pi^-K^+K^-$

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
NODE=M056R35

NODE=M056R35;LINKAGE=AB

$$\Gamma(K^+ K^- \pi^0 \pi^0) / \Gamma_{\text{total}} \quad \Gamma_{22} / \Gamma$$

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.54±0.09 OUR AVERAGE		[(0.55 ± 0.09)% OUR 2013 AVERAGE]		
0.54±0.09±0.01	213.5	¹ HE	08B CLEO	$e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$
¹ HE 08B reports $0.59 \pm 0.05 \pm 0.08 \pm 0.03$ % from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow K^+ K^- \pi^0 \pi^0) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.99 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M056R64
 NODE=M056R64
 NEW

NODE=M056R64;LINKAGE=HE

$$\Gamma(K^+ \pi^- \bar{K}^0 \pi^0 + \text{c.c.}) / \Gamma_{\text{total}} \quad \Gamma_{23} / \Gamma$$

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
2.44±0.33 OUR AVERAGE		[(2.47 ± 0.33)% OUR 2013 AVERAGE]		
2.44±0.32±0.07	401.7	¹ HE	08B CLEO	$e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$
¹ HE 08B reports $2.64 \pm 0.15 \pm 0.31 \pm 0.14$ % from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow K^+ \pi^- \bar{K}^0 \pi^0 + \text{c.c.}) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.99 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M056R66
 NODE=M056R66
 NEW

NODE=M056R66;LINKAGE=HE

$$\Gamma(\rho^+ K^- K^0 + \text{c.c.}) / \Gamma_{\text{total}} \quad \Gamma_{24} / \Gamma$$

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
1.18±0.21 OUR AVERAGE		[(1.20 ± 0.21)% OUR 2013 AVERAGE]		
1.18±0.20±0.03	179.7	¹ HE	08B CLEO	$e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$
¹ HE 08B reports $1.28 \pm 0.16 \pm 0.15 \pm 0.07$ % from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \rho^+ K^- K^0 + \text{c.c.}) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.99 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M056R67
 NODE=M056R67
 NEW

NODE=M056R67;LINKAGE=HE

$$\Gamma(K^*(892)^- K^+ \pi^0 \rightarrow K^+ \pi^- \bar{K}^0 \pi^0 + \text{c.c.}) / \Gamma_{\text{total}} \quad \Gamma_{25} / \Gamma$$

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.45±0.11 OUR AVERAGE		[(0.46 ± 0.12)% OUR 2013 AVERAGE]		
0.45±0.11±0.01	64.1	¹ HE	08B CLEO	$e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$
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
 NODE=M056R68
 NEW

NODE=M056R68;LINKAGE=HE

$$\Gamma(K_S^0 K_S^0 \pi^+ \pi^-) / \Gamma_{\text{total}} \quad \Gamma_{26} / \Gamma$$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
5.6±1.0 OUR AVERAGE		[(5.7 ± 1.1) $\times 10^{-3}$ OUR 2013 AVERAGE]		
5.6±1.0±0.2	152 ± 14	¹ ABLIKIM	05o BES2	$\psi(2S) \rightarrow \gamma \chi_{c0}$
¹ ABLIKIM 05o reports $[\Gamma(\chi_{c0}(1P) \rightarrow K_S^0 K_S^0 \pi^+ \pi^-) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ = $(0.558 \pm 0.051 \pm 0.089) \times 10^{-3}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.99 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M056R47
 NODE=M056R47
 NEW

NODE=M056R47;LINKAGE=AB

$$\Gamma(K^+ K^- \eta \pi^0) / \Gamma_{\text{total}} \quad \Gamma_{27} / \Gamma$$

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.30±0.07±0.01	56.4	¹ HE	08B CLEO	$e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$
¹ HE 08B reports $0.32 \pm 0.05 \pm 0.05 \pm 0.02$ % from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow K^+ K^- \eta \pi^0) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.99 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M056R69
 NODE=M056R69

NODE=M056R69;LINKAGE=HE

$$\Gamma(3(\pi^+ \pi^-)) / \Gamma_{\text{total}} \quad \Gamma_{28} / \Gamma$$

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
12.0±1.8 OUR EVALUATION	Treating systematic error as correlated.		
12.0±1.7 OUR AVERAGE			
11.7±1.0±1.9	¹ BAI	99B BES	$\psi(2S) \rightarrow \gamma \chi_{c0}$
12.5±2.9±0.5	¹ TANENBAUM	78 MRK1	$\psi(2S) \rightarrow \gamma \chi_{c0}$
¹ Rescaled by us using $B(\psi(2S) \rightarrow \gamma \chi_{c0}) = (9.4 \pm 0.4)\%$ and $B(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-) = (32.6 \pm 0.5)\%$.			

NODE=M056R4
 NODE=M056R4
 → UNCHECKED ←

NODE=M056R;LINKAGE=X1

$$\Gamma(K^+ \bar{K}^*(892)^0 \pi^- + \text{c.c.}) / \Gamma_{\text{total}}$$

VALUE

DOCUMENT ID

0.0072 ± 0.0016 OUR FIT

[0.0073 ± 0.0016 OUR 2013 FIT]

 Γ_{29}/Γ

NODE=M056R10

NODE=M056R10

NEW

$$\Gamma(K^*(892)^0 \bar{K}^*(892)^0) / \Gamma_{\text{total}}$$

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_{30}/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[(8.5 ± 0.4) × 10⁻³ OUR 2013 FIT] Γ_{31}/Γ

NODE=M056R22

NODE=M056R22

NEW

$$\Gamma(\eta\eta) / \Gamma_{\text{total}}$$

VALUE (units 10⁻³)

DOCUMENT ID

2.95 ± 0.19 OUR FIT[(3.01 ± 0.20) × 10⁻³ OUR 2013 FIT] Γ_{34}/Γ

NODE=M056R13

NODE=M056R13

NEW

$$\Gamma(\eta\eta) / \Gamma(\pi\pi)$$

VALUE

DOCUMENT ID

TECN

COMMENT

0.354 ± 0.025 OUR FIT

[0.356 ± 0.025 OUR 2013 FIT]

 Γ_{34}/Γ_{31}

NODE=M056R20

NODE=M056R20

NEW

• • • 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_{35}/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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = 9.99 \times 10^{-2}$.

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=AS

NODE=M056R03;LINKAGE=AD

$$\Gamma(\eta' \eta') / \Gamma_{\text{total}}$$

VALUE (units 10⁻³)

EVTS

DOCUMENT ID

TECN

COMMENT

1.96 ± 0.21 OUR AVERAGE [(1.99 ± 0.22) × 10⁻³ OUR 2013 AVERAGE]**1.96 ± 0.20 ± 0.05**

0.4k

¹

ASNER

09

CLEO

 $\psi(2S) \rightarrow \gamma \eta' \eta'$ Γ_{36}/Γ

NODE=M056R04

NODE=M056R04

NEW

• • • 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_{37}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT

0.95±0.11 OUR AVERAGE[(0.96 ± 0.11) × 10⁻³ OUR 2013 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

NEW

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_{38}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT

1.16±0.21 OUR AVERAGE [(1.17 ± 0.22) × 10⁻⁴ OUR 2013 AVERAGE]**1.16±0.21±0.03** 76 ¹ ABLIKIM 11K BES3 $\psi(2S) \rightarrow \gamma$ hadrons

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

NODE=M056R76

NEW

NODE=M056R76;LINKAGE=AL

$\Gamma(K^+ K^-)/\Gamma_{\text{total}}$ Γ_{39}/Γ

VALUE (units 10^{-3})	DOCUMENT ID

5.91±0.32 OUR FIT[(5.98 ± 0.34) × 10⁻³ OUR 2013 FIT]

NODE=M056R6

NODE=M056R6

NEW

$\Gamma(K_S^0 K_S^0)/\Gamma_{\text{total}}$ Γ_{40}/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_{40}/Γ_{31}

VALUE	DOCUMENT ID	TECN	COMMENT

0.372±0.023 OUR FIT

[0.367 ± 0.022 OUR 2013 FIT]

NODE=M056R53

NODE=M056R53

NEW

• • • 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_{40}/Γ_{39}

VALUE	DOCUMENT ID	TECN	COMMENT

0.52±0.04 OUR FIT

[0.519 ± 0.035 OUR 2013 FIT]

NODE=M056R52

NODE=M056R52

NEW

• • • 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_{41}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<0.19 (CL = 90%)		[<0.20 $\times 10^{-3}$ (CL = 90%) OUR 2013 BEST LIMIT]		
<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_{42}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<0.35 (CL = 90%)		[<0.4 $\times 10^{-3}$ (CL = 90%) OUR 2013 BEST LIMIT]		
<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_{43}/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_{44}/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_{45}/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_{46}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.38 $\pm$ 0.46 $\pm$ 0.04	16.8 $\pm$ 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})

DOCUMENT ID

2.75±0.28 OUR FIT[(2.77 ± 0.29) × 10^{-3} OUR 2013 FIT] Γ_{47}/Γ

NODE=M056R14

NODE=M056R14

NEW

 $\Gamma(K^+ K^- \phi)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

EVTS

DOCUMENT ID

TECN

COMMENT

0.95±0.24 OUR AVERAGE [(0.96 ± 0.25) × 10^{-3} OUR 2013 AVERAGE]**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.

 Γ_{48}/Γ

NODE=M056R01

NODE=M056R01

NEW

NODE=M056R01;LINKAGE=AB

 $\Gamma(\phi\phi)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

DOCUMENT ID

0.77±0.07 OUR FIT[(0.79 ± 0.08) × 10^{-3} OUR 2013 FIT] Γ_{49}/Γ

NODE=M056R16

NODE=M056R16

NEW

 $\Gamma(p\bar{p})/\Gamma_{\text{total}}$ VALUE (units 10^{-4})

DOCUMENT ID

2.25±0.09 OUR FIT[(2.13 ± 0.12) × 10^{-4} OUR 2013 FIT] Γ_{50}/Γ

NODE=M056R11

NODE=M056R11

NEW

 $\Gamma(p\bar{p}\pi^0)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

DOCUMENT ID

TECN

COMMENT

0.68±0.07 OUR AVERAGE Error includes scale factor of 1.3. [(0.69 ± 0.07) × 10^{-3} OUR 2013 AVERAGE Scale factor = 1.2]

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.

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.

 Γ_{51}/Γ

NODE=M056R06

NODE=M056R06

NEW

NODE=M056R06;LINKAGE=ON

NODE=M056R06;LINKAGE=AT

 $\Gamma(p\bar{p}\eta)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

DOCUMENT ID

TECN

COMMENT

0.35±0.04 OUR AVERAGE

0.34±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.

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.

 Γ_{52}/Γ

NODE=M056R50

NODE=M056R50

NODE=M056R50;LINKAGE=ON

NODE=M056R50;LINKAGE=AT

 $\Gamma(p\bar{p}\omega)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

DOCUMENT ID

TECN

COMMENT

0.51±0.06 OUR AVERAGE [(0.52 ± 0.06) × 10^{-3} OUR 2013 AVERAGE]**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.

 Γ_{53}/Γ

NODE=M056R70

NODE=M056R70

NEW

NODE=M056R70;LINKAGE=ON

$\Gamma(p\bar{p}\phi)/\Gamma_{\text{total}}$ Γ_{54}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT

5.9±1.4 OUR AVERAGE $[(6.0 \pm 1.4) \times 10^{-5}]$ OUR 2013 AVERAGE]**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
NODE=M056R75

NEW

NODE=M056R75;LINKAGE=AB

 $\Gamma(p\bar{p}\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{55}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT

2.1 ±0.7 OUR EVALUATION Error includes scale factor of 1.4. Treating systematic error as correlated.**2.1 ±1.0 OUR AVERAGE** Error includes scale factor of 2.0.1.57±0.21±0.53 ¹ BAI 99B BES $\psi(2S) \rightarrow \gamma\chi_{c0}$ 4.20±1.15±0.18 ¹ TANENBAUM 78 MRK1 $\psi(2S) \rightarrow \gamma\chi_{c0}$

¹ Rescaled by us using $B(\psi(2S) \rightarrow \gamma\chi_{c0}) = (9.4 \pm 0.4)\%$ and $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (32.6 \pm 0.5)\%$.

NODE=M056R7
NODE=M056R7

→ UNCHECKED ←

NODE=M056R7;LINKAGE=X1

 $\Gamma(p\bar{p}\pi^0\pi^0)/\Gamma_{\text{total}}$ Γ_{56}/Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT

0.102±0.027 OUR AVERAGE $[(0.103 \pm 0.028)\%]$ OUR 2013 AVERAGE]**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
NODE=M056R65

NEW

NODE=M056R65;LINKAGE=HE

 $\Gamma(p\bar{p}K^+K^- \text{ (non-resonant)})/\Gamma_{\text{total}}$ Γ_{57}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT

1.19±0.26 OUR AVERAGE $[(1.21 \pm 0.26) \times 10^{-4}]$ OUR 2013 AVERAGE]**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
NODE=M056R72

NEW

NODE=M056R72;LINKAGE=AB

 $\Gamma(p\bar{p}K_S^0K_S^0)/\Gamma_{\text{total}}$ Γ_{58}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT

<8.8 90 ¹ ABLIKIM 06D BES2 $\psi(2S) \rightarrow \chi_{c0}\gamma$

¹ Using $B(\psi(2S) \rightarrow \chi_{c0}\gamma) = (9.2 \pm 0.5)\%$

NODE=M056R46
NODE=M056R46

NODE=M056R;LINKAGE=AB

 $\Gamma(p\bar{n}\pi^-)/\Gamma_{\text{total}}$ Γ_{59}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT

12.4±1.1 OUR AVERAGE $[(11.2 \pm 3.1) \times 10^{-4}]$ OUR 2013 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.

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
NODE=M056R49

NEW

NODE=M056R49;LINKAGE=AL

NODE=M056R49;LINKAGE=AB

$\Gamma(\bar{p}n\pi^+)/\Gamma_{\text{total}}$ Γ_{60}/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_{61}/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_{62}/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_{63}/Γ

VALUE (units 10^{-4})	DOCUMENT ID
3.21±0.25 OUR FIT	
$[(3.3 \pm 0.4) \times 10^{-4} \text{ OUR 2013 FIT}]$	

NODE=M056R23
 NODE=M056R23
 NEW

 $\Gamma(\Lambda\bar{\Lambda}\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{64}/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_{65}/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_{66}/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_{67}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<50	90	¹ ABLIKIM	12I BES3	$\psi(2S) \rightarrow \gamma \Sigma(1385)^-\bar{\Lambda}\pi^+$
¹ ABLIKIM 12I reports $< 50 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \Sigma(1385)^-\bar{\Lambda}\pi^+ + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.68 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = 9.99 \times 10^{-2}$.				

NODE=M056R79
 NODE=M056R79

NODE=M056R79;LINKAGE=AL

 $\Gamma(K^+\bar{p}\Lambda + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{68}/Γ

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
1.22±0.12 OUR AVERAGE		Error includes scale factor of 1.3. $[(1.24 \pm 0.12) \times 10^{-3} \text{ OUR 2013 AVERAGE Scale factor} = 1.3]$		
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

NEW

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_{69}/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_{70}/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_{71}/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
4.4±0.4 OUR AVERAGE		[(4.1 ± 0.7) × 10 ⁻⁴ OUR 2013 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

NEW

NODE=M056R59;LINKAGE=AB

NODE=M056R59;LINKAGE=NA

$\Gamma(\Sigma^+ \bar{\Sigma}^-)/\Gamma_{\text{total}}$ Γ_{72}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT

3.9±0.7 OUR AVERAGE Error includes scale factor of 1.7. $[(3.0 \pm 0.7) \times 10^{-4}]$ OUR 2013 AVERAGE]

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

NEW

NODE=M056R60;LINKAGE=AB

NODE=M056R60;LINKAGE=NA

 $\Gamma(\Sigma(1385)^+ \bar{\Sigma}(1385)^-)/\Gamma_{\text{total}}$ Γ_{73}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT

15.9±5.7±0.4 27 ¹ ABLIKIM 12I BES3 $\psi(2S) \rightarrow \gamma \Lambda \bar{\Lambda} \pi^+ \pi^-$

¹ ABLIKIM 12I reports $(16.4 \pm 5.7 \pm 1.6) \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \Sigma(1385)^+ \bar{\Sigma}(1385)^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.68 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.99 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R80
NODE=M056R80

NODE=M056R80;LINKAGE=AL

 $\Gamma(\Sigma(1385)^- \bar{\Sigma}(1385)^+)/\Gamma_{\text{total}}$ Γ_{74}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT

23±6±1 33 ¹ ABLIKIM 12I BES3 $\psi(2S) \rightarrow \gamma \Lambda \bar{\Lambda} \pi^+ \pi^-$

¹ ABLIKIM 12I reports $(23.5 \pm 6.2 \pm 2.3) \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \Sigma(1385)^- \bar{\Sigma}(1385)^+)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.68 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.99 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R81
NODE=M056R81

NODE=M056R81;LINKAGE=AL

 $\Gamma(\Xi^0 \bar{\Xi}^0)/\Gamma_{\text{total}}$ Γ_{75}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT

3.1±0.8±0.1 23.3 ± 4.9 ¹ NAIK 08 CLEO $\psi(2S) \rightarrow \gamma \Xi^0 \bar{\Xi}^0$

¹ NAIK 08 reports $(3.34 \pm 0.70 \pm 0.48) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \Xi^0 \bar{\Xi}^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.99 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R61
NODE=M056R61

NODE=M056R61;LINKAGE=NA

 $\Gamma(\Xi^- \bar{\Xi}^+)/\Gamma_{\text{total}}$ Γ_{76}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT

4.7±0.7 OUR AVERAGE $[(4.8 \pm 0.7) \times 10^{-4}]$ OUR 2013 AVERAGE]

4.7±0.7±0.1 95 ± 11 ¹ NAIK 08 CLEO $\psi(2S) \rightarrow \gamma \Xi^+ \bar{\Xi}^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<10.3 90 ² ABLIKIM 06D BES2 $\psi(2S) \rightarrow \chi_{c0} \gamma$

¹ NAIK 08 reports $(5.14 \pm 0.60 \pm 0.47) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \Xi^- \bar{\Xi}^+)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.99 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² Using $B(\psi(2S) \rightarrow \chi_{c0} \gamma) = (9.2 \pm 0.5)\%$

NODE=M056R45
NODE=M056R45

NEW

NODE=M056R45;LINKAGE=NA

NODE=M056R45;LINKAGE=AB

 $\Gamma(p \bar{p})/\Gamma_{\text{total}} \times \Gamma(\pi \pi)/\Gamma_{\text{total}}$ $\Gamma_{50}/\Gamma \times \Gamma_{31}/\Gamma$

VALUE (units 10^{-7})	DOCUMENT ID	TECN	COMMENT

18.8±1.2 OUR FIT
 $[(18.0 \pm 1.2) \times 10^{-7}]$ OUR 2013 FIT]

15.3±2.4±0.8 ¹ ANDREOTTI 03 E835 $\bar{p} p \rightarrow \chi_{c0} \rightarrow \pi^0 \pi^0$

¹ We have multiplied $B(p \bar{p}) \cdot B(\pi^0 \pi^0)$ measurement by 3 to obtain $B(p \bar{p}) \cdot B(\pi \pi)$.

NODE=M056R21
NODE=M056R21

NEW

NODE=M056R;LINKAGE=AD

$$\Gamma(p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\pi^0\eta)/\Gamma_{\text{total}}$$

VALUE (units 10^{-7})

<0.4

DOCUMENT ID

TECN

COMMENT

ANDREOTTI 05C E835

$\bar{p}p \rightarrow \pi^0\eta$

$$\Gamma_{50}/\Gamma \times \Gamma_{32}/\Gamma$$

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

$\bar{p}p \rightarrow \pi^0\eta$

$$\Gamma_{50}/\Gamma \times \Gamma_{33}/\Gamma$$

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

[(6.4 ± 0.5) $\times 10^{-7}$ OUR 2013 FIT]

$4.0 \pm 1.2^{+0.5}_{-0.3}$

DOCUMENT ID

TECN

COMMENT

ANDREOTTI 05C E835

$\bar{p}p \rightarrow \eta\eta$

$$\Gamma_{50}/\Gamma \times \Gamma_{34}/\Gamma$$

NODE=M056R40
NODE=M056R40

NEW

$$\Gamma(p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\eta\eta')/\Gamma_{\text{total}}$$

VALUE (units 10^{-6})

• • • We do not use the following data for averages, fits, limits, etc. • • •

$2.1^{+2.3}_{-1.5}$

DOCUMENT ID

TECN

COMMENT

ANDREOTTI 05C E835

$\bar{p}p \rightarrow \pi^0\eta$

$$\Gamma_{50}/\Gamma \times \Gamma_{35}/\Gamma$$

NODE=M056R43
NODE=M056R43

RADIATIVE DECAYS

$$\Gamma(\gamma J/\psi(1S))/\Gamma_{\text{total}}$$

VALUE (units 10^{-4})

127 ± 6 OUR FIT

[(130 ± 7) $\times 10^{-4}$ OUR 2013 FIT]

• • • We do not use the following data for averages, fits, limits, etc. • • •

$200 \pm 20 \pm 20$

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.

$$\Gamma_{77}/\Gamma$$

NODE=M056310

NODE=M056R8
NODE=M056R8

NEW

NODE=M056R8;LINKAGE=AD

$$\Gamma(\gamma\rho^0)/\Gamma_{\text{total}}$$

VALUE (units 10^{-6})

CL%

EVTS

DOCUMENT ID

TECN

COMMENT

< 9

90

1.2 ± 4.5

¹ BENNETT

08A CLEO

$\psi(2S) \rightarrow \gamma\gamma\rho^0$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<10

90

6 ± 12

² ABLIKIM

11E BES3

$\psi(2S) \rightarrow \gamma\gamma\rho^0$

¹ BENNETT 08A reports $< 9.6 \times 10^{-6}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \gamma\rho^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = 9.99 \times 10^{-2}$.

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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = 9.99 \times 10^{-2}$.

$$\Gamma_{78}/\Gamma$$

NODE=M056R56
NODE=M056R56

NODE=M056R56;LINKAGE=BE

NODE=M056R56;LINKAGE=AB

$$\Gamma(\gamma\omega)/\Gamma_{\text{total}}$$

VALUE (units 10^{-6})

CL%

EVTS

DOCUMENT ID

TECN

COMMENT

< 8

90

0.0 ± 2.8

¹ BENNETT

08A CLEO

$\psi(2S) \rightarrow \gamma\gamma\omega$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = 9.99 \times 10^{-2}$.

$$\Gamma_{79}/\Gamma$$

NODE=M056R57
NODE=M056R57

NODE=M056R57;LINKAGE=BE

NODE=M056R57;LINKAGE=AB

$$\Gamma(\gamma\phi)/\Gamma_{\text{total}}$$

VALUE (units 10^{-6})

CL%

EVTS

DOCUMENT ID

TECN

COMMENT

< 6

90

0.1 ± 1.6

¹ BENNETT

08A CLEO

$\psi(2S) \rightarrow \gamma\gamma\phi$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<16

90

15 ± 7

² ABLIKIM

11E BES3

$\psi(2S) \rightarrow \gamma\gamma\phi$

¹ BENNETT 08A reports $< 6.4 \times 10^{-6}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \gamma\phi)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = 9.99 \times 10^{-2}$.

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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = 9.99 \times 10^{-2}$.

$$\Gamma_{80}/\Gamma$$

NODE=M056R58
NODE=M056R58

NODE=M056R58;LINKAGE=BE

NODE=M056R58;LINKAGE=AB

$\Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ Γ_{81}/Γ VALUE (units 10^{-4})

CL%

DOCUMENT ID

TECN

COMMENT

2.23±0.13 OUR FIT[(2.25 ± 0.17) × 10^{-4} OUR 2013 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 [$\Gamma(\chi_{c0}(1P) \rightarrow \gamma\gamma)/\Gamma_{\text{total}}$] × [$B(B^+ \rightarrow \chi_{c0}(1P) K^+)$] < 0.11 × 10^{-6} which we divide by our best value $B(B^+ \rightarrow \chi_{c0}(1P) K^+) = 1.50 \times 10^{-4}$.

NODE=M056R1

NODE=M056R1

NEW

NODE=M056R1;LINKAGE=W1

 $\Gamma(\gamma\gamma)/\Gamma(\gamma J/\psi(1S))$ Γ_{81}/Γ_{77} VALUE (units 10^{-2})

DOCUMENT ID

TECN

COMMENT

1.76±0.13 OUR FIT[(1.73 ± 0.16) × 10^{-2} OUR 2013 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 $p\bar{p} \rightarrow \chi_{c2} \rightarrow \gamma\gamma, \gamma J/\psi$ ¹ The values of $B(p\bar{p})B(\gamma\gamma)$ and $B(\gamma\gamma)B(\gamma J/\psi)$ measured by ANDREOTTI 04 are not independent. The latter is used in the fit because of smaller systematics.² Calculated by us using $B(J/\psi(1S) \rightarrow e^+ e^-) = 0.0593 \pm 0.0010$.

NODE=M056R18

NODE=M056R18

NEW

NODE=M056R;LINKAGE=AN

NODE=M056R;LINKAGE=7A

 $\Gamma(p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\gamma J/\psi(1S))/\Gamma_{\text{total}}$ $\Gamma_{50}/\Gamma \times \Gamma_{77}/\Gamma$ VALUE (units 10^{-7})

EVTS

DOCUMENT ID

TECN

COMMENT

28.5±1.6 OUR FIT[(27.8 ± 1.7) × 10^{-7} OUR 2013 FIT]**28.2±2.1 OUR AVERAGE**

28.0±1.9±1.3

392

1,2,3

BAGNASCO

02

E835

 $p\bar{p} \rightarrow \chi_{c0} \rightarrow J/\psi\gamma$ 29.3 ^{+5.7}_{-4.7} ±1.5

89

1,2

AMBROGIANI

99B

E835

 $p\bar{p} \rightarrow \chi_{c0} \rightarrow J/\psi\gamma$ ¹ Values in ($\Gamma(p\bar{p}) \times \Gamma(\gamma J/\psi(1S))/\Gamma_{\text{total}}$) and ($\Gamma(p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\gamma J/\psi(1S))/\Gamma_{\text{total}}$) are not independent. The latter is used in the fit since it is less correlated to the total width.² Calculated by us using $B(J/\psi(1S) \rightarrow e^+ e^-) = 0.0593 \pm 0.0010$.³ Recalculated by ANDREOTTI 05A.

NODE=M056R19

NODE=M056R19

NEW

NODE=M056R;LINKAGE=KS

NODE=M056R19;LINKAGE=7A

NODE=M056R19;LINKAGE=AN

 $\Gamma(p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_{50}/\Gamma \times \Gamma_{81}/\Gamma$ VALUE (units 10^{-8})

DOCUMENT ID

TECN

COMMENT

5.0 ±0.4 OUR FIT[(4.8 ± 0.5) × 10^{-8} OUR 2013 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

NEW

NODE=M056R25;LINKAGE=AN

$\chi_{c0}(1P)$ CROSS-PARTICLE BRANCHING RATIOS

NODE=M056230

 $\Gamma(\chi_{c0}(1P) \rightarrow p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))/\Gamma_{\text{total}}$ $\Gamma_{50}/\Gamma \times \Gamma_{128}^{\psi(2S)}/\Gamma\psi(2S)$ VALUE (units 10^{-6})

EVTS

DOCUMENT ID

TECN

COMMENT

22.5±0.9 OUR FIT[(21.0 ± 1.4) × 10^{-6} OUR 2013 FIT]**23.7±1.0 OUR AVERAGE**[(23.7 ± 1.8) × 10^{-6} OUR 2013 AVERAGE]

23.7±0.8±0.9

1222

ABLIKIM

13v

BES3

ψ(2S)

 $\rightarrow \gamma p\bar{p}$

23.7±1.4±1.4

383 ± 22

¹ NAIK

08

CLEO

ψ(2S)

 $\rightarrow \gamma p\bar{p}$ 23.6 ^{+3.7}_{-3.4} ±3.489.5 ⁺¹⁴₋₁₃

BAI

04F

BES

ψ(2S)

 $\rightarrow \gamma\chi_{c0}(1P) \rightarrow \gamma p\bar{p}$ ¹ Calculated by us. NAIK 08 reports $B(\chi_{c0} \rightarrow p\bar{p}) = (25.7 \pm 1.5 \pm 1.5 \pm 1.3) \times 10^{-5}$ using $B(\psi(2S) \rightarrow \gamma\chi_{c0}) = (9.22 \pm 0.11 \pm 0.46)\%$.

NODE=M056B6

NODE=M056B6

NEW

NEW

NODE=M056B6;LINKAGE=NA

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)}{\Gamma_{50}/\Gamma \times \Gamma_{128}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10^{-5})

DOCUMENT ID

TECN

COMMENT

6.54±0.27 OUR FIT[(6.2 ± 0.4) × 10⁻⁵ OUR 2013 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

NEW

NODE=M056B;LINKAGE=B1

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow \Lambda\bar{\Lambda})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))/\Gamma_{\text{total}}}{\Gamma_{63}/\Gamma \times \Gamma_{128}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10^{-6})

EVTS

DOCUMENT ID

TECN

COMMENT

32.0±2.3 OUR FIT[(32 ± 4) × 10⁻⁶ OUR 2013 FIT]**31.7±2.3 OUR AVERAGE**[(31 ± 4) × 10⁻⁶ OUR 2013 AVERAGE]

32.0±1.9±2.2

369

¹ ABLIKIM

13H

BES3

 $\psi(2S) \rightarrow \gamma\Lambda\bar{\Lambda}$

31.2±3.3±2.0

131 ± 12

² NAIK

08

CLEO

 $\psi(2S) \rightarrow \gamma\Lambda\bar{\Lambda}$

¹ Calculated by us. ABLIKIM 13H reports $B(\chi_{c0} \rightarrow \Lambda\bar{\Lambda}) = (33.3 \pm 2.0 \pm 2.6) \times 10^{-5}$ from a measurement of $B(\chi_{c0} \rightarrow \Lambda\bar{\Lambda}) \times B(\psi(2S) \rightarrow \gamma\chi_{c0})$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}) = (9.62 \pm 0.31)\%$.

² Calculated by us. NAIK 08 reports $B(\chi_{c0} \rightarrow \Lambda\bar{\Lambda}) = (33.8 \pm 3.6 \pm 2.2 \pm 1.7) \times 10^{-5}$ using $B(\psi(2S) \rightarrow \gamma\chi_{c0}) = (9.22 \pm 0.11 \pm 0.46)\%$.

NODE=M056B20

NODE=M056B20

NEW

NEW

NODE=M056B20;LINKAGE=AB

NODE=M056B20;LINKAGE=NA

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow \Lambda\bar{\Lambda})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)}{\Gamma_{63}/\Gamma \times \Gamma_{128}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10^{-5})

EVTS

DOCUMENT ID

TECN

COMMENT

9.3±0.7 OUR FIT[(9.4 ± 1.1) × 10⁻⁵ OUR 2013 FIT]**13.0^{+3.6}_{-3.5}±2.5**15.2^{+4.2}_{-4.0}¹ BAI

03E

BES

 $\psi(2S) \rightarrow \gamma\Lambda\bar{\Lambda}$

¹ BAI 03E reports $[B(\chi_{c0} \rightarrow \Lambda\bar{\Lambda}) B(\psi(2S) \rightarrow \gamma\chi_{c0}) / B(\psi(2S) \rightarrow J/\psi\pi^+\pi^-)] \times [B^2(\Lambda \rightarrow \pi^- p) / B(J/\psi \rightarrow p\bar{p})] = (2.45^{+0.68}_{-0.65} \pm 0.46)\%$. We calculate from this measurement the presented value using $B(\Lambda \rightarrow \pi^- p) = (63.9 \pm 0.5)\%$ and $B(J/\psi \rightarrow p\bar{p}) = (2.17 \pm 0.07) \times 10^{-3}$.

NODE=M056B21

NODE=M056B21

NEW

NODE=M056B21;LINKAGE=BA

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow \gamma J/\psi(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))/\Gamma_{\text{total}}}{\Gamma_{77}/\Gamma \times \Gamma_{128}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10^{-2})

EVTS

DOCUMENT ID

TECN

COMMENT

0.126±0.006 OUR FIT[(0.128 ± 0.007) × 10⁻² OUR 2013 FIT]**0.131±0.035 OUR AVERAGE**

Error includes scale factor of 3.9.

0.151±0.003±0.010

4.3k

ABLIKIM

120

BES3

 $\psi(2S) \rightarrow \gamma\chi_{c0}$

0.069±0.018

¹ OREGLIA

82

CBAL

 $\psi(2S) \rightarrow \gamma\chi_{c0}$

0.4 ± 0.3

² BRANDELIK

79B

DASP

 $\psi(2S) \rightarrow \gamma\chi_{c0}$

0.16 ± 0.11

² BARTEL

78B

CNTR

 $\psi(2S) \rightarrow \gamma\chi_{c0}$

3.3 ± 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±0.007±0.013

560

⁴ MENDEZ

08

CLEO

 $\psi(2S) \rightarrow \gamma\chi_{c0}$

0.18 ± 0.01 ± 0.02

172

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=M056B2

NODE=M056B2

NEW

NODE=M056B;LINKAGE=3Q

NODE=M056B;LINKAGE=2Q

NODE=M056B;LINKAGE=EA

NODE=M056B2;LINKAGE=ME

NODE=M056B2;LINKAGE=AD

$$\Gamma(\chi_{c0}(1P) \rightarrow \gamma J/\psi(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S) \text{ anything})$$

$$\frac{\Gamma_{77}/\Gamma \times \Gamma_{128}^{\psi(2S)}/\Gamma_9^{\psi(2S)}}{\Gamma_{128}^{\psi(2S)}/\Gamma_9^{\psi(2S)} + \Gamma_{11}^{\psi(2S)}/\Gamma_{12}^{\psi(2S)} + \Gamma_{13}^{\psi(2S)}/\Gamma_{130}^{\psi(2S)}} = \Gamma_{77}/\Gamma \times \Gamma_{128}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)} + \Gamma_{12}^{\psi(2S)}/\Gamma_{13}^{\psi(2S)} + 0.339\Gamma_{129}^{\psi(2S)}/0.192\Gamma_{130}^{\psi(2S)}$$

NODE=M056B7

NODE=M056B7

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT

0.208±0.011 OUR FIT[(0.213 ± 0.011) × 10⁻² OUR 2013 FIT]

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.201±0.011±0.021	560	¹ MENDEZ	08	CLEO $\psi(2S) \rightarrow \gamma \chi_{c0}$
0.31 ± 0.02 ± 0.03	172	ADAM	05A	CLEO Repl. by MENDEZ 08

¹ Not independent from other measurements of MENDEZ 08.

NODE=M056B7

NEW

NODE=M056B7;LINKAGE=ME

$$\Gamma(\chi_{c0}(1P) \rightarrow \gamma J/\psi(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)$$

$$\frac{\Gamma_{77}/\Gamma \times \Gamma_{128}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}{\Gamma_{128}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT

0.367±0.019 OUR FIT[(0.376 ± 0.020) × 10⁻² OUR 2013 FIT]

0.358±0.020±0.037	560	MENDEZ	08	CLEO $\psi(2S) \rightarrow \gamma \chi_{c0}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.55 ± 0.04 ± 0.06	172	¹ ADAM	05A	CLEO Repl. by MENDEZ 08

¹ Not independent from other values reported by ADAM 05A.

NODE=M056B8

NODE=M056B8

NEW

NODE=M056B;LINKAGE=AD

$$\Gamma(\chi_{c0}(1P) \rightarrow \gamma \gamma)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))/\Gamma_{\text{total}}$$

$$\frac{\Gamma_{81}/\Gamma \times \Gamma_{128}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}{\Gamma_{128}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT

2.23±0.14 OUR FIT[(2.21 ± 0.19) × 10⁻⁵ OUR 2013 FIT]**2.18±0.18 OUR AVERAGE**[(2.21 ± 0.33) × 10⁻⁵ OUR 2013 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 $\psi(2S) \rightarrow \gamma \chi_{c0}$

NODE=M056B3

NODE=M056B3

NEW

NEW

$$\Gamma(\chi_{c0}(1P) \rightarrow \pi \pi)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))/\Gamma_{\text{total}}$$

$$\frac{\Gamma_{31}/\Gamma \times \Gamma_{128}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}{\Gamma_{128}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

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 $\psi(2S) \rightarrow \gamma \pi^0 \pi^0$

¹ Calculated by us. ABLIKIM 10A reports $B(\chi_{c0} \rightarrow \pi^0 \pi^0) = (3.23 \pm 0.03 \pm 0.23 \pm 0.14) \times 10^{-3}$ using $B(\psi(2S) \rightarrow \gamma \chi_{c0}) = (9.4 \pm 0.4)\%$. We have multiplied the $\pi^0 \pi^0$ measurement by 3 to obtain $\pi \pi$.² Calculated by us. ASNER 09 reports $B(\chi_{c0} \rightarrow \pi^+ \pi^-) = (6.37 \pm 0.08 \pm 0.31 \pm 0.32) \times 10^{-3}$ using $B(\psi(2S) \rightarrow \gamma \chi_{c0}) = (9.22 \pm 0.11 \pm 0.46)\%$. We have multiplied the $\pi^+ \pi^-$ measurement by 3/2 to obtain $\pi \pi$.³ Calculated by us. ASNER 09 reports $B(\chi_{c0} \rightarrow \pi^0 \pi^0) = (2.94 \pm 0.07 \pm 0.32 \pm 0.15) \times 10^{-3}$ using $B(\psi(2S) \rightarrow \gamma \chi_{c0}) = (9.22 \pm 0.11 \pm 0.46)\%$. We have multiplied the $\pi^0 \pi^0$ measurement by 3 to obtain $\pi \pi$.

NODE=M056B22

NODE=M056B22

OCCUR=2

NODE=M056B22;LINKAGE=AB

NODE=M056B22;LINKAGE=AS

NODE=M056B22;LINKAGE=AN

$$\Gamma(\chi_{c0}(1P) \rightarrow \pi \pi)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)$$

$$\frac{\Gamma_{31}/\Gamma \times \Gamma_{128}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}{\Gamma_{128}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT

24.2±0.8 OUR FIT[(24.4 ± 0.9) × 10⁻⁴ OUR 2013 FIT]**20.7±1.7 OUR AVERAGE**

23.9±2.7±4.1	97 ± 11	¹ BAI	03C	BES $\psi(2S) \rightarrow \gamma \chi_{c0} \rightarrow \gamma \pi^0 \pi^0$
20.2±1.1±1.5	720 ± 32	² BAI	98I	BES $\psi(2S) \rightarrow \gamma \chi_{c0} \rightarrow \gamma \pi^+ \pi^-$

¹ We have multiplied $\pi^0 \pi^0$ measurement by 3 to obtain $\pi \pi$.² Calculated by us. The value for $B(\chi_{c0} \rightarrow \pi^+ \pi^-)$ reported in BAI 98I is derived using $B(\psi' \rightarrow \gamma \chi_{c0}) = (9.3 \pm 0.8)\%$ and $B(\psi' \rightarrow J/\psi \pi^+ \pi^-) = (32.4 \pm 2.6)\%$ [BAI 98D]. We have multiplied $\pi^+ \pi^-$ measurement by 3/2 to obtain $\pi \pi$.

NODE=M056B5

NODE=M056B5

NEW

NODE=M056B;LINKAGE=D1

NODE=M056B;LINKAGE=D2

$$\Gamma(\chi_{c0}(1P) \rightarrow \eta\eta) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) / \Gamma_{\text{total}}$$

$$\Gamma_{34} / \Gamma \times \Gamma_{128}^{\psi(2S)} / \Gamma^{\psi(2S)}$$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.95±0.18 OUR FIT				
[(2.96 ± 0.18) × 10 ⁻⁴ OUR 2013 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
NODE=M056B11
NEW

NODE=M056B11;LINKAGE=AB

NODE=M056B11;LINKAGE=AS

NODE=M056B11;LINKAGE=AD

$$\Gamma(\chi_{c0}(1P) \rightarrow \eta\eta) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) / \Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)$$

$$\Gamma_{34} / \Gamma \times \Gamma_{128}^{\psi(2S)} / \Gamma_{11}^{\psi(2S)}$$

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
0.86 ±0.05 OUR FIT			
[(0.87 ± 0.05) × 10 ⁻³ OUR 2013 FIT]			
0.578±0.241±0.158	BAI	03C	BES $\psi(2S) \rightarrow \gamma\eta\eta$

NODE=M056B10
NODE=M056B10
NEW

$$\Gamma(\chi_{c0}(1P) \rightarrow K^+K^-) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) / \Gamma_{\text{total}}$$

$$\Gamma_{39} / \Gamma \times \Gamma_{128}^{\psi(2S)} / \Gamma^{\psi(2S)}$$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
5.90±0.28 OUR FIT				
[(5.89 ± 0.28) × 10 ⁻⁴ OUR 2013 FIT]				
5.97±0.07±0.32	8.1k	¹ ASNER	09	CLEO $\psi(2S) \rightarrow \gamma K^+K^-$

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
NODE=M056B23
NEW

NODE=M056B23;LINKAGE=AS

$$\Gamma(\chi_{c0}(1P) \rightarrow K^+K^-) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) / \Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)$$

$$\Gamma_{39} / \Gamma \times \Gamma_{128}^{\psi(2S)} / \Gamma_{11}^{\psi(2S)}$$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.71±0.08 OUR FIT				
[(1.73 ± 0.08) × 10 ⁻³ OUR 2013 FIT]				
1.63±0.10±0.15	774 ± 38	¹ BAI	98i	BES $\psi(2S) \rightarrow \gamma K^+K^-$

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
NODE=M056B9
NEW

NODE=M056B9;LINKAGE=BA

$$\Gamma(\chi_{c0}(1P) \rightarrow K_S^0 K_S^0) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) / \Gamma_{\text{total}}$$

$$\Gamma_{40} / \Gamma \times \Gamma_{128}^{\psi(2S)} / \Gamma^{\psi(2S)}$$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
3.09±0.16 OUR FIT				
[(3.05 ± 0.15) × 10 ⁻⁴ OUR 2013 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	$\psi(2S) \rightarrow \gamma K_S^0 K_S^0$

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
NODE=M056B12
NEW

NODE=M056B12;LINKAGE=AS

$$\Gamma(\chi_{c0}(1P) \rightarrow K_S^0 K_S^0) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) / \Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)$$

$$\Gamma_{40} / \Gamma \times \Gamma_{128}^{\psi(2S)} / \Gamma_{11}^{\psi(2S)}$$

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
9.0±0.5 OUR FIT			
[(9.0 ± 0.4) × 10 ⁻⁴ OUR 2013 FIT]			
5.6±0.8±1.3	¹ BAI	99B	BES $\psi(2S) \rightarrow \gamma K_S^0 K_S^0$

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
NODE=M056B13
NEW

NODE=M056B13;LINKAGE=BA

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow 2(\pi^+ \pi^-))}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))}{\Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)} \times \frac{\Gamma_1}{\Gamma} \times \frac{\Gamma_{128}^{\psi(2S)}}{\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10^{-3})

DOCUMENT ID

TECN

COMMENT

NODE=M056B4
NODE=M056B4**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

 $\psi(2S) \rightarrow \gamma \chi_{c0}$

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

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow \pi^+ \pi^- K^+ K^-)}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))}{\Gamma_{\text{total}}} \times \frac{\Gamma_8}{\Gamma} \times \frac{\Gamma_{128}^{\psi(2S)}}{\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10^{-3})

DOCUMENT ID

TECN

COMMENT

NODE=M056B18
NODE=M056B18**1.75±0.14 OUR FIT**[(1.74 ± 0.14) × 10^{-3} OUR 2013 FIT]**1.64±0.05±0.2**

ABLIKIM

05Q

BES2

 $\psi(2S) \rightarrow \gamma \chi_{c0}$

NEW

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow \pi^+ \pi^- K^+ K^-)}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))}{\Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)} \times \frac{\Gamma_8}{\Gamma} \times \frac{\Gamma_{128}^{\psi(2S)}}{\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10^{-3})

DOCUMENT ID

TECN

COMMENT

NODE=M056B19
NODE=M056B19**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;LINKAGE=TA

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow K^+ K^- K^+ K^-)}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))}{\Gamma_{\text{total}}} \times \frac{\Gamma_{47}}{\Gamma} \times \frac{\Gamma_{128}^{\psi(2S)}}{\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10^{-4})

EVTS

DOCUMENT ID

TECN

COMMENT

NODE=M056B14
NODE=M056B14**2.74±0.28 OUR FIT**[(2.72 ± 0.27) × 10^{-4} OUR 2013 FIT]**3.20±0.11±0.41**

278

¹ ABLIKIM

06T

BES2

 $\psi(2S) \rightarrow \gamma 2K^+ 2K^-$

NEW

¹ Calculated by us. The value of $B(\chi_{c0} \rightarrow 2K^+ 2K^-)$ reported by ABLIKIM 06T was derived using $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.2 \pm 0.4)\%$.

NODE=M056B14;LINKAGE=AB

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow K^+ K^- K^+ K^-)}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))}{\Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)} \times \frac{\Gamma_{47}}{\Gamma} \times \frac{\Gamma_{128}^{\psi(2S)}}{\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10^{-4})

DOCUMENT ID

TECN

COMMENT

NODE=M056B15
NODE=M056B15**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;LINKAGE=BA

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow \phi \phi)}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))}{\Gamma_{\text{total}}} \times \frac{\Gamma_{49}}{\Gamma} \times \frac{\Gamma_{128}^{\psi(2S)}}{\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10^{-4})

EVTS

DOCUMENT ID

TECN

COMMENT

NODE=M056B16
NODE=M056B16**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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.62 \pm 0.31)\%$.

NODE=M056B16;LINKAGE=AL

² Calculated by us. The value of $B(\chi_{c0} \rightarrow \phi \phi)$ reported by ABLIKIM 06T was derived using $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.2 \pm 0.4)\%$.

NODE=M056B16;LINKAGE=AB

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow \phi\phi)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)}{\Gamma_{49}/\Gamma \times \Gamma_{128}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10^{-4})

DOCUMENT ID

TECN

COMMENT

2.24±0.21 OUR FIT[(2.27 ± 0.21) × 10⁻⁴ OUR 2013 FIT]**2.6 ±1.0 ±1.1**¹ BAI

99B BES

 $\psi(2S) \rightarrow \gamma 2K^+ 2K^-$

¹ Calculated by us. The value of $B(\chi_{c0} \rightarrow \phi\phi)$ reported by BAI 99B was derived using $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.3 \pm 0.8)\%$ and $B(\psi(2S) \rightarrow J/\psi\pi^+\pi^-) = (32.4 \pm 2.6)\%$ [BAI 98d].

NODE=M056B17

NODE=M056B17

NEW

NODE=M056B17;LINKAGE=BA

 $\chi_{c0}(1P)$ REFERENCES

NODE=M056

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
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	11K	PR D83 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
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

$\chi_{c1}(1P)$

$$J^G(J^{PC}) = 0^+(1^{++})$$

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 ± 4.0		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

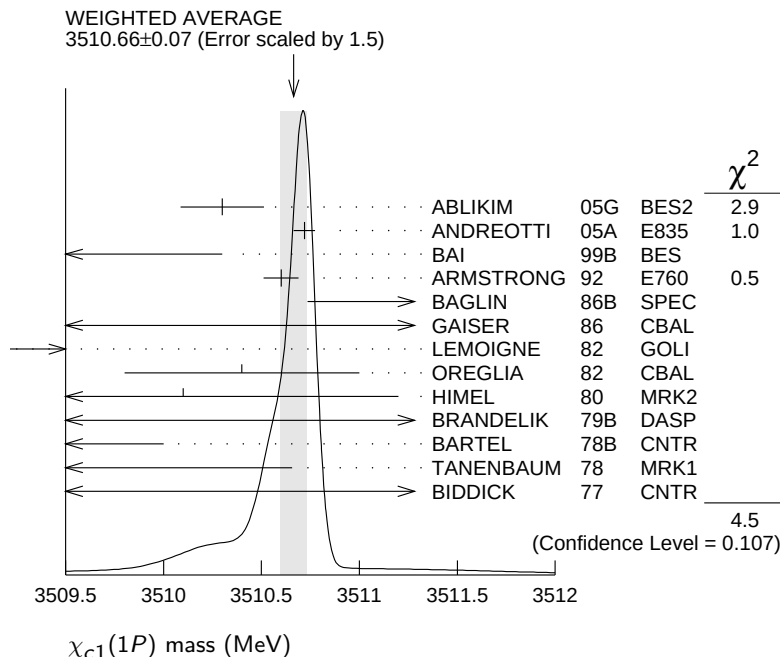
¹ Recalculated by ANDREOTTI 05A, using the value of $\psi(2S)$ mass from AULCHENKO 03.

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					

NODE=M055W

NODE=M055W

NEW

[0.86 ± 0.05 MeV OUR 2013 FIT]

0.88 ± 0.05 OUR AVERAGE

1.39	$+0.40$ -0.38	$+0.26$ -0.77	ABLIKIM	05G	BES2	$\psi(2S) \rightarrow \gamma \chi_{c1}$
0.876 ± 0.045 ± 0.026			ANDREOTTI	05A	E835	$p\bar{p} \rightarrow e^+ e^- \gamma$
0.87 ± 0.11 ± 0.08	513	¹	ARMSTRONG	92	E760	$p\bar{p} \rightarrow e^+ e^- \gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<1.3	95	BAGLIN	86B	SPEC	$p\bar{p} \rightarrow e^+ e^- X$
<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
Γ_2 $2(\pi^+ \pi^-)$	$(7.6 \pm 2.6) \times 10^{-3}$	
Γ_3 $\pi^+ \pi^- \pi^0 \pi^0$	$(1.22 \pm 0.16) \%$	
Γ_4 $\rho^+ \pi^- \pi^0 + \text{c.c.}$	$(1.48 \pm 0.25) \%$	
Γ_5 $\rho^0 \pi^+ \pi^-$	$(3.9 \pm 3.5) \times 10^{-3}$	
Γ_6 $4\pi^0$	$(5.5 \pm 0.8) \times 10^{-4}$	
Γ_7 $\pi^+ \pi^- K^+ K^-$	$(4.5 \pm 1.0) \times 10^{-3}$	
Γ_8 $K^+ K^- \pi^0 \pi^0$	$(1.14 \pm 0.28) \times 10^{-3}$	
Γ_9 $K^+ \pi^- \bar{K}^0 \pi^0 + \text{c.c.}$	$(8.7 \pm 1.4) \times 10^{-3}$	
Γ_{10} $\rho^- K^+ \bar{K}^0 + \text{c.c.}$	$(5.1 \pm 1.2) \times 10^{-3}$	
Γ_{11} $K^*(892)^0 \bar{K}^0 \pi^0 \rightarrow$ $K^+ \pi^- \bar{K}^0 \pi^0 + \text{c.c.}$	$(2.4 \pm 0.7) \times 10^{-3}$	
Γ_{12} $K^+ K^- \eta \pi^0$	$(1.14 \pm 0.35) \times 10^{-3}$	
Γ_{13} $\pi^+ \pi^- K_S^0 K_S^0$	$(7.0 \pm 3.0) \times 10^{-4}$	
Γ_{14} $K^+ K^- \eta$	$(3.2 \pm 1.0) \times 10^{-4}$	
Γ_{15} $\bar{K}^0 K^+ \pi^- + \text{c.c.}$	$(7.1 \pm 0.6) \times 10^{-3}$	
Γ_{16} $K^*(892)^0 \bar{K}^0 + \text{c.c.}$	$(1.0 \pm 0.4) \times 10^{-3}$	
Γ_{17} $K^*(892)^+ K^- + \text{c.c.}$	$(1.5 \pm 0.7) \times 10^{-3}$	
Γ_{18} $K_J^*(1430)^0 \bar{K}^0 + \text{c.c.} \rightarrow$ $K_S^0 K^+ \pi^- + \text{c.c.}$	$< 8 \times 10^{-4}$	CL=90%
Γ_{19} $K_J^*(1430)^+ K^- + \text{c.c.} \rightarrow$ $K_S^0 K^+ \pi^- + \text{c.c.}$	$< 2.2 \times 10^{-3}$	CL=90%
Γ_{20} $K^+ K^- \pi^0$	$(1.85 \pm 0.25) \times 10^{-3}$	
Γ_{21} $\eta \pi^+ \pi^-$	$(4.9 \pm 0.5) \times 10^{-3}$	
Γ_{22} $a_0(980)^+ \pi^- + \text{c.c.} \rightarrow \eta \pi^+ \pi^-$	$(1.8 \pm 0.6) \times 10^{-3}$	
Γ_{23} $f_2(1270) \eta$	$(2.7 \pm 0.8) \times 10^{-3}$	
Γ_{24} $\pi^+ \pi^- \eta'$	$(2.3 \pm 0.5) \times 10^{-3}$	
Γ_{25} $\pi^0 f_0(980) \rightarrow \pi^0 \pi^+ \pi^-$	$< 6 \times 10^{-6}$	CL=90%
Γ_{26} $K^+ \bar{K}^*(892)^0 \pi^- + \text{c.c.}$	$(3.2 \pm 2.1) \times 10^{-3}$	
Γ_{27} $K^*(892)^0 \bar{K}^*(892)^0$	$(1.5 \pm 0.4) \times 10^{-3}$	
Γ_{28} $K^+ K^- K_S^0 K_S^0$	$< 4 \times 10^{-4}$	CL=90%
Γ_{29} $K^+ K^- K^+ K^-$	$(5.5 \pm 1.1) \times 10^{-4}$	
Γ_{30} $K^+ K^- \phi$	$(4.2 \pm 1.6) \times 10^{-4}$	
Γ_{31} $\omega \omega$	$(5.8 \pm 0.7) \times 10^{-4}$	
Γ_{32} $\omega \phi$	$(2.1 \pm 0.6) \times 10^{-5}$	
Γ_{33} $\phi \phi$	$(4.2 \pm 0.5) \times 10^{-4}$	
Γ_{34} $\rho \bar{\rho}$	$(7.72 \pm 0.35) \times 10^{-5}$	
Γ_{35} $\rho \bar{\rho} \pi^0$	$(1.59 \pm 0.19) \times 10^{-4}$	
Γ_{36} $\rho \bar{\rho} \eta$	$(1.48 \pm 0.25) \times 10^{-4}$	
Γ_{37} $\rho \bar{\rho} \omega$	$(2.16 \pm 0.31) \times 10^{-4}$	
Γ_{38} $\rho \bar{\rho} \phi$	$< 1.8 \times 10^{-5}$	CL=90%
Γ_{39} $\rho \bar{\rho} \pi^+ \pi^-$	$(5.0 \pm 1.9) \times 10^{-4}$	

NODE=M055;CLUMP=A

DESIG=6

DESIG=5

DESIG=51

DESIG=52

DESIG=9

DESIG=60

DESIG=7

DESIG=53

DESIG=55

DESIG=56

DESIG=57

DESIG=58

DESIG=28

DESIG=42

DESIG=17

DESIG=32

DESIG=33

DESIG=34

DESIG=35

DESIG=38

DESIG=31

DESIG=36

DESIG=37

DESIG=44

DESIG=61

DESIG=10

DESIG=21

DESIG=29

DESIG=14

DESIG=30

DESIG=66

DESIG=67

DESIG=68

DESIG=11

DESIG=39

DESIG=43

DESIG=59

DESIG=65

DESIG=8

Γ ₄₀	$p\bar{p}\pi^0\pi^0$			DESIG=54
Γ ₄₁	$p\bar{p}K^+K^-$ (non-resonant)	$(1.30 \pm 0.23) \times 10^{-4}$		DESIG=62
Γ ₄₂	$p\bar{p}K_S^0 K_S^0$	$< 4.5 \times 10^{-4}$	CL=90%	DESIG=25
Γ ₄₃	$p\bar{n}\pi^-$	$(3.9 \pm 0.5) \times 10^{-4}$		DESIG=74
Γ ₄₄	$\bar{p}n\pi^+$	$(4.0 \pm 0.5) \times 10^{-4}$		DESIG=75
Γ ₄₅	$p\bar{n}\pi^-\pi^0$	$(1.05 \pm 0.12) \times 10^{-3}$		DESIG=76
Γ ₄₆	$\bar{p}n\pi^+\pi^0$	$(1.03 \pm 0.12) \times 10^{-3}$		DESIG=77
Γ ₄₇	$\Lambda\bar{\Lambda}$	$(1.16 \pm 0.12) \times 10^{-4}$		DESIG=19
Γ ₄₈	$\Lambda\bar{\Lambda}\pi^+\pi^-$	$(3.0 \pm 0.5) \times 10^{-4}$		DESIG=24
Γ ₄₉	$\Lambda\bar{\Lambda}\pi^+\pi^-$ (non-resonant)	$(2.5 \pm 0.6) \times 10^{-4}$		DESIG=69
Γ ₅₀	$\Sigma(1385)^+\bar{\Lambda}\pi^- + \text{c.c.}$	$< 1.3 \times 10^{-4}$	CL=90%	DESIG=70
Γ ₅₁	$\Sigma(1385)^-\bar{\Lambda}\pi^+ + \text{c.c.}$	$< 1.3 \times 10^{-4}$	CL=90%	DESIG=71
Γ ₅₂	$K^+\bar{p}\Lambda$	$(4.2 \pm 0.4) \times 10^{-4}$	S=1.1	DESIG=40
Γ ₅₃	$K^+\bar{p}\Lambda(1520) + \text{c.c.}$	$(1.7 \pm 0.5) \times 10^{-4}$		DESIG=63
Γ ₅₄	$\Lambda(1520)\bar{\Lambda}(1520)$	$< 1.0 \times 10^{-4}$	CL=90%	DESIG=64
Γ ₅₅	$\Sigma^0\bar{\Sigma}^0$	$< 4 \times 10^{-5}$	CL=90%	DESIG=48
Γ ₅₆	$\Sigma^+\bar{\Sigma}^-$	$< 6 \times 10^{-5}$	CL=90%	DESIG=49
Γ ₅₇	$\Sigma(1385)^+\bar{\Sigma}(1385)^-$	$< 1.0 \times 10^{-4}$	CL=90%	DESIG=72
Γ ₅₈	$\Sigma(1385)^-\bar{\Sigma}(1385)^+$	$< 5 \times 10^{-5}$	CL=90%	DESIG=73
Γ ₅₉	$\Xi^0\bar{\Xi}^0$	$< 6 \times 10^{-5}$	CL=90%	DESIG=50
Γ ₆₀	$\Xi^-\bar{\Xi}^+$	$(8.2 \pm 2.2) \times 10^{-5}$		DESIG=26
Γ ₆₁	$\pi^+\pi^- + K^+K^-$	$< 2.1 \times 10^{-3}$		DESIG=23
Γ ₆₂	$K_S^0 K_S^0$	$< 6 \times 10^{-5}$	CL=90%	DESIG=27

Radiative decays

Γ ₆₃	$\gamma J/\psi(1S)$	$(33.9 \pm 1.2) \%$		NODE=M055;CLUMP=B DESIG=1
Γ ₆₄	$\gamma\rho^0$	$(2.20 \pm 0.18) \times 10^{-4}$		DESIG=45
Γ ₆₅	$\gamma\omega$	$(6.9 \pm 0.8) \times 10^{-5}$		DESIG=46
Γ ₆₆	$\gamma\phi$	$(2.5 \pm 0.5) \times 10^{-5}$		DESIG=47
Γ ₆₇	$\gamma\gamma$			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 238 measurements to determine 49 parameters. The overall fit has a $\chi^2 = 339.7$ for 189 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta p_i \delta p_j \rangle / (\delta p_i \delta p_j)$, in percent, from the fit to parameters p_i , including the branching fractions, $x_i \equiv \Gamma_i / \Gamma_{\text{total}}$.

x_{29}	6				
x_{34}	8	3			
x_{47}	13	5	7		
x_{63}	31	13	6	26	
Γ	-19	-8	-62	-16	-51
	x_{15}	x_{29}	x_{34}	x_{47}	x_{63}

 $\chi_{c1}(1P)$ PARTIAL WIDTHS

———— $\chi_{c1}(1P) \Gamma(i) \Gamma(\gamma J/\psi(1S)) / \Gamma(\text{total})$ ————

$\Gamma(p\bar{p}) \times \Gamma(\gamma J/\psi(1S)) / \Gamma_{\text{total}}$ $\Gamma_{34}\Gamma_{63}/\Gamma$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT

21.9±0.8 OUR FIT

[21.7 ± 0.8 eV OUR 2013 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=M055G1

NEW

NODE=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±0.16 OUR AVERAGE [(1.25 ± 0.17)% OUR 2013 AVERAGE]**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

NEW

NODE=M055R35;LINKAGE=HE

 $\Gamma(\rho^+\pi^-\pi^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE (%)

EVTS

DOCUMENT ID

TECN

COMMENT

1.48±0.25 OUR AVERAGE [(1.53 ± 0.26)% OUR 2013 AVERAGE]**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

NEW

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±35¹ 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 OUR AVERAGE [(0.57 ± 0.08) × 10⁻³ OUR 2013 AVERAGE]**0.55±0.08±0.02**

608

¹ ABLIKIM

11A

BES3

 $e^+e^- \rightarrow \psi(2S) \rightarrow \gamma\chi_{c1}$ ¹ ABLIKIM 11A reports $(0.57 \pm 0.03 \pm 0.08) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow 4\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.NODE=M055R44
NODE=M055R44

NEW

NODE=M055R44;LINKAGE=AB

$\Gamma(\pi^+\pi^-K^+K^-)/\Gamma_{\text{total}}$ Γ_7/Γ VALUE (units 10^{-3})

DOCUMENT ID

TECN

COMMENT

4.5±1.0 OUR EVALUATION

Treating systematic error as correlated.

4.5±0.9 OUR AVERAGE

4.2±0.4±0.9

¹BAI

99B

BES

 $\psi(2S) \rightarrow \gamma\chi_{c1}$

7.3±3.0±0.4

¹TANENBAUM

78

MRK1

 $\psi(2S) \rightarrow \gamma\chi_{c1}$

¹Rescaled by us using $B(\psi(2S) \rightarrow \gamma\chi_{c1}) = (8.8 \pm 0.4)\%$ and $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (32.6 \pm 0.5)\%$.

NODE=M055R5

NODE=M055R5

→ UNCHECKED ←

NODE=M055R5;LINKAGE=X2

 $\Gamma(K^+K^-\pi^0\pi^0)/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE (%)

EVTS

DOCUMENT ID

TECN

COMMENT

0.114±0.028 OUR AVERAGE

[(0.117 ± 0.029)% OUR 2013 AVERAGE]

0.114±0.028±0.004

45.1

¹HE

08B

CLEO

 $e^+e^- \rightarrow \gamma h^+ h^- h^0 h^0$

¹HE 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

NODE=M055R37

NEW

NODE=M055R37;LINKAGE=HE

 $\Gamma(K^+\pi^-\bar{K}^0\pi^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE (%)

EVTS

DOCUMENT ID

TECN

COMMENT

0.87±0.14 OUR AVERAGE

[(0.90 ± 0.14)% OUR 2013 AVERAGE]

0.87±0.14±0.03

141.3

¹HE

08B

CLEO

 $e^+e^- \rightarrow \gamma h^+ h^- h^0 h^0$

¹HE 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

NODE=M055R39

NEW

NODE=M055R39;LINKAGE=HE

 $\Gamma(\rho^-K^+\bar{K}^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{10}/Γ

VALUE (%)

EVTS

DOCUMENT ID

TECN

COMMENT

0.51±0.12 OUR AVERAGE

[(0.53 ± 0.13)% OUR 2013 AVERAGE]

0.51±0.12±0.02

141.3

¹HE

08B

CLEO

 $e^+e^- \rightarrow \gamma h^+ h^- h^0 h^0$

¹HE 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

NODE=M055R40

NEW

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_{11}/Γ

VALUE (%)

EVTS

DOCUMENT ID

TECN

COMMENT

0.24±0.06±0.01

141.3

¹HE

08B

CLEO

 $e^+e^- \rightarrow \gamma h^+ h^- h^0 h^0$

¹HE 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

NODE=M055R41

NODE=M055R41;LINKAGE=HE

 $\Gamma(K^+K^-\eta\pi^0)/\Gamma_{\text{total}}$ Γ_{12}/Γ

VALUE (%)

EVTS

DOCUMENT ID

TECN

COMMENT

0.114±0.035 OUR AVERAGE

[(0.12 ± 0.04)% OUR 2013 AVERAGE]

0.114±0.035±0.004

141.3

¹HE

08B

CLEO

 $e^+e^- \rightarrow \gamma h^+ h^- h^0 h^0$

¹HE 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

NODE=M055R42

NEW

NODE=M055R42;LINKAGE=HE

 $\Gamma(\pi^+\pi^-K_S^0K_S^0)/\Gamma_{\text{total}}$ Γ_{13}/Γ VALUE (units 10^{-4})

EVTS

DOCUMENT ID

TECN

COMMENT

7.0±3.0 OUR AVERAGE[(7.2 ± 3.1) × 10⁻⁴ OUR 2013 AVERAGE]**7.0±3.0±0.2**

19.8 ± 7.7

¹ABLIKIM

050

BES2

 $\psi(2S) \rightarrow \chi_{c1}\gamma$

¹ABLIKIM 050 reports $[\Gamma(\chi_{c1}(1P) \rightarrow \pi^+\pi^-K_S^0K_S^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))] = (0.67 \pm 0.26 \pm 0.11) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R05

NODE=M055R05

NEW

NODE=M055R05;LINKAGE=AB

$\Gamma(K^+ K^- \eta)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

DOCUMENT ID

TECN

COMMENT

 Γ_{14}/Γ NODE=M055R25
NODE=M055R25**0.32±0.10 OUR AVERAGE** $[(0.33 \pm 0.10) \times 10^{-3}]$ OUR 2013 AVERAGE]

NEW

0.32±0.10±0.01¹ ATHAR

07

CLEO

 $\psi(2S) \rightarrow \gamma h^+ h^- h^0$

NODE=M055R25;LINKAGE=AT

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.

 $\Gamma(\bar{K}^0 K^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

DOCUMENT ID

 Γ_{15}/Γ NODE=M055R17
NODE=M055R17**7.1±0.6 OUR FIT** $[(7.3 \pm 0.6) \times 10^{-3}]$ OUR 2013 FIT]

NEW

 $\Gamma(K^*(892)^0 \bar{K}^0 + \text{c.c.})/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

EVTS

DOCUMENT ID

TECN

COMMENT

 Γ_{16}/Γ NODE=M055R09
NODE=M055R09**1.00±0.37±0.03**

22

¹ ABLIKIM

06R

BES2

 $\psi(2S) \rightarrow \gamma \chi_{c1}$

NODE=M055R09;LINKAGE=AB

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.

 $\Gamma(K^*(892)^+ K^- + \text{c.c.})/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

EVTS

DOCUMENT ID

TECN

COMMENT

 Γ_{17}/Γ NODE=M055R10
NODE=M055R10**1.46±0.66±0.05**

27

¹ ABLIKIM

06R

BES2

 $\psi(2S) \rightarrow \gamma \chi_{c1}$

NODE=M055R10;LINKAGE=AB

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.

 $\Gamma(K_J^*(1430)^0 \bar{K}^0 + \text{c.c.} \rightarrow K_S^0 K^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

CL%

DOCUMENT ID

TECN

COMMENT

 Γ_{18}/Γ NODE=M055R12
NODE=M055R12**<0.8**

90

¹ ABLIKIM

06R

BES2

 $\psi(2S) \rightarrow \gamma \chi_{c1}$

NODE=M055R12;LINKAGE=AB

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 $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 9.55 \times 10^{-2}$.

 $\Gamma(K_J^*(1430)^+ K^- + \text{c.c.} \rightarrow K_S^0 K^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

CL%

DOCUMENT ID

TECN

COMMENT

 Γ_{19}/Γ NODE=M055R13
NODE=M055R13**<2.2 (CL = 90%)** $[<2.3 \times 10^{-3}]$ (CL = 90%) OUR 2013 BEST LIMIT]**<2.2**

90

¹ ABLIKIM

06R

BES2

 $\psi(2S) \rightarrow \gamma \chi_{c1}$

NODE=M055R13;LINKAGE=AB

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 $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 9.55 \times 10^{-2}$.

 $\Gamma(K^+ K^- \pi^0)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

DOCUMENT ID

TECN

COMMENT

 Γ_{20}/Γ NODE=M055R20
NODE=M055R20**1.85±0.25 OUR AVERAGE** $[(1.91 \pm 0.26) \times 10^{-3}]$ OUR 2013 AVERAGE]

NEW

1.85±0.24±0.06¹ ATHAR

07

CLEO

 $\psi(2S) \rightarrow \gamma h^+ h^- h^0$

NODE=M055R20;LINKAGE=AT

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.

$\Gamma(\eta\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{21}/Γ VALUE (units 10^{-3})

EVTS

DOCUMENT ID

TECN

COMMENT

4.9±0.5 OUR AVERAGE[(5.0 ± 0.5) × 10⁻³ OUR 2013 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 ± 0.3 ± 0.5) × 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 ± 0.7 ± 0.8) × 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.

NODE=M055R08
NODE=M055R08

NEW

NODE=M055R08;LINKAGE=AT

NODE=M055R08;LINKAGE=AB

 $\Gamma(a_0(980)^+\pi^- + \text{c.c.} \rightarrow \eta\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{22}/Γ VALUE (units 10^{-3})

EVTS

DOCUMENT ID

TECN

COMMENT

1.8±0.6 OUR AVERAGE [(1.9 ± 0.7) × 10⁻³ OUR 2013 AVERAGE]**1.8±0.6±0.1**

58

¹ ABLIKIM

06R

BES2

 $\psi(2S) \rightarrow \gamma \chi_{c1}$

¹ ABLIKIM 06R reports (2.0 ± 0.5 ± 0.5) × 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.

NODE=M055R15
NODE=M055R15

NEW

NODE=M055R15;LINKAGE=AB

 $\Gamma(f_2(1270)\eta)/\Gamma_{\text{total}}$ Γ_{23}/Γ VALUE (units 10^{-3})

EVTS

DOCUMENT ID

TECN

COMMENT

2.7±0.8 OUR AVERAGE [(2.8 ± 0.8) × 10⁻³ OUR 2013 AVERAGE]**2.7±0.8±0.1**

53

¹ ABLIKIM

06R

BES2

 $\psi(2S) \rightarrow \gamma \chi_{c1}$

¹ ABLIKIM 06R reports (3.0 ± 0.7 ± 0.5) × 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.

NODE=M055R16
NODE=M055R16

NEW

NODE=M055R16;LINKAGE=AB

 $\Gamma(\pi^+\pi^-\eta')/\Gamma_{\text{total}}$ Γ_{24}/Γ VALUE (units 10^{-3})

DOCUMENT ID

TECN

COMMENT

2.3±0.5±0.1¹ ATHAR

07

CLEO

 $\psi(2S) \rightarrow \gamma h^+ h^- h^0$

¹ ATHAR 07 reports (2.4 ± 0.4 ± 0.3) × 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.

NODE=M055R28
NODE=M055R28

NODE=M055R28;LINKAGE=AT

 $\Gamma(\pi^0 f_0(980) \rightarrow \pi^0 \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{25}/Γ

VALUE

CL%

DOCUMENT ID

TECN

COMMENT

<6 × 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 × 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_{26}/Γ VALUE (units 10^{-4})

DOCUMENT ID

TECN

COMMENT

32±21¹ 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_{27}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.47±0.36±0.05	8.4 ± 5.5	^{1,2} ABLIKIM	04H BES	$\psi(2S) \rightarrow \gamma K^+ K^- \pi^+ \pi^-$

NODE=M055R26
 NODE=M055R26

¹ ABLIKIM 04H reports $[\Gamma(\chi_{c1}(1P) \rightarrow K^*(892)^0 \bar{K}^*(892)^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))] = (1.40 \pm 0.27 \pm 0.22) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R26;LINKAGE=AB

² Assumes $B(K^*(892)^0 \rightarrow K^- \pi^+) = 2/3$.

NODE=M055R26;LINKAGE=AL

 $\Gamma(K^+ K^- K_S^0 \bar{K}_S^0)/\Gamma_{\text{total}}$ Γ_{28}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<4 (CL = 90%)	$<5 \times 10^{-4}$ (CL = 90%)				OUR 2013 BEST LIMIT]

NODE=M055R06
 NODE=M055R06

<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;LINKAGE=AB

 $\Gamma(K^+ K^- K^+ K^-)/\Gamma_{\text{total}}$ Γ_{29}/Γ

VALUE (units 10^{-3})	DOCUMENT ID
0.55±0.11 OUR FIT	
[(0.56 ± 0.12) × 10 ⁻³ OUR 2013 FIT]	

NODE=M055R14
 NODE=M055R14

NEW

 $\Gamma(K^+ K^- \phi)/\Gamma_{\text{total}}$ Γ_{30}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
0.42±0.16 OUR AVERAGE				[(0.43 ± 0.16) × 10 ⁻³ OUR 2013 AVERAGE]

NODE=M055R07
 NODE=M055R07

NEW

0.42±0.15±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;LINKAGE=AB

 $\Gamma(\omega\omega)/\Gamma_{\text{total}}$ Γ_{31}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
5.8±0.7 OUR AVERAGE				[(6.0 ± 0.7) × 10 ⁻⁴ OUR 2013 AVERAGE]

NODE=M055R49
 NODE=M055R49

NEW

5.8±0.7±0.2 597 ¹ ABLIKIM 11K BES3 $\psi(2S) \rightarrow \gamma$ hadrons

¹ ABLIKIM 11K reports $(6.0 \pm 0.3 \pm 0.7) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \omega\omega)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$. 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

 $\Gamma(\omega\phi)/\Gamma_{\text{total}}$ Γ_{32}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
0.21±0.06 OUR AVERAGE				[(0.22 ± 0.06) × 10 ⁻⁴ OUR 2013 AVERAGE]

NODE=M055R50
 NODE=M055R50

NEW

0.21±0.06±0.01 15 ¹ ABLIKIM 11K BES3 $\psi(2S) \rightarrow \gamma$ hadrons

¹ 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_{33}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
4.2±0.5 OUR AVERAGE				[(4.4 ± 0.6) × 10 ⁻⁴ OUR 2013 AVERAGE]

NODE=M055R51
 NODE=M055R51

NEW

4.2±0.5±0.1 366 ¹ ABLIKIM 11K BES3 $\psi(2S) \rightarrow \gamma$ hadrons

¹ ABLIKIM 11K reports $(4.4 \pm 0.3 \pm 0.5) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \phi\phi)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$. 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

$\Gamma(p\bar{p})/\Gamma_{\text{total}}$ VALUE (units 10^{-4})

DOCUMENT ID

0.772±0.035 OUR FIT[(0.73 ± 0.04) × 10^{-4} OUR 2013 FIT] Γ_{34}/Γ

NODE=M055R11

NODE=M055R11

NEW

 $\Gamma(p\bar{p}\pi^0)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

DOCUMENT ID

TECN

COMMENT

0.159±0.019 OUR AVERAGE[(0.163 ± 0.020) × 10^{-3} OUR 2013 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

 $\psi(2S) \rightarrow \gamma h^+ h^- h^0$

¹ ONYISI 10 reports $(1.75 \pm 0.16 \pm 0.13 \pm 0.11) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow p\bar{p}\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$. 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 $(1.2 \pm 0.5 \pm 0.1) \times 10^{-4}$ 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.

 Γ_{35}/Γ

NODE=M055R21

NODE=M055R21

NEW

NODE=M055R21;LINKAGE=ON

NODE=M055R21;LINKAGE=AT

 $\Gamma(p\bar{p}\eta)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

CL%

DOCUMENT ID

TECN

COMMENT

0.148±0.025 OUR AVERAGE [(0.153 ± 0.026) × 10^{-3} OUR 2013 AVERAGE]**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 $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = 9.55 \times 10^{-2}$.

 Γ_{36}/Γ

NODE=M055R27

NODE=M055R27

NEW

NODE=M055R27;LINKAGE=ON

NODE=M055R27;LINKAGE=AT

 $\Gamma(p\bar{p}\omega)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

DOCUMENT ID

TECN

COMMENT

0.216±0.031 OUR AVERAGE [(0.223 ± 0.033) × 10^{-3} OUR 2013 AVERAGE]**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.

 Γ_{37}/Γ

NODE=M055R43

NODE=M055R43

NEW

NODE=M055R43;LINKAGE=ON

 $\Gamma(p\bar{p}\phi)/\Gamma_{\text{total}}$ 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 $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = 9.55 \times 10^{-2}$.

 Γ_{38}/Γ

NODE=M055R48

NODE=M055R48

NODE=M055R48;LINKAGE=AB

 $\Gamma(p\bar{p}\pi^+\pi^-)/\Gamma_{\text{total}}$ 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±0.015

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 $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (32.6 \pm 0.5)\%$.

 Γ_{39}/Γ

NODE=M055R7

NODE=M055R7

→ UNCHECKED ←

NODE=M055R7;LINKAGE=X2

$\Gamma(p\bar{p}\pi^0\pi^0)/\Gamma_{\text{total}}$ Γ_{40}/Γ

VALUE (%)	CL%	DOCUMENT ID	TECN	COMMENT
<0.05	90	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_{41}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.30±0.23 OUR AVERAGE		[(1.34 ± 0.24) × 10 ⁻⁴ OUR 2013 AVERAGE]		
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 ± 0.15 ± 0.19) × 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

NEW

NODE=M055R45;LINKAGE=AB

 $\Gamma(p\bar{p}K_S^0K_S^0)/\Gamma_{\text{total}}$ Γ_{42}/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_{43}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
3.9±0.5±0.1	1412	¹ ABLIKIM	12J BES3	$\psi(2S) \rightarrow \gamma p\bar{n}\pi^-$
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
 NODE=M055R56

NODE=M055R56;LINKAGE=AL

 $\Gamma(\bar{p}n\pi^+)/\Gamma_{\text{total}}$ Γ_{44}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
4.0±0.5±0.1	1625	¹ ABLIKIM	12J BES3	$\psi(2S) \rightarrow \gamma \bar{p}n\pi^+$
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
 NODE=M055R57

NODE=M055R57;LINKAGE=AL

 $\Gamma(p\bar{n}\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{45}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
10.5±1.2±0.3	1082	¹ ABLIKIM	12J BES3	$\psi(2S) \rightarrow \gamma p\bar{n}\pi^-\pi^0$
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
 NODE=M055R58

NODE=M055R58;LINKAGE=AL

 $\Gamma(\bar{p}n\pi^+\pi^0)/\Gamma_{\text{total}}$ Γ_{46}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
10.3±1.2±0.3	1261	¹ ABLIKIM	12J BES3	$\psi(2S) \rightarrow \gamma \bar{p}n\pi^+\pi^0$
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
 NODE=M055R59

NODE=M055R59;LINKAGE=AL

 $\Gamma(\Lambda\bar{\Lambda})/\Gamma_{\text{total}}$ Γ_{47}/Γ

VALUE (units 10^{-4})	DOCUMENT ID
1.16±0.12 OUR FIT	
[(1.18 ± 0.19) × 10 ⁻⁴ OUR 2013 FIT]	

NODE=M055R23
 NODE=M055R23

NEW

$\Gamma(\Lambda\bar{\Lambda}\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{48}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$30 \pm 5 \pm 1$		105	¹ ABLIKIM	12I BES3	$\psi(2S) \rightarrow \gamma \Lambda \bar{\Lambda} \pi^+ \pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<150	90		² ABLIKIM	06D BES2	$\psi(2S) \rightarrow \gamma \chi_{c1}$

¹ ABLIKIM 12I reports $(31.1 \pm 3.4 \pm 3.9) \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \Lambda \bar{\Lambda} \pi^+ \pi^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$. 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=M055R01
NODE=M055R01

NODE=M055R01;LINKAGE=AL

NODE=M055R01;LINKAGE=AB

 $\Gamma(\Lambda\bar{\Lambda}\pi^+\pi^- (\text{non-resonant}))/\Gamma_{\text{total}}$ Γ_{49}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$25 \pm 6 \pm 1$		13	¹ ABLIKIM	12I BES3	$\psi(2S) \rightarrow \gamma \Lambda \bar{\Lambda} \pi^+ \pi^-$

¹ ABLIKIM 12I reports $(26.2 \pm 5.5 \pm 3.3) \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \Lambda \bar{\Lambda} \pi^+ \pi^- (\text{non-resonant}))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R19
NODE=M055R19

NODE=M055R19;LINKAGE=AL

 $\Gamma(\Sigma(1385)^+ \bar{\Lambda} \pi^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{50}/Γ

VALUE (units 10^{-5})	CL%	EVTS	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=M055R52
NODE=M055R52

NODE=M055R52;LINKAGE=AL

 $\Gamma(\Sigma(1385)^- \bar{\Lambda} \pi^+ + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{51}/Γ

VALUE (units 10^{-5})	CL%	EVTS	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_{52}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT

4.2 ± 0.4 OUR AVERAGE Error includes scale factor of 1.1. $[(4.3 \pm 0.4) \times 10^{-4}]$ OUR 2013 AVERAGE Scale factor = 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

NEW

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_{53}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT

1.7 ± 0.5 OUR AVERAGE $[(1.8 \pm 0.5) \times 10^{-4}]$ OUR 2013 AVERAGE]

$1.7 \pm 0.4 \pm 0.1$	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

NEW

NODE=M055R46;LINKAGE=AB

$\Gamma(\Lambda(1520)\bar{\Lambda}(1520))/\Gamma_{\text{total}}$ Γ_{54}/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 $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 9.55 \times 10^{-2}$.				

NODE=M055R47
 NODE=M055R47

NODE=M055R47;LINKAGE=AB

 $\Gamma(\Sigma^0 \bar{\Sigma}^0)/\Gamma_{\text{total}}$ Γ_{55}/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_{56}/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	$\psi(2S) \rightarrow \gamma \Sigma^+ \bar{\Sigma}^-$
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 $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 9.55 \times 10^{-2}$.					
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
 NODE=M055R33

NODE=M055R33;LINKAGE=NA

NODE=M055R33;LINKAGE=AB

 $\Gamma(\Sigma(1385)^+ \bar{\Sigma}(1385)^-)/\Gamma_{\text{total}}$ Γ_{57}/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_{58}/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

 $\Gamma(\Xi^0 \bar{\Xi}^0)/\Gamma_{\text{total}}$ Γ_{59}/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_{60}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
0.82±0.22 OUR AVERAGE $[(0.84 \pm 0.23) \times 10^{-4}]$ OUR 2013 AVERAGE					
0.82±0.22±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	$\psi(2S) \rightarrow \gamma \chi_{c1}$

NODE=M055R03
 NODE=M055R03

NEW

¹ NAIK 08 reports $(0.86 \pm 0.22 \pm 0.08) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \Xi^- \Xi^+) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$. 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;LINKAGE=NA

NODE=M055R03;LINKAGE=AB

$[\Gamma(\pi^+ \pi^-) + \Gamma(K^+ K^-)] / \Gamma_{\text{total}} \quad \Gamma_{61} / \Gamma$

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

$\Gamma(K_S^0 K_S^0) / \Gamma_{\text{total}} \quad \Gamma_{62} / \Gamma$

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 $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 9.55 \times 10^{-2}$.

NODE=M055R04
NODE=M055R04

NODE=M055R04;LINKAGE=AB

———— RADIATIVE DECAYS ————

$\Gamma(\gamma J/\psi(1S)) / \Gamma_{\text{total}} \quad \Gamma_{63} / \Gamma$

VALUE	DOCUMENT ID	TECN	COMMENT

0.339 ± 0.012 OUR FIT

[0.348 ± 0.015 OUR 2013 FIT]

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.379 ± 0.008 ± 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.

NODE=M055310

NODE=M055R1
NODE=M055R1
NEW

NODE=M055R1;LINKAGE=AD

$\Gamma(\gamma \rho^0) / \Gamma_{\text{total}} \quad \Gamma_{64} / \Gamma$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT

220 ± 18 OUR AVERAGE

[(227 ± 19) × 10⁻⁶ OUR 2013 AVERAGE]

220 ± 23 ± 7	432 ± 25	¹ ABLIKIM	11E	BES3 $\psi(2S) \rightarrow \gamma \gamma \rho^0$

221 ± 24 ± 7	186 ± 15	² BENNETT	08A	CLEO $\psi(2S) \rightarrow \gamma \gamma \rho^0$

¹ ABLIKIM 11E reports $(228 \pm 13 \pm 22) \times 10^{-6}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \gamma \rho^0) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$. 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.

NODE=M055R29
NODE=M055R29

NEW

NODE=M055R29;LINKAGE=AB

NODE=M055R29;LINKAGE=BE

$\Gamma(\gamma \omega) / \Gamma_{\text{total}} \quad \Gamma_{65} / \Gamma$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT

69 ± 8 OUR AVERAGE

[(71 ± 9) × 10⁻⁶ OUR 2013 AVERAGE]

67 ± 9 ± 2	136 ± 14	¹ ABLIKIM	11E	BES3 $\psi(2S) \rightarrow \gamma \gamma \omega$

76 ± 17 ± 2	39 ± 7	² BENNETT	08A	CLEO $\psi(2S) \rightarrow \gamma \gamma \omega$

¹ ABLIKIM 11E reports $(69.7 \pm 7.2 \pm 6.6) \times 10^{-6}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \gamma \omega) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$. 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.

NODE=M055R30
NODE=M055R30

NEW

NODE=M055R30;LINKAGE=AB

NODE=M055R30;LINKAGE=BE

$\Gamma(\gamma\phi)/\Gamma_{\text{total}}$ Γ_{66}/Γ

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT

25±5 OUR AVERAGE $[(26 \pm 6) \times 10^{-6} \text{ OUR 2013 AVERAGE}]$ **25±5±1** 43 ± 9 ¹ ABLIKIM 11E BES3 $\psi(2S) \rightarrow \gamma\gamma\phi$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<24 90 5.2 ± 3.1 ² BENNETT 08A CLEO $\psi(2S) \rightarrow \gamma\gamma\phi$

¹ ABLIKIM 11E reports $(25.8 \pm 5.2 \pm 2.3) \times 10^{-6}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \gamma\phi)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$. 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
NODE=M055R31

NEW

NODE=M055R31;LINKAGE=AB

NODE=M055R31;LINKAGE=BE

 $\Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ Γ_{67}/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

 $\Gamma(\chi_{c1}(1P) \rightarrow p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))/\Gamma(\psi(2S) \rightarrow$ $J/\psi(1S)\pi^+\pi^-)$ $\Gamma_{34}/\Gamma \times \Gamma_{129}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}$

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT

2.14±0.11 OUR FIT
[(1.98 ± 0.16) × 10⁻⁵ OUR 2013 FIT]**1.1 ±1.0** ¹ BAI 98i BES $\psi(2S) \rightarrow \gamma\chi_{c1} \rightarrow \gamma\bar{p}p$

¹ Calculated by us. The value for $B(\chi_{c1} \rightarrow p\bar{p})$ reported in BAI 98i is derived using $B(\psi(2S) \rightarrow \gamma\chi_{c1}) = (8.7 \pm 0.8)\%$ and $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (32.4 \pm 2.6)\%$ [BAI 98d].

NODE=M055B1
NODE=M055B1

NEW

NODE=M055B;LINKAGE=J2

 $\Gamma(\chi_{c1}(1P) \rightarrow \Lambda\bar{\Lambda})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))/\Gamma_{\text{total}}$ $\Gamma_{47}/\Gamma \times \Gamma_{129}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT

11.1±1.1 OUR FIT
[(10.9 ± 1.7) × 10⁻⁶ OUR 2013 FIT]**10.9±1.1 OUR AVERAGE**
[(10.5 ± 1.7) × 10⁻⁶ OUR 2013 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

NEW

NEW

NODE=M055B10;LINKAGE=AB

NODE=M055B10;LINKAGE=NA

 $\Gamma(\chi_{c1}(1P) \rightarrow \Lambda\bar{\Lambda})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))/\Gamma(\psi(2S) \rightarrow$ $J/\psi(1S)\pi^+\pi^-)$ $\Gamma_{47}/\Gamma \times \Gamma_{129}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT

3.22±0.31 OUR FIT
[(3.2 ± 0.5) × 10⁻⁵ OUR 2013 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

NEW

NODE=M055B11;LINKAGE=BA

$$\frac{\Gamma(\chi_{c1}(1P) \rightarrow \gamma J/\psi(1S))}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))}{\Gamma_{\text{total}}} \times \frac{\Gamma_{63}/\Gamma \times \Gamma_{129}^{\psi(2S)}/\Gamma_{\psi(2S)}}{129}$$

VALUE (units 10^{-2})	EVTs	DOCUMENT ID	TECN	COMMENT

3.24 ±0.07 OUR FIT[(3.23 ± 0.07) × 10⁻² OUR 2013 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	$\psi(2S) \rightarrow \gamma \chi_{c1}$
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=M055B2

NODE=M055B2

NEW

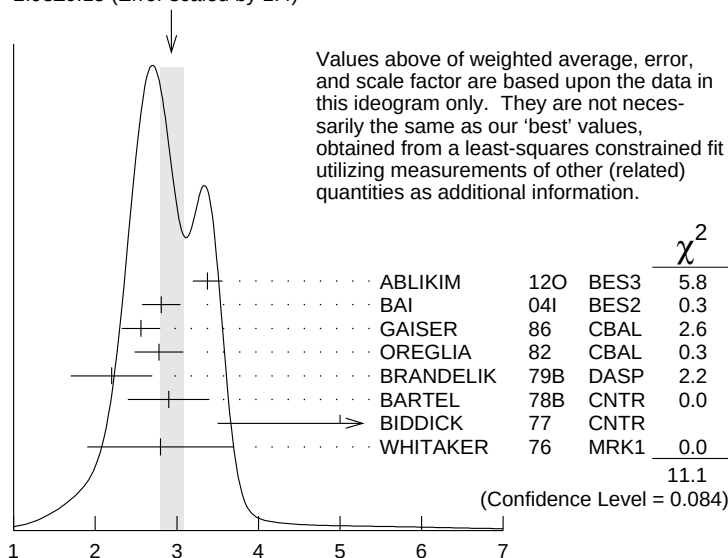
NODE=M055B;LINKAGE=3Q

NODE=M055B;LINKAGE=2Q

NODE=M055B;LINKAGE=EA

NODE=M055B2;LINKAGE=ME

NODE=M055B;LINKAGE=AD

WEIGHTED AVERAGE
2.93±0.15 (Error scaled by 1.4)

$$\frac{\Gamma(\chi_{c1}(1P) \rightarrow \gamma J/\psi(1S))}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))}{\Gamma_{\text{total}}} \text{ (units } 10^{-2})$$

$$\frac{\Gamma(\chi_{c1}(1P) \rightarrow \gamma J/\psi(1S))}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))}{\Gamma(\psi(2S) \rightarrow J/\psi(1S) \text{ anything})} \times \frac{\Gamma_{63}/\Gamma \times \Gamma_{129}^{\psi(2S)}/\Gamma_9^{\psi(2S)}}{129}$$

$$\frac{\Gamma_{63}/\Gamma \times \Gamma_{129}^{\psi(2S)}/\Gamma_9^{\psi(2S)}}{0.339\Gamma_{129}^{\psi(2S)} + 0.192\Gamma_{130}^{\psi(2S)}} = \frac{\Gamma_{63}/\Gamma \times \Gamma_{129}^{\psi(2S)}}{(\Gamma_{11}^{\psi(2S)} + \Gamma_{12}^{\psi(2S)} + \Gamma_{13}^{\psi(2S)})}$$

VALUE (units 10^{-2})	EVTs	DOCUMENT ID	TECN	COMMENT

5.32±0.11 OUR FIT[(5.36 ± 0.12) × 10⁻² OUR 2013 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

NODE=M055B7

NODE=M055B7

NEW

NODE=M055B7;LINKAGE=ME

$$\frac{\Gamma(\chi_{c1}(1P) \rightarrow \gamma J/\psi(1S))}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))}{\Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)} \quad \frac{\Gamma_{63}/\Gamma \times \Gamma_{129}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}{\Gamma_{129}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10^{-2}) EVTS DOCUMENT ID TECN COMMENT

9.41±0.21 OUR FIT

[(9.49 ± 0.21) × 10^{-2} OUR 2013 FIT]

10.15±0.28 OUR AVERAGE

10.17 ± 0.07 ± 0.27	24.9k	MENDEZ	08	CLEO	$\psi(2S) \rightarrow \gamma \chi_{c1}$
12.6 ± 0.3 ± 3.8	3k	¹ ABLIKIM	04B	BES	$\psi(2S) \rightarrow J/\psi X$
8.5 ± 2.1		² HIMEL	80	MRK2	$\psi(2S) \rightarrow \gamma \chi_{c1}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

10.24 ± 0.17 ± 0.23	3.7k	³ ADAM	05A	CLEO	Repl. by MENDEZ 08

¹ From a fit to the J/ψ recoil mass spectra.

² The value for $B(\psi(2S) \rightarrow \gamma \chi_{c1}) \times B(\chi_{c1} \rightarrow \gamma J/\psi(1S))$ quoted in HIMEL 80 is derived using $B(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-) = (33 \pm 3)\%$ and $B(J/\psi(1S) \rightarrow \ell^+ \ell^-) = 0.138 \pm 0.018$. Calculated by us using $B(J/\psi(1S) \rightarrow \ell^+ \ell^-) = 0.1181 \pm 0.0020$.

³ Not independent from other values reported by ADAM 05A.

NODE=M055B3

NODE=M055B3

NEW

NODE=M055B;LINKAGE=AB

NODE=M055B;LINKAGE=J3

NODE=M055B3;LINKAGE=AD

$$\frac{\Gamma(\chi_{c1}(1P) \rightarrow \bar{K}^0 K^+ \pi^- + \text{c.c.})}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))}{\Gamma_{\text{total}}} \quad \frac{\Gamma_{15}/\Gamma \times \Gamma_{129}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}{\Gamma_{129}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10^{-4}) DOCUMENT ID TECN COMMENT

6.8±0.5 OUR FIT

7.2±0.6 OUR AVERAGE

7.3 ± 0.5 ± 0.5	¹ ATHAR	07	CLEO	$\psi(2S) \rightarrow \gamma K_S^0 K^+ \pi^-$
7.0 ± 0.5 ± 0.9	² ABLIKIM	06R	BES2	$\psi(2S) \rightarrow \gamma \chi_{c1}$

¹ Calculated by us. The value of $B(\chi_{c1} \rightarrow K_S^0 K^+ \pi^- + \text{c.c.})$ 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

$$\frac{\Gamma(\chi_{c1}(1P) \rightarrow \bar{K}^0 K^+ \pi^- + \text{c.c.})}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))}{\Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)} \quad \frac{\Gamma_{15}/\Gamma \times \Gamma_{129}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}{\Gamma_{129}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10^{-4}) DOCUMENT ID TECN COMMENT

19.7±1.6 OUR FIT

[(19.9 ± 1.6) × 10^{-4} OUR 2013 FIT]

13.2±2.4±3.2

	¹ BAI	99B	BES	$\psi(2S) \rightarrow \gamma K_S^0 K^+ \pi^-$

¹ Calculated by us. The value of $B(\chi_{c1} \rightarrow K_S^0 K^+ \pi^-)$ reported by BAI 99B was derived using $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (8.7 \pm 0.8)\%$ and $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = (32.4 \pm 2.6)\%$ [BAI 98D].

NODE=M055B17

NODE=M055B17

NEW

NODE=M055B17;LINKAGE=BA

$$\frac{\Gamma(\chi_{c1}(1P) \rightarrow K^+ K^- K^+ K^-)}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))}{\Gamma_{\text{total}}} \quad \frac{\Gamma_{29}/\Gamma \times \Gamma_{129}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}{\Gamma_{129}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

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

$$\frac{\Gamma(\chi_{c1}(1P) \rightarrow K^+ K^- K^+ K^-)}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))}{\Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)} \quad \frac{\Gamma_{29}/\Gamma \times \Gamma_{129}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}{\Gamma_{129}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10^{-4}) DOCUMENT ID TECN COMMENT

1.52±0.31 OUR FIT

[(1.53 ± 0.31) × 10^{-4} OUR 2013 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

NEW

NODE=M055B15;LINKAGE=BA

$$\Gamma(\chi_{c1}(1P) \rightarrow p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))/\Gamma_{\text{total}}$$

$$\Gamma_{34}/\Gamma \times \Gamma_{129}^{\psi(2S)}/\Gamma\psi(2S)$$

VALUE (units 10^{-6}) EVTS DOCUMENT ID TECN COMMENT

7.4±0.4 OUR FIT

[(6.7 ± 0.5) × 10⁻⁶ OUR 2013 FIT]

7.8±0.6 OUR AVERAGE Error includes scale factor of 1.4. See the ideogram below.

[(7.5 ± 1.4) × 10⁻⁶ OUR 2013 AVERAGE Scale factor = 2.0]

7.9±0.4±0.3	453	ABLIKIM	13v	BES3	$\psi(2S) \rightarrow \gamma p\bar{p}$
8.2±0.7±0.4	141 ± 13	1 NAIK	08	CLEO	$\psi(2S) \rightarrow \gamma p\bar{p}$
4.8 ^{+1.4} _{-1.3} ±0.6	18.2 ^{+5.5} _{-4.9}	BAI	04F	BES	$\psi(2S) \rightarrow \gamma\chi_{c1}(1P) \rightarrow \gamma p\bar{p}$

¹ Calculated by us. NAIK 08 reports $B(\chi_{c1} \rightarrow p\bar{p}) = (9.0 \pm 0.8 \pm 0.4 \pm 0.5) \times 10^{-5}$ using $B(\psi(2S) \rightarrow \gamma\chi_{c1}) = (9.07 \pm 0.11 \pm 0.54)\%$.

NODE=M055B6

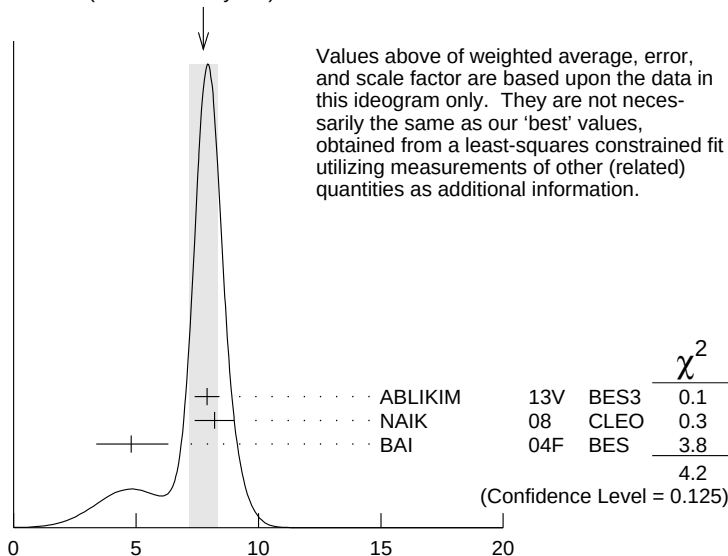
NODE=M055B6

NEW

NEW

NODE=M055B6;LINKAGE=NA

WEIGHTED AVERAGE
7.8±0.6 (Error scaled by 1.4)



$$\Gamma(\chi_{c1}(1P) \rightarrow p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))/\Gamma_{\text{total}} \text{ (units } 10^{-6}\text{)}$$

MULTIPOLE AMPLITUDES IN $\chi_{c1}(1P) \rightarrow \gamma J/\psi(1S)$

NODE=M055240

$a_2 = M_2/\sqrt{E_1^2 + M_2^2}$ Magnetic quadrupole fractional transition amplitude

VALUE (units 10^{-2}) EVTS DOCUMENT ID TECN COMMENT

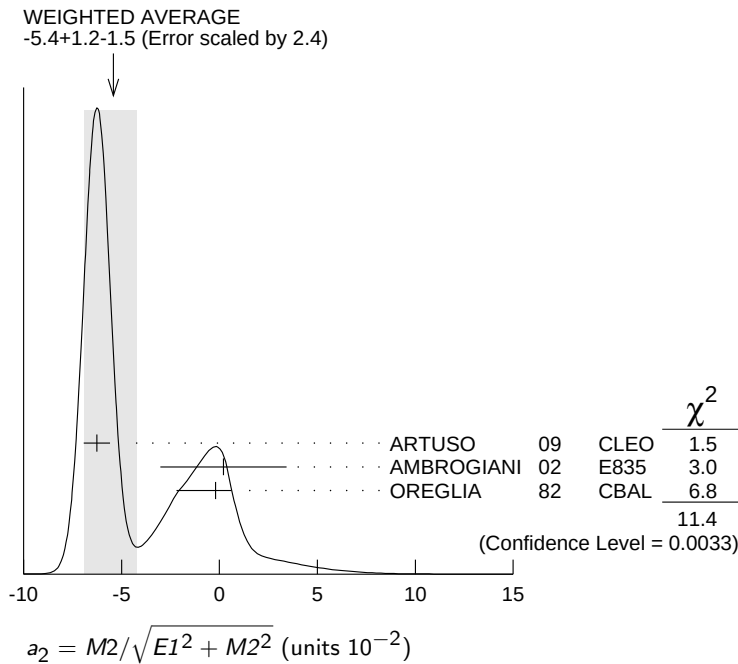
-5.4^{+1.2}_{-1.5} OUR AVERAGE

Error includes scale factor of 2.4. See the ideogram below.

-6.26±0.63±0.24	39k	ARTUSO	09	CLEO	$\psi(2S) \rightarrow \gamma\gamma\ell^+\ell^-$
0.2 ± 3.2 ± 0.4	2090	AMBROGIANI	02	E835	$p\bar{p} \rightarrow \chi_{c1} \rightarrow J/\psi\gamma$
-0.2 ^{+0.8} _{-2.0}	921	OREGLIA	82	CBAL	$\psi(2S) \rightarrow \chi_{c1}\gamma \rightarrow J/\psi\gamma\gamma$

NODE=M055A1

NODE=M055A1



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 $\psi(2S) \rightarrow \gamma\chi_{c1}(1S)$ and $\chi_{c1} \rightarrow \gamma J/\psi(1S)$

NODE=M055260

a_2/b_2 Magnetic quadrupole transition amplitude ratio

NODE=M055QAR
NODE=M055QAR

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
-2.27$^{+0.57}_{-0.99}$	39k	¹ ARTUSO	09	CLEO $\psi(2S) \rightarrow \gamma\gamma\ell^+\ell^-$

¹ Statistical and systematic errors combined. Not independent of $a_2(\chi_{c1})$ and $b_2(\chi_{c1})$ values from ARTUSO 09.

NODE=M055QAR;LINKAGE=AR

$\chi_{c1}(1P)$ REFERENCES

NODE=M055

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.)
BAI	04F	PR D69 092001	J.Z. Bai <i>et al.</i>	(BES Collab.)
BAI	04I	PR D70 012006	J.Z. Bai <i>et al.</i>	(BES Collab.)
AULCHENKO	03	PL B573 63	V.M. Aulchenko <i>et al.</i>	(KEDR Collab.)
BAI	03E	PR D67 112001	J.Z. Bai <i>et al.</i>	(BES Collab.)
AMBROGIANI	02	PR D65 052002	M. Ambrogiani <i>et al.</i>	(FNAL E835 Collab.)
BAI	99B	PR D60 072001	J.Z. Bai <i>et al.</i>	(BES Collab.)
BAI	98D	PR D58 092006	J.Z. Bai <i>et al.</i>	(BES Collab.)
BAI	98I	PRL 81 3091	J.Z. Bai <i>et al.</i>	(BES Collab.)
ARMSTRONG	92	NP B373 35	T.A. Armstrong <i>et al.</i>	(FNAL, FERR, GENO+)
Also		PRL 68 1468	T.A. Armstrong <i>et al.</i>	(FNAL, FERR, GENO+)
BAGLIN	86B	PL B172 455	C. Baglin	(LAPP, CERN, GENO, LYON, OSLO+)
GAISER	86	PR D34 711	J. Gaiser <i>et al.</i>	(Crystal Ball Collab.)
LEMOIGNE	82	PL 113B 509	Y. Lemoigne <i>et al.</i>	(SACL, LOIC, SHMP+)
OREGLIA	82	PR D25 2259	M.J. Oreglia <i>et al.</i>	(SLAC, CIT, HARV+)
Also		Private Comm.	M.J. Oreglia	(EFI)
HIMEL	80	PRL 44 920	T. Himel <i>et al.</i>	(LBL, SLAC)
Also		Private Comm.	G. Trilling	(LBL, UCB)
BRANDELIK	79B	NP B160 426	R. Brandelik <i>et al.</i>	(DASP Collab.)
BARTEL	78B	PL 79B 492	W. Bartel <i>et al.</i>	(DESY, HEIDP)
TANENBAUM	78	PR D17 1731	W.M. Tanenbaum <i>et al.</i>	(SLAC, LBL)
Also		Private Comm.	G. Trilling	(LBL, UCB)
BIDDICK	77	PRL 38 1324	C.J. Biddick <i>et al.</i>	(UCSD, UMD, PAVI+)
FELDMAN	77	PRPL 33C 285	G.J. Feldman, M.L. Perl	(LBL, SLAC)
YAMADA	77	Hamburg Conf. 69	S. Yamada	(DASP Collab.)
WHITAKER	76	PRL 37 1596	J.S. Whitaker <i>et al.</i>	(SLAC, LBL)
TANENBAUM	75	PRL 35 1323	W.M. Tanenbaum <i>et al.</i>	(LBL, SLAC)

REFID=50331
REFID=49752
REFID=49755
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REFID=22111
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REFID=22113
REFID=22059
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REFID=22064
REFID=22151
REFID=22106

$$h_c(1P)$$

$$I^G(J^{PC}) = ?^?(1^{+-})$$

Quantum numbers are quark model prediction, $C = -$ established by $\eta_c \gamma$ decay.

NODE=M144

NODE=M144

$h_c(1P)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
3525.38±0.11 OUR AVERAGE				
3525.31±0.11±0.14	832	¹ ABLIKIM	12N BES3	$\psi(2S) \rightarrow \pi^0 \gamma$ hadrons
3525.40±0.13±0.18	3679	ABLIKIM	10B BES3	$\psi(2S) \rightarrow \pi^0 \gamma \eta_c$
3525.20±0.18±0.12	1282	² DOBBS	08A CLEO	$\psi(2S) \rightarrow \pi^0 \eta_c \gamma$
3525.8 ±0.2 ±0.2	13	ANDREOTTI	05B E835	$\bar{p}p \rightarrow \eta_c \gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
3525.6 ±0.5	92 ⁺²³ ₋₂₂	ADAMS	09 CLEO	$\psi(2S) \rightarrow 2(\pi^+ \pi^- \pi^0)$
3524.4 ±0.6 ±0.4	168 ± 40	³ ROSNER	05 CLEO	$\psi(2S) \rightarrow \pi^0 \eta_c \gamma$
3527 ±8	42	ANTONIAZZI	94 E705	300 $\pi^\pm, p\text{Li} \rightarrow J/\psi \pi^0 X$
3526.28±0.18±0.19	59	⁴ ARMSTRONG	92D E760	$\bar{p}p \rightarrow J/\psi \pi^0$
3525.4 ±0.8 ±0.4	5	BAGLIN	86 SPEC	$\bar{p}p \rightarrow J/\psi X$

¹ With floating width.

² Combination of exclusive and inclusive analyses for the reaction $\psi(2S) \rightarrow \pi^0 h_c \rightarrow \pi^0 \eta_c \gamma$. This result is the average of DOBBS 08A and ROSNER 05.

³ Superseded by DOBBS 08A.

⁴ Mass central value and systematic error recalculated by us according to Eq.(16) in ARMSTRONG 93B, using the value for the $\psi(2S)$ mass from AULCHENKO 03.

NODE=M144M

NODE=M144M

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		832	⁵ ABLIKIM	12N BES3	$\psi(2S) \rightarrow \pi^0 \gamma$ hadrons
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 1.44	90	3679	⁶ 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	$\bar{p}p \rightarrow J/\psi \pi^0$

⁵ With floating mass.

⁶ The central value is $\Gamma = 0.73 \pm 0.45 \pm 0.28$ MeV.

NODE=M144W

NODE=M144W

NODE=M144W;LINKAGE=AL

NODE=M144W;LINKAGE=AB

$h_c(1P)$ DECAY MODES

NODE=M144215;NODE=M144

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 $\eta_c(1S)\gamma$	$(51 \pm 6) \%$	
Γ_5 $\pi^+\pi^-\pi^0$	$< 2.2 \times 10^{-3}$	
Γ_6 $2\pi^+2\pi^-\pi^0$	$(2.2^{+0.8}_{-0.7}) \%$	
Γ_7 $3\pi^+3\pi^-\pi^0$	$< 2.9 \%$	

DESIG=1

DESIG=2;OUR EST;→ UNCHECKED ←

DESIG=3

DESIG=4

DESIG=5

DESIG=6

DESIG=7

 $h_c(1P)$ PARTIAL WIDTHS

NODE=M144220

 $h_c(1P) \Gamma(i)\Gamma(\bar{p}p)/\Gamma(\text{total})$

NODE=M144223

$\Gamma(\eta_c(1S)\gamma) \times \Gamma(p\bar{p})/\Gamma_{\text{total}}$		$\Gamma_4\Gamma_3/\Gamma$		
VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
12.0 ± 4.5	13	⁷ ANDREOTTI	05B E835	$\bar{p}p \rightarrow \eta_c\gamma$
⁷ Assuming $\Gamma = 1$ MeV.				

NODE=M144G1

NODE=M144G1

NODE=M144G1;LINKAGE=AN

 $h_c(1P)$ BRANCHING RATIOS

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

$\Gamma(\eta_c(1S)\gamma)/\Gamma_{\text{total}}$		Γ_4/Γ		
VALUE (units 10^{-2})	EVTs	DOCUMENT ID	TECN	COMMENT
51 ± 6 OUR AVERAGE				
54.3 ± 6.7 ± 5.2	3679	ABLIKIM	10B BES3	$\psi(2S) \rightarrow \pi^0\gamma\eta_c$
48 ± 6 ± 7		⁸ DOBBS	08A CLEO	$\psi(2S) \rightarrow \pi^0\eta_c\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
48 ± 6 ± 7	1282	⁹ DOBBS	08A CLEO	$\psi(2S) \rightarrow \pi^0\eta_c\gamma$
46 ± 12 ± 7	168	¹⁰ ROSNER	05 CLEO	$\psi(2S) \rightarrow \pi^0\eta_c\gamma$

NODE=M144R2

NODE=M144R2

OCCUR=2

NODE=M144R2;LINKAGE=DB

NODE=M144R2;LINKAGE=DO

NODE=M144R2;LINKAGE=RO

⁸ Average of DOBBS 08A and ROSNER 05. DOBBS 08A reports $[\Gamma(h_c(1P) \rightarrow \eta_c(1S)\gamma)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \pi^0 h_c(1P))] = (4.16 \pm 0.30 \pm 0.37) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow \pi^0 h_c(1P)) = (8.6 \pm 1.3) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

⁹ DOBBS 08A reports $[\Gamma(h_c(1P) \rightarrow \eta_c(1S)\gamma)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \pi^0 h_c(1P))] = (4.19 \pm 0.32 \pm 0.45) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow \pi^0 h_c(1P)) = (8.6 \pm 1.3) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

¹⁰ ROSNER 05 reports $[\Gamma(h_c(1P) \rightarrow \eta_c(1S)\gamma)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \pi^0 h_c(1P))] = (4.0 \pm 0.8 \pm 0.7) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow \pi^0 h_c(1P)) = (8.6 \pm 1.3) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$		Γ_5/Γ		
VALUE (units 10^{-3})		DOCUMENT ID	TECN	COMMENT
<2.2		¹¹ ADAMS	09 CLEO	$\psi(2S) \rightarrow \pi^0\gamma\eta_c$

NODE=M144R01

NODE=M144R01

¹¹ ADAMS 09 reports $[\Gamma(h_c(1P) \rightarrow \pi^+\pi^-\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \pi^0 h_c(1P))] < 0.19 \times 10^{-5}$ which we divide by our best value $B(\psi(2S) \rightarrow \pi^0 h_c(1P)) = 8.6 \times 10^{-4}$.

NODE=M144R01;LINKAGE=AD

$\Gamma(2\pi^+2\pi^-\pi^0)/\Gamma_{\text{total}}$		Γ_6/Γ		
VALUE (units 10^{-2})	EVTs	DOCUMENT ID	TECN	COMMENT
$2.2^{+0.8}_{-0.6} \pm 0.3$	92	¹² ADAMS	09 CLEO	$\psi(2S) \rightarrow \pi^0\gamma\eta_c$

NODE=M144R02

NODE=M144R02

¹² ADAMS 09 reports $[\Gamma(h_c(1P) \rightarrow 2\pi^+2\pi^-\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \pi^0 h_c(1P))] = (1.88^{+0.48+0.47}_{-0.45-0.30}) \times 10^{-5}$ which we divide by our best value $B(\psi(2S) \rightarrow \pi^0 h_c(1P)) = (8.6 \pm 1.3) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M144R02;LINKAGE=AD

$$\Gamma(3\pi^+ 3\pi^- \pi^0)/\Gamma_{\text{total}}$$

$$\Gamma_7/\Gamma$$

VALUE (units 10^{-2})

DOCUMENT ID

TECN

COMMENT

<2.9

13 ADAMS

09

CLEO

 $\psi(2S) \rightarrow \pi^0 \gamma \eta_c$

^{13} ADAMS 09 reports $[\Gamma(h_c(1P) \rightarrow 3\pi^+ 3\pi^- \pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \pi^0 h_c(1P))]$
 $< 2.5 \times 10^{-5}$ which we divide by our best value $B(\psi(2S) \rightarrow \pi^0 h_c(1P)) = 8.6 \times 10^{-4}$.

NODE=M144R03
 NODE=M144R03

NODE=M144R03;LINKAGE=AD

$$\Gamma(h_c(1P) \rightarrow \eta_c(1S) \gamma)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}}$$

$$\Gamma_4/\Gamma \times \Gamma_{15}^{\psi(2S)}/\Gamma\psi(2S)$$

VALUE (units 10^{-4})

EVTS

DOCUMENT ID

TECN

COMMENT

4.3 ± 0.4 OUR AVERAGE

4.58 ± 0.40 ± 0.50

3679

14

ABLIKIM

10B

BES3

 $\psi(2S) \rightarrow \pi^0 \gamma X$

4.16 ± 0.30 ± 0.37

1430

15

DOBBS

08A

CLEO

 $\psi(2S) \rightarrow \pi^0 \gamma \eta_c$

^{14} Not independent of other branching fractions in ABLIKIM 10B.

^{15} Not independent of other branching fractions in DOBBS 08A.

NODE=M144R04
 NODE=M144R04

NODE=M144R04;LINKAGE=AB
 NODE=M144R04;LINKAGE=DO

$$\Gamma(h_c(1P) \rightarrow p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}}$$

$$\Gamma_3/\Gamma \times \Gamma_{15}^{\psi(2S)}/\Gamma\psi(2S)$$

VALUE

CL%

DOCUMENT ID

TECN

COMMENT

<1.3 × 10⁻⁷

90

ABLIKIM

13V

BES3

 $\psi(2S) \rightarrow \gamma p\bar{p}$

NODE=M144R05
 NODE=M144R05

$h_c(1P)$ REFERENCES

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=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

 $e^+ e^- \rightarrow J/\psi 2\gamma$

NODE=M057M

NODE=M057M

¹ Recalculated by ANDREOTTI 05A, using the value of $\psi(2S)$ mass from AULCHENKO 03.

² Using mass of $\psi(2S) = 3686.0$ MeV.

³ $J/\psi(1S)$ mass constrained to 3097 MeV.

⁴ Assuming $\psi(2S)$ mass = 3686 MeV and $J/\psi(1S)$ mass = 3097 MeV.

⁵ Mass value shifted by us by amount appropriate for $\psi(2S)$ mass = 3686 MeV and $J/\psi(1S)$ mass = 3097 MeV.

⁶ From a simultaneous fit to radiative and hadronic decay channels.

NODE=M057M;LINKAGE=NW

NODE=M057M;LINKAGE=C

NODE=M057M;LINKAGE=P

NODE=M057M;LINKAGE=E

NODE=M057M;LINKAGE=D

NODE=M057M;LINKAGE=M

$\chi_{c2}(1P)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1.93 ±0.11 OUR FIT				
[1.97 ± 0.11 MeV OUR 2013 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 $^{+1.4}_{-1.0}$	50	BAGLIN 86B	SPEC	$\bar{p}p \rightarrow e^+e^-X$
2.8 $^{+2.1}_{-2.0}$		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

NEW

NODE=M057W;LINKAGE=AN

NODE=M057W;LINKAGE=E

$\chi_{c2}(1P)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)	Confidence level
Hadronic decays		
Γ_1 $2(\pi^+\pi^-)$	(1.07 ±0.10) %	
Γ_2 $\rho\rho$		
Γ_3 $\pi^+\pi^-\pi^0\pi^0$	(1.92 ±0.25) %	
Γ_4 $\rho^+\pi^-\pi^0 + \text{c.c.}$	(2.3 ±0.4) %	
Γ_5 $4\pi^0$	(1.16 ±0.16) × 10 ⁻³	
Γ_6 $K^+K^-\pi^0\pi^0$	(2.2 ±0.4) × 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) × 10 ⁻³	
Γ_9 $K^*(892)^0K^-\pi^+ \rightarrow K^-\pi^+K^0\pi^0 + \text{c.c.}$	(3.1 ±0.8) × 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) × 10 ⁻³	
Γ_{11} $K^*(892)^-K^+\pi^0 \rightarrow K^+\pi^-\bar{K}^0\pi^0 + \text{c.c.}$	(3.9 ±0.9) × 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) × 10 ⁻³	
Γ_{13} $K^+K^-\eta\pi^0$	(1.3 ±0.5) × 10 ⁻³	
Γ_{14} $K^+K^-\pi^+\pi^-$	(8.8 ±1.0) × 10 ⁻³	
Γ_{15} $K^+K^-\pi^+\pi^-\pi^0$	(1.23 ±0.34) %	
Γ_{16} $K^+\bar{K}^*(892)^0\pi^- + \text{c.c.}$	(2.2 ±1.1) × 10 ⁻³	
Γ_{17} $K^*(892)^0\bar{K}^*(892)^0$	(2.4 ±0.5) × 10 ⁻³	
Γ_{18} $3(\pi^+\pi^-)$	(8.6 ±1.8) × 10 ⁻³	
Γ_{19} $\phi\phi$	(1.12 ±0.10) × 10 ⁻³	
Γ_{20} $\omega\omega$	(8.8 ±1.1) × 10 ⁻⁴	
Γ_{21} $\omega\phi$		
Γ_{22} $\pi\pi$	(2.33 ±0.12) × 10 ⁻³	
Γ_{23} $\rho^0\pi^+\pi^-$	(3.8 ±1.6) × 10 ⁻³	
Γ_{24} $\pi^+\pi^-\eta$	(5.0 ±1.3) × 10 ⁻⁴	
Γ_{25} $\pi^+\pi^-\eta'$	(5.2 ±1.9) × 10 ⁻⁴	
Γ_{26} $\eta\eta$	(5.7 ±0.5) × 10 ⁻⁴	
Γ_{27} K^+K^-	(1.05 ±0.07) × 10 ⁻³	
Γ_{28} $K_S^0K_S^0$	(5.5 ±0.4) × 10 ⁻⁴	
Γ_{29} $\bar{K}^0K^+\pi^- + \text{c.c.}$	(1.34 ±0.19) × 10 ⁻³	
Γ_{30} $K^+K^-\pi^0$	(3.2 ±0.8) × 10 ⁻⁴	
Γ_{31} $K^+K^-\eta$	< 3.4 × 10 ⁻⁴	90%
Γ_{32} $\eta\eta'$	< 6 × 10 ⁻⁵	90%

NODE=M057215;NODE=M057

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=10

DESIG=21

DESIG=4

DESIG=16

DESIG=25

DESIG=68

DESIG=22

DESIG=9

DESIG=39

DESIG=42

DESIG=14

DESIG=2

DESIG=15

DESIG=17

DESIG=36

DESIG=40

DESIG=34

Г33	$\eta' \eta'$	$< 1.0 \times 10^{-4}$	90%	DESIG=35
Г34	$\pi^+ \pi^- K_S^0 K_S^0$	$(2.3 \pm 0.6) \times 10^{-3}$		DESIG=29
Г35	$K^+ K^- K_S^0 K_S^0$	$< 4 \times 10^{-4}$	90%	DESIG=30
Г36	$K^+ K^- K^+ K^-$	$(1.73 \pm 0.21) \times 10^{-3}$		DESIG=24
Г37	$K^+ K^- \phi$	$(1.48 \pm 0.31) \times 10^{-3}$		DESIG=32
Г38	$p \bar{p}$	$(7.5 \pm 0.4) \times 10^{-5}$		DESIG=11
Г39	$p \bar{p} \pi^0$	$(4.9 \pm 0.4) \times 10^{-4}$		DESIG=37
Г40	$p \bar{p} \eta$	$(1.82 \pm 0.26) \times 10^{-4}$		DESIG=41
Г41	$p \bar{p} \omega$	$(3.8 \pm 0.5) \times 10^{-4}$		DESIG=61
Г42	$p \bar{p} \phi$	$(2.9 \pm 0.9) \times 10^{-5}$		DESIG=66
Г43	$p \bar{p} \pi^+ \pi^-$	$(1.32 \pm 0.34) \times 10^{-3}$		DESIG=8
Г44	$p \bar{p} \pi^0 \pi^0$	$(8.2 \pm 2.5) \times 10^{-4}$		DESIG=53
Г45	$p \bar{p} K^+ K^-$ (non-resonant)	$(2.00 \pm 0.34) \times 10^{-4}$		DESIG=63
Г46	$p \bar{p} K_S^0 K_S^0$	$< 7.9 \times 10^{-4}$	90%	DESIG=28
Г47	$p \bar{n} \pi^-$	$(8.9 \pm 1.0) \times 10^{-4}$		DESIG=31
Г48	$\bar{p} n \pi^+$	$(9.3 \pm 0.9) \times 10^{-4}$		DESIG=75
Г49	$p \bar{n} \pi^- \pi^0$	$(2.27 \pm 0.19) \times 10^{-3}$		DESIG=76
Г50	$\bar{p} n \pi^+ \pi^0$	$(2.21 \pm 0.20) \times 10^{-3}$		DESIG=77
Г51	$\Lambda \bar{\Lambda}$	$(1.92 \pm 0.16) \times 10^{-4}$		DESIG=19
Г52	$\Lambda \bar{\Lambda} \pi^+ \pi^-$	$(1.31 \pm 0.17) \times 10^{-3}$		DESIG=27
Г53	$\Lambda \bar{\Lambda} \pi^+ \pi^-$ (non-resonant)	$(6.9 \pm 1.6) \times 10^{-4}$		DESIG=70
Г54	$\Sigma(1385)^+ \bar{\Lambda} \pi^- + \text{c.c.}$	$< 4 \times 10^{-4}$	90%	DESIG=71
Г55	$\Sigma(1385)^- \bar{\Lambda} \pi^+ + \text{c.c.}$	$< 6 \times 10^{-4}$	90%	DESIG=72
Г56	$K^+ \bar{p} \Lambda + \text{c.c.}$	$(8.1 \pm 0.6) \times 10^{-4}$		DESIG=38
Г57	$K^+ \bar{p} \Lambda(1520) + \text{c.c.}$	$(2.9 \pm 0.7) \times 10^{-4}$		DESIG=64
Г58	$\Lambda(1520) \bar{\Lambda}(1520)$	$(4.8 \pm 1.5) \times 10^{-4}$		DESIG=65
Г59	$\Sigma^0 \bar{\Sigma}^0$	$< 6 \times 10^{-5}$	90%	DESIG=47
Г60	$\Sigma^+ \bar{\Sigma}^-$	$< 7 \times 10^{-5}$	90%	DESIG=48
Г61	$\Sigma(1385)^+ \bar{\Sigma}(1385)^-$	$< 1.6 \times 10^{-4}$	90%	DESIG=73
Г62	$\Sigma(1385)^- \bar{\Sigma}(1385)^+$	$< 8 \times 10^{-5}$	90%	DESIG=74
Г63	$\Xi^0 \bar{\Xi}^0$	$< 1.1 \times 10^{-4}$	90%	DESIG=49
Г64	$\Xi^- \bar{\Xi}^+$	$(1.48 \pm 0.33) \times 10^{-4}$		DESIG=26
Г65	$J/\psi(1S) \pi^+ \pi^- \pi^0$	$< 1.5 \%$	90%	DESIG=12
Г66	$\eta_c(1S) \pi^+ \pi^-$	$< 2.2 \%$	90%	DESIG=69

Radiative decays

Г67	$\gamma J/\psi(1S)$	$(19.2 \pm 0.7) \%$		NODE=M057;CLUMP=B DESIG=6
Г68	$\gamma \rho^0$	$< 2.0 \times 10^{-5}$	90%	DESIG=44
Г69	$\gamma \omega$	$< 6 \times 10^{-6}$	90%	DESIG=45
Г70	$\gamma \phi$	$< 8 \times 10^{-6}$	90%	DESIG=46
Г71	$\gamma \gamma$	$(2.74 \pm 0.14) \times 10^{-4}$		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 238 measurements to determine 49 parameters. The overall fit has a $\chi^2 = 339.7$ for 189 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta p_i \delta p_j \rangle / (\delta p_i \cdot \delta p_j)$, in percent, from the fit to parameters p_i , including the branching fractions, $x_i \equiv \Gamma_i / \Gamma_{\text{total}}$.

x_{14}	13									
x_{16}	3	21								
x_{17}	8	7	1							
x_{19}	14	12	3	7						
x_{22}	19	16	3	10	24					
x_{23}	19	3	1	2	3	4				
x_{26}	11	9	2	6	14	27	2			
x_{27}	14	12	3	7	17	33	3	19		
x_{28}	13	11	2	6	15	28	3	17	20	
x_{29}	7	6	1	4	8	16	1	9	11	10
x_{36}	9	8	2	5	10	18	2	10	13	11
x_{38}	16	13	3	8	16	24	4	14	17	15
x_{51}	11	9	2	6	14	28	2	16	20	17
x_{67}	24	21	4	12	29	55	5	32	40	34
x_{71}	-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_{16}	x_{17}	x_{19}	x_{22}	x_{23}	x_{26}	x_{27}	x_{28}
x_{36}	6									
x_{38}	8	10								
x_{51}	9	11	14							
x_{67}	19	22	19	33						
x_{71}	6	4	26	13	30					
Γ	-15	-19	-54	-25	-61	-52				
	x_{29}	x_{36}	x_{38}	x_{51}	x_{67}	x_{71}				

$\chi_{c2}(1P)$ PARTIAL WIDTHS

$$\chi_{c2}(1P) \Gamma(i) \Gamma(\gamma J/\psi(1S)) / \Gamma(\text{total})$$

$$\Gamma(p\bar{p}) \times \Gamma(\gamma J/\psi(1S)) / \Gamma_{\text{total}}$$

$$\Gamma_{38} \Gamma_{67} / \Gamma$$

VALUE (eV)

DOCUMENT ID

TECN

COMMENT

27.9 ± 1.3 OUR FIT

[27.8 ± 1.4 eV OUR 2013 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 $\bar{p}p \rightarrow e^+ e^- \gamma$

36 ± 8

¹ BAGLIN 86B SPEC $\bar{p}p \rightarrow e^+ e^- X$

¹ Calculated by us using $B(J/\psi(1S) \rightarrow e^+ e^-) = 0.0593 \pm 0.0010$.

² Recalculated by ANDREOTTI 05A.

NODE=M057220

NODE=M057223

NODE=M057G1

NODE=M057G1

NEW

NODE=M057G;LINKAGE=7A

NODE=M057G;LINKAGE=AN

$$\Gamma(\gamma\gamma) \times \Gamma(\gamma J/\psi(1S)) / \Gamma_{\text{total}}$$

$$\Gamma_{71} \Gamma_{67} / \Gamma$$

VALUE (eV)

EVTs

DOCUMENT ID

TECN

COMMENT

102 ± 5 OUR FIT

[102 ± 6 eV OUR 2013 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

NEW

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

$\Gamma(2(\pi^+ \pi^-)) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}} \quad \Gamma_1 \Gamma_{71} / \Gamma$

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

$\Gamma(\rho\rho) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}} \quad \Gamma_2 \Gamma_{71} / \Gamma$

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

$\Gamma(K^+ K^- \pi^+ \pi^-) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}} \quad \Gamma_{14} \Gamma_{71} / \Gamma$

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

$\Gamma(K^+ K^- \pi^+ \pi^- \pi^0) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}} \quad \Gamma_{15} \Gamma_{71} / \Gamma$

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

$\Gamma(K^*(892)^0 \bar{K}^*(892)^0) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}} \quad \Gamma_{17} \Gamma_{71} / \Gamma$

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

$\Gamma(\phi\phi) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}} \quad \Gamma_{19} \Gamma_{71} / \Gamma$

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

NODE=M057G12

NODE=M057G12;LINKAGE=LI

$\Gamma(\omega\omega) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}} \quad \Gamma_{20} \Gamma_{71} / \Gamma$

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

$\Gamma(\omega\phi) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}} \quad \Gamma_{21} \Gamma_{71} / \Gamma$

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

$$\Gamma(\pi\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{22}\Gamma_{71}/\Gamma$$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT

1.23±0.08 OUR FIT

[1.24 ± 0.08 eV OUR 2013 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 ⁻ π ⁰ π ⁰
1.14±0.21±0.17	54 ± 10	² NAKAZAWA	05 BELL	10.6 e ⁺ e ⁻ → e ⁺ e ⁻ π ⁺ π ⁻

¹ We multiplied the measurement by 3 to convert from π⁰π⁰ to ππ. Interference with the continuum included.

² We have multiplied π⁺π⁻ measurement by 3/2 to obtain ππ.

NODE=M057G4

NODE=M057G4

NEW

NODE=M057G4;LINKAGE=UE

NODE=M057G;LINKAGE=NA

$$\Gamma(\rho^0\pi^+\pi^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{23}\Gamma_{71}/\Gamma$$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT

2.0±0.9 OUR FIT

3.2±1.9±0.5	986 ± 578	UEHARA	08 BELL	γγ → χ _{c2} → 2(π ⁺ π ⁻)

NODE=M057G07

NODE=M057G07

$$\Gamma(\eta\eta) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{26}\Gamma_{71}/\Gamma$$

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

$$\Gamma(K^+K^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{27}\Gamma_{71}/\Gamma$$

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

$$\Gamma(K_S^0 K_S^0) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{28}\Gamma_{71}/\Gamma$$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT

0.291±0.025 OUR FIT

[0.297 ± 0.025 eV OUR 2013 FIT]

0.27 ^{+0.08}/_{-0.07} OUR AVERAGE [0.31 ± 0.06 eV OUR 2013 AVERAGE]

0.27 ^{+0.07} / _{-0.06} ± 0.03	53	¹ UEHARA	13 BELL	γγ → K _S ⁰ K _S ⁰

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.31 ± 0.05 ± 0.03	38 ± 7	CHEN	07B BELL	e ⁺ e ⁻ → e ⁺ e ⁻ χ _{c2}

¹ Supersedes CHEN 07B.

NEW

NODE=M057G6;LINKAGE=UE

$$\Gamma(\bar{K}^0 K^+ \pi^- + \text{c.c.}) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{29}\Gamma_{71}/\Gamma$$

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 _S ⁰ K [±] 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

$$\Gamma(K^+K^-K^+K^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{36}\Gamma_{71}/\Gamma$$

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

$$\Gamma(\eta_c(1S)\pi^+\pi^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{66}\Gamma_{71}/\Gamma$$

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

[0.0110 ± 0.0011 OUR 2013 FIT]

NODE=M057R2

NODE=M057R2

NEW

$$\Gamma(\rho^0\pi^+\pi^-)/\Gamma(2(\pi^+\pi^-)) \quad \Gamma_{23}/\Gamma_1$$

VALUE	DOCUMENT ID	TECN	COMMENT

0.36±0.15 OUR FIT

0.31±0.17	TANENBAUM	78 MRK1	ψ(2S) → γχ _{c2}

NODE=M057R38

NODE=M057R38

$\Gamma(\pi^+\pi^-\pi^0\pi^0)/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
1.92±0.25 OUR AVERAGE		[(1.99 ± 0.26)% OUR 2013 AVERAGE]		
1.92±0.24±0.07	903.5	¹ HE	08B CLEO	$e^+e^- \rightarrow \gamma h^+ h^- h^0 h^0$

¹ HE 08B reports $1.87 \pm 0.07 \pm 0.22 \pm 0.13$ % from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \pi^+\pi^-\pi^0\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R46
 NODE=M057R46

NEW

NODE=M057R46;LINKAGE=HE

 $\Gamma(\rho^+\pi^-\pi^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
2.3 ± 0.4 OUR AVERAGE		[(2.4 ± 0.4)% OUR 2013 AVERAGE]		
2.28±0.35±0.08	1031.9	^{1,2} HE	08B CLEO	$e^+e^- \rightarrow \gamma h^+ h^- h^0 h^0$

¹ HE 08B reports $2.23 \pm 0.11 \pm 0.32 \pm 0.16$ % from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \rho^+\pi^-\pi^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² Calculated by us. We have added the values from HE 08B for $\rho^+\pi^-\pi^0$ and $\rho^-\pi^+\pi^0$ decays assuming uncorrelated statistical and fully correlated systematic uncertainties.

NODE=M057R47
 NODE=M057R47

NEW

NODE=M057R47;LINKAGE=HE

NODE=M057R47;LINKAGE=OC

 $\Gamma(4\pi^0)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.16±0.16 OUR AVERAGE		[(1.21 ± 0.17) $\times 10^{-3}$ OUR 2013 AVERAGE]		
1.16±0.15±0.04	1164	¹ ABLIKIM	11A BES3	$e^+e^- \rightarrow \psi(2S) \rightarrow \gamma\chi_{c2}$

¹ ABLIKIM 11A reports $(1.21 \pm 0.05 \pm 0.16) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow 4\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.74 \pm 0.35) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R58
 NODE=M057R58

NEW

NODE=M057R58;LINKAGE=AB

 $\Gamma(K^+K^-\pi^0\pi^0)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.22±0.04±0.01	76.9	¹ HE	08B CLEO	$e^+e^- \rightarrow \gamma h^+ h^- h^0 h^0$

¹ HE 08B reports $0.21 \pm 0.03 \pm 0.03 \pm 0.01$ % from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K^+K^-\pi^0\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R48
 NODE=M057R48

NODE=M057R48;LINKAGE=HE

 $\Gamma(K^+\pi^-\bar{K}^0\pi^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
1.44±0.21 OUR AVERAGE		[(1.50 ± 0.22)% OUR 2013 AVERAGE]		
1.44±0.20±0.05	211.6	¹ HE	08B CLEO	$e^+e^- \rightarrow \gamma h^+ h^- h^0 h^0$

¹ HE 08B reports $1.41 \pm 0.11 \pm 0.16 \pm 0.10$ % from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K^+\pi^-\bar{K}^0\pi^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R50
 NODE=M057R50

NEW

NODE=M057R50;LINKAGE=HE

 $\Gamma(\rho^-K^+\bar{K}^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.43±0.13 OUR AVERAGE		[(0.45 ± 0.14)% OUR 2013 AVERAGE]		
0.43±0.13±0.01	62.9	¹ HE	08B CLEO	$e^+e^- \rightarrow \gamma h^+ h^- h^0 h^0$

¹ HE 08B reports $0.42 \pm 0.11 \pm 0.06 \pm 0.03$ % from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \rho^-K^+\bar{K}^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R51
 NODE=M057R51

NEW

NODE=M057R51;LINKAGE=HE

$$\Gamma(K^*(892)^0 K^- \pi^+ \rightarrow K^- \pi^+ K^0 \pi^0 + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_9/\Gamma$$

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.31±0.08 OUR AVERAGE	[(0.32 ± 0.09)% OUR 2013 AVERAGE]			
0.31±0.08±0.01	38.7	¹ HE	08B CLEO	$e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$

¹ HE 08B reports $0.30 \pm 0.07 \pm 0.04 \pm 0.02$ % from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K^*(892)^0 K^- \pi^+ \rightarrow K^- \pi^+ K^0 \pi^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R57
NODE=M057R57

NEW

NODE=M057R57;LINKAGE=HE

$$\Gamma(K^*(892)^0 \bar{K}^0 \pi^0 \rightarrow K^+ \pi^- \bar{K}^0 \pi^0 + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_{10}/\Gamma$$

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.40±0.09 OUR AVERAGE	[(0.42 ± 0.09)% OUR 2013 AVERAGE]			
0.40±0.09±0.01	63.0	¹ HE	08B CLEO	$e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$

¹ HE 08B reports $0.39 \pm 0.07 \pm 0.05 \pm 0.03$ % from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K^*(892)^0 \bar{K}^0 \pi^0 \rightarrow K^+ \pi^- \bar{K}^0 \pi^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R52
NODE=M057R52

NEW

NODE=M057R52;LINKAGE=HE

$$\Gamma(K^*(892)^- K^+ \pi^0 \rightarrow K^+ \pi^- \bar{K}^0 \pi^0 + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_{11}/\Gamma$$

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.39±0.09 OUR AVERAGE	[(0.40 ± 0.09)% OUR 2013 AVERAGE]			
0.39±0.08±0.01	51.1	¹ HE	08B CLEO	$e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$

¹ HE 08B reports $0.38 \pm 0.07 \pm 0.04 \pm 0.03$ % from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K^*(892)^- K^+ \pi^0 \rightarrow K^+ \pi^- \bar{K}^0 \pi^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R53
NODE=M057R53

NEW

NODE=M057R53;LINKAGE=HE

$$\Gamma(K^*(892)^+ \bar{K}^0 \pi^- \rightarrow K^+ \pi^- \bar{K}^0 \pi^0 + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_{12}/\Gamma$$

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.31±0.08 OUR AVERAGE	[(0.32 ± 0.09)% OUR 2013 AVERAGE]			
0.31±0.08±0.01	39.3	¹ HE	08B CLEO	$e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$

¹ HE 08B reports $0.30 \pm 0.07 \pm 0.04 \pm 0.02$ % from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K^*(892)^+ \bar{K}^0 \pi^- \rightarrow K^+ \pi^- \bar{K}^0 \pi^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R54
NODE=M057R54

NEW

NODE=M057R54;LINKAGE=HE

$$\Gamma(K^+ K^- \eta \pi^0)/\Gamma_{\text{total}} \quad \Gamma_{13}/\Gamma$$

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.13 ± 0.05 OUR AVERAGE	[(0.14 ± 0.05)% OUR 2013 AVERAGE]			
0.133±0.046±0.005	22.9	¹ HE	08B CLEO	$e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$

¹ HE 08B reports $0.13 \pm 0.04 \pm 0.02 \pm 0.01$ % from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K^+ K^- \eta \pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R55
NODE=M057R55

NEW

NODE=M057R55;LINKAGE=HE

$$\Gamma(K^+ K^- \pi^+ \pi^-)/\Gamma_{\text{total}} \quad \Gamma_{14}/\Gamma$$

VALUE (units 10^{-3})	DOCUMENT ID
8.8±1.0 OUR FIT	
[(9.1 ± 1.1) × 10 ⁻³ OUR 2013 FIT]	

NODE=M057R3
NODE=M057R3

NEW

$$\Gamma(K^+ \bar{K}^*(892)^0 \pi^- + \text{c.c.})/\Gamma(K^+ K^- \pi^+ \pi^-) \quad \Gamma_{16}/\Gamma_{14}$$

VALUE	DOCUMENT ID	TECN	COMMENT
0.25±0.13 OUR FIT			
0.25±0.13	TANENBAUM 78	MRK1	$\psi(2S) \rightarrow \gamma \chi_{c2}$

NODE=M057R39
NODE=M057R39

$$\Gamma(K^+ \bar{K}^*(892)^0 \pi^- + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_{16}/\Gamma$$

VALUE (units 10^{-4})	DOCUMENT ID
22±11 OUR FIT	
[(23 ± 12) × 10 ⁻⁴ OUR 2013 FIT]	

NODE=M057R9
NODE=M057R9

NEW

$\Gamma(K^*(892)^0 \bar{K}^*(892)^0)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

DOCUMENT ID

2.4±0.5 OUR FIT[(2.5 ± 0.5) × 10^{-3} OUR 2013 FIT] Γ_{17}/Γ

NODE=M057R26

NODE=M057R26

NEW

 $\Gamma(3(\pi^+ \pi^-))/\Gamma_{\text{total}}$ 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_{18}/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[(1.16 ± 0.10) × 10^{-3} OUR 2013 FIT] Γ_{19}/Γ

NODE=M057R20

NODE=M057R20

NEW

 $\Gamma(\omega\omega)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

EVTS

DOCUMENT ID

TECN

COMMENT

0.88±0.11 OUR AVERAGE[(0.92 ± 0.11) × 10^{-3} OUR 2013 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_{20}/Γ

NODE=M057R28

NODE=M057R28

NEW

NODE=M057R28;LINKAGE=AL

NODE=M057R28;LINKAGE=AB

 $\Gamma(\omega\phi)/\Gamma_{\text{total}}$ 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_{21}/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[(2.42 ± 0.13) × 10^{-3} OUR 2013 FIT] Γ_{22}/Γ

NODE=M057R27

NODE=M057R27

NEW

 $\Gamma(\rho^0 \pi^+ \pi^-)/\Gamma_{\text{total}}$ VALUE (units 10^{-4})

DOCUMENT ID

38±16 OUR FIT[(40 ± 17) × 10^{-4} OUR 2013 FIT] Γ_{23}/Γ

NODE=M057R8

NODE=M057R8

NEW

 $\Gamma(\pi^+ \pi^- \eta)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

CL%

DOCUMENT ID

TECN

COMMENT

0.50±0.13 OUR AVERAGE [(0.52 ± 0.14) × 10^{-3} OUR 2013 AVERAGE]**0.50±0.13±0.02**¹ ATHAR

07

CLEO

 $\psi(2S) \rightarrow \gamma h^+ h^- h^0$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<1.5

90

² ABLIKIM

06R

BES2

 $\psi(2S) \rightarrow \gamma \chi_{c2}$

¹ ATHAR 07 reports $(0.49 \pm 0.12 \pm 0.06) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \pi^+ \pi^- \eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$. 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_{24}/Γ

NODE=M057R08

NODE=M057R08

NEW

NODE=M057R08;LINKAGE=AT

NODE=M057R08;LINKAGE=AB

$\Gamma(\pi^+ \pi^- \eta')/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

DOCUMENT ID

TECN

COMMENT

 Γ_{25}/Γ NODE=M057R35
NODE=M057R35**0.52±0.19 OUR AVERAGE** $[(0.54 \pm 0.20) \times 10^{-3}]$ OUR 2013 AVERAGE]

NEW

0.52±0.19±0.02¹ ATHAR

07

CLEO

 $\psi(2S) \rightarrow \gamma h^+ h^- h^0$

NODE=M057R35;LINKAGE=AT

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.

 $\Gamma(\eta\eta)/\Gamma_{\text{total}}$ VALUE (units 10^{-4})

DOCUMENT ID

 Γ_{26}/Γ NODE=M057R16
NODE=M057R16**5.7±0.5 OUR FIT**

NEW

 $[(5.9 \pm 0.5) \times 10^{-4}]$ OUR 2013 FIT] $\Gamma(K^+ K^-)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

DOCUMENT ID

 Γ_{27}/Γ NODE=M057R11
NODE=M057R11**1.05±0.07 OUR FIT**

NEW

 $[(1.09 \pm 0.08) \times 10^{-3}]$ OUR 2013 FIT] $\Gamma(K_S^0 K_S^0)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

DOCUMENT ID

 Γ_{28}/Γ NODE=M057R19
NODE=M057R19**0.55±0.04 OUR FIT**

NEW

 $[(0.58 \pm 0.05) \times 10^{-3}]$ OUR 2013 FIT] $\Gamma(K_S^0 K_S^0)/\Gamma(\pi\pi)$

VALUE

DOCUMENT ID

TECN

COMMENT

 Γ_{28}/Γ_{22} NODE=M057R36
NODE=M057R36**0.235±0.019 OUR FIT**

NEW

 $[0.239 \pm 0.019]$ OUR 2013 FIT]

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.27 ±0.07 ±0.04

^{1,2} CHEN

07B

BELL

 $e^+ e^- \rightarrow e^+ e^- \chi_{c2}$

NODE=M057R36;LINKAGE=CH

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=NI

 $\Gamma(K_S^0 K_S^0)/\Gamma(K^+ K^-)$

VALUE

DOCUMENT ID

TECN

COMMENT

 Γ_{28}/Γ_{27} NODE=M057R37
NODE=M057R37**0.52±0.05 OUR FIT**

NEW

 $[0.53 \pm 0.05]$ OUR 2013 FIT]

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.70±0.21±0.12

^{1,2} CHEN

07B

BELL

 $e^+ e^- \rightarrow e^+ e^- \chi_{c2}$

NODE=M057R37;LINKAGE=CH

¹ Using $\Gamma(K^+ K^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ from NAKAZAWA 05.

² Not independent from other measurements.

NODE=M057R37;LINKAGE=NI

 $\Gamma(K^+ K^- \pi^0)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

DOCUMENT ID

TECN

COMMENT

 Γ_{30}/Γ NODE=M057R05
NODE=M057R05**0.32±0.08 OUR AVERAGE** $[(0.33 \pm 0.08) \times 10^{-3}]$ OUR 2013 AVERAGE]

NEW

0.32±0.08±0.01¹ ATHAR

07

CLEO

 $\psi(2S) \rightarrow \gamma h^+ h^- h^0$

NODE=M057R05;LINKAGE=AT

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.

 $\Gamma(K^+ K^- \eta)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

CL%

DOCUMENT ID

TECN

COMMENT

 Γ_{31}/Γ NODE=M057R09
NODE=M057R09**<0.34 (CL = 90%)** $[<0.35 \times 10^{-3} \text{ (CL = 90\%)}]$ OUR 2013 BEST LIMIT]**<0.34**

90

¹ ATHAR

07

CLEO

 $\psi(2S) \rightarrow \gamma h^+ h^- h^0$

NODE=M057R09;LINKAGE=AT

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 $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 9.11 \times 10^{-2}$.

$\Gamma(\eta\eta')/\Gamma_{\text{total}}$ Γ_{32}/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_{33}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<1.0 (CL = 90%)					$[<1.1 \times 10^{-4} \text{ (CL = 90\%)} \text{ OUR 2013 BEST LIMIT}]$
<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_{34}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
2.3 ± 0.6 OUR AVERAGE				$[(2.4 \pm 0.6) \times 10^{-3} \text{ OUR 2013 AVERAGE}]$
$2.3 \pm 0.6 \pm 0.1$	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

NEW

NODE=M057R31;LINKAGE=AB

 $\Gamma(K^+K^-K_S^0K_S^0)/\Gamma_{\text{total}}$ Γ_{35}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<4	90	2.3 ± 2.2	¹ ABLIKIM	050 BES2	$e^+e^- \rightarrow \chi_{c2}\gamma$
¹ ABLIKIM 050 reports $[\Gamma(\chi_{c2}(1P) \rightarrow K^+K^-K_S^0K_S^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ < 3.5×10^{-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_{36}/Γ

VALUE (units 10^{-3})	DOCUMENT ID
1.73 ± 0.21 OUR FIT	
$[(1.78 \pm 0.22) \times 10^{-3} \text{ OUR 2013 FIT}]$	

NODE=M057R18
NODE=M057R18

NEW

 $\Gamma(K^+K^-\phi)/\Gamma_{\text{total}}$ Γ_{37}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.48 ± 0.31 OUR AVERAGE				$[(1.54 \pm 0.32) \times 10^{-3} \text{ OUR 2013 AVERAGE}]$
$1.48 \pm 0.31 \pm 0.05$	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

NEW

NODE=M057R01;LINKAGE=AB

 $\Gamma(\rho\rho)/\Gamma_{\text{total}}$ Γ_{38}/Γ

VALUE (units 10^{-4})	DOCUMENT ID
0.75 ± 0.04 OUR FIT	
$[(0.71 \pm 0.04) \times 10^{-4} \text{ OUR 2013 FIT}]$	

NODE=M057R12
NODE=M057R12

NEW

$\Gamma(p\bar{p}\pi^0)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

DOCUMENT ID

TECN

COMMENT

 Γ_{39}/Γ

NODE=M057R06

NODE=M057R06

NEW

0.49±0.04 OUR AVERAGE[(0.51 ± 0.05) × 10⁻³ OUR 2013 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;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

 $\Gamma(p\bar{p}\eta)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

DOCUMENT ID

TECN

COMMENT

 Γ_{40}/Γ

NODE=M057R34

NODE=M057R34

NEW

0.182±0.026 OUR AVERAGE[(0.189 ± 0.028) × 10⁻³ OUR 2013 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;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

 $\Gamma(p\bar{p}\omega)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

DOCUMENT ID

TECN

COMMENT

 Γ_{41}/Γ

NODE=M057R56

NODE=M057R56

NEW

0.38±0.05 OUR AVERAGE [(0.39 ± 0.05) × 10⁻³ OUR 2013 AVERAGE]**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;LINKAGE=ON

 $\Gamma(p\bar{p}\phi)/\Gamma_{\text{total}}$ VALUE (units 10^{-5})

EVTS

DOCUMENT ID

TECN

COMMENT

 Γ_{42}/Γ

NODE=M057R62

NODE=M057R62

NEW

2.9±0.9 OUR AVERAGE [(3.0 ± 1.0) × 10⁻⁵ OUR 2013 AVERAGE]**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;LINKAGE=AB

 $\Gamma(p\bar{p}\pi^+\pi^-)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

DOCUMENT ID

TECN

COMMENT

 Γ_{43}/Γ

NODE=M057R6

NODE=M057R6

→ UNCHECKED ←

1.32±0.34 OUR EVALUATION Treating systematic error as correlated.**1.3 ± 0.4 OUR AVERAGE** Error includes scale factor of 1.3.

1.17±0.19±0.30

¹ BAI

99B

BES

 $\psi(2S) \rightarrow \gamma\chi_{c2}$

2.64±1.03±0.14

¹ TANENBAUM

78

MRK1

 $\psi(2S) \rightarrow \gamma\chi_{c2}$

¹ Rescaled by us using $B(\psi(2S) \rightarrow \gamma\chi_{c2}) = (8.3 \pm 0.4)\%$ and $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (32.6 \pm 0.5)\%$. Multiplied by a factor of 2 to convert from $K_S^0 K^+ \pi^-$ to $K^0 K^+ \pi^-$ decay.

NODE=M057R6;LINKAGE=X3

$\Gamma(p\bar{p}\pi^0\pi^0)/\Gamma_{\text{total}}$ Γ_{44}/Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.082±0.025 OUR AVERAGE		[(0.085 ± 0.026)% OUR 2013 AVERAGE]		
0.082±0.024±0.003	29.2	¹ HE	08B CLEO	$e^+e^- \rightarrow \gamma h^+ h^- h^0 h^0$

¹ HE 08B reports $0.08 \pm 0.02 \pm 0.01 \pm 0.01$ % from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow p\bar{p}\pi^0\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R49
NODE=M057R49

NEW

NODE=M057R49;LINKAGE=HE

 $\Gamma(p\bar{p}K^+K^- \text{ (non-resonant)})/\Gamma_{\text{total}}$ Γ_{45}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.00±0.34 OUR AVERAGE		[(2.08 ± 0.35) $\times 10^{-4}$ OUR 2013 AVERAGE]		
2.00±0.33±0.07	131 ± 12	¹ ABLIKIM	11F BES3	$\psi(2S) \rightarrow \gamma p\bar{p}K^+K^-$

¹ ABLIKIM 11F reports $(2.08 \pm 0.19 \pm 0.30) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow p\bar{p}K^+K^- \text{ (non-resonant)})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.74 \pm 0.35) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R59
NODE=M057R59

NEW

NODE=M057R59;LINKAGE=AB

 $\Gamma(p\bar{p}K_S^0 K_S^0)/\Gamma_{\text{total}}$ Γ_{46}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<7.9	90	¹ ABLIKIM	06D BES2	$\psi(2S) \rightarrow \chi_{c2}\gamma$

¹ Using $B(\psi(2S) \rightarrow \chi_{c2}\gamma) = (9.3 \pm 0.6)\%$.

NODE=M057R30
NODE=M057R30

NODE=M057R;LINKAGE=AB

 $\Gamma(p\bar{n}\pi^-)/\Gamma_{\text{total}}$ Γ_{47}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
8.9±1.0 OUR AVERAGE		[(11 ± 4) $\times 10^{-4}$ OUR 2013 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	$\psi(2S) \rightarrow \gamma p\pi^- X$

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.

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
NODE=M057R33

NEW

NODE=M057R33;LINKAGE=AL

NODE=M057R33;LINKAGE=AB

 $\Gamma(p\bar{n}\pi^+)/\Gamma_{\text{total}}$ Γ_{48}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
9.3±0.8±0.3	3732	¹ ABLIKIM	12J BES3	$\psi(2S) \rightarrow \gamma p\bar{n}\pi^+$

¹ ABLIKIM 12J reports $[\Gamma(\chi_{c2}(1P) \rightarrow p\bar{n}\pi^+)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ = $(0.85 \pm 0.02 \pm 0.07) \times 10^{-4}$ 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
NODE=M057R70

NODE=M057R70;LINKAGE=AL

 $\Gamma(p\bar{n}\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{49}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
22.7±1.8±0.8	2128	¹ ABLIKIM	12J BES3	$\psi(2S) \rightarrow \gamma p\bar{n}\pi^-\pi^0$

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
NODE=M057R71

NODE=M057R71;LINKAGE=AL

 $\Gamma(p\bar{n}\pi^+\pi^0)/\Gamma_{\text{total}}$ Γ_{50}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
22.1±1.9±0.8	2352	¹ ABLIKIM	12J BES3	$\psi(2S) \rightarrow \gamma p\bar{n}\pi^+\pi^0$

¹ ABLIKIM 12J reports $[\Gamma(\chi_{c2}(1P) \rightarrow p\bar{n}\pi^+\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ = $(2.01 \pm 0.06 \pm 0.16) \times 10^{-4}$ 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
NODE=M057R72

NODE=M057R72;LINKAGE=AL

$\Gamma(\Lambda\bar{\Lambda})/\Gamma_{\text{total}}$ VALUE (units 10^{-4})

DOCUMENT ID

1.92±0.16 OUR FIT[(1.86 ± 0.27) × 10^{-4} OUR 2013 FIT] Γ_{51}/Γ

NODE=M057R25

NODE=M057R25

NEW

 $\Gamma(\Lambda\bar{\Lambda}\pi^+\pi^-)/\Gamma_{\text{total}}$ 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_{52}/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_{53}/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_{54}/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_{55}/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[(8.4 ± 0.6) × 10^{-4} OUR 2013 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_{56}/Γ

NODE=M057R07

NODE=M057R07

NEW

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_{57}/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT

2.9±0.7 OUR AVERAGE $[(3.1 \pm 0.7) \times 10^{-4}]$ OUR 2013 AVERAGE]**2.9±0.7±0.1** 79 ± 13 ¹ ABLIKIM 11F BES3 $\psi(2S) \rightarrow \gamma p \bar{p} K^+ K^-$

¹ ABLIKIM 11F reports $(3.06 \pm 0.50 \pm 0.54) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K^+ \bar{p} \Lambda(1520) + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (8.74 \pm 0.35) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R60
NODE=M057R60

NEW

NODE=M057R60;LINKAGE=AB

 $\Gamma(\Lambda(1520) \bar{\Lambda}(1520))/\Gamma_{\text{total}}$ Γ_{58}/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT

4.8±1.5 OUR AVERAGE $[(5.0 \pm 1.6) \times 10^{-4}]$ OUR 2013 AVERAGE]**4.8±1.5±0.2** 29 ± 7 ¹ ABLIKIM 11F BES3 $\psi(2S) \rightarrow \gamma p \bar{p} K^+ K^-$

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
NODE=M057R61

NEW

NODE=M057R61;LINKAGE=AB

 $\Gamma(\Sigma^0 \bar{\Sigma}^0)/\Gamma_{\text{total}}$ Γ_{59}/Γ

VALUE (units 10^{-4})	CL%	EVTs	DOCUMENT ID	TECN	COMMENT

<0.6 (CL = 90%) $[<0.8 \times 10^{-4}]$ (CL = 90%) OUR 2013 BEST LIMIT]**<0.6** 90 ¹ ABLIKIM 13H BES3 $\psi(2S) \rightarrow \gamma \Sigma^0 \bar{\Sigma}^0$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.8 90 7.5 ± 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 $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 9.11 \times 10^{-2}$.

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
NODE=M057R43

NODE=M057R43;LINKAGE=AB

NODE=M057R43;LINKAGE=NA

 $\Gamma(\Sigma^+ \bar{\Sigma}^-)/\Gamma_{\text{total}}$ Γ_{60}/Γ

VALUE (units 10^{-4})	CL%	EVTs	DOCUMENT ID	TECN	COMMENT

<0.7 90 4.0 ± 3.5 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 $\psi(2S) \rightarrow \gamma \Sigma^+ \bar{\Sigma}^-$

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 $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 9.11 \times 10^{-2}$.

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
NODE=M057R44

NODE=M057R44;LINKAGE=NA

NODE=M057R44;LINKAGE=AB

 $\Gamma(\Sigma(1385)^+ \bar{\Sigma}(1385)^-)/\Gamma_{\text{total}}$ Γ_{61}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT

<16 90 ¹ ABLIKIM 12I BES3 $\psi(2S) \rightarrow \gamma \Sigma(1385)^+ \bar{\Sigma}(1385)^-$

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
NODE=M057R68

NODE=M057R68;LINKAGE=AL

 $\Gamma(\Sigma(1385)^- \bar{\Sigma}(1385)^+)/\Gamma_{\text{total}}$ Γ_{62}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT

<8 90 ¹ ABLIKIM 12I BES3 $\psi(2S) \rightarrow \gamma \Sigma(1385)^- \bar{\Sigma}(1385)^+$

¹ ABLIKIM 12I reports $< 8.5 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \Sigma(1385)^- \bar{\Sigma}(1385)^+)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (8.72 \pm 0.34) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 9.11 \times 10^{-2}$.

NODE=M057R69
NODE=M057R69

NODE=M057R69;LINKAGE=AL

$\Gamma(\Xi^0 \Xi^0)/\Gamma_{\text{total}}$ Γ_{63}/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_{64}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
1.48±0.33 OUR AVERAGE					$[(1.55 \pm 0.35) \times 10^{-4} \text{ OUR 2013 AVERAGE}]$
1.48±0.33±0.05	29 ± 5		¹ NAIK	08 CLEO	$\psi(2S) \rightarrow \gamma \Xi^+ \Xi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 3.7	90		² ABLIKIM	06D BES2	$\psi(2S) \rightarrow \chi_{c2} \gamma$
¹ NAIK 08 reports $(1.45 \pm 0.30 \pm 0.15) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \Xi^- \Xi^+)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$. 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

NEW

NODE=M057R17;LINKAGE=NA

NODE=M057R17;LINKAGE=AB

 $\Gamma(J/\psi(1S) \pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}$ Γ_{65}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.015	90	BARATE	81 SPEC	190 GeV $\pi^- \text{Be} \rightarrow 2\pi 2\mu$

NODE=M057R13
 NODE=M057R13

 $\Gamma(\eta_c(1S) \pi^+ \pi^-)/\Gamma(K^0 K^+ \pi^- + \text{c.c.})$ Γ_{66}/Γ_{29}

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_{67}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
0.192±0.007 OUR FIT			
[0.198 ± 0.008 OUR 2013 FIT]			
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.199±0.005±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
 NEW

NODE=M057R7;LINKAGE=AD

 $\Gamma(\gamma \rho^0)/\Gamma_{\text{total}}$ Γ_{68}/Γ

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<20 (CL = 90%)					$[<21 \times 10^{-6} \text{ (CL = 90\% OUR 2013 BEST LIMIT)}]$
<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_{69}/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_{70}/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_{71}/Γ

VALUE (units 10^{-4})	DOCUMENT ID
2.74±0.14 OUR FIT	
$[(2.61 \pm 0.16) \times 10^{-4}]$ OUR 2013 FIT	

NODE=M057R1
NODE=M057R1
NEW

 $\Gamma(\gamma\gamma)/\Gamma(\gamma J/\psi(1S))$
 Γ_{71}/Γ_{67}

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
1.43±0.08 OUR FIT			
$[(1.31 \pm 0.09) \times 10^{-3}]$ OUR 2013 FIT			

NODE=M057R23
NODE=M057R23
NEW

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=M057R;LINKAGE=7A

 $\Gamma(\gamma\gamma)/\Gamma_{\text{total}} \times \Gamma(p\bar{p})/\Gamma_{\text{total}}$
 $\Gamma_{71}/\Gamma \times \Gamma_{38}/\Gamma$

VALUE (units 10^{-8})	DOCUMENT ID	TECN	COMMENT
2.06±0.16 OUR FIT			
$[(1.85 \pm 0.18) \times 10^{-8}]$ OUR 2013 FIT			
1.7 ±0.4 OUR AVERAGE			
1.60 ± 0.42	ARMSTRONG	93 E760	$\bar{p}p \rightarrow \gamma\gamma X$
9.9 ± 4.5	BAGLIN	87B SPEC	$\bar{p}p \rightarrow \gamma\gamma X$

NODE=M057R24
NODE=M057R24
NEW

$\chi_{c2}(1P)$ CROSS-PARTICLE BRANCHING RATIOS

NODE=M057230

 $\Gamma(\chi_{c2}(1P) \rightarrow K^+K^-\pi^+\pi^-)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)$
 $\Gamma_{14}/\Gamma \times \Gamma_{130}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}$

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
2.34±0.26 OUR FIT			
$[(2.35 \pm 0.26) \times 10^{-3}]$ OUR 2013 FIT			

NODE=M057B18
NODE=M057B18
NEW

2.5 ±0.9 OUR AVERAGE Error includes scale factor of 2.3.

$1.90 \pm 0.14 \pm 0.44$	BAI	99B BES	$\psi(2S) \rightarrow \gamma\chi_{c2}$
3.8 ± 0.67	¹ TANENBAUM	78 MRK1	$\psi(2S) \rightarrow \gamma\chi_{c2}$

¹ The reported value is derived using $B(\psi(2S) \rightarrow \pi^+\pi^-J/\psi) \times B(J/\psi \rightarrow \ell^+\ell^-) = (4.6 \pm 0.7)\%$. Calculated by us using $B(J/\psi \rightarrow \ell^+\ell^-) = 0.1181 \pm 0.0020$.

NODE=M057B18;LINKAGE=TA

 $\Gamma(\chi_{c2}(1P) \rightarrow K^*(892)^0\bar{K}^*(892)^0)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))/\Gamma_{\text{total}}$
 $\Gamma_{17}/\Gamma \times \Gamma_{130}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}$

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
2.2 ±0.4 OUR FIT			
3.11±0.36±0.48	ABLIKIM	04H BES2	$\psi(2S) \rightarrow \gamma\chi_{c2}$

NODE=M057B19
NODE=M057B19

 $\Gamma(\chi_{c2}(1P) \rightarrow p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)$
 $\Gamma_{38}/\Gamma \times \Gamma_{130}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}$

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
1.99±0.10 OUR FIT			
$[(1.83 \pm 0.13) \times 10^{-5}]$ OUR 2013 FIT			

NODE=M057B1
NODE=M057B1
NEW

1.4 ±1.1	¹ BAI	98I BES	$\psi(2S) \rightarrow \gamma\chi_{c2} \rightarrow \gamma\bar{p}p$

¹ Calculated by us. The value for $B(\chi_{c2} \rightarrow p\bar{p})$ reported in BAI 98I is derived using $B(\psi(2S) \rightarrow \gamma\chi_{c2}) = (7.8 \pm 0.8)\%$ and $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (32.4 \pm 2.6)\%$ [BAI 98D].

NODE=M057B;LINKAGE=J8

$$\Gamma(\chi_{c2}(1P) \rightarrow p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))/\Gamma_{\text{total}}$$

$$\Gamma_{38}/\Gamma \times \Gamma_{130}^{\psi(2S)}/\Gamma\psi(2S)$$

VALUE (units 10^{-6}) EVTS DOCUMENT ID TECN COMMENT

6.85±0.33 OUR FIT

[(6.2 ± 0.5) × 10^{-6} OUR 2013 FIT]

7.1 ±0.5 OUR AVERAGE Error includes scale factor of 1.2. [(6.7 ± 1.1) × 10^{-6} OUR 2013 AVERAGE Scale factor = 1.5]

7.3 ±0.4 ±0.3	405	ABLIKIM	13V	BES3	$\psi(2S) \rightarrow \gamma p\bar{p}$
7.2 ±0.7 ±0.4	121 ± 12	¹ NAIK	08	CLEO	$\psi(2S) \rightarrow \gamma p\bar{p}$
4.4 ^{+1.6} _{-1.4} ±0.6	14.3 ^{+5.2} _{-4.7}	BAI	04F	BES	$\psi(2S) \rightarrow \gamma\chi_{c2}(1P) \rightarrow \gamma p\bar{p}$

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
NODE=M057B6

NEW

NEW

$$\Gamma(\chi_{c2}(1P) \rightarrow \Lambda\bar{\Lambda})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))/\Gamma_{\text{total}}$$

$$\Gamma_{51}/\Gamma \times \Gamma_{130}^{\psi(2S)}/\Gamma\psi(2S)$$

VALUE (units 10^{-6}) EVTS DOCUMENT ID TECN COMMENT

17.5±1.3 OUR FIT

[(16.3 ± 2.3) × 10^{-6} OUR 2013 FIT]

17.4±1.4 OUR AVERAGE

[(15.9 ± 2.3) × 10^{-6} OUR 2013 AVERAGE]

18.2±1.4±0.9	207	¹ ABLIKIM	13H	BES3	$\psi(2S) \rightarrow \gamma\Lambda\bar{\Lambda}$
15.9±2.1±1.0	71 ± 9	² NAIK	08	CLEO	$\psi(2S) \rightarrow \gamma\Lambda\bar{\Lambda}$

¹ Calculated by us. ABLIKIM 13H reports $B(\chi_{c2} \rightarrow \Lambda\bar{\Lambda}) = (20.8 \pm 1.6 \pm 2.3) \times 10^{-5}$ from a measurement of $B(\chi_{c2} \rightarrow \Lambda\bar{\Lambda}) \times B(\psi(2S) \rightarrow \gamma\chi_{c2})$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}) = (8.74 \pm 0.35)\%$.

² Calculated by us. NAIK 08 reports $B(\chi_{c2} \rightarrow \Lambda\bar{\Lambda}) = (17.0 \pm 2.2 \pm 1.1 \pm 1.1) \times 10^{-5}$ using $B(\psi(2S) \rightarrow \gamma\chi_{c2}) = (9.33 \pm 0.14 \pm 0.61)\%$.

NODE=M057B10
NODE=M057B10

NEW

NEW

NODE=M057B10;LINKAGE=AB

NODE=M057B10;LINKAGE=NA

$$\Gamma(\chi_{c2}(1P) \rightarrow \Lambda\bar{\Lambda})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)$$

$$\Gamma_{51}/\Gamma \times \Gamma_{130}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}$$

VALUE (units 10^{-5}) EVTS DOCUMENT ID TECN COMMENT

5.1±0.4 OUR FIT

[(4.8 ± 0.7) × 10^{-5} OUR 2013 FIT]

7.1 ^{+3.1} _{-2.9} ±1.3	8.3 ^{+3.7} _{-3.4}	¹ BAI	03E	BES	$\psi(2S) \rightarrow \gamma\Lambda\bar{\Lambda}$

¹ BAI 03E reports [$B(\chi_{c2} \rightarrow \Lambda\bar{\Lambda}) B(\psi(2S) \rightarrow \gamma\chi_{c2}) / B(\psi(2S) \rightarrow J/\psi\pi^+\pi^-)] \times [B^2(\Lambda \rightarrow \pi^-\rho) / B(J/\psi \rightarrow \rho\bar{\rho})] = (1.33 ^{+0.59}_{-0.55} ± 0.25)\%$. We calculate from this measurement the presented value using $B(\Lambda \rightarrow \pi^-\rho) = (63.9 \pm 0.5)\%$ and $B(J/\psi \rightarrow \rho\bar{\rho}) = (2.17 \pm 0.07) \times 10^{-3}$.

NODE=M057B11
NODE=M057B11

NEW

NODE=M057B11;LINKAGE=BA

$$\Gamma(\chi_{c2}(1P) \rightarrow \pi\pi)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))/\Gamma_{\text{total}}$$

$$\Gamma_{22}/\Gamma \times \Gamma_{130}^{\psi(2S)}/\Gamma\psi(2S)$$

VALUE (units 10^{-4}) EVTS DOCUMENT ID TECN COMMENT

2.12±0.08 OUR FIT**2.17±0.09 OUR AVERAGE**

2.19±0.05±0.15	4.5k	¹ ABLIKIM	10A	BES3	$e^+e^- \rightarrow \psi(2S) \rightarrow \gamma\chi_{c2}$
2.23±0.06±0.10	2.5k	² ASNER	09	CLEO	$\psi(2S) \rightarrow \gamma\pi^+\pi^-$
1.90±0.08±0.20	0.8k	³ ASNER	09	CLEO	$\psi(2S) \rightarrow \gamma\pi^0\pi^0$

¹ Calculated by us. ABLIKIM 10A reports $B(\chi_{c2} \rightarrow \pi^0\pi^0) = (0.88 \pm 0.02 \pm 0.06 \pm 0.04) \times 10^{-3}$ using $B(\psi(2S) \rightarrow \gamma\chi_{c2}) = (8.3 \pm 0.4)\%$. We have multiplied the $\pi^0\pi^0$ measurement by 3 to obtain $\pi\pi$.

² Calculated by us. ASNER 09 reports $B(\chi_{c2} \rightarrow \pi^+\pi^-) = (1.59 \pm 0.04 \pm 0.07 \pm 0.10) \times 10^{-3}$ using $B(\psi(2S) \rightarrow \gamma\chi_{c2}) = (9.33 \pm 0.14 \pm 0.61)\%$. We have multiplied the $\pi^+\pi^-$ measurement by 3/2 to obtain $\pi\pi$.

³ Calculated by us. ASNER 09 reports $B(\chi_{c2} \rightarrow \pi^0\pi^0) = (0.68 \pm 0.03 \pm 0.07 \pm 0.04) \times 10^{-3}$ using $B(\psi(2S) \rightarrow \gamma\chi_{c2}) = (9.33 \pm 0.14 \pm 0.61)\%$. We have multiplied the $\pi^0\pi^0$ measurement by 3 to obtain $\pi\pi$.

NODE=M057B02
NODE=M057B02

OCCUR=2

NODE=M057B02;LINKAGE=AB

NODE=M057B02;LINKAGE=AS

NODE=M057B02;LINKAGE=AN

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow \pi\pi)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)}{\Gamma_{22}/\Gamma \times \Gamma_{130}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10^{-3}) EVTS DOCUMENT ID TECN COMMENT

0.616±0.023 OUR FIT

[(0.622 ± 0.024) × 10^{-3} OUR 2013 FIT]

0.54 ±0.06 OUR AVERAGE

0.66 ±0.18 ±0.37	21 ± 6	¹ BAI	03C	BES	$\psi(2S) \rightarrow \gamma\pi^0\pi^0$
0.54 ±0.05 ±0.04	185 ± 16	² BAI	98I	BES	$\psi(2S) \rightarrow \gamma\pi^+\pi^-$

¹ We have multiplied $\pi^0\pi^0$ measurement by 3 to obtain $\pi\pi$.

² Calculated by us. The value for $B(\chi_{c2} \rightarrow \pi^+\pi^-)$ reported by BAI 98I is derived using $B(\psi(2S) \rightarrow \gamma\chi_{c2}) = (7.8 \pm 0.8)\%$ and $B(\psi(2S) \rightarrow J/\psi\pi^+\pi^-) = (32.4 \pm 2.6)\%$ [BAI 98D]. We have multiplied $\pi^+\pi^-$ measurement by 3/2 to obtain $\pi\pi$.

NODE=M057B9

NODE=M057B9

NEW

NODE=M057B;LINKAGE=BM

NODE=M057B;LINKAGE=BA

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow \eta\eta)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))/\Gamma_{\text{total}}}{\Gamma_{26}/\Gamma \times \Gamma_{130}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

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 ± 14	ASNER	09	CLEO	$\psi(2S) \rightarrow \gamma\eta\eta$

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 0.44	90	² ADAMS	07	CLEO	$\psi(2S) \rightarrow \gamma\chi_{c2}$
< 3	90	BAI	03C	BES	$\psi(2S) \rightarrow \gamma\eta\eta \rightarrow 5\gamma$
0.62±0.31±0.19		LEE	85	CBAL	$\psi(2S) \rightarrow \text{photons}$

¹ Calculated by us. ABLIKIM 10A reports $B(\chi_{c2} \rightarrow \eta\eta) = (0.65 \pm 0.04 \pm 0.05 \pm 0.03) \times 10^{-3}$ using $B(\psi(2S) \rightarrow \gamma\chi_{c2}) = (8.3 \pm 0.4)\%$.

² Superseded by ASNER 09.

NODE=M057B04

NODE=M057B04

NODE=M057B04;LINKAGE=AB

NODE=M057B04;LINKAGE=AD

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow K^+K^-)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))/\Gamma_{\text{total}}}{\Gamma_{27}/\Gamma \times \Gamma_{130}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10^{-5}) EVTS DOCUMENT ID TECN COMMENT

9.6±0.6 OUR FIT

[(9.5 ± 0.6) × 10^{-5} OUR 2013 FIT]

10.5±0.3±0.6	1.6k	¹ ASNER	09	CLEO	$\psi(2S) \rightarrow \gamma K^+K^-$

¹ Calculated by us. ASNER 09 reports $B(\chi_{c2} \rightarrow K^+K^-) = (1.13 \pm 0.03 \pm 0.06 \pm 0.07) \times 10^{-3}$ using $B(\psi(2S) \rightarrow \gamma\chi_{c2}) = (9.33 \pm 0.14 \pm 0.61)\%$.

NODE=M057B03

NODE=M057B03

NEW

NODE=M057B03;LINKAGE=AS

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow K^+K^-)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)}{\Gamma_{27}/\Gamma \times \Gamma_{130}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10^{-3}) EVTS DOCUMENT ID TECN COMMENT

0.278±0.017 OUR FIT

[(0.280 ± 0.017) × 10^{-3} OUR 2013 FIT]

0.190±0.034±0.019	115 ± 13	¹ BAI	98I	BES	$\psi(2S) \rightarrow \gamma K^+K^-$

¹ Calculated by us. The value for $B(\chi_{c2} \rightarrow K^+K^-)$ reported by BAI 98I is derived using $B(\psi(2S) \rightarrow \gamma\chi_{c2}) = (7.8 \pm 0.8)\%$ and $B(\psi(2S) \rightarrow J/\psi\pi^+\pi^-) = (32.4 \pm 2.6)\%$ [BAI 98D].

NODE=M057B8

NODE=M057B8

NEW

NODE=M057B;LINKAGE=BI

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow K_S^0 K_S^0)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))/\Gamma_{\text{total}}}{\Gamma_{28}/\Gamma \times \Gamma_{130}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10^{-5}) EVTS DOCUMENT ID TECN COMMENT

5.0 ±0.4 OUR FIT

[(5.1 ± 0.4) × 10^{-5} OUR 2013 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

NEW

NODE=M057B12;LINKAGE=AS

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow K_S^0 K_S^0)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)}{\Gamma_{28}/\Gamma \times \Gamma_{130}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10^{-5})

DOCUMENT ID

TECN

COMMENT

14.5±1.1 OUR FIT[(14.9 ± 1.1) × 10⁻⁵ OUR 2013 FIT]**14.7±4.1±3.3**¹ BAI

99B BES

 $\psi(2S) \rightarrow \gamma K_S^0 K_S^0$ ¹ Calculated by us. The value of $B(\chi_{c2} \rightarrow K_S^0 K_S^0)$ reported by BAI 99B was derived using $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (7.8 \pm 0.8)\%$ and $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = (32.4 \pm 2.6)\%$ [BAI 98D].

NODE=M057B13

NODE=M057B13

NEW

NODE=M057B13;LINKAGE=BA

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow \bar{K}^0 K^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))/\Gamma_{\text{total}}}{\Gamma_{29}/\Gamma \times \Gamma_{130}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

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

 $\psi(2S) \rightarrow \gamma K_S^0 K^\pm \pi^\mp$ ¹ Calculated by us. ATHAR 07 reports $B(\chi_{c2} \rightarrow \bar{K}^0 K^+ \pi^- + \text{c.c.}) = (1.3 \pm 0.2 \pm 0.1 \pm 0.1) \times 10^{-3}$ using $B(\psi(2S) \rightarrow \gamma \chi_{c2}) = (9.33 \pm 0.14 \pm 0.61)\%$.² Calculated by us. ABLIKIM 06R reports $B(\chi_{c2} \rightarrow K_S^0 K^\pm \pi^\mp) = (0.6 \pm 0.2 \pm 0.1) \times 10^{-3}$ using $B(\psi(2S) \rightarrow \gamma \chi_{c2}) = (8.1 \pm 0.6)\%$. We have multiplied by 2 to obtain $\bar{K}^0 K^+ \pi^- + \text{c.c.}$ from $K_S^0 K^\pm \pi^\mp$.

NODE=M057B05

NODE=M057B05

NODE=M057B05;LINKAGE=AT

NODE=M057B05;LINKAGE=AB

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow 2(\pi^+ \pi^-))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)}{\Gamma_1/\Gamma \times \Gamma_{130}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10^{-3})

DOCUMENT ID

TECN

COMMENT

2.83±0.27 OUR FIT[(2.84 ± 0.27) × 10⁻³ OUR 2013 FIT]**3.1 ±1.0 OUR AVERAGE** Error includes scale factor of 2.5.

2.3 ±0.1 ±0.5

¹ BAI

99B

BES

 $\psi(2S) \rightarrow \gamma \chi_{c2}$

4.3 ±0.6

² TANENBAUM

78

MRK1

 $\psi(2S) \rightarrow \gamma \chi_{c2}$ ¹ Calculated by us. The value for $B(\chi_{c2} \rightarrow 2\pi^+ 2\pi^-)$ reported in BAI 99B is derived using $B(\psi(2S) \rightarrow \gamma \chi_{c2}) = (7.8 \pm 0.8)\%$ and $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (32.4 \pm 2.6)\%$ [BAI 98D].² The value for $B(\psi(2S) \rightarrow \gamma \chi_{c2}) \times B(\chi_{c2} \rightarrow 2\pi^+ \pi^-)$ reported in TANENBAUM 78 is derived using $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) \times B(J/\psi(1S)\ell^+\ell^-) = (4.6 \pm 0.7)\%$. Calculated by us using $B(J/\psi(1S) \rightarrow \ell^+ \ell^-) = 0.1181 \pm 0.0020$.

NODE=M057B5

NODE=M057B5

NEW

NODE=M057B;LINKAGE=K1

NODE=M057B;LINKAGE=K2

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow K^+ K^- K^+ K^-)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))/\Gamma_{\text{total}}}{\Gamma_{36}/\Gamma \times \Gamma_{130}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10^{-4})

EVTS

DOCUMENT ID

TECN

COMMENT

1.57±0.19 OUR FIT[(1.56 ± 0.19) × 10⁻⁴ OUR 2013 FIT]**1.76±0.16±0.24**

160

¹ ABLIKIM

06T

BES2

 $\psi(2S) \rightarrow \gamma 2K^+ 2K^-$ ¹ Calculated by us. The value of $B(\chi_{c2} \rightarrow 2K^+ 2K^-)$ reported by ABLIKIM 06T was derived using $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (8.1 \pm 0.4)\%$.

NODE=M057B14

NODE=M057B14

NEW

NODE=M057B14;LINKAGE=AB

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow K^+ K^- K^+ K^-)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)}{\Gamma_{36}/\Gamma \times \Gamma_{130}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10^{-4})

DOCUMENT ID

TECN

COMMENT

4.6±0.5 OUR FIT**3.6±0.6±0.6**¹ BAI

99B

BES

 $\psi(2S) \rightarrow \gamma 2K^+ 2K^-$ ¹ Calculated by us. The value of $B(\chi_{c2} \rightarrow 2K^+ 2K^-)$ reported by BAI 99B was derived using $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (7.8 \pm 0.8)\%$ and $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = (32.4 \pm 2.6)\%$ [BAI 98D].

NODE=M057B15

NODE=M057B15

NODE=M057B15;LINKAGE=BA

$$\Gamma(\chi_{c2}(1P) \rightarrow \phi\phi) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) / \Gamma_{\text{total}}$$

$$\Gamma_{19} / \Gamma \times \Gamma_{130}^{\psi(2S)} / \Gamma^{\psi(2S)}$$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT

1.02±0.08 OUR FIT[(1.01 ± 0.08) × 10⁻⁴ OUR 2013 FIT]**0.98±0.13 OUR AVERAGE** Error includes scale factor of 1.3.

0.94 ± 0.03 ± 0.10	849	¹ ABLIKIM	11K BES3	$\psi(2S) \rightarrow \gamma \text{ hadrons}$
1.38 ± 0.24 ± 0.23	41	² ABLIKIM	06T BES2	$\psi(2S) \rightarrow \gamma 2K^+ 2K^-$

¹ Calculated by us. The value of $B(\chi_{c2} \rightarrow \phi\phi)$ reported by ABLIKIM 11K was derived using $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.74 \pm 0.35)\%$.² Calculated by us. The value of $B(\chi_{c2} \rightarrow \phi\phi)$ reported by ABLIKIM 06T was derived using $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.1 \pm 0.4)\%$.

NODE=M057B16

NODE=M057B16

NEW

NODE=M057B16;LINKAGE=AL

NODE=M057B16;LINKAGE=AB

$$\Gamma(\chi_{c2}(1P) \rightarrow \phi\phi) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) / \Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)$$

$$\Gamma_{19} / \Gamma \times \Gamma_{130}^{\psi(2S)} / \Gamma_{11}^{\psi(2S)}$$

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT

2.95±0.24 OUR FIT[(2.98 ± 0.25) × 10⁻⁴ OUR 2013 FIT]**4.8 ± 1.3 ± 1.3** ¹ BAI 99B BES $\psi(2S) \rightarrow \gamma 2K^+ 2K^-$ ¹ Calculated by us. The value of $B(\chi_{c2} \rightarrow \phi\phi)$ reported by BAI 99B was derived using $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (7.8 \pm 0.8)\%$ and $B(\psi(2S) \rightarrow J/\psi\pi^+\pi^-) = (32.4 \pm 2.6)\%$ [BAI 98b].

NODE=M057B17

NODE=M057B17

NEW

NODE=M057B17;LINKAGE=BA

$$\Gamma(\chi_{c2}(1P) \rightarrow \gamma J/\psi(1S)) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) / \Gamma_{\text{total}}$$

$$\Gamma_{67} / \Gamma \times \Gamma_{130}^{\psi(2S)} / \Gamma^{\psi(2S)}$$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT

1.75 ± 0.04 OUR FIT[(1.74 ± 0.04) × 10⁻² OUR 2013 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=M057B2

NODE=M057B2

NEW

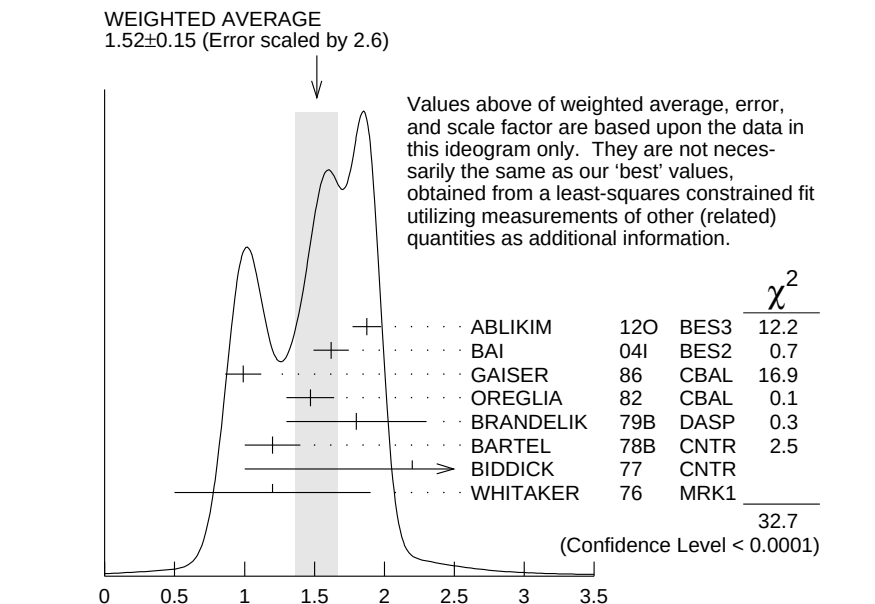
NODE=M057B;LINKAGE=3Q

NODE=M057B;LINKAGE=2Q

NODE=M057B;LINKAGE=EA

NODE=M057B2;LINKAGE=ME

NODE=M057B;LINKAGE=AD



$$\Gamma(\chi_{c2}(1P) \rightarrow \gamma J/\psi(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))/\Gamma_{\text{total}} \text{ (units } 10^{-2})$$

$$\Gamma(\chi_{c2}(1P) \rightarrow \gamma J/\psi(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S) \text{ anything})$$

$$\Gamma_{67}/\Gamma \times \Gamma_{130}^{\psi(2S)}/\Gamma_9^{\psi(2S)}$$

$$\Gamma_{67}/\Gamma \times \Gamma_{130}^{\psi(2S)}/(\Gamma_{11}^{\psi(2S)} + \Gamma_{12}^{\psi(2S)} + \Gamma_{13}^{\psi(2S)} + 0.339\Gamma_{129}^{\psi(2S)} + 0.192\Gamma_{130}^{\psi(2S)})$$

NODE=M057B7

NODE=M057B7

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
2.87±0.07 OUR FIT				
[(2.88 ± 0.07) × 10^{-2} OUR 2013 FIT]				

NODE=M057B7

NEW

• • • 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

$$\Gamma(\chi_{c2}(1P) \rightarrow \gamma J/\psi(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)$$

$$\Gamma_{67}/\Gamma \times \Gamma_{130}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}$$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
5.08±0.12 OUR FIT				
[(5.10 ± 0.12) × 10^{-2} OUR 2013 FIT]				

NODE=M057B3

NODE=M057B3

NEW

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

$$\Gamma(\chi_{c2}(1P) \rightarrow \gamma \gamma)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))/\Gamma_{\text{total}}$$

$$\Gamma_{71}/\Gamma \times \Gamma_{130}^{\psi(2S)}/\Gamma^{\psi(2S)}$$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
2.50±0.13 OUR FIT				
[(2.28 ± 0.16) × 10^{-5} OUR 2013 FIT]				

NODE=M057B4

NODE=M057B4

NEW

2.78±0.18 OUR AVERAGE

[(2.73 ± 0.32) × 10^{-5} OUR 2013 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	$\psi(2S) \rightarrow \gamma \chi_{c2}$

NEW

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

$\Gamma(\chi_{c2}(1P) \rightarrow \gamma\gamma) / \Gamma(\chi_{c0}(1P) \rightarrow \gamma\gamma)$ $\Gamma_{71} / \Gamma_{81}^{\chi_{c0}(1P)}$

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	$\psi(2S) \rightarrow \gamma\chi_{cJ} \rightarrow 3\gamma$

NODE=M057B06
NODE=M057B06

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 ⁺ _{-4.1} ± 3.9 ± 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 ⁺ _{-29.2} ± 11.6	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 $\psi(2S) \rightarrow \gamma\gamma\ell^+\ell^-$

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 .

OCCUR=2

NODE=M057A1;LINKAGE=AR

NODE=M057A1;LINKAGE=A

NODE=M057A1;LINKAGE=AT

$a_3 = E_3 / \sqrt{E_1^2 + M_2^2 + E_3^2}$ Electric octupole fractional transition amplitude

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
1.6 ± 1.3 OUR AVERAGE				
1.7 ± 1.4 ± 0.3	19.8k	¹ ARTUSO 09	CLEO	$\psi(2S) \rightarrow \gamma\gamma\ell^+\ell^-$
2.0 ⁺ _{-4.4} ± 5.5 ± 0.9	5908	AMBROGIANI 02	E835	$p\bar{p} \rightarrow \chi_{c2} \rightarrow J/\psi\gamma$
0 ⁺ ₋₅ ± 6	1904	ARMSTRONG 93E	E760	$p\bar{p} \rightarrow \chi_{c2} \rightarrow J/\psi\gamma$

¹ From a fit with floating M_2 and E_3 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

$b_2 = M_2 / \sqrt{E_1^2 + M_2^2 + E_3^2}$ Magnetic quadrupole fractional transition amplitude

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
2.2 ± 1.8 OUR AVERAGE				
4.6 ± 1.0 ± 1.3	13.8k	¹ ABLIKIM 11I	BES3	$\psi(2S) \rightarrow \gamma\pi^+\pi^-, \gamma K^+K^-$
0.2 ± 1.5 ± 0.4	19.8k	² ARTUSO 09	CLEO	$\psi(2S) \rightarrow \gamma\gamma\ell^+\ell^-$
-5.1 ⁺ _{-3.6} ± 5.4	721	¹ ABLIKIM 04I	BES2	$\psi(2S) \rightarrow \gamma\pi^+\pi^-, \gamma K^+K^-$
13.2 ⁺ _{-7.5} ± 9.8	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 ± 1.3 ± 0.3 19.8k ³ ARTUSO 09 CLEO $\psi(2S) \rightarrow \gamma\gamma\ell^+\ell^-$

¹ From a fit with floating M_2 and E_3 amplitudes b_2 and b_3 .

² From a fit with floating M_2 and E_3 amplitudes a_2 , b_2 , and a_3 , and b_3 .

³ From a fit with floating M_2 amplitudes a_2 and b_2 , and fixed E_3 amplitudes $a_3=b_3=0$.

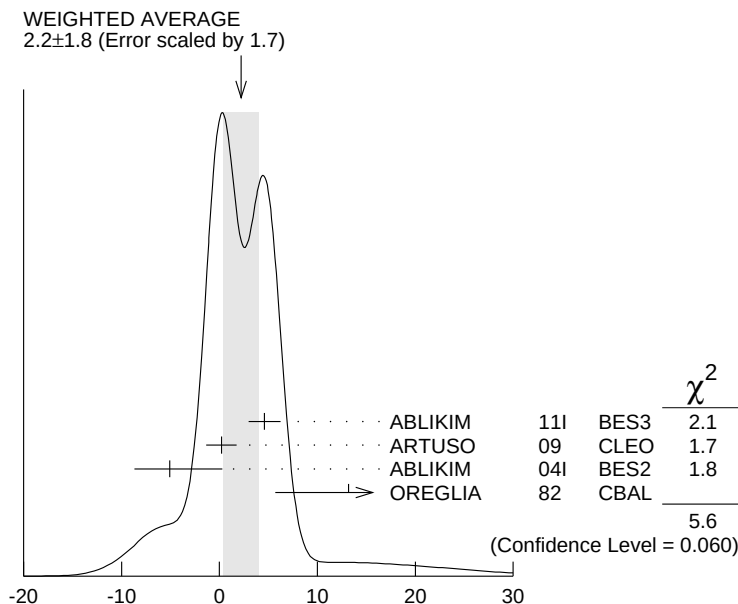
NODE=M057QB2
NODE=M057QB2

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±0.8±1.8	13.8k	¹ ABLIKIM	11I BES3	$\psi(2S) \rightarrow \gamma\pi^+\pi^-, \gamma K^+K^-$
-0.8±1.2±0.2	19.8k	ARTUSO	09 CLEO	$\psi(2S) \rightarrow \gamma\gamma\ell^+\ell^-$
-2.7 ^{+4.3} _{-2.9}	721	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

$\psi(2S) \rightarrow \gamma\chi_{c2}(1P)$ and $\chi_{c2} \rightarrow \gamma J/\psi(1S)$

NODE=M057260

b_2/a_2 Magnetic quadrupole transition amplitude ratio

NODE=M057QAR
NODE=M057QAR

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
-11⁺¹⁴₋₁₅	19.8k	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=M057QAR;LINKAGE=AR

$\chi_{c2}(1P)$ REFERENCES

NODE=M057

ABLIKIM	13D	PR D87 012007	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=54879
ABLIKIM	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
ACCARI	99E	PL B453 73	M. Acciarri <i>et al.</i>	(L3 Collab.)	REFID=46943
BAI	99B	PR D60 072001	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=47385
ACKER...,K...	98	PL B439 197	K. Ackerstaff <i>et al.</i>	(OPAL Collab.)	REFID=46324
BAI	98D	PR D58 092006	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=46338
BAI	98I	PRL 81 3091	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=46343
DOMINICK	94	PR D50 4265	J. Dominick <i>et al.</i>	(CLEO Collab.)	REFID=44077
ARMSTRONG	93	PRL 70 2988	T.A. Armstrong <i>et al.</i>	(FNAL E760 Collab.)	REFID=43306
ARMSTRONG	93E	PR D48 3037	T.A. Armstrong <i>et al.</i>	(FNAL-E760 Collab.)	REFID=48616
BAUER	93	PL B302 345	D.A. Bauer <i>et al.</i>	(TPC Collab.)	REFID=43315
ARMSTRONG	92	NP B373 35	T.A. Armstrong <i>et al.</i>	(FNAL, FERR, GENO+)	REFID=41865
Also		PRL 68 1468	T.A. Armstrong <i>et al.</i>	(FNAL, FERR, GENO+)	REFID=41907
BAGLIN	87B	PL B187 191	C. Baglin <i>et al.</i>	(R704 Collab.)	REFID=40018
BAGLIN	86B	PL B172 455	C. Baglin (LAPP, CERN, GENO, LYON, OSLO+)		REFID=22145
GAISER	86	PR D34 711	J. Gaiser <i>et al.</i>	(Crystal Ball Collab.)	REFID=22012
LEE	85	SLAC 282	R.A. Lee	(SLAC)	REFID=40589
LEMOIGNE	82	PL 113B 509	Y. Lemoigne <i>et al.</i>	(SACL, LOIC, SHMP+)	REFID=22084
OREGLIA	82	PR D25 2259	M.J. Oreglia <i>et al.</i>	(SLAC, CIT, HARV+)	REFID=22120
Also		Private Comm.	M.J. Oreglia	(EFI)	REFID=22143
BARATE	81	PR D24 2994	R. Barate <i>et al.</i>	(SACL, LOIC, SHMP, CERN+)	REFID=22164
HIMEL	80	PRL 44 920	T. Himel <i>et al.</i>	(LBL, SLAC)	REFID=22119
Also		Private Comm.	G. Trilling	(LBL, UCB)	REFID=22113
BRANDELIK	79B	NP B160 426	R. Brandelik <i>et al.</i>	(DASP Collab.)	REFID=22115
BARTEL	78B	PL 79B 492	W. Bartel <i>et al.</i>	(DESY, HEIDP)	REFID=22111
TANENBAUM	78	PR D17 1731	W.M. Tanenbaum <i>et al.</i>	(SLAC, LBL)	REFID=22112
Also		Private Comm.	G. Trilling	(LBL, UCB)	REFID=22113
BIDDICK	77	PRL 38 1324	C.J. Biddick <i>et al.</i>	(UCSD, UMD, PAVI+)	REFID=22059
WHITAKER	76	PRL 37 1596	J.S. Whitaker <i>et al.</i>	(SLAC, LBL)	REFID=22151

$$\eta_c(2S)$$

$$J^{PC} = 0^+(0^-+)$$

Quantum numbers are quark model predictions.

NODE=M059

NODE=M059

NODE=M059M

NODE=M059M

$\eta_c(2S)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
3639.4±1.3 OUR AVERAGE		Error includes scale factor of 1.2.		
3646.9±1.6±3.6	57 ± 17	ABLIKIM	13K BES3	$\psi(2S) \rightarrow \gamma K_S^0 K^\pm \pi^\mp \pi^+ \pi^-$
3637.6±2.9±1.6	127 ± 18	¹ ABLIKIM	12G BES3	$\psi(2S) \rightarrow \gamma K^0 K \pi,$ $K K \pi^0$
3638.5±1.5±0.8	624	² DEL-AMO-SA..11M BABR		$\gamma \gamma \rightarrow K_S^0 K^\pm \pi^\mp$
3640.5±3.2±2.5	1201	² DEL-AMO-SA..11M BABR		$\gamma \gamma \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$
3636.1 ^{+3.9+0.7} _{-4.2-2.0}	128	³ VINOKUROVA 11	BELL	$B^\pm \rightarrow K^\pm (K_S^0 K^\pm \pi^\mp)$
3626 ±5 ±6	311	⁴ ABE	07 BELL	$e^+ e^- \rightarrow J/\psi (c \bar{c})$
3645.0±5.5 ^{+4.9} _{-7.8}	121 ± 27	AUBERT	05C BABR	$e^+ e^- \rightarrow J/\psi c \bar{c}$
3642.9±3.1±1.5	61	ASNER	04 CLEO	$\gamma \gamma \rightarrow \eta_c \rightarrow K_S^0 K^\pm \pi^\mp$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
3639 ±7	98 ± 52	⁵ AUBERT	06E BABR	$B^\pm \rightarrow K^\pm X_{c \bar{c}}$
3630.8±3.4±1.0	112 ± 24	⁶ AUBERT	04D BABR	$\gamma \gamma \rightarrow \eta_c(2S) \rightarrow K \bar{K} \pi$
3654 ±6 ±8	39 ± 11	⁷ CHOI	02 BELL	$B \rightarrow K K_S K^- \pi^+$
3594 ±5		⁸ EDWARDS	82C CBAL	$e^+ e^- \rightarrow \gamma X$

¹ From a simultaneous fit to $K_S^0 K^\pm \pi^\mp$ and $K^+ K^- \pi^0$ decay modes.

² Ignoring possible interference with continuum.

³ Accounts for interference with non-resonant continuum.

⁴ From a fit of the J/ψ recoil mass spectrum. Supersedes ABE,K 02 and ABE 04G.

⁵ From the fit of the kaon momentum spectrum. Systematic errors not evaluated.

⁶ Superseded by DEL-AMO-SANCHEZ 11M.

⁷ Superseded by VINOKUROVA 11.

⁸ Assuming mass of $\psi(2S) = 3686$ MeV.

OCCUR=2

NODE=M059M;LINKAGE=AB
 NODE=M059M;LINKAGE=DE
 NODE=M059M;LINKAGE=VA
 NODE=M059M;LINKAGE=EB
 NODE=M059M;LINKAGE=AU
 NODE=M059M;LINKAGE=AR
 NODE=M059M;LINKAGE=CH
 NODE=M059M;LINKAGE=A

$\eta_c(2S)$ WIDTH

VALUE (MeV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
11.3^{+3.2}_{-2.9} OUR AVERAGE					
9.9± 4.8±2.9		57 ± 17	ABLIKIM	13K BES3	$\psi(2S) \rightarrow \gamma K_S^0 K^\pm \pi^\mp \pi^+ \pi^-$
16.9± 6.4±4.8		127 ± 18	⁹ ABLIKIM	12G BES3	$\psi(2S) \rightarrow \gamma K^0 K \pi,$ $K K \pi^0$
13.4± 4.6±3.2		624	¹⁰ DEL-AMO-SA..11M BABR		$\gamma \gamma \rightarrow K_S^0 K^\pm \pi^\mp$
6.6 ^{+8.4+2.6} _{-5.1-0.9}		128	¹¹ VINOKUROVA 11	BELL	$B^\pm \rightarrow K^\pm (K_S^0 K^\pm \pi^\mp)$
6.3±12.4±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 ± 52	¹² AUBERT	06E BABR	$B^\pm \rightarrow K^\pm X_{c \bar{c}}$
22 ±14		121 ± 27	AUBERT	05C BABR	$e^+ e^- \rightarrow J/\psi c \bar{c}$
17.0± 8.3±2.5		112 ± 24	¹³ AUBERT	04D BABR	$\gamma \gamma \rightarrow \eta_c(2S) \rightarrow K \bar{K} \pi$
<55	90	39 ± 11	¹⁴ CHOI	02 BELL	$B \rightarrow K K_S K^- \pi^+$
<8.0	95		¹⁵ EDWARDS	82C CBAL	$e^+ e^- \rightarrow \gamma X$

⁹ From a simultaneous fit to $K_S^0 K^\pm \pi^\mp$ and $K^+ K^- \pi^0$ decay modes.

¹⁰ Ignoring possible interference with continuum.

¹¹ Accounts for interference with non-resonant continuum.

¹² From the fit of the kaon momentum spectrum. Systematic errors not evaluated.

¹³ Superseded by DEL-AMO-SANCHEZ 11M.

¹⁴ For a mass value of 3654 ± 6 MeV. Superseded by VINOKUROVA 11.

¹⁵ For a mass value of 3594 ± 5 MeV

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

$\eta_c(2S)$ DECAY MODES

NODE=M059215;NODE=M059

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 hadrons	not seen	
Γ_2 $K\bar{K}\pi$	(1.9 ± 1.2) %	
Γ_3 $2\pi^+ 2\pi^-$	not seen	
Γ_4 $\rho^0 \rho^0$	not seen	
Γ_5 $3\pi^+ 3\pi^-$	not seen	
Γ_6 $K^+ K^- \pi^+ \pi^-$	not seen	
Γ_7 $K^{*0} \bar{K}^{*0}$	not seen	
Γ_8 $K^+ K^- \pi^+ \pi^- \pi^0$	(1.4 ± 1.0) %	
Γ_9 $K^+ K^- 2\pi^+ 2\pi^-$	not seen	
Γ_{10} $K_S^0 K^- 2\pi^+ \pi^- + \text{c.c.}$	seen	
Γ_{11} $2K^+ 2K^-$	not seen	
Γ_{12} $\phi\phi$	not seen	
Γ_{13} $p\bar{p}$	$< 2.0 \times 10^{-3}$	90%
Γ_{14} $\gamma\gamma$	(1.9 ± 1.3) $\times 10^{-4}$	
Γ_{15} $\pi^+ \pi^- \eta$	not seen	
Γ_{16} $\pi^+ \pi^- \eta'$	not seen	
Γ_{17} $K^+ K^- \eta$	not seen	
Γ_{18} $\pi^+ \pi^- \eta_c(1S)$	< 25 %	90%

DESIG=1
DESIG=4
DESIG=5
DESIG=16
DESIG=8;OUR EVAL;→ UNCHECKED ←
DESIG=6
DESIG=17
DESIG=9
DESIG=10;OUR EVAL;→ UNCHECKED ←
DESIG=11
DESIG=7
DESIG=18
DESIG=3
DESIG=2
DESIG=12;OUR EVAL;→ UNCHECKED ←
DESIG=13;OUR EVAL;→ UNCHECKED ←
DESIG=14;OUR EVAL;→ UNCHECKED ←
DESIG=15

 $\eta_c(2S)$ PARTIAL WIDTHS

NODE=M059216

$\Gamma(\gamma\gamma)$	Γ_{14}
VALUE (keV)	DOCUMENT ID TECN COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •	
1.3 ± 0.6	¹⁶ ASNER 04 CLEO $\gamma\gamma \rightarrow \eta_c \rightarrow K_S^0 K^\pm \pi^\mp$
¹⁶ They measure $\Gamma(\eta_c(2S)\gamma\gamma) B(\eta_c(2S) \rightarrow K\bar{K}\pi) = (0.18 \pm 0.05 \pm 0.02) \Gamma(\eta_c(1S)\gamma\gamma) B(\eta_c(1S) \rightarrow K\bar{K}\pi)$. The value for $\Gamma(\eta_c(2S) \rightarrow \gamma\gamma)$ is derived assuming that the branching fractions for $\eta_c(2S)$ and $\eta_c(1S)$ decays to $K_S K\pi$ are equal and using $\Gamma(\eta_c(1S) \rightarrow \gamma\gamma) = 7.4 \pm 0.4 \pm 2.3$ keV.	

NODE=M059W1
NODE=M059W1

NODE=M059W1;LINKAGE=AS

 $\eta_c(2S) \Gamma(i) \Gamma(\gamma\gamma) / \Gamma(\text{total})$

NODE=M059218

$\Gamma(2\pi^+ 2\pi^-) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$	$\Gamma_3 \Gamma_{14} / \Gamma$
VALUE (eV) CL% DOCUMENT ID TECN COMMENT	
<6.5 90 UEHARA 08 BELL $\gamma\gamma \rightarrow \eta_c(2S) \rightarrow 2(\pi^+ \pi^-)$	
$\Gamma(K\bar{K}\pi) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$	$\Gamma_2 \Gamma_{14} / \Gamma$
VALUE (eV) EVTS DOCUMENT ID TECN COMMENT	
$41 \pm 4 \pm 6$ 624 ¹⁷ DEL-AMO-SA..11M BABR $\gamma\gamma \rightarrow K_S^0 K^\pm \pi^\mp$	
¹⁷ Not independent from other measurements reported in DEL-AMO-SANCHEZ 11M.	
$\Gamma(K^+ K^- \pi^+ \pi^-) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$	$\Gamma_6 \Gamma_{14} / \Gamma$
VALUE (eV) CL% DOCUMENT ID TECN COMMENT	
<5.0 90 UEHARA 08 BELL $\gamma\gamma \rightarrow \eta_c(2S) \rightarrow K^+ K^- \pi^+ \pi^-$	
$\Gamma(K^+ K^- \pi^+ \pi^- \pi^0) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$	$\Gamma_8 \Gamma_{14} / \Gamma$
VALUE (eV) EVTS DOCUMENT ID TECN COMMENT	
$30 \pm 6 \pm 5$ 1201 ¹⁸ DEL-AMO-SA..11M BABR $\gamma\gamma \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$	
¹⁸ Not independent from other measurements reported in DEL-AMO-SANCHEZ 11M.	
$\Gamma(2K^+ 2K^-) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$	$\Gamma_{11} \Gamma_{14} / \Gamma$
VALUE (eV) CL% DOCUMENT ID TECN COMMENT	
<2.9 90 UEHARA 08 BELL $\gamma\gamma \rightarrow \eta_c(2S) \rightarrow 2(K^+ K^-)$	
$\Gamma(\pi^+ \pi^- \eta_c(1S)) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$	$\Gamma_{18} \Gamma_{14} / \Gamma$
VALUE (eV) CL% DOCUMENT ID TECN COMMENT	
<133 90 LEES 12AE BABR $e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^- \eta_c$	

NODE=M059G01
NODE=M059G01

NODE=M059G04
NODE=M059G04

NODE=M059G04;LINKAGE=DE

NODE=M059G02
NODE=M059G02

NODE=M059G05
NODE=M059G05

NODE=M059G05;LINKAGE=DE

NODE=M059G03
NODE=M059G03

NODE=M059G06
NODE=M059G06

$\eta_c(2S) \Gamma(i) \Gamma(\gamma\gamma) / \Gamma^2(\text{total})$

NODE=M059217

 $\Gamma(p\bar{p}) / \Gamma_{\text{total}} \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$ $\Gamma_{13} / \Gamma \times \Gamma_{14} / \Gamma$

VALUE (units 10^{-8})	CL%	DOCUMENT ID	TECN	COMMENT
< 5.6	90 ^{19,20,21}	AMBROGIANI 01	E835	$\bar{p}p \rightarrow \gamma\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
< 8.0	90 ^{19,20,22}	AMBROGIANI 01	E835	$\bar{p}p \rightarrow \gamma\gamma$
< 12.0	90 ^{20,22}	AMBROGIANI 01	E835	$\bar{p}p \rightarrow \gamma\gamma$

¹⁹ Including the measurements of of ARMSTRONG 95F in the AMBROGIANI 01 analysis.²⁰ For a total width $\Gamma=5$ MeV.²¹ For the resonance mass region 3589–3599 MeV/ c^2 .²² For the resonance mass region 3575–3660 MeV/ c^2 .NODE=M059G1
NODE=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	²³ EDWARDS 82C	CBAL	$e^+e^- \rightarrow \gamma X$
²³ 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	²⁴ AUBERT 08AB	BABR	$B \rightarrow \eta_c(2S) K \rightarrow K\bar{K}\pi K$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
seen	127 ± 18	ABLIKIM 13K	BES3	$\psi(2S) \rightarrow \gamma K\bar{K}\pi$
seen	39 ± 11	²⁵ CHOI 02	BELL	$B \rightarrow K K_S K^- \pi^+$
²⁴ Derived from a measurement of $[B(B^+ \rightarrow \eta_c(2S) K^+) \times B(\eta_c(2S) \rightarrow K\bar{K}\pi)] / [B(B^+ \rightarrow \eta_c K^+) \times B(\eta_c \rightarrow K\bar{K}\pi)] = (9.6^{+2.0}_{-1.9} \pm 2.5)\%$ and using $B(B^+ \rightarrow \eta_c(2S) K^+) = (3.4 \pm 1.8) \times 10^{-4}$, and $[B(B^+ \rightarrow \eta_c K^+) \times B(\eta_c \rightarrow K\bar{K}\pi)] = (6.88 \pm 0.77^{+0.55}_{-0.66}) \times 10^{-5}$.				
²⁵ For a mass value of 3654 ± 6 MeV				

NODE=M059R3
NODE=M059R3

NODE=M059R3;LINKAGE=AU

NODE=M059R;LINKAGE=W2

 $\Gamma(2\pi^+ 2\pi^-) / \Gamma_{\text{total}}$ Γ_3 / Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	UEHARA 08	BELL	$\gamma\gamma \rightarrow \eta_c(2S)$

NODE=M059R01
NODE=M059R01 $\Gamma(\rho^0 \rho^0) / \Gamma_{\text{total}}$ Γ_4 / Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	ABLIKIM 11H	BES3	$\psi(2S) \rightarrow \gamma 2\pi^+ 2\pi^-$

NODE=M059R15
NODE=M059R15 $\Gamma(K^+ K^- \pi^+ \pi^-) / \Gamma_{\text{total}}$ Γ_6 / Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	UEHARA 08	BELL	$\gamma\gamma \rightarrow \eta_c(2S)$

NODE=M059R02
NODE=M059R02 $\Gamma(K^+ K^- \pi^+ \pi^- \pi^0) / \Gamma(K\bar{K}\pi)$ Γ_8 / Γ_2

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
$0.73 \pm 0.17 \pm 0.17$	1201	²⁶ DEL-AMO-SA..11M	BABR	$\gamma\gamma \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$
²⁶ We have multiplied the value of $\Gamma(K^+ K^- \pi^+ \pi^- \pi^0) / \Gamma(K_S^0 K^\pm \pi^\mp \pi^\pm \pi^\mp)$ reported in DEL-AMO-SANCHEZ 11M by a factor 1/3 to obtain $\Gamma(K^+ K^- \pi^+ \pi^- \pi^0) / \Gamma(K\bar{K}\pi)$. Not independent from other measurements reported in DEL-AMO-SANCHEZ 11M.				

NODE=M059R21
NODE=M059R21

NODE=M059R21;LINKAGE=DE

 $\Gamma(K^{*0} \bar{K}^{*0}) / \Gamma_{\text{total}}$ Γ_7 / Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	ABLIKIM 11H	BES3	$\psi(2S) \rightarrow \gamma K^+ K^- \pi^+ \pi^-$

NODE=M059R16
NODE=M059R16 $\Gamma(K_S^0 K^- 2\pi^+ \pi^- + \text{c.c.}) / \Gamma_{\text{total}}$ Γ_{10} / Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
seen	57 ± 17	ABLIKIM 13K	BES3	$\psi(2S) \rightarrow \gamma K_S^0 K^\pm \pi^\mp \pi^\pm \pi^\mp$

NODE=M059R22
NODE=M059R22 $\Gamma(2K^+ 2K^-) / \Gamma_{\text{total}}$ Γ_{11} / Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	UEHARA 08	BELL	$\gamma\gamma \rightarrow \eta_c(2S)$

NODE=M059R03
NODE=M059R03

$\Gamma(\phi\phi)/\Gamma_{\text{total}}$ Γ_{12}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	ABLIKIM	11H BES3	$\psi(2S) \rightarrow \gamma K^+ K^- K^+ K^-$

NODE=M059R17
 NODE=M059R17

 $\Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ Γ_{14}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

<5 $\times 10^{-4}$	90	27 WICHT	08 BELL	$B^\pm \rightarrow K^\pm \gamma\gamma$
not seen		AMBROGIANI	01 E835	$\bar{p}p \rightarrow \gamma\gamma$
<0.01	90	LEE	85 CBAL	$\psi' \rightarrow \text{photons}$
27 WICHT 08 reports $[\Gamma(\eta_c(2S) \rightarrow \gamma\gamma)/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \eta_c(2S) K^+)] < 0.18 \times 10^{-6}$ which we divide by our best value $B(B^+ \rightarrow \eta_c(2S) K^+) = 3.4 \times 10^{-4}$.				

NODE=M059R2
 NODE=M059R2

NODE=M059R2;LINKAGE=WI

 $\Gamma(\pi^+ \pi^- \eta_c(1S))/\Gamma(K\bar{K}\pi)$ Γ_{18}/Γ_2

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<3.33	90	28 LEES	12AE BABR	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^- \eta_c$
28 We divided the reported limit by 3 to take into account isospin relations.				

NODE=M059R23
 NODE=M059R23

NODE=M059R23;LINKAGE=LE

$\eta_c(2S)$ CROSS-PARTICLE BRANCHING RATIOS

NODE=M059230

 $\Gamma(\eta_c(2S) \rightarrow 2\pi^+ 2\pi^-)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\eta_c(2S))/\Gamma_{\text{total}}$
 $\Gamma_3/\Gamma \times \Gamma_{132}^{\psi(2S)}/\Gamma\psi(2S)$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<14.6 $\times 10^{-6}$	90	29 CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma 2\pi^+ 2\pi^-$

29 Assuming $\Gamma(\eta_c(2S)) = 14$ MeV. CRONIN-HENNESSY 10 gives the analytic dependence of limits on width.

NODE=M059R05
 NODE=M059R05

NODE=M059R05;LINKAGE=CR

 $\Gamma(\eta_c(2S) \rightarrow \rho^0 \rho^0)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\eta_c(2S))/\Gamma_{\text{total}}$
 $\Gamma_4/\Gamma \times \Gamma_{132}^{\psi(2S)}/\Gamma\psi(2S)$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<12.7 $\times 10^{-7}$	90	ABLIKIM	11H BES3	$\psi(2S) \rightarrow \gamma 2\pi^+ 2\pi^-$

NODE=M059R18
 NODE=M059R18

 $\Gamma(\eta_c(2S) \rightarrow 3\pi^+ 3\pi^-)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\eta_c(2S))/\Gamma_{\text{total}}$
 $\Gamma_5/\Gamma \times \Gamma_{132}^{\psi(2S)}/\Gamma\psi(2S)$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<13.2 $\times 10^{-6}$	90	30 CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma 3\pi^+ 3\pi^-$

30 Assuming $\Gamma(\eta_c(2S)) = 14$ MeV. CRONIN-HENNESSY 10 gives the analytic dependence of limits on width.

NODE=M059R06
 NODE=M059R06

NODE=M059R06;LINKAGE=CR

 $\Gamma(\eta_c(2S) \rightarrow K^+ K^- \pi^+ \pi^-)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\eta_c(2S))/\Gamma_{\text{total}}$
 $\Gamma_6/\Gamma \times \Gamma_{132}^{\psi(2S)}/\Gamma\psi(2S)$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<9.6 $\times 10^{-6}$	90	31 CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma K^+ K^- \pi^+ \pi^-$

31 Assuming $\Gamma(\eta_c(2S)) = 14$ MeV. CRONIN-HENNESSY 10 gives the analytic dependence of limits on width.

NODE=M059R07
 NODE=M059R07

NODE=M059R07;LINKAGE=CR

 $\Gamma(\eta_c(2S) \rightarrow K^{*0} \bar{K}^{*0})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\eta_c(2S))/\Gamma_{\text{total}}$
 $\Gamma_7/\Gamma \times \Gamma_{132}^{\psi(2S)}/\Gamma\psi(2S)$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<19.6 $\times 10^{-7}$	90	ABLIKIM	11H BES3	$\psi(2S) \rightarrow \gamma K^+ K^- \pi^+ \pi^-$

NODE=M059R19
 NODE=M059R19

 $\Gamma(\eta_c(2S) \rightarrow K^+ K^- \pi^+ \pi^- \pi^0)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\eta_c(2S))/\Gamma_{\text{total}}$
 $\Gamma_8/\Gamma \times \Gamma_{132}^{\psi(2S)}/\Gamma\psi(2S)$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<43.0 $\times 10^{-6}$	90	32 CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma K^+ K^- \pi^+ \pi^- \pi^0$

32 Assuming $\Gamma(\eta_c(2S)) = 14$ MeV. CRONIN-HENNESSY 10 gives the analytic dependence of limits on width.

NODE=M059R08
 NODE=M059R08

NODE=M059R08;LINKAGE=CR

$$\Gamma(\eta_c(2S) \rightarrow K^+ K^- 2\pi^+ 2\pi^-) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S)) / \Gamma_{\text{total}}$$

$$\Gamma_9 / \Gamma \times \Gamma_{132}^{\psi(2S)} / \Gamma \psi(2S)$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<9.7 \times 10^{-6}$	90	33 CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma K^+ K^- 2\pi^+ 2\pi^-$
33 Assuming $\Gamma(\eta_c(2S)) = 14$ MeV. CRONIN-HENNESSY 10 gives the analytic dependence of limits on width.				

NODE=M059R09
NODE=M059R09

NODE=M059R09;LINKAGE=CR

$$\Gamma(\eta_c(2S) \rightarrow K_S^0 K^- 2\pi^+ \pi^- + \text{c.c.}) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S)) / \Gamma_{\text{total}}$$

$$\Gamma_{10} / \Gamma \times \Gamma_{132}^{\psi(2S)} / \Gamma \psi(2S)$$

VALUE (units 10^{-6})	CL% EVTS	DOCUMENT ID	TECN	COMMENT
$7.03 \pm 2.10 \pm 0.7$	60	ABLIKIM	13K BES3	$\psi(2S) \rightarrow \gamma K_S^0 K^- 2\pi^+ \pi^- + \text{c.c.}$

NODE=M059R10
NODE=M059R10

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 15.2	90	34 CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma K_S^0 K^- 2\pi^+ \pi^- + \text{c.c.}$

34 Assuming $\Gamma(\eta_c(2S)) = 14$ MeV. CRONIN-HENNESSY 10 gives the analytic dependence of limits on width.

NODE=M059R10;LINKAGE=CR

$$\Gamma(\eta_c(2S) \rightarrow \phi \phi) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S)) / \Gamma_{\text{total}}$$

$$\Gamma_{12} / \Gamma \times \Gamma_{132}^{\psi(2S)} / \Gamma \psi(2S)$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<7.8 \times 10^{-7}$	90	ABLIKIM	11H BES3	$\psi(2S) \rightarrow \gamma K^+ K^- K^+ K^-$

NODE=M059R20
NODE=M059R20

$$\Gamma(\eta_c(2S) \rightarrow \pi^+ \pi^- \eta) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S)) / \Gamma_{\text{total}}$$

$$\Gamma_{15} / \Gamma \times \Gamma_{132}^{\psi(2S)} / \Gamma \psi(2S)$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<4.3 \times 10^{-6}$	90	35 CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- \eta$

35 Assuming $\Gamma(\eta_c(2S)) = 14$ MeV. CRONIN-HENNESSY 10 gives the analytic dependence of limits on width.

NODE=M059R11
NODE=M059R11

NODE=M059R11;LINKAGE=CR

$$\Gamma(\eta_c(2S) \rightarrow \pi^+ \pi^- \eta') / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S)) / \Gamma_{\text{total}}$$

$$\Gamma_{16} / \Gamma \times \Gamma_{132}^{\psi(2S)} / \Gamma \psi(2S)$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<14.2 \times 10^{-6}$	90	36 CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- \eta'$

36 Assuming $\Gamma(\eta_c(2S)) = 14$ MeV. CRONIN-HENNESSY 10 gives the analytic dependence of limits on width.

NODE=M059R12
NODE=M059R12

NODE=M059R12;LINKAGE=CR

$$\Gamma(\eta_c(2S) \rightarrow K^+ K^- \eta) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S)) / \Gamma_{\text{total}}$$

$$\Gamma_{17} / \Gamma \times \Gamma_{132}^{\psi(2S)} / \Gamma \psi(2S)$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<5.9 \times 10^{-6}$	90	37 CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma K^+ K^- \eta$

37 Assuming $\Gamma(\eta_c(2S)) = 14$ MeV. CRONIN-HENNESSY 10 gives the analytic dependence of limits on width.

NODE=M059R13
NODE=M059R13

NODE=M059R13;LINKAGE=CR

$$\Gamma(\eta_c(2S) \rightarrow \pi^+ \pi^- \eta_c(1S)) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S)) / \Gamma_{\text{total}}$$

$$\Gamma_{18} / \Gamma \times \Gamma_{132}^{\psi(2S)} / \Gamma \psi(2S)$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<1.7 \times 10^{-4}$	90	38 CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- \eta_c(1S)$

38 Assuming $\Gamma(\eta_c(2S)) = 14$ MeV. CRONIN-HENNESSY 10 gives the analytic dependence of limits on width.

NODE=M059R14
NODE=M059R14

NODE=M059R14;LINKAGE=CR

$$\Gamma(\eta_c(2S) \rightarrow p \bar{p}) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S)) / \Gamma_{\text{total}}$$

$$\Gamma_{13} / \Gamma \times \Gamma_{132}^{\psi(2S)} / \Gamma \psi(2S)$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<1.4 \times 10^{-6}$	90	ABLIKIM	13V BES3	$\psi(2S) \rightarrow \gamma p \bar{p}$

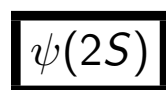
NODE=M059R24
NODE=M059R24

$\eta_c(2S)$ REFERENCES

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=54956
REFID=55583
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REFID=16751
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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

OUR FIT includes measurements of $m_{\psi(2S)}$, $m_{\psi(3770)}$, and $m_{\psi(3770)} - m_{\psi(2S)}$.

NODE=M071M

NODE=M071M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
3686.109^{+0.012}_{-0.014} OUR FIT				
3686.108^{+0.011}_{-0.014} OUR AVERAGE				
3686.12 ± 0.06 ± 0.10	4k	AAIJ	12H LHCb	$pp \rightarrow J/\psi \pi^+ \pi^- X$
3686.114 ± 0.007 ^{+0.011} _{-0.016}		¹ ANASHIN	12 KEDR	$e^+ e^- \rightarrow \text{hadrons}$
3686.111 ± 0.025 ± 0.009		AULCHENKO	03 KEDR	$e^+ e^- \rightarrow \text{hadrons}$
3685.95 ± 0.10	413	² ARTAMONOV	00 OLYA	$e^+ e^- \rightarrow \text{hadrons}$
3685.98 ± 0.09 ± 0.04		³ ARMSTRONG	93B E760	$\bar{p} p \rightarrow e^+ e^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
3686.00 ± 0.10	413	⁴ ZHOLENTZ	80 OLYA	$e^+ e^-$

NODE=M071M

¹ From the scans in 2004 and 2006. ANASHIN 12 reports the value $3686.114 \pm 0.007 \pm 0.011^{+0.002}_{-0.012}$ MeV, where the third uncertainty is due to assumptions on the interference between the resonance and hadronic continuum. We combined the two systematic uncertainties.

NODE=M071M;LINKAGE=AN

² Reanalysis of ZHOLENTZ 80 using new electron mass (COHEN 87) and radiative corrections (KURAEV 85).

NODE=M071M;LINKAGE=AR

³ Mass central value and systematic error recalculated by us according to Eq.(16) in ARMSTRONG 93B, using the value for the $J/\psi(1S)$ mass from AULCHENKO 03.

NODE=M071M;LINKAGE=NW

⁴ Superseded by ARTAMONOV 00.

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

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
299 ± 8 OUR FIT				
[303 ± 9 keV OUR 2013 FIT]				
286 ± 16 OUR AVERAGE				
358 ± 88 ± 4		ABLIKIM	08B BES2	$e^+e^- \rightarrow \text{hadrons}$
290 ± 25 ± 4	2.7k	ANDREOTTI	07 E835	$p\bar{p} \rightarrow e^+e^-, J/\psi X$
331 ± 58 ± 2		ABLIKIM	06L BES2	$e^+e^- \rightarrow \text{hadrons}$
264 ± 27		¹ BAI	02B BES2	e^+e^-
287 ± 37 ± 16		² ARMSTRONG	93B E760	$p\bar{p} \rightarrow e^+e^-$

NODE=M071W
NEW¹ 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 ± 0.13) %	
Γ_2 virtual $\gamma \rightarrow \text{hadrons}$	(1.73 ± 0.14) %	S=1.5
Γ_3 $g g g$	(10.6 ± 1.6) %	
Γ_4 $\gamma g g$	(1.03 ± 0.29) %	
Γ_5 light hadrons	(15.4 ± 1.5) %	
Γ_6 e^+e^-	(7.89 ± 0.17) × 10 ⁻³	
Γ_7 $\mu^+\mu^-$	(7.9 ± 0.9) × 10 ⁻³	
Γ_8 $\tau^+\tau^-$	(3.1 ± 0.4) × 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
DESIG=11
DESIG=12
DESIG=13
DESIG=14
DESIG=15
DESIG=18

Γ_9 $J/\psi(1S)\text{anything}$	(60.9 ± 0.6) %
Γ_{10} $J/\psi(1S)\text{neutrals}$	(25.10 ± 0.33) %
Γ_{11} $J/\psi(1S)\pi^+\pi^-$	(34.45 ± 0.30) %
Γ_{12} $J/\psi(1S)\pi^0\pi^0$	(18.13 ± 0.31) %
Γ_{13} $J/\psi(1S)\eta$	(3.36 ± 0.05) %
Γ_{14} $J/\psi(1S)\pi^0$	(1.268 ± 0.032) × 10 ⁻³

Hadronic decays

NODE=M071;CLUMP=B

Γ_{15} $\pi^0 h_c(1P)$	(8.6 ± 1.3) × 10 ⁻⁴	
Γ_{16} $3(\pi^+\pi^-)\pi^0$	(3.5 ± 1.6) × 10 ⁻³	
Γ_{17} $2(\pi^+\pi^-)\pi^0$	(2.9 ± 1.0) × 10 ⁻³	S=4.7
Γ_{18} $\rho a_2(1320)$	(2.6 ± 0.9) × 10 ⁻⁴	
Γ_{19} $p\bar{p}$	(2.80 ± 0.11) × 10 ⁻⁴	
Γ_{20} $\Delta^{++}\bar{\Delta}^{--}$	(1.28 ± 0.35) × 10 ⁻⁴	
Γ_{21} $\Lambda\bar{\Lambda}\pi^0$	< 2.9 × 10 ⁻⁶	CL=90%
Γ_{22} $\Lambda\bar{\Lambda}\eta$	(2.5 ± 0.4) × 10 ⁻⁵	
Γ_{23} $\Lambda\bar{p}K^+$	(1.00 ± 0.14) × 10 ⁻⁴	
Γ_{24} $\Lambda\bar{p}K^+\pi^+\pi^-$	(1.8 ± 0.4) × 10 ⁻⁴	
Γ_{25} $\Lambda\bar{\Lambda}\pi^+\pi^-$	(2.8 ± 0.6) × 10 ⁻⁴	
Γ_{26} $\Lambda\bar{\Lambda}$	(2.8 ± 0.5) × 10 ⁻⁴	S=2.6
Γ_{27} $\Lambda\bar{\Sigma}^+\pi^- + \text{c.c.}$	(1.40 ± 0.13) × 10 ⁻⁴	
Γ_{28} $\Lambda\bar{\Sigma}^-\pi^+ + \text{c.c.}$	(1.54 ± 0.14) × 10 ⁻⁴	
Γ_{29} $\Sigma^0\bar{p}K^+ + \text{c.c.}$	(1.67 ± 0.18) × 10 ⁻⁵	
Γ_{30} $\Sigma^+\bar{\Sigma}^-$	(2.6 ± 0.8) × 10 ⁻⁴	
Γ_{31} $\Sigma^0\bar{\Sigma}^0$	(2.2 ± 0.4) × 10 ⁻⁴	S=1.5
Γ_{32} $\Sigma(1385)^+\bar{\Sigma}(1385)^-$	(1.1 ± 0.4) × 10 ⁻⁴	
Γ_{33} $\Xi^-\bar{\Xi}^+$	(1.8 ± 0.6) × 10 ⁻⁴	S=2.8
Γ_{34} $\Xi^0\bar{\Xi}^0$	(2.8 ± 0.9) × 10 ⁻⁴	
Γ_{35} $\Xi(1530)^0\bar{\Xi}(1530)^0$	(5.2 $^{+3.2}_{-1.2}$) × 10 ⁻⁵	
Γ_{36} $\Omega^-\bar{\Omega}^+$	< 7.3 × 10 ⁻⁵	CL=90%
Γ_{37} $\pi^0 p\bar{p}$	(1.53 ± 0.07) × 10 ⁻⁴	

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=29
DESIG=224
DESIG=73
DESIG=74
DESIG=35

Г ₃₈	$N(940)\bar{p} + \text{c.c.} \rightarrow \pi^0 p \bar{p}$	$(6.4 \pm_{-1.3}^{+1.8}) \times 10^{-5}$		DESIG=267
Г ₃₉	$N(1440)\bar{p} + \text{c.c.} \rightarrow \pi^0 p \bar{p}$	$(7.3 \pm_{-1.5}^{+1.7}) \times 10^{-5}$	S=2.5	DESIG=261
Г ₄₀	$N(1520)\bar{p} + \text{c.c.} \rightarrow \pi^0 p \bar{p}$	$(6.4 \pm_{-1.8}^{+2.3}) \times 10^{-6}$		DESIG=268
Г ₄₁	$N(1535)\bar{p} + \text{c.c.} \rightarrow \pi^0 p \bar{p}$	$(2.5 \pm 1.0) \times 10^{-5}$		DESIG=269
Г ₄₂	$N(1650)\bar{p} + \text{c.c.} \rightarrow \pi^0 p \bar{p}$	$(3.8 \pm_{-1.7}^{+1.4}) \times 10^{-5}$		DESIG=270
Г ₄₃	$N(1720)\bar{p} + \text{c.c.} \rightarrow \pi^0 p \bar{p}$	$(1.79 \pm_{-0.70}^{+0.26}) \times 10^{-5}$		DESIG=271
Г ₄₄	$N(2300)\bar{p} + \text{c.c.} \rightarrow \pi^0 p \bar{p}$	$(2.6 \pm_{-0.7}^{+1.2}) \times 10^{-5}$		DESIG=272
Г ₄₅	$N(2570)\bar{p} + \text{c.c.} \rightarrow \pi^0 p \bar{p}$	$(2.13 \pm_{-0.31}^{+0.40}) \times 10^{-5}$		DESIG=273
Г ₄₆	$\pi^0 f_0(2100) \rightarrow \pi^0 p \bar{p}$	$(1.1 \pm 0.4) \times 10^{-5}$		DESIG=262
Г ₄₇	$\eta p \bar{p}$	$(6.0 \pm 0.4) \times 10^{-5}$		DESIG=200
Г ₄₈	$\eta f_0(2100) \rightarrow \eta p \bar{p}$	$(1.2 \pm 0.4) \times 10^{-5}$		DESIG=263
Г ₄₉	$N(1535)\bar{p} \rightarrow \eta p \bar{p}$	$(4.4 \pm 0.7) \times 10^{-5}$		DESIG=264
Г ₅₀	$\omega p \bar{p}$	$(6.9 \pm 2.1) \times 10^{-5}$		DESIG=77
Г ₅₁	$\phi p \bar{p}$	$< 2.4 \times 10^{-5}$	CL=90%	DESIG=80
Г ₅₂	$\pi^+ \pi^- p \bar{p}$	$(6.0 \pm 0.4) \times 10^{-4}$		DESIG=31
Г ₅₃	$p \bar{n} \pi^- \text{ or c.c.}$	$(2.48 \pm 0.17) \times 10^{-4}$		DESIG=227
Г ₅₄	$p \bar{n} \pi^- \pi^0$	$(3.2 \pm 0.7) \times 10^{-4}$		DESIG=228
Г ₅₅	$2(\pi^+ \pi^- \pi^0)$	$(4.7 \pm 1.5) \times 10^{-3}$		DESIG=221
Г ₅₆	$\eta \pi^+ \pi^-$	$< 1.6 \times 10^{-4}$	CL=90%	DESIG=202
Г ₅₇	$\eta \pi^+ \pi^- \pi^0$	$(9.5 \pm 1.7) \times 10^{-4}$		DESIG=203
Г ₅₈	$2(\pi^+ \pi^-) \eta$	$(1.2 \pm 0.6) \times 10^{-3}$		DESIG=251
Г ₅₉	$\eta' \pi^+ \pi^- \pi^0$	$(4.5 \pm 2.1) \times 10^{-4}$		DESIG=204
Г ₆₀	$\omega \pi^+ \pi^-$	$(7.3 \pm 1.2) \times 10^{-4}$	S=2.1	DESIG=75
Г ₆₁	$b_1^\pm \pi^\mp$	$(4.0 \pm 0.6) \times 10^{-4}$	S=1.1	DESIG=40
Г ₆₂	$b_1^0 \pi^0$	$(2.4 \pm 0.6) \times 10^{-4}$		DESIG=193
Г ₆₃	$\omega f_2(1270)$	$(2.2 \pm 0.4) \times 10^{-4}$		DESIG=64
Г ₆₄	$\pi^+ \pi^- K^+ K^-$	$(7.5 \pm 0.9) \times 10^{-4}$	S=1.9	DESIG=26
Г ₆₅	$\rho^0 K^+ K^-$	$(2.2 \pm 0.4) \times 10^{-4}$		DESIG=205
Г ₆₆	$K^*(892)^0 \bar{K}_2^*(1430)^0$	$(1.9 \pm 0.5) \times 10^{-4}$		DESIG=66
Г ₆₇	$K^+ K^- \pi^+ \pi^- \eta$	$(1.3 \pm 0.7) \times 10^{-3}$		DESIG=252
Г ₆₈	$K^+ K^- 2(\pi^+ \pi^-) \pi^0$	$(1.00 \pm 0.31) \times 10^{-3}$		DESIG=240
Г ₆₉	$K^+ K^- 2(\pi^+ \pi^-)$	$(1.9 \pm 0.9) \times 10^{-3}$		DESIG=222
Г ₇₀	$K_1(1270)^\pm K^\mp$	$(1.00 \pm 0.28) \times 10^{-3}$		DESIG=41
Г ₇₁	$K_S^0 K_S^0 \pi^+ \pi^-$	$(2.2 \pm 0.4) \times 10^{-4}$		DESIG=225
Г ₇₂	$\rho^0 p \bar{p}$	$(5.0 \pm 2.2) \times 10^{-5}$		DESIG=210
Г ₇₃	$K^+ \bar{K}^*(892)^0 \pi^- + \text{c.c.}$	$(6.7 \pm 2.5) \times 10^{-4}$		DESIG=34
Г ₇₄	$2(\pi^+ \pi^-)$	$(2.4 \pm 0.6) \times 10^{-4}$	S=2.2	DESIG=24
Г ₇₅	$\rho^0 \pi^+ \pi^-$	$(2.2 \pm 0.6) \times 10^{-4}$	S=1.4	DESIG=33
Г ₇₆	$K^+ K^- \pi^+ \pi^- \pi^0$	$(1.26 \pm 0.09) \times 10^{-3}$		DESIG=206
Г ₇₇	$\omega f_0(1710) \rightarrow \omega K^+ K^-$	$(5.9 \pm 2.2) \times 10^{-5}$		DESIG=216
Г ₇₈	$K^*(892)^0 K^- \pi^+ \pi^0 + \text{c.c.}$	$(8.6 \pm 2.2) \times 10^{-4}$		DESIG=217
Г ₇₉	$K^*(892)^+ K^- \pi^+ \pi^- + \text{c.c.}$	$(9.6 \pm 2.8) \times 10^{-4}$		DESIG=218
Г ₈₀	$K^*(892)^+ K^- \rho^0 + \text{c.c.}$	$(7.3 \pm 2.6) \times 10^{-4}$		DESIG=219
Г ₈₁	$K^*(892)^0 K^- \rho^+ + \text{c.c.}$	$(6.1 \pm 1.8) \times 10^{-4}$		DESIG=220
Г ₈₂	$\eta K^+ K^-$, no $\eta \phi$	$(3.1 \pm 0.4) \times 10^{-5}$		DESIG=207
Г ₈₃	$\omega K^+ K^-$	$(1.85 \pm 0.25) \times 10^{-4}$	S=1.1	DESIG=76
Г ₈₄	$\omega K^*(892)^+ K^- + \text{c.c.}$	$(2.07 \pm 0.26) \times 10^{-4}$		DESIG=276
Г ₈₅	$\omega K_2^*(1430)^+ K^- + \text{c.c.}$	$(6.1 \pm 1.2) \times 10^{-5}$		DESIG=277
Г ₈₆	$\omega \bar{K}^*(892)^0 K^0$	$(1.68 \pm 0.30) \times 10^{-4}$		DESIG=278
Г ₈₇	$\omega \bar{K}_2^*(1430)^0 K^0$	$(5.8 \pm 2.2) \times 10^{-5}$		DESIG=279
Г ₈₈	$\omega X(1440) \rightarrow \omega K_S^0 K^- \pi^+ + \text{c.c.}$	$(1.6 \pm 0.4) \times 10^{-5}$		DESIG=282
Г ₈₉	$\omega X(1440) \rightarrow \omega K^+ K^- \pi^0$	$(1.09 \pm 0.26) \times 10^{-5}$		DESIG=283
Г ₉₀	$\omega f_1(1285) \rightarrow \omega K_S^0 K^- \pi^+ + \text{c.c.}$	$(3.0 \pm 1.0) \times 10^{-6}$		DESIG=284

Г ₉₁	$\omega f_1(1285) \rightarrow \omega K^+ K^- \pi^0$	$(1.2 \pm 0.7) \times 10^{-6}$		DESIG=285
Г ₉₂	$3(\pi^+ \pi^-)$	$(3.5 \pm 2.0) \times 10^{-4}$	S=2.8	DESIG=32
Г ₉₃	$p \bar{p} \pi^+ \pi^- \pi^0$	$(7.3 \pm 0.7) \times 10^{-4}$		DESIG=211
Г ₉₄	$K^+ K^-$	$(7.1 \pm 0.5) \times 10^{-5}$	S=1.5	DESIG=23
Г ₉₅	$K_S^0 K_L^0$	$(5.34 \pm 0.33) \times 10^{-5}$		DESIG=85
Г ₉₆	$\pi^+ \pi^- \pi^0$	$(2.01 \pm 0.17) \times 10^{-4}$	S=1.7	DESIG=36
Г ₉₇	$\rho(2150) \pi \rightarrow \pi^+ \pi^- \pi^0$	$(1.9 \pm 1.2_{-0.4}) \times 10^{-4}$		DESIG=201
Г ₉₈	$\rho(770) \pi \rightarrow \pi^+ \pi^- \pi^0$	$(3.2 \pm 1.2) \times 10^{-5}$	S=1.8	DESIG=22
Г ₉₉	$\pi^+ \pi^-$	$(7.8 \pm 2.6) \times 10^{-6}$		DESIG=21
Г ₁₀₀	$K_1(1400)^\pm K^\mp$	$< 3.1 \times 10^{-4}$	CL=90%	DESIG=42
Г ₁₀₁	$K_2^*(1430)^\pm K^\mp$	$(7.1 \pm 1.3_{-0.9}) \times 10^{-5}$		DESIG=265
Г ₁₀₂	$K^+ K^- \pi^0$	$(4.07 \pm 0.31) \times 10^{-5}$		DESIG=38
Г ₁₀₃	$K^+ K^*(892)^- + \text{c.c.}$	$(2.9 \pm 0.4) \times 10^{-5}$	S=1.2	DESIG=39
Г ₁₀₄	$K^*(892)^0 \bar{K}^0 + \text{c.c.}$	$(1.09 \pm 0.20) \times 10^{-4}$		DESIG=194
Г ₁₀₅	$\phi \pi^+ \pi^-$	$(1.17 \pm 0.29) \times 10^{-4}$	S=1.7	DESIG=78
Г ₁₀₆	$\phi f_0(980) \rightarrow \pi^+ \pi^-$	$(6.8 \pm 2.4) \times 10^{-5}$	S=1.1	DESIG=81
Г ₁₀₇	$2(K^+ K^-)$	$(6.0 \pm 1.4) \times 10^{-5}$		DESIG=208
Г ₁₀₈	$\phi K^+ K^-$	$(7.0 \pm 1.6) \times 10^{-5}$		DESIG=79
Г ₁₀₉	$2(K^+ K^-) \pi^0$	$(1.10 \pm 0.28) \times 10^{-4}$		DESIG=209
Г ₁₁₀	$\phi \eta$	$(3.10 \pm 0.31) \times 10^{-5}$		DESIG=89
Г ₁₁₁	$\phi \eta'$	$(3.1 \pm 1.6) \times 10^{-5}$		DESIG=90
Г ₁₁₂	$\omega \eta'$	$(3.2 \pm 2.5_{-2.1}) \times 10^{-5}$		DESIG=91
Г ₁₁₃	$\omega \pi^0$	$(2.1 \pm 0.6) \times 10^{-5}$		DESIG=92
Г ₁₁₄	$\rho \eta'$	$(1.9 \pm 1.7_{-1.2}) \times 10^{-5}$		DESIG=93
Г ₁₁₅	$\rho \eta$	$(2.2 \pm 0.6) \times 10^{-5}$	S=1.1	DESIG=94
Г ₁₁₆	$\omega \eta$	$< 1.1 \times 10^{-5}$	CL=90%	DESIG=95
Г ₁₁₇	$\phi \pi^0$	$< 4 \times 10^{-7}$	CL=90%	DESIG=96
Г ₁₁₈	$\eta_c \pi^+ \pi^- \pi^0$	$< 1.0 \times 10^{-3}$	CL=90%	DESIG=229
Г ₁₁₉	$p \bar{p} K^+ K^-$	$(2.7 \pm 0.7) \times 10^{-5}$		DESIG=212
Г ₁₂₀	$\bar{\Lambda} n K_S^0 + \text{c.c.}$	$(8.1 \pm 1.8) \times 10^{-5}$		DESIG=237
Г ₁₂₁	$\phi f_2'(1525)$	$(4.4 \pm 1.6) \times 10^{-5}$		DESIG=67
Г ₁₂₂	$\Theta(1540) \bar{\Theta}(1540) \rightarrow K_S^0 p K^- \bar{n} + \text{c.c.}$	$< 8.8 \times 10^{-6}$	CL=90%	DESIG=195
Г ₁₂₃	$\Theta(1540) K^- \bar{n} \rightarrow K_S^0 p K^- \bar{n}$	$< 1.0 \times 10^{-5}$	CL=90%	DESIG=196
Г ₁₂₄	$\Theta(1540) K_S^0 \bar{p} \rightarrow K_S^0 \bar{p} K^+ n$	$< 7.0 \times 10^{-6}$	CL=90%	DESIG=197
Г ₁₂₅	$\bar{\Theta}(1540) K^+ n \rightarrow K_S^0 \bar{p} K^+ n$	$< 2.6 \times 10^{-5}$	CL=90%	DESIG=198
Г ₁₂₆	$\bar{\Theta}(1540) K_S^0 p \rightarrow K_S^0 p K^- \bar{n}$	$< 6.0 \times 10^{-6}$	CL=90%	DESIG=199
Г ₁₂₇	$K_S^0 K_S^0$	$< 4.6 \times 10^{-6}$		DESIG=86

Radiative decays

NODE=M071;CLUMP=C

Г ₁₂₈	$\gamma \chi_{c0}(1P)$	$(9.99 \pm 0.27) \%$		DESIG=56
Г ₁₂₉	$\gamma \chi_{c1}(1P)$	$(9.55 \pm 0.31) \%$		DESIG=58
Г ₁₃₀	$\gamma \chi_{c2}(1P)$	$(9.11 \pm 0.31) \%$		DESIG=59
Г ₁₃₁	$\gamma \eta_c(1S)$	$(3.4 \pm 0.5) \times 10^{-3}$	S=1.3	DESIG=61
Г ₁₃₂	$\gamma \eta_c(2S)$	$(7 \pm 5) \times 10^{-4}$		DESIG=63
Г ₁₃₃	$\gamma \pi^0$	$(1.6 \pm 0.4) \times 10^{-6}$		DESIG=52
Г ₁₃₄	$\gamma \eta'(958)$	$(1.23 \pm 0.06) \times 10^{-4}$		DESIG=54
Г ₁₃₅	$\gamma f_2(1270)$	$(2.1 \pm 0.4) \times 10^{-4}$		DESIG=82
Г ₁₃₆	$\gamma f_0(1710)$			DESIG=236
Г ₁₃₇	$\gamma f_0(1710) \rightarrow \gamma \pi \pi$	$(3.0 \pm 1.3) \times 10^{-5}$		DESIG=83
Г ₁₃₈	$\gamma f_0(1710) \rightarrow \gamma K \bar{K}$	$(6.0 \pm 1.6) \times 10^{-5}$		DESIG=84
Г ₁₃₉	$\gamma \gamma$	$< 1.4 \times 10^{-4}$	CL=90%	DESIG=51
Г ₁₄₀	$\gamma \eta$	$(1.4 \pm 0.5) \times 10^{-6}$		DESIG=53
Г ₁₄₁	$\gamma \eta \pi^+ \pi^-$	$(8.7 \pm 2.1) \times 10^{-4}$		DESIG=230
Г ₁₄₂	$\gamma \eta(1405)$			DESIG=231
Г ₁₄₃	$\gamma \eta(1405) \rightarrow \gamma K \bar{K} \pi$	$< 9 \times 10^{-5}$	CL=90%	DESIG=62
Г ₁₄₄	$\gamma \eta(1405) \rightarrow \eta \pi^+ \pi^-$	$(3.6 \pm 2.5) \times 10^{-5}$		DESIG=232

Γ_{145}	$\gamma\eta(1475)$				DESIG=233
Γ_{146}	$\gamma\eta(1475) \rightarrow K\bar{K}\pi$	< 1.4	$\times 10^{-4}$	CL=90%	DESIG=234
Γ_{147}	$\gamma\eta(1475) \rightarrow \eta\pi^+\pi^-$	< 8.8	$\times 10^{-5}$	CL=90%	DESIG=235
Γ_{148}	$\gamma 2(\pi^+\pi^-)$	(4.0 ± 0.6)	$\times 10^{-4}$		DESIG=241
Γ_{149}	$\gamma K^{*0} K^+\pi^- + \text{c.c.}$	(3.7 ± 0.9)	$\times 10^{-4}$		DESIG=242
Γ_{150}	$\gamma K^{*0} \bar{K}^{*0}$	(2.4 ± 0.7)	$\times 10^{-4}$		DESIG=243
Γ_{151}	$\gamma K_S^0 K^+\pi^- + \text{c.c.}$	(2.6 ± 0.5)	$\times 10^{-4}$		DESIG=244
Γ_{152}	$\gamma K^+ K^-\pi^+\pi^-$	(1.9 ± 0.5)	$\times 10^{-4}$		DESIG=245
Γ_{153}	$\gamma p\bar{p}$	(3.9 ± 0.5)	$\times 10^{-5}$	S=2.0	DESIG=246
Γ_{154}	$\gamma f_2(1950) \rightarrow \gamma p\bar{p}$	(1.20 ± 0.22)	$\times 10^{-5}$		DESIG=257
Γ_{155}	$\gamma f_2(2150) \rightarrow \gamma p\bar{p}$	(7.2 ± 1.8)	$\times 10^{-6}$		DESIG=258
Γ_{156}	$\gamma X(1835) \rightarrow \gamma p\bar{p}$	(4.6 ± 1.8)	$\times 10^{-6}$		DESIG=259
Γ_{157}	$\gamma X \rightarrow \gamma p\bar{p}$	$[a] < 2$	$\times 10^{-6}$	CL=90%	DESIG=260
Γ_{158}	$\gamma\pi^+\pi^- p\bar{p}$	(2.8 ± 1.4)	$\times 10^{-5}$		DESIG=247
Γ_{159}	$\gamma 2(\pi^+\pi^-) K^+ K^-$	< 2.2	$\times 10^{-4}$	CL=90%	DESIG=248
Γ_{160}	$\gamma 3(\pi^+\pi^-)$	< 1.7	$\times 10^{-4}$	CL=90%	DESIG=249
Γ_{161}	$\gamma K^+ K^- K^+ K^-$	< 4	$\times 10^{-5}$	CL=90%	DESIG=250
Γ_{162}	$\gamma\gamma J/\psi$	(3.1 ± 1.0)	$\times 10^{-4}$		DESIG=266

Other decays

Γ_{163}	invisible	< 1.6	%	CL=90%

NODE=M071;CLUMP=D
DESIG=275

[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 238 measurements to determine 49 parameters. The overall fit has a $\chi^2 = 339.7$ for 189 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	37	16					
x_{19}	0	1	0	6	4	3				
x_{128}	1	0	0	3	1	1	0			
x_{129}	2	0	0	4	1	1	0	0		
x_{130}	1	0	0	4	2	1	0	0	0	
Γ	-79	-3	-1	-40	-35	-17	-11	-1	-2	-2
	x_6	x_7	x_8	x_{11}	x_{12}	x_{13}	x_{19}	x_{128}	x_{129}	x_{130}

$\psi(2S)$ 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
2.36 ± 0.04 OUR FIT			
[2.37 ± 0.04 keV OUR 2013 FIT]			
2.33 ± 0.07 OUR AVERAGE			
2.338 $\pm 0.037 \pm 0.096$	ABLIKIM	08B	BES2 $e^+e^- \rightarrow \text{hadrons}$
2.330 $\pm 0.036 \pm 0.110$	ABLIKIM	06L	BES2 $e^+e^- \rightarrow \text{hadrons}$
2.44 ± 0.21	¹ BAI	02B	BES2 e^+e^-
2.14 ± 0.21	ALEXANDER	89	RVUE See Υ mini-review
• • • We do not use the following data for averages, fits, limits, etc. • • •			
2.0 ± 0.3	BRANDELIK	79C	DASP e^+e^-
2.1 ± 0.3	² LUTH	75	MRK1 e^+e^-

¹ From a simultaneous fit to e^+e^- , $\mu^+\mu^-$, and hadronic channel, assuming $\Gamma_e = \Gamma_\mu = \Gamma_\tau/0.38847$.

² From a simultaneous fit to e^+e^- , $\mu^+\mu^-$, and hadronic channels assuming $\Gamma(e^+e^-) = \Gamma(\mu^+\mu^-)$.

NODE=M071W1
NODE=M071W1
NEW

NODE=M071W;LINKAGE=BB

NODE=M071W1;LINKAGE=F

 $\Gamma(\gamma\gamma)$ Γ_{139}

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

 $\Gamma(\text{hadrons}) \times \Gamma(e^+e^-) / \Gamma_{\text{total}}$ $\Gamma_1 \Gamma_6 / \Gamma$

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
2.233 $\pm 0.015 \pm 0.042$	¹ ANASHIN	12	KEDR $e^+e^- \rightarrow \text{hadrons}$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
2.2 ± 0.4	ABRAMS	75	MRK1 e^+e^-

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

 $\Gamma(\tau^+\tau^-) \times \Gamma(e^+e^-) / \Gamma_{\text{total}}$ $\Gamma_8 \Gamma_6 / \Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
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

 $\Gamma(J/\psi(1S)\pi^+\pi^-) \times \Gamma(e^+e^-) / \Gamma_{\text{total}}$ $\Gamma_{11} \Gamma_6 / \Gamma$

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
0.813 ± 0.013 OUR FIT				
[0.807 ± 0.014 keV OUR 2013 FIT]				
0.837 ± 0.025 OUR AVERAGE				Error includes scale factor of 1.3. See the ideogram below.
[0.839 ± 0.025 keV OUR 2013 AVERAGE Scale factor = 1.3]				
0.837 $\pm 0.028 \pm 0.005$		¹ LEES	12E	BABR 10.6 $e^+e^- \rightarrow 2\pi^+2\pi^-\gamma$
0.852 $\pm 0.010 \pm 0.026$	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 $\pm 0.08 \pm 0.03$	256	³ AUBERT	07AU	BABR 10.6 $e^+e^- \rightarrow J/\psi\pi^+\pi^-\gamma$
0.755 $\pm 0.048 \pm 0.004$	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

NODE=M071G1
NODE=M071G1
NEW

NEW

NODE=M071G1;LINKAGE=LE

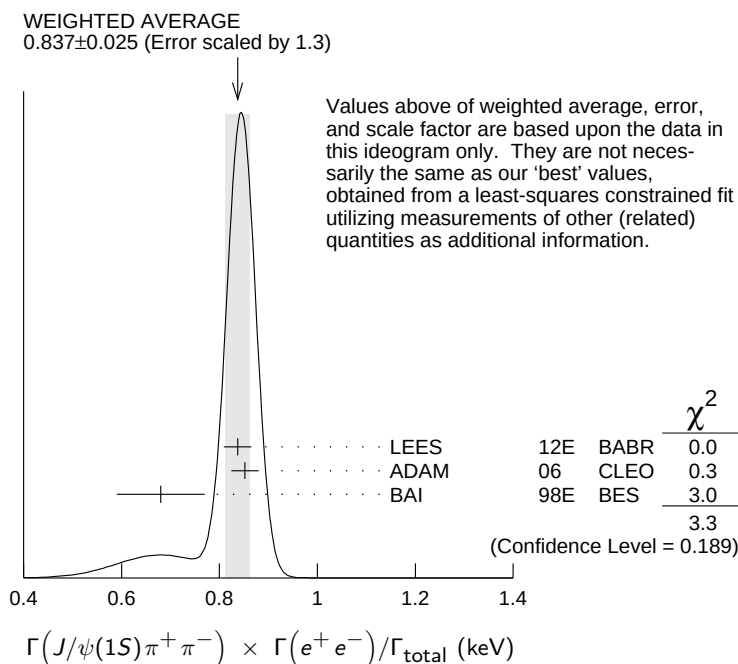
NODE=M071G1;LINKAGE=A

NODE=M071G1;LINKAGE=UB

their experiment's error and our second error is the systematic error from using our best value.

⁴AUBERT 05D reports $[\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) \times \Gamma(\psi(2S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \mu^+\mu^-)] = 0.0450 \pm 0.0018 \pm 0.0022 \text{ keV}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \mu^+\mu^-) = (5.961 \pm 0.033) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value. Superseded by LEES 12E.

NODE=M071G1;LINKAGE=AU



$\Gamma(J/\psi(1S)\pi^0\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{12}\Gamma_6/\Gamma$

VALUE (keV)	EVTs	DOCUMENT ID	TECN	COMMENT
0.428±0.009 OUR FIT				
[0.425 ± 0.009 keV OUR 2013 FIT]				
0.411±0.008±0.018	3.6k±96	ADAM	06	CLEO 3.773 e ⁺ e ⁻ → γψ(2S)

NODE=M071G6
NODE=M071G6
NEW

$\Gamma(J/\psi(1S)\eta) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{13}\Gamma_6/\Gamma$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT
79.2± 1.7 OUR FIT				
[79.0 ± 1.7 eV OUR 2013 FIT]				
87 ± 9 OUR AVERAGE				
83 ±25 ±5	14	¹ AUBERT	07AU	BABR 10.6 e ⁺ e ⁻ → J/ψπ ⁺ π ⁻ π ⁰ γ
88 ± 6 ±7	291 ± 24	ADAM	06	CLEO 3.773 e ⁺ e ⁻ → γψ(2S)
¹ AUBERT 07AU quotes $\Gamma_{ee}^{\psi(2S)} \cdot B(\psi(2S) \rightarrow J/\psi\eta) \cdot B(J/\psi \rightarrow \mu^+\mu^-) \cdot B(\eta \rightarrow \pi^+\pi^-\pi^0) = 1.11 \pm 0.33 \pm 0.07 \text{ eV}$.				

NODE=M071G7
NODE=M071G7
NEW

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 ⁻ → γψ(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
0.661±0.026 OUR FIT				
[0.653 ± 0.028 eV OUR 2013 FIT]				
0.64 ±0.04 OUR AVERAGE				
[0.59 ± 0.05 eV OUR 2013 AVERAGE]				
0.67 ±0.12 ±0.02	43	LEES	130	BABR e ⁺ e ⁻ → p $\bar{p}$ γ
0.74 ±0.07 ±0.04	142	LEES	13Y	BABR e ⁺ e ⁻ → p $\bar{p}$ γ
0.579±0.038±0.036	2.7k	ANDREOTTI	07	E835 p $\bar{p}$ → e ⁺ e ⁻ , J/ψX
0.70 ±0.17 ±0.03	22	AUBERT	06B	e ⁺ e ⁻ → p $\bar{p}$ γ

NODE=M071G2
NODE=M071G2
NEW

NEW

$\Gamma(\Lambda\bar{\Lambda}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{26}\Gamma_6/\Gamma$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
1.5±0.4±0.1	AUBERT	07BD	BABR 10.6 e ⁺ e ⁻ → Λ $\bar{\Lambda}$ γ

NODE=M071G11
NODE=M071G11

$$\Gamma(2(\pi^+\pi^-\pi^0)) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{55}\Gamma_6/\Gamma$$

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

$$\Gamma(K^+K^-2(\pi^+\pi^-)) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{69}\Gamma_6/\Gamma$$

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

$$\Gamma(\pi^+\pi^-K^+K^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{64}\Gamma_6/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
2.56±0.42±0.16	85	AUBERT	07AK BABR	10.6 $e^+e^- \rightarrow \pi^+\pi^-K^+K^-\gamma$

NODE=M071G12
NODE=M071G12

$$\Gamma(\phi f_0(980) \rightarrow \pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{106}\Gamma_6/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
0.347±0.169±0.003	6 ± 3	¹ AUBERT	07AK BABR	10.6 $e^+e^- \rightarrow \pi^+\pi^-K^+K^-\gamma$

NODE=M071G13
NODE=M071G13

¹ 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 $B(\phi(1020) \rightarrow K^+K^-) = (48.9 \pm 0.5) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M071G13;LINKAGE=AU

$$\Gamma(\phi\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{105}\Gamma_6/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
0.57±0.23±0.01	10	¹ AUBERT, BE	06D BABR	10.6 $e^+e^- \rightarrow K^+K^-\pi^+\pi^-\gamma$

NODE=M071G10
NODE=M071G10

¹ 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 $B(\phi(1020) \rightarrow K^+K^-) = (48.9 \pm 0.5) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=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

$$\Gamma(\omega\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{60}\Gamma_6/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
3.01±0.84±0.02	37	¹ AUBERT	07AU BABR	10.6 $e^+e^- \rightarrow \omega\pi^+\pi^-\gamma$

NODE=M071G02
NODE=M071G02

¹ AUBERT 07AU reports $[\Gamma(\psi(2S) \rightarrow \omega\pi^+\pi^-) \times \Gamma(\psi(2S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\omega(782) \rightarrow \pi^+\pi^-\pi^0)] = 2.69 \pm 0.73 \pm 0.16$ eV which we divide by our best value $B(\omega(782) \rightarrow \pi^+\pi^-\pi^0) = (89.2 \pm 0.7) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M071G02;LINKAGE=UB

$$\Gamma(2(\pi^+\pi^-\eta)) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{58}\Gamma_6/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
2.87±1.41±0.01	16	¹ AUBERT	07AU BABR	10.6 $e^+e^- \rightarrow 2(\pi^+\pi^-\eta)\gamma$

NODE=M071G03
NODE=M071G03

¹ AUBERT 07AU reports $[\Gamma(\psi(2S) \rightarrow 2(\pi^+\pi^-\eta)) \times \Gamma(\psi(2S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\eta \rightarrow 2\gamma)] = 1.13 \pm 0.55 \pm 0.08$ eV which we divide by our best value $B(\eta \rightarrow 2\gamma) = (39.41 \pm 0.20) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M071G03;LINKAGE=UB

$$\Gamma(K^+K^-\pi^+\pi^-\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{76}\Gamma_6/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
4.4±1.3±0.3	32	AUBERT	07AU BABR	10.6 $e^+e^- \rightarrow K^+K^-\pi^+\pi^-\pi^0\gamma$

NODE=M071G04
NODE=M071G04

$$\Gamma(K^+K^-\pi^+\pi^-\eta) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{67}\Gamma_6/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
3.04±1.79±0.02	7	¹ AUBERT	07AU BABR	10.6 $e^+e^- \rightarrow K^+K^-\pi^+\pi^-\eta\gamma$

NODE=M071G05
NODE=M071G05

¹ AUBERT 07AU reports $[\Gamma(\psi(2S) \rightarrow K^+K^-\pi^+\pi^-\eta) \times \Gamma(\psi(2S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\eta \rightarrow 2\gamma)] = 1.2 \pm 0.7 \pm 0.1$ eV which we divide by our best value $B(\eta \rightarrow 2\gamma) = (39.41 \pm 0.20) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M071G05;LINKAGE=UB

$$\Gamma(K^+K^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{94}\Gamma_6/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
0.35±0.14±0.03	11	LEES	13Q BABR	$e^+e^- \rightarrow K^+K^-\gamma$

NODE=M071G06
NODE=M071G06

$\psi(2S)$ BRANCHING RATIOS

NODE=M071235

 $\Gamma(\text{hadrons})/\Gamma_{\text{total}}$ Γ_1/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
0.9785$\pm$0.0013 OUR AVERAGE			
0.9779 $\pm$ 0.0015	¹ BAI	02B	BES2 e^+e^-
0.981 $\pm$ 0.003	¹ LUTH	75	MRK1 e^+e^-

¹ Includes cascade decay into $J/\psi(1S)$.NODE=M071R3
NODE=M071R3

NODE=M071R;LINKAGE=P

 $\Gamma(\text{virtual } \gamma \rightarrow \text{hadrons})/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
0.0173$\pm$0.0014 OUR AVERAGE			Error includes scale factor of 1.5.
0.0166 $\pm$ 0.0010	^{1,2} SETH	04	RVUE e^+e^-
0.0199 $\pm$ 0.0019	¹ BAI	02B	BES2 e^+e^-
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.029 $\pm$ 0.004	¹ LUTH	75	MRK1 e^+e^-

¹ Included in $\Gamma(\text{hadrons})/\Gamma_{\text{total}}$.² Using $B(\psi(2S) \rightarrow \ell^+ \ell^-) = (0.73 \pm 0.04)\%$ from RPP-2002 and $R = 2.28 \pm 0.04$ determined by a fit to data from BAI 00 and BAI 02C.NODE=M071R5
NODE=M071R5NODE=M071R;LINKAGE=Z
NODE=M071R5;LINKAGE=SE $\Gamma(g g g)/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
10.58$\pm$1.62	2.9 M	¹ LIBBY	09	CLEO $\psi(2S) \rightarrow \text{hadrons}$

¹ Calculated using $\Gamma(\gamma g g)/\Gamma(g g g) = 0.097 \pm 0.026 \pm 0.016$ from LIBBY 09, $B(\psi(2S) \rightarrow X J/\psi)$ relative and absolute branching fractions from MENDEZ 08, $B(\psi(2S) \rightarrow \gamma \eta_c)$ from MITCHELL 09, and $B(\psi(2S) \rightarrow \text{virtual } \gamma \rightarrow \text{hadrons})$, $B(\psi(2S) \rightarrow \gamma \chi_{cJ})$, and $B(\psi(2S) \rightarrow \ell^+ \ell^-)$ from PDG 08. The statistical error is negligible and the systematic error is largely uncorrelated with that of $\Gamma(\gamma g g)/\Gamma_{\text{total}}$ LIBBY 09 measurement.NODE=M071S43
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$\pm$0.288	200 k	¹ LIBBY	09	CLEO $\psi(2S) \rightarrow \gamma + \text{hadrons}$

¹ Calculated using $\Gamma(\gamma g g)/\Gamma(g g g) = 0.097 \pm 0.026 \pm 0.016$ from LIBBY 09. The statistical error is negligible and the systematic error is largely uncorrelated with that of $\Gamma(g g g)/\Gamma_{\text{total}}$ LIBBY 09 measurement.NODE=M071S44
NODE=M071S44

NODE=M071S44;LINKAGE=LI

 $\Gamma(\gamma g g)/\Gamma(g g g)$ Γ_4/Γ_3

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
9.7$\pm$2.6$\pm$1.6	2.9 M	LIBBY	09	CLEO $\psi(2S) \rightarrow (\gamma +) \text{hadrons}$

NODE=M071S45
NODE=M071S45 $\Gamma(\text{light hadrons})/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
0.154$\pm$0.015	¹ MENDEZ	08	CLEO $e^+e^- \rightarrow \psi(2S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.169 $\pm$ 0.026	² ADAM	05A	CLEO $e^+e^- \rightarrow \psi(2S)$

¹ Uses $B(\psi(2S) \rightarrow J/\psi X)$ from MENDEZ 08 and other branching fractions from PDG 07.² Uses $B(J/\psi X)$ from ADAM 05A, $B(\chi_{cJ} \gamma)$, $B(\eta_c \gamma)$ from ATHAR 04 and $B(\ell^+ \ell^-)$ from PDG 04. Superseded by MENDEZ 08.NODE=M071S27
NODE=M071S27NODE=M071S27;LINKAGE=ME
NODE=M071S27;LINKAGE=AD $\Gamma(e^+ e^-)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
78.9$\pm$ 1.7 OUR FIT			
[(78.2 $\pm$ 1.7) $\times 10^{-4}$ OUR 2013 FIT]			

• • • We do not use the following data for averages, fits, limits, etc. • • •

88 $\pm$ 13	¹ FELDMAN	77	RVUE e^+e^-

¹ From an overall fit assuming equal partial widths for e^+e^- and $\mu^+\mu^-$. For a measurement of the ratio see the entry $\Gamma(\mu^+\mu^-)/\Gamma(e^+e^-)$ below. Includes LUTH 75, HILGER 75, BURMESTER 77.NODE=M071R1
NODE=M071R1
NEW

NODE=M071R;LINKAGE=L

 $\Gamma(\mu^+ \mu^-)/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE (units 10^{-4})	DOCUMENT ID
79$\pm$9 OUR FIT	
[(78 $\pm$ 9) $\times 10^{-4}$ OUR 2013 FIT]	

NODE=M071R2
NODE=M071R2
NEW

$$\Gamma(\mu^+\mu^-)/\Gamma(e^+e^-)$$

VALUE	DOCUMENT ID	TECN	COMMENT

1.00±0.11 OUR FIT

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.89±0.16	BOYARSKI	75C	MRK1	e^+e^-

$$\Gamma_7/\Gamma_6$$

NODE=M071R4
NODE=M071R4

$$\Gamma(\tau^+\tau^-)/\Gamma_{\text{total}}$$

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT

31 ±4 OUR FIT

30.8±2.1±3.8

¹ ABLIKIM	06W	BES	$e^+e^- \rightarrow \psi(2S)$

¹ Computed using PDG 02 value of $B(\psi(2S) \rightarrow \text{hadrons}) = 0.9810 \pm 0.0030$ to estimate the total number of $\psi(2S)$ events.

$$\Gamma_8/\Gamma$$

NODE=M071R75
NODE=M071R75

———— DECAYS INTO $J/\psi(1S)$ AND ANYTHING ————

$$\Gamma(J/\psi(1S)\text{anything})/\Gamma_{\text{total}}$$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

0.609 ±0.006 OUR FIT

[0.603 ± 0.007 OUR 2013 FIT]

0.55 ±0.07 OUR AVERAGE

0.51 ±0.12	BRANDELIK	79C	DASP	$e^+e^- \rightarrow \mu^+\mu^-X$

0.57 ±0.08	ABRAMS	75B	MRK1	$e^+e^- \rightarrow \mu^+\mu^-X$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.6254±0.0016±0.0155	1.1M	¹ MENDEZ	08	CLEO	$\psi(2S) \rightarrow \ell^+\ell^-X$

0.5950±0.0015±0.0190	151k	ADAM	05A	CLEO	Repl. by MENDEZ 08

¹ Not independent from other measurements of MENDEZ 08.

$$\Gamma_9/\Gamma$$

NODE=M071R10
NODE=M071R10
NEW

$$\Gamma(e^+e^-)/\Gamma(J/\psi(1S)\text{anything})$$

$$\Gamma_6/\Gamma_9 = \Gamma_6/(\Gamma_{11}+\Gamma_{12}+\Gamma_{13}+0.339\Gamma_{129}+0.192\Gamma_{130})$$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT

1.295±0.026 OUR FIT

[(1.298 ± 0.026) × 10^{-2} OUR 2013 FIT]

1.28 ±0.04 OUR AVERAGE Error includes scale factor of 1.6. See the ideogram below.

1.22 ±0.02 ±0.05	5097 ± 73	¹ ANDREOTTI	05	E835	$p\bar{p} \rightarrow \psi(2S) \rightarrow e^+e^-$

1.28 ±0.03 ±0.02	¹ AMBROGIANI	00A	E835	$p\bar{p} \rightarrow \psi(2S)$

1.44 ±0.08 ±0.02	¹ ARMSTRONG	97	E760	$\bar{p}p \rightarrow \psi(2S)$

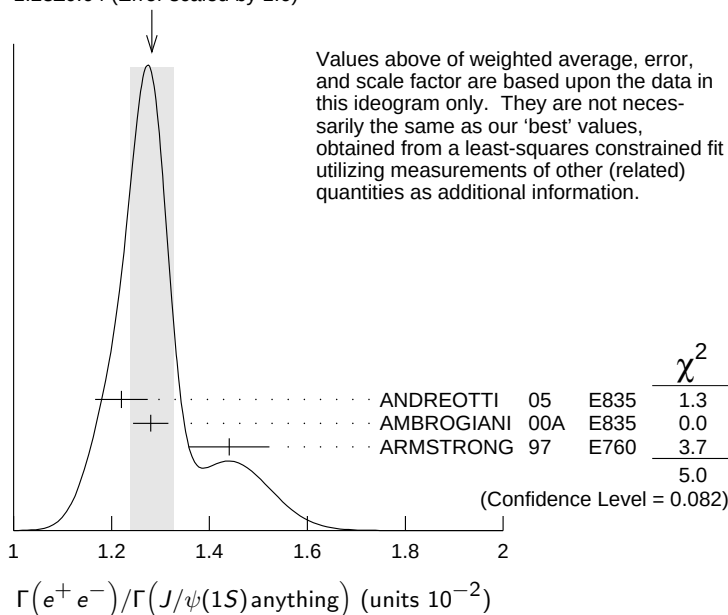
¹ Using $B(J/\psi(1S) \rightarrow e^+e^-) = 0.0593 \pm 0.0010$.

NODE=M071R10;LINKAGE=ME

NODE=M071R72
NODE=M071R72
NEW

NODE=M071R;LINKAGE=7A

WEIGHTED AVERAGE
1.28±0.04 (Error scaled by 1.6)



$$\Gamma(\mu^+\mu^-)/\Gamma(J/\psi(1S)\text{anything})$$

$$\Gamma_7/\Gamma_9 = \Gamma_7/(\Gamma_{11}+\Gamma_{12}+\Gamma_{13}+0.339\Gamma_{129}+0.192\Gamma_{130})$$

VALUE	DOCUMENT ID	TECN	COMMENT

0.0130±0.0014 OUR FIT

0.014 ±0.003

HILGER	75	SPEC	e^+e^-

NODE=M071R74
NODE=M071R74

$\Gamma(J/\psi(1S)\text{neutrals})/\Gamma_{\text{total}}$

VALUE

DOCUMENT ID

0.2510 $\pm$ 0.0033 OUR FIT[0.249 $\pm$ 0.004 OUR 2013 FIT] Γ_{10}/Γ

NODE=M071R18

NODE=M071R18

NEW

 $\Gamma(J/\psi(1S)\pi^+\pi^-)/\Gamma_{\text{total}}$

VALUE

EVTS

DOCUMENT ID

TECN

COMMENT

 Γ_{11}/Γ

NODE=M071R12

NODE=M071R12

NEW

0.3445 $\pm$ 0.0030 OUR FIT[0.340 $\pm$ 0.004 OUR 2013 FIT]**0.348 $\pm$ 0.005 OUR AVERAGE** Error includes scale factor of 1.3. See the ideogram below. [0.343 $\pm$ 0.011 OUR 2013 AVERAGE Scale factor = 1.7]

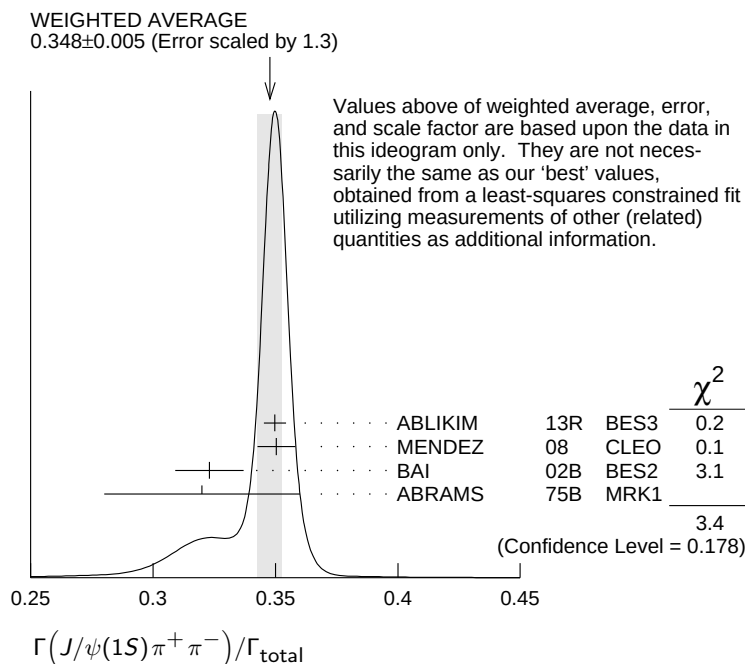
NEW

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=M071R;LINKAGE=AD

 $\Gamma(e^+e^-)/\Gamma(J/\psi(1S)\pi^+\pi^-)$

VALUE

DOCUMENT ID

TECN

COMMENT

 Γ_6/Γ_{11}

NODE=M071R73

NODE=M071R73

NEW

0.0229 $\pm$ 0.0005 OUR FIT[0.0230 $\pm$ 0.0005 OUR 2013 FIT]**0.0252 $\pm$ 0.0028 $\pm$ 0.0011** ¹AUBERT 02B BABR e^+e^- ¹ Using $B(J/\psi(1S) \rightarrow e^+e^-) = 0.0593 \pm 0.0010$.

NODE=M071R73;LINKAGE=7A

 $\Gamma(\mu^+\mu^-)/\Gamma(J/\psi(1S)\pi^+\pi^-)$

VALUE

DOCUMENT ID

TECN

COMMENT

 Γ_7/Γ_{11}

NODE=M071R63

NODE=M071R63

0.0229 $\pm$ 0.0025 OUR FIT**0.0224 $\pm$ 0.0029 OUR AVERAGE**0.0216 $\pm$ 0.0026 $\pm$ 0.0014 ¹AUBERT 02B BABR e^+e^- 0.0327 $\pm$ 0.0077 $\pm$ 0.0072 ¹GRIBUSHIN 96 FMPS 515 $\pi^- \text{Be} \rightarrow 2\mu X$ ¹ Using $B(J/\psi(1S) \rightarrow \mu^+\mu^-) = 0.0588 \pm 0.0010$.

NODE=M071R;LINKAGE=Q2

 $\Gamma(\tau^+\tau^-)/\Gamma(J/\psi(1S)\pi^+\pi^-)$ VALUE (units 10^{-3})

DOCUMENT ID

TECN

COMMENT

 Γ_8/Γ_{11}

NODE=M071R76

NODE=M071R76

NEW

8.9 $\pm$ 1.1 OUR FIT[(9.0 $\pm$ 1.1) $\times 10^{-3}$ OUR 2013 FIT]**8.73 $\pm$ 1.39 $\pm$ 1.57** BAI 02 BES e^+e^-

$\Gamma(J/\psi(1S)\pi^+\pi^-)/\Gamma(J/\psi(1S)\text{anything})$
 Γ_{11}/Γ_9

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

0.5654±0.0026 OUR FIT

[0.5648 ± 0.0026 OUR 2013 FIT]

0.554 ±0.008 OUR AVERAGE Error includes scale factor of 1.3. See the ideogram below.0.5604±0.0009±0.0062 565k MENDEZ 08 CLEO $\psi(2S) \rightarrow \ell^+\ell^-\pi^+\pi^-$ 0.525 ±0.009 ±0.022 4k ANDREOTTI 05 E835 $\psi(2S) \rightarrow J/\psi X$ 0.536 ±0.007 ±0.016 20k ^{1,2}ABLIKIM 04B BES $\psi(2S) \rightarrow J/\psi X$ 0.496 ±0.037 ARMSTRONG 97 E760 $\bar{p}p \rightarrow \psi(2S)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.5637±0.0027±0.0046 60k ADAM 05A CLEO Repl. by MENDEZ 08

¹ From a fit to the J/ψ recoil mass spectra.² ABLIKIM 04B quotes $B(\psi(2S) \rightarrow J/\psi X) / B(\psi(2S) \rightarrow J/\psi\pi^+\pi^-)$.

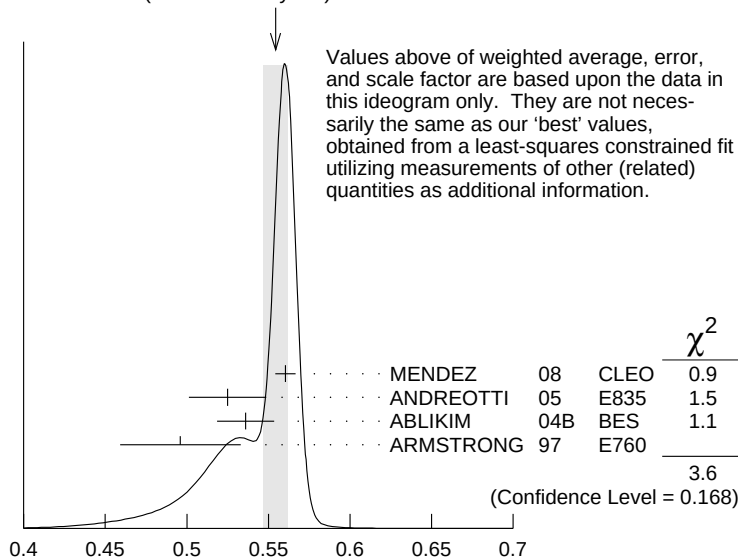
NODE=M071R70

NODE=M071R70

NEW

NODE=M071R;LINKAGE=AB

NODE=M071R;LINKAGE=AL

WEIGHTED AVERAGE
0.554±0.008 (Error scaled by 1.3)
 $\Gamma(J/\psi(1S)\pi^+\pi^-)/\Gamma(J/\psi(1S)\text{anything})$
 Γ_{11}/Γ_9
 $\Gamma(J/\psi(1S)\text{neutrals})/\Gamma(J/\psi(1S)\pi^+\pi^-)$
 $\Gamma_{10}/\Gamma_{11} = (0.9761\Gamma_{12} + 0.719\Gamma_{13} + 0.339\Gamma_{129} + 0.192\Gamma_{130})/\Gamma_{11}$

VALUE	DOCUMENT ID	TECN	COMMENT

0.729±0.008 OUR FIT

[0.730 ± 0.008 OUR 2013 FIT]

0.73 ±0.09 TANENBAUM 76 MRK1 e^+e^-

NODE=M071R11

NODE=M071R11

NEW

 $\Gamma(J/\psi(1S)\pi^0\pi^0)/\Gamma_{\text{total}}$
 Γ_{12}/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

0.1813±0.0031 OUR FIT

[0.1793 ± 0.0033 OUR 2013 FIT]

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.1769±0.0008±0.0053 61k ¹ MENDEZ 08 CLEO $\psi(2S) \rightarrow \ell^+\ell^-\pi^0$ 0.1652±0.0014±0.0058 13.4k ² ADAM 05A CLEO Repl. by MENDEZ 08¹ Not independent from other measurements of MENDEZ 08.² Not independent from other values reported by ADAM 05A.

NODE=M071R17

NODE=M071R17

NEW

NODE=M071R17;LINKAGE=ME

NODE=M071R17;LINKAGE=AD

 $\Gamma(J/\psi(1S)\pi^0\pi^0)/\Gamma(J/\psi(1S)\text{anything})$
 Γ_{12}/Γ_9

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

0.2976±0.0031 OUR FIT

[0.2975 ± 0.0031 OUR 2013 FIT]

0.320 ±0.012 OUR AVERAGE0.300 ±0.008 ±0.022 1655 ± 44 ANDREOTTI 05 E835 $\psi(2S) \rightarrow J/\psi X$ 0.328 ±0.013 ±0.008 AMBROGIANI 00A E835 $\rho\bar{\rho} \rightarrow \psi(2S)$ 0.323 ±0.033 ARMSTRONG 97 E760 $\bar{p}p \rightarrow \psi(2S)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.2829±0.0012±0.0056 61k MENDEZ 08 CLEO $\psi(2S) \rightarrow \ell^+\ell^-\pi^0$

0.2776±0.0025±0.0043 13.4k ADAM 05A CLEO Repl. by MENDEZ 08

NODE=M071R69

NODE=M071R69

NEW

$\Gamma(J/\psi(1S)\pi^0\pi^0)/\Gamma(J/\psi(1S)\pi^+\pi^-)$
 Γ_{12}/Γ_{11}

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.526 ± 0.008 OUR FIT				
[0.527 ± 0.008 OUR 2013 FIT]				
0.513 ± 0.022 OUR AVERAGE				Error includes scale factor of 2.2.
0.5047 ± 0.0022 ± 0.0102	61k	MENDEZ	08	CLEO $\psi(2S) \rightarrow \ell^+\ell^-2\pi^0$
0.570 ± 0.009 ± 0.026	14k	¹ ABLIKIM	04B	BES $\psi(2S) \rightarrow J/\psi X$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.4924 ± 0.0047 ± 0.0086	73k	^{2,3} ADAM	05A	CLEO Repl. by MENDEZ 08
0.571 ± 0.018 ± 0.044		⁴ ANDREOTTI	05	E835 $\psi(2S) \rightarrow J/\psi X$
0.53 ± 0.06		TANENBAUM	76	MRK1 e^+e^-
0.64 ± 0.15		⁵ HILGER	75	SPEC e^+e^-

¹ From a fit to the J/ψ recoil mass spectra.

² Not independent from other values reported by ADAM 05A.

³ Using 13,217 $J/\psi\pi^0\pi^0$ and 60,010 $J/\psi\pi^+\pi^-$ events.

⁴ Not independent from other values reported by ANDREOTTI 05.

⁵ Ignoring the $J/\psi(1S)\eta$ and $J/\psi(1S)\gamma\gamma$ decays.

NODE=M071R14
NODE=M071R14
NEW

NODE=M071R14;LINKAGE=AB
NODE=M071R14;LINKAGE=AD
NODE=M071R14;LINKAGE=AM
NODE=M071R;LINKAGE=AN
NODE=M071R;LINKAGE=I

 $\Gamma(J/\psi(1S)\eta)/\Gamma_{\text{total}}$
 Γ_{13}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
33.6 ± 0.5 OUR FIT				
[(33.3 ± 0.5) × 10^{-3} OUR 2013 FIT]				
32.9 ± 1.7 OUR AVERAGE				Error includes scale factor of 2.1. See the ideogram below.
33.75 ± 0.17 ± 0.86	68.2k	ABLIKIM	12M	BES3 $e^+e^- \rightarrow \ell^+\ell^-2\gamma$
29.8 ± 0.9 ± 2.3	5.7k	BAI	04I	BES2 $\psi(2S) \rightarrow J/\psi\gamma\gamma$
25.5 ± 2.9	386	¹ OREGLIA	80	CBAL $e^+e^- \rightarrow J/\psi2\gamma$
45 ± 12	17	² BRANDELIK	79B	DASP $e^+e^- \rightarrow J/\psi2\gamma$
42 ± 6	164	² BARTEL	78B	CNTR e^+e^-
• • • We do not use the following data for averages, fits, limits, etc. • • •				
34.3 ± 0.4 ± 0.9	18.4k	³ MENDEZ	08	CLEO $\psi(2S) \rightarrow \ell^+\ell^-\eta$
32.5 ± 0.6 ± 1.1	2.8k	⁴ ADAM	05A	CLEO Repl. by MENDEZ 08
43 ± 8	44	TANENBAUM	76	MRK1 e^+e^-

¹ Recalculated by us using $B(J/\psi(1S) \rightarrow \ell^+\ell^-) = 0.1181 \pm 0.0020$.

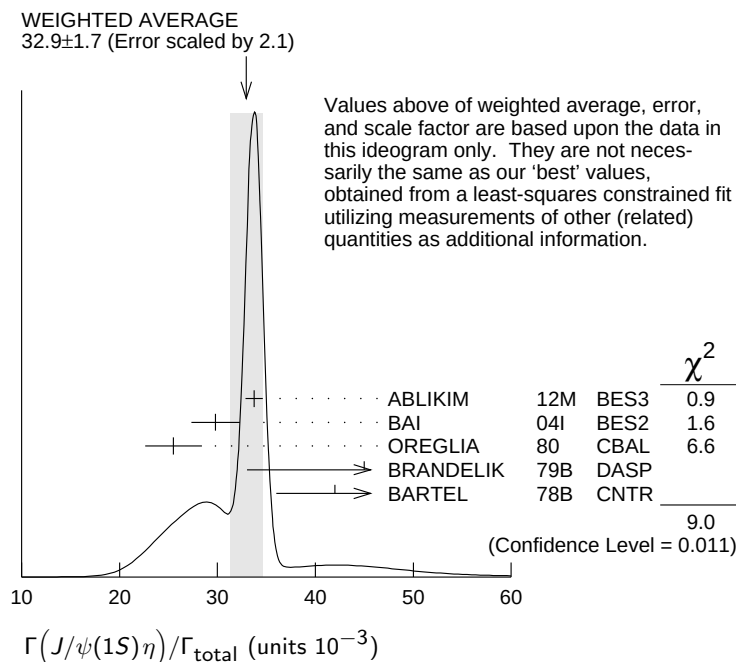
² Recalculated by us using $B(J/\psi(1S) \rightarrow \mu^+\mu^-) = 0.0588 \pm 0.0010$.

³ Not independent from other measurements of MENDEZ 08.

⁴ Not independent from other values reported by ADAM 05A.

NODE=M071R15
NODE=M071R15
NEW

NODE=M071R;LINKAGE=3Q
NODE=M071R;LINKAGE=2Q
NODE=M071R15;LINKAGE=ME
NODE=M071R15;LINKAGE=AD



$\Gamma(J/\psi(1S)\eta)/\Gamma(J/\psi(1S)\text{anything})$ Γ_{13}/Γ_9

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

0.0551 ± 0.0008 OUR FIT

[0.0553 ± 0.0008 OUR 2013 FIT]

0.058 ± 0.007 OUR AVERAGE Error includes scale factor of 1.4. See the ideogram below.0.050 ± 0.006 ± 0.003 298 ± 20 ANDREOTTI 05 E835 $\psi(2S) \rightarrow J/\psi X$ 0.072 ± 0.009 AMBROGIANI 00A E835 $p\bar{p} \rightarrow \psi(2S)$ 0.061 ± 0.015 ARMSTRONG 97 E760 $p\bar{p} \rightarrow \psi(2S)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.0549 ± 0.0006 ± 0.0009 18.4k ¹ MENDEZ 08 CLEO $\psi(2S) \rightarrow \ell^+ \ell^- \eta$

0.0546 ± 0.0010 ± 0.0007 2.8k ADAM 05A CLEO Repl. by MENDEZ 08

¹ Not independent from other measurements of MENDEZ 08.

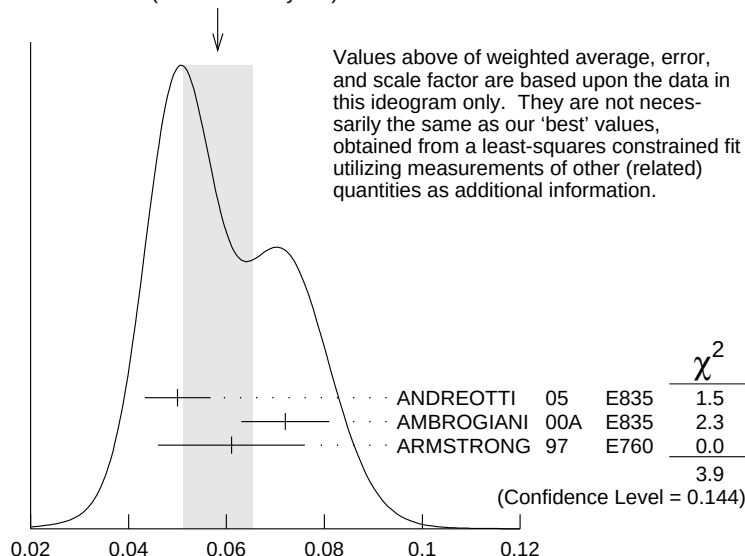
NODE=M071R68

NODE=M071R68

NEW

OCCUR=2

NODE=M071R68;LINKAGE=ME

WEIGHTED AVERAGE
0.058 ± 0.007 (Error scaled by 1.4) $\Gamma(J/\psi(1S)\eta)/\Gamma(J/\psi(1S)\text{anything})$ Γ_{13}/Γ_9 $\Gamma(J/\psi(1S)\eta)/\Gamma(J/\psi(1S)\pi^+\pi^-)$ Γ_{13}/Γ_{11}

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

0.0975 ± 0.0014 OUR FIT

[0.0979 ± 0.0014 OUR 2013 FIT]

0.0979 ± 0.0018 OUR AVERAGE0.0979 ± 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 080.095 ± 0.007 ± 0.007 ⁴ ANDREOTTI 05 E835 $\psi(2S) \rightarrow J/\psi X$ ¹ From a fit to the J/ψ recoil mass spectra.² The value for $B(\psi(2S) \rightarrow J/\psi(1S)\eta)$ reported in HIMEL 80 is derived using $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (33 \pm 3)\%$ and $B(J/\psi(1S) \rightarrow \ell^+ \ell^-) = 0.138 \pm 0.018$. Calculated by us using $B(J/\psi(1S) \rightarrow \ell^+ \ell^-) = (0.1181 \pm 0.0020)$.³ Not independent from other values reported by ADAM 05A.⁴ Not independent from other values reported by ANDREOTTI 05.

NODE=M071R71

NODE=M071R71

NEW

NODE=M071R71;LINKAGE=AB

NODE=M071R;LINKAGE=8H

NODE=M071R71;LINKAGE=AD

NODE=M071R71;LINKAGE=AN

 $\Gamma(J/\psi(1S)\pi^0)/\Gamma_{\text{total}}$ Γ_{14}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT

12.68 ± 0.32 OUR AVERAGE12.6 ± 0.2 ± 0.3 4.1k ABLIKIM 12M BES3 $e^+ e^- \rightarrow \ell^+ \ell^- 2\gamma$ 13.3 ± 0.8 ± 0.3 530 MENDEZ 08 CLEO $\psi(2S) \rightarrow \ell^+ \ell^- 2\gamma$ 14.3 ± 1.4 ± 1.2 280 BAI 04i BES2 $\psi(2S) \rightarrow J/\psi \gamma \gamma$ 14 ± 6 7 HIMEL 80 MRK2 $e^+ e^-$ 9 ± 2 ± 1 23 ¹ OREGLIA 80 CBAL $\psi(2S) \rightarrow J/\psi 2\gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

13 ± 1 ± 1 88 ADAM 05A CLEO Repl. by MENDEZ 08

¹ Recalculated by us using $B(J/\psi(1S) \rightarrow \ell^+ \ell^-) = 0.1181 \pm 0.0020$.

NODE=M071R16

NODE=M071R16

NODE=M071R16;LINKAGE=3Q

$\Gamma(J/\psi(1S)\pi^0)/\Gamma(J/\psi(1S)\text{anything})$

$$\Gamma_{14}/\Gamma_9 = \Gamma_{14}/(\Gamma_{11} + \Gamma_{12} + \Gamma_{13} + 0.339\Gamma_{129} + 0.192\Gamma_{130})$$

VALUE (units 10^{-2})	EVTs	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

$0.213 \pm 0.012 \pm 0.003$	527	¹ MENDEZ	08	CLEO $e^+e^- \rightarrow J/\psi\gamma\gamma$
$0.22 \pm 0.02 \pm 0.01$		² ADAM	05A	CLEO $e^+e^- \rightarrow \psi(2S) \rightarrow J/\psi\gamma\gamma$

¹ Not independent from other values reported by MENDEZ 08. Supersedes ADAM 05A.

² Not independent from other values reported by ADAM 05A.

NODE=M071S25
NODE=M071S25

NODE=M071S25;LINKAGE=ME
NODE=M071S25;LINKAGE=AD

 $\Gamma(J/\psi(1S)\pi^0)/\Gamma(J/\psi(1S)\pi^+\pi^-)$
 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

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 $\psi(2S) \rightarrow \pi^0 \text{ anything}$
$8.4 \pm 1.3 \pm 1.0$	11k	ABLIKIM	10B	BES3 $\psi(2S) \rightarrow \pi^0 h_c$

• • • We do not use the following data for averages, fits, limits, etc. • • •

seen	92^{+23}_{-22}	ADAMS	09	CLEO $\psi(2S) \rightarrow 2\pi^+ 2\pi^- 2\pi^0$
seen	1282	DOBBS	08A	CLEO $\psi(2S) \rightarrow \pi^0 \eta_c \gamma$
seen	168 ± 40	ROSNER	05	CLEO $\psi(2S) \rightarrow \pi^0 \eta_c \gamma$

¹ Assuming a width $\Gamma(h_c(1P)) = 0.86 \text{ MeV} \equiv \Gamma_0$, a measured dependence of the central value of $B = (7.6 \pm 1.4 \times \Gamma(h_c(1P)/\Gamma_0) \times 10^{-4}$, and with a systematic error that accounts for the width variation range 0.43–1.29 MeV.

NODE=M071S42
NODE=M071S42

NODE=M071S10

NODE=M071S42;LINKAGE=GE

 $\Gamma(3(\pi^+\pi^-)\pi^0)/\Gamma_{\text{total}}$
 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.
 $[(29 \pm 10) \times 10^{-4} \text{ OUR 2013 AVERAGE Scale factor} = 4.6]$

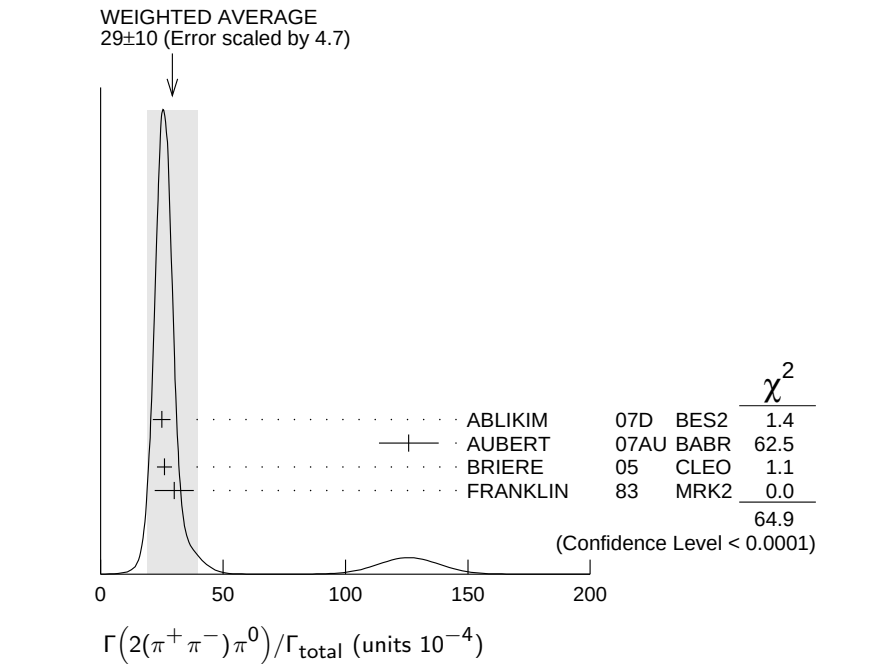
$24.9 \pm 0.7 \pm 3.6$	2173	ABLIKIM	07D	BES2 $e^+e^- \rightarrow \psi(2S)$
$126 \pm 12 \pm 2$	410	¹ AUBERT	07AU	BABR $10.6 e^+e^- \rightarrow 2(\pi^+\pi^-)\pi^0\gamma$
$26.1 \pm 0.7 \pm 3.0$	1703	BRIERE	05	CLEO $e^+e^- \rightarrow \psi(2S) \rightarrow 2(\pi^+\pi^-)\pi^0$
30 ± 8	42	FRANKLIN	83	MRK2 e^+e^-

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 $\Gamma(\psi(2S) \rightarrow e^+e^-) = 2.36 \pm 0.04 \text{ keV}$. 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

NEW

NODE=M071R22;LINKAGE=UB

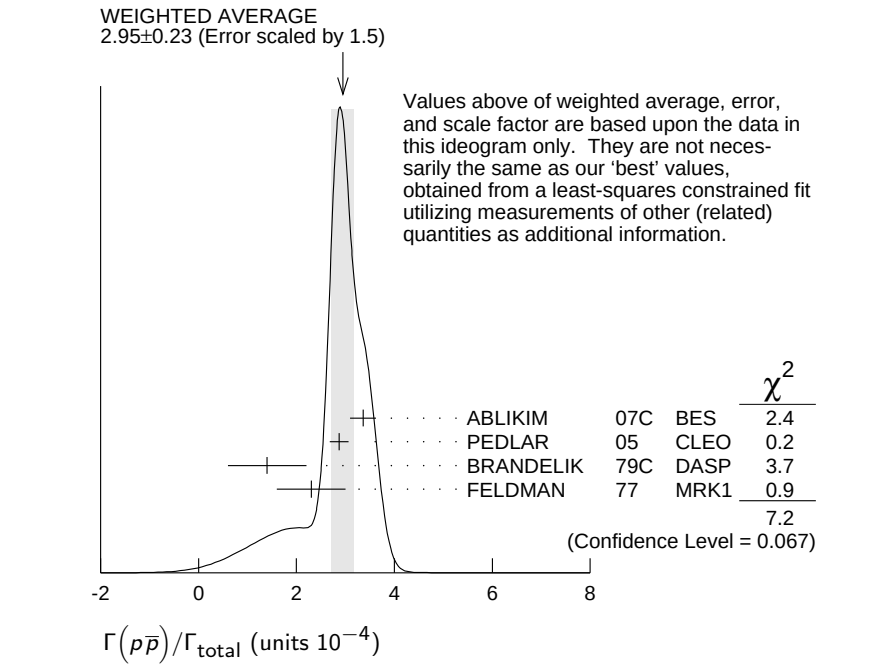


$\Gamma(\rho_2(1320))/\Gamma_{\text{total}}$					Γ_{18}/Γ
VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
2.55±0.73±0.47		112 ± 31	BAI	04C BES2	$\psi(2S) \rightarrow 2(\pi^+\pi^-\pi^0)$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<2.3	90		BAI	98J BES	e^+e^-

NODE=M071R65
NODE=M071R65

$\Gamma(\rho\bar{\rho})/\Gamma_{\text{total}}$					Γ_{19}/Γ
VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT	
2.80±0.11 OUR FIT					
[(2.75 ± 0.12) × 10 ⁻⁴ OUR 2013 FIT]					
2.95±0.23 OUR AVERAGE		Error includes scale factor of 1.5. See the ideogram below.			
3.36±0.09±0.25	1618	ABLIKIM	07C BES	$e^+e^- \rightarrow \psi(2S) \rightarrow \rho\bar{\rho}$	
2.87±0.12±0.15	557	PEDLAR	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow \rho\bar{\rho}$	
1.4 ±0.8	4	BRANDELIK	79C DASP	$e^+e^- \rightarrow \psi(2S) \rightarrow \rho\bar{\rho}$	
2.3 ±0.7		FELDMAN	77 MRK1	$e^+e^- \rightarrow \psi(2S) \rightarrow \rho\bar{\rho}$	

NODE=M071R25
NODE=M071R25
NEW



$\Gamma(p\bar{p})/\Gamma(J/\psi(1S)\pi^+\pi^-)$ Γ_{19}/Γ_{11} VALUE (units 10^{-4})

DOCUMENT ID

TECN

COMMENT

8.13±0.32 OUR FIT[(8.09 ± 0.35) × 10⁻⁴ OUR 2013 FIT]**6.98±0.49±0.97**

BAI

01

BES

 $e^+e^- \rightarrow \psi(2S) \rightarrow p\bar{p}$

NODE=M071S40

NODE=M071S40

NEW

 $\Gamma(\Delta^{++}\bar{\Delta}^{--})/\Gamma_{\text{total}}$ Γ_{20}/Γ VALUE (units 10^{-5})

EVTS

DOCUMENT ID

TECN

COMMENT

12.8±1.0±3.4

157

¹BAI

01

BES

 $e^+e^- \rightarrow \psi(2S) \rightarrow$
hadrons

NODE=M071R50

NODE=M071R50

¹ Estimated using $B(\psi(2S) \rightarrow J/\psi\pi^+\pi^-) = 0.310 \pm 0.028$.

NODE=M071R50;LINKAGE=PP

 $\Gamma(\Lambda\bar{\Lambda}\pi^0)/\Gamma_{\text{total}}$ Γ_{21}/Γ VALUE (units 10^{-5})

CL%

DOCUMENT ID

TECN

COMMENT

< **0.29**

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 $B(\eta \rightarrow \gamma\gamma) = 39.4\%$.

NODE=M071R6

NODE=M071R6

NODE=M071R6;LINKAGE=AL

NODE=M071R6;LINKAGE=AB

 $\Gamma(\Lambda\bar{\Lambda}\eta)/\Gamma_{\text{total}}$ Γ_{22}/Γ VALUE (units 10^{-5})

CL%

EVTS

DOCUMENT ID

TECN

COMMENT

2.48±0.34±0.19

60

¹

ABLIKIM

13F

BES3

 $\psi(2S) \rightarrow p\bar{p}\pi^+\pi^-\gamma\gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<4.9

90

²

ABLIKIM

07H

BES2

 $e^+e^- \rightarrow \psi(2S)$ ¹ Using $B(\Lambda \rightarrow \pi^- p) = 63.9\%$ and $B(\eta \rightarrow \gamma\gamma) = 39.31\%$.² Using $B(\Lambda \rightarrow \pi^- p) = 63.9\%$.

NODE=M071R7

NODE=M071R7

NODE=M071R7;LINKAGE=AL

NODE=M071R7;LINKAGE=AB

 $\Gamma(\Lambda\bar{p}K^+)/\Gamma_{\text{total}}$ Γ_{23}/Γ VALUE (units 10^{-4})

EVTS

DOCUMENT ID

TECN

COMMENT

1.0±0.1±0.1

74.0

BRIERE

05

CLEO

 $e^+e^- \rightarrow \psi(2S) \rightarrow$
 $p\bar{p}K^+\pi^-$

NODE=M071S18

NODE=M071S18

 $\Gamma(\Lambda\bar{p}K^+\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{24}/Γ VALUE (units 10^{-4})

EVTS

DOCUMENT ID

TECN

COMMENT

1.8±0.3±0.3

45.8

BRIERE

05

CLEO

 $e^+e^- \rightarrow \psi(2S) \rightarrow$
 $p\bar{p}K^+\pi^+\pi^-\pi^-$

NODE=M071S19

NODE=M071S19

 $\Gamma(\Lambda\bar{\Lambda}\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{25}/Γ VALUE (units 10^{-4})

EVTS

DOCUMENT ID

TECN

COMMENT

2.8±0.4±0.5

73.4

BRIERE

05

CLEO

 $e^+e^- \rightarrow \psi(2S) \rightarrow$
 $p\bar{p}2(\pi^+\pi^-)$

NODE=M071S17

NODE=M071S17

 $\Gamma(\Lambda\bar{\Lambda})/\Gamma_{\text{total}}$ Γ_{26}/Γ VALUE (units 10^{-4})

CL% EVTS

DOCUMENT ID

TECN

COMMENT

2.8 ±0.5 OUR AVERAGE

Error includes scale factor of 2.6. See the ideogram below.

3.39±0.20±0.32

337

ABLIKIM

07C

BES

 $e^+e^- \rightarrow \psi(2S) \rightarrow$ hadrons

6.4 ±1.7 ±0.1

¹

AUBERT

07BD

BABR

10.6 $e^+e^- \rightarrow \Lambda\bar{\Lambda}\gamma$

3.28±0.23±0.25

208

PEDLAR

05

CLEO

 $e^+e^- \rightarrow \psi(2S) \rightarrow$ hadrons

1.81±0.20±0.27

80

²

BAI

01

BES

 $e^+e^- \rightarrow \psi(2S) \rightarrow$ hadrons

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 4

90

FELDMAN

77

MRK1

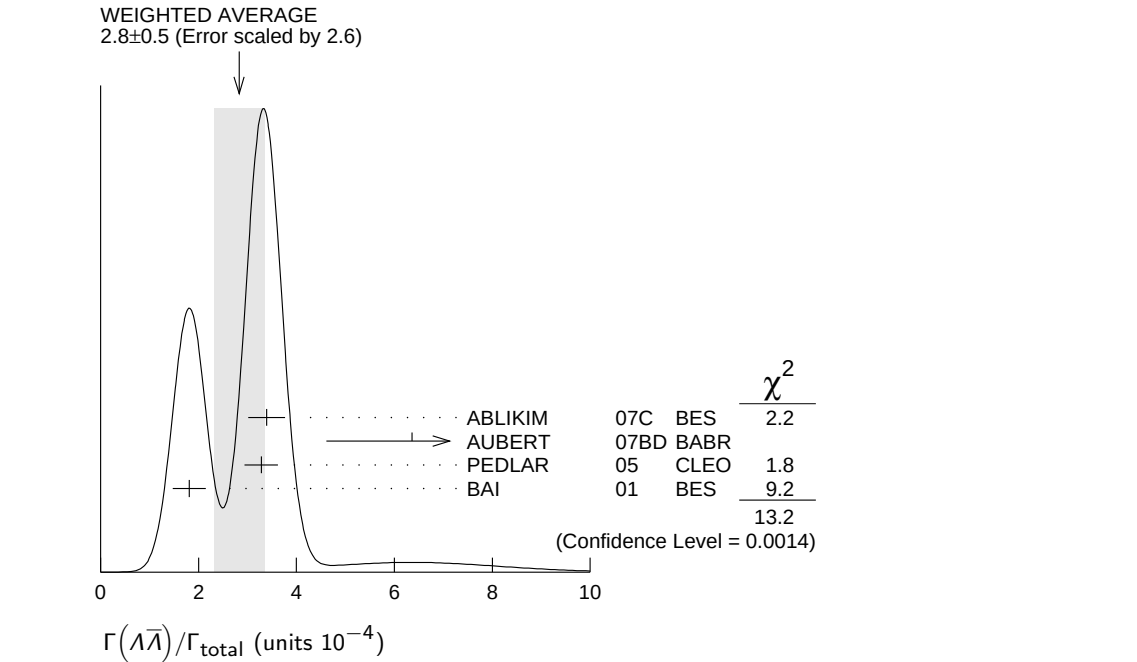
 $e^+e^- \rightarrow \psi(2S) \rightarrow$ hadrons¹ AUBERT 07BD reports $[\Gamma(\psi(2S) \rightarrow \Lambda\bar{\Lambda})/\Gamma_{\text{total}}] \times [\Gamma(\psi(2S) \rightarrow e^+e^-)] = (15 \pm 4 \pm 1) \times 10^{-4}$ keV which we divide by our best value $\Gamma(\psi(2S) \rightarrow e^+e^-) = 2.36 \pm 0.04$ keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.² Estimated using $B(\psi(2S) \rightarrow J/\psi\pi^+\pi^-) = 0.310 \pm 0.028$.

NODE=M071R28

NODE=M071R28

NODE=M071R28;LINKAGE=AU

NODE=M071R28;LINKAGE=PP



$\Gamma(\Lambda\bar{\Sigma}^+\pi^- + \text{c.c.})/\Gamma_{\text{total}}$					Γ_{27}/Γ	
VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT		
1.40±0.03±0.13	2.8k	ABLIKIM	13W	BES3	$\psi(2S) \rightarrow \text{hadrons}$	NODE=M071S65 NODE=M071S65

$\Gamma(\Lambda\bar{\Sigma}^-\pi^+ + \text{c.c.})/\Gamma_{\text{total}}$					Γ_{28}/Γ	
VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT		
1.54±0.04±0.13	2.8k	ABLIKIM	13W	BES3	$\psi(2S) \rightarrow \text{hadrons}$	NODE=M071S66 NODE=M071S66

$\Gamma(\Sigma^0\bar{p}K^+ + \text{c.c.})/\Gamma_{\text{total}}$					Γ_{29}/Γ	
VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT		
1.67±0.13±0.12	276	¹ ABLIKIM	13D	BES3	$\psi(2S) \rightarrow \gamma\Lambda\bar{p}K^+$	NODE=M071S63 NODE=M071S63

¹ Using $B(\Lambda \rightarrow p\pi^-) = 63.9\%$, and $B(\Sigma^0 \rightarrow \Lambda\gamma) = 100\%$.

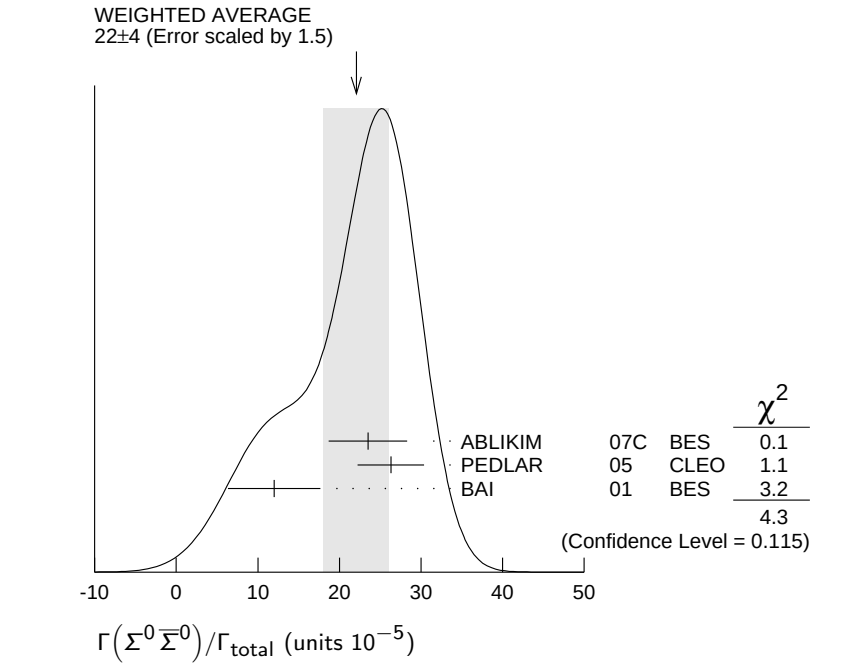
NODE=M071S63;LINKAGE=AB

$\Gamma(\Sigma^+\bar{\Sigma}^-)/\Gamma_{\text{total}}$					Γ_{30}/Γ	
VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT		
25.7±4.4±6.8	35	PEDLAR	05	CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$	NODE=M071R47 NODE=M071R47

$\Gamma(\Sigma^0\bar{\Sigma}^0)/\Gamma_{\text{total}}$					Γ_{31}/Γ	
VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT		
22 ±4 OUR AVERAGE		Error includes scale factor of 1.5. See the ideogram below.				
23.5±3.6±3.2	59	ABLIKIM	07C	BES	$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$	NODE=M071R51 NODE=M071R51
26.3±3.5±2.1	58	PEDLAR	05	CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$	
12 ±4 ±4	8	¹ BAI	01	BES	$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$	

¹ Estimated using $B(\psi(2S) \rightarrow J/\psi\pi^+\pi^-) = 0.310 \pm 0.028$.

NODE=M071R51;LINKAGE=PP



$\Gamma(\Sigma(1385)^+ \bar{\Sigma}(1385)^-)/\Gamma_{\text{total}}$					Γ_{32}/Γ
VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT	
11±3±3	14	¹ BAI	01	BES $e^+e^- \rightarrow \psi(2S) \rightarrow$ hadrons	

¹ Estimated using $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = 0.310 \pm 0.028$.

NODE=M071R52
NODE=M071R52

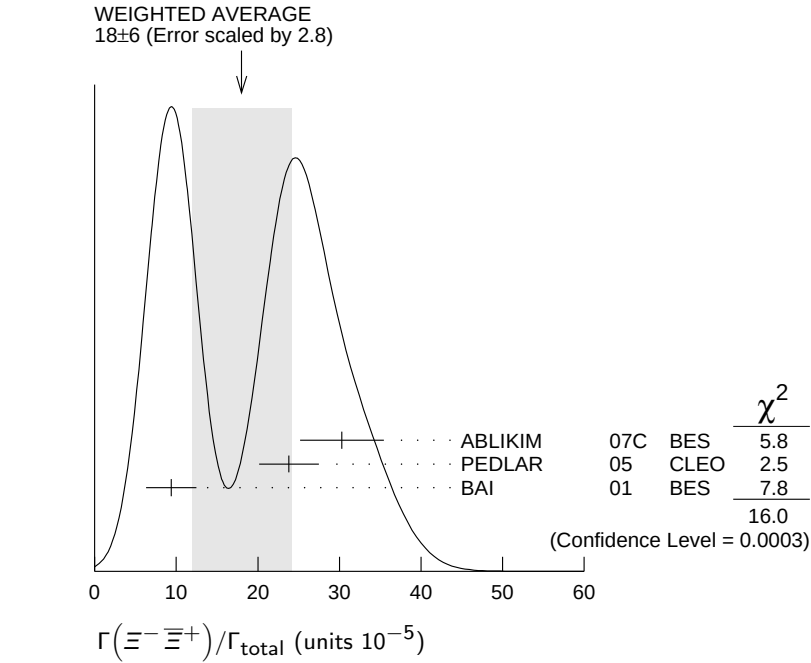
NODE=M071R52;LINKAGE=PP

$\Gamma(\Xi^- \bar{\Xi}^+)/\Gamma_{\text{total}}$					Γ_{33}/Γ
VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
18 ±6	OUR AVERAGE		Error includes scale factor of 2.8. See the ideogram below.		
30.3±4.0±3.2	67		ABLIKIM	07C	BES $e^+e^- \rightarrow \psi(2S) \rightarrow$ hadrons
23.8±3.0±2.1	63		PEDLAR	05	CLEO $e^+e^- \rightarrow \psi(2S) \rightarrow$ hadrons
9.4±2.7±1.5	12		¹ BAI	01	BES $e^+e^- \rightarrow \psi(2S) \rightarrow$ hadrons
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<20	90		FELDMAN	77	MRK1 $e^+e^- \rightarrow \psi(2S) \rightarrow$ hadrons

¹ Estimated using $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = 0.310 \pm 0.028$.

NODE=M071R29
NODE=M071R29

NODE=M071R29;LINKAGE=PP



$\Gamma(\Xi^0 \Xi^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
27.5±6.4±6.1	19	PEDLAR	05	CLEO $e^+e^- \rightarrow \psi(2S) \rightarrow$ hadrons

 Γ_{34}/Γ

NODE=M071R48
NODE=M071R48

 $\Gamma(\Xi(1530)^0 \Xi(1530)^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
5.2±0.3^{+3.2}_{-1.2}		527	¹ ABLIKIM	13S	BES3 $\psi(2S) \rightarrow \eta p \bar{p}$

 Γ_{35}/Γ

NODE=M071R53
NODE=M071R53

• • • We do not use the following data for averages, fits, limits, etc. • • •

<32	90	PEDLAR	05	CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow$ hadrons
< 8.1	90	² BAI	01	BES	$e^+e^- \rightarrow \psi(2S) \rightarrow$ 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;LINKAGE=A
NODE=M071R53;LINKAGE=PP

 $\Gamma(\Omega^- \bar{\Omega}^+)/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
< 7.3	90	¹ BAI	01	BES $e^+e^- \rightarrow \psi(2S) \rightarrow$ hadrons
<15	90	ABLIKIM	12Q	BES2 $e^+e^- \rightarrow \psi(2S) \rightarrow$ hadrons
<16	90	PEDLAR	05	CLEO $e^+e^- \rightarrow \psi(2S) \rightarrow$ hadrons

 Γ_{36}/Γ

NODE=M071R54
NODE=M071R54

• • • We do not use the following data for averages, fits, limits, etc. • • •

¹ Estimated using $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = 0.310 \pm 0.028$.

NODE=M071R54;LINKAGE=PP

 $\Gamma(\pi^0 p \bar{p})/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.53±0.07 OUR AVERAGE				
1.65±0.03±0.15	4.5k	ABLIKIM	13A	BES3 $\psi(2S) \rightarrow p \bar{p} \pi^0$
1.54±0.06±0.06	948	ALEXANDER	10	CLEO $\psi(2S) \rightarrow \pi^0 p \bar{p}$
1.32±0.10±0.15	256 ± 18	¹ ABLIKIM	05E	BES2 $e^+e^- \rightarrow \psi(2S) \rightarrow$ $p \bar{p} \gamma \gamma$
1.4 ±0.5	9	FRANKLIN	83	MRK2 e^+e^-

 Γ_{37}/Γ

NODE=M071R35
NODE=M071R35

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
6.42±0.20^{+1.78}_{-1.28}	1.9k	¹ ABLIKIM	13A	BES3 $\psi(2S) \rightarrow p \bar{p} \pi^0$

 Γ_{38}/Γ

NODE=M071S56
NODE=M071S56

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
7.3 ^{+1.7}_{-1.5} OUR AVERAGE				Error includes scale factor of 2.5.

 Γ_{39}/Γ

NODE=M071S50
NODE=M071S50

3.58±0.25 ^{+1.59} _{-0.84}	1.1k	¹ ABLIKIM	13A	BES3 $\psi(2S) \rightarrow p \bar{p} \pi^0$
8.1 ±0.7 ±0.3	474	² ALEXANDER	10	CLEO $\psi(2S) \rightarrow \pi^0 p \bar{p}$

¹ From a fit of $\pi^0 p \bar{p}$ data to eight distinct intermediate $N \bar{p}$ resonant states.

² From a fit of the $p \bar{p}$ and $p \pi^0$ mass distributions to a combination of $N(1440) \bar{p}$, $\pi^0 f_0(2100)$, and two other broad, unestablished resonances.

NODE=M071S50;LINKAGE=AB
NODE=M071S50;LINKAGE=AL

 $\Gamma(N(1520) \bar{p} + \text{c.c.} \rightarrow \pi^0 p \bar{p})/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
0.64±0.05^{+0.22}_{-0.17}	0.2k	¹ ABLIKIM	13A	BES3 $\psi(2S) \rightarrow p \bar{p} \pi^0$

 Γ_{40}/Γ

NODE=M071S57
NODE=M071S57

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
2.47±0.28^{+0.99}_{-0.97}	0.7k	¹ ABLIKIM	13A	BES3 $\psi(2S) \rightarrow p \bar{p} \pi^0$

 Γ_{41}/Γ

NODE=M071S58
NODE=M071S58

¹ From a fit of $\pi^0 p \bar{p}$ data to eight distinct intermediate $N \bar{p}$ resonant states.

NODE=M071S58;LINKAGE=AB

$$\Gamma(N(1650)\bar{p} + \text{c.c.} \rightarrow \pi^0 p \bar{p}) / \Gamma_{\text{total}} \quad \Gamma_{42}/\Gamma$$

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT
$3.76 \pm 0.28^{+1.37}_{-1.66}$	1.1k	¹ ABLIKIM	13A BES3	$\psi(2S) \rightarrow p \bar{p} \pi^0$

¹ From a fit of $\pi^0 p \bar{p}$ data to eight distinct intermediate $N \bar{p}$ resonant states.

NODE=M071S59
NODE=M071S59

NODE=M071S59;LINKAGE=AB

$$\Gamma(N(1720)\bar{p} + \text{c.c.} \rightarrow \pi^0 p \bar{p}) / \Gamma_{\text{total}} \quad \Gamma_{43}/\Gamma$$

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT
$1.79 \pm 0.10^{+0.24}_{-0.71}$	0.5k	¹ ABLIKIM	13A BES3	$\psi(2S) \rightarrow p \bar{p} \pi^0$

¹ From a fit of $\pi^0 p \bar{p}$ data to eight distinct intermediate $N \bar{p}$ resonant states.

NODE=M071S60
NODE=M071S60

NODE=M071S60;LINKAGE=AB

$$\Gamma(N(2300)\bar{p} + \text{c.c.} \rightarrow \pi^0 p \bar{p}) / \Gamma_{\text{total}} \quad \Gamma_{44}/\Gamma$$

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT
$2.62 \pm 0.28^{+1.12}_{-0.64}$	0.9k	¹ ABLIKIM	13A BES3	$\psi(2S) \rightarrow p \bar{p} \pi^0$

¹ From a fit of $\pi^0 p \bar{p}$ data to eight distinct intermediate $N \bar{p}$ resonant states.

NODE=M071S61
NODE=M071S61

NODE=M071S61;LINKAGE=AB

$$\Gamma(N(2570)\bar{p} + \text{c.c.} \rightarrow \pi^0 p \bar{p}) / \Gamma_{\text{total}} \quad \Gamma_{45}/\Gamma$$

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT
$2.13 \pm 0.08^{+0.40}_{-0.30}$	0.8k	¹ ABLIKIM	13A BES3	$\psi(2S) \rightarrow p \bar{p} \pi^0$

¹ From a fit of $\pi^0 p \bar{p}$ data to eight distinct intermediate $N \bar{p}$ resonant states.

NODE=M071S62
NODE=M071S62

NODE=M071S62;LINKAGE=AB

$$\Gamma(\pi^0 f_0(2100) \rightarrow \pi^0 p \bar{p}) / \Gamma_{\text{total}} \quad \Gamma_{46}/\Gamma$$

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT
$1.1 \pm 0.4 \pm 0.1$	76	¹ ALEXANDER	10 CLEO	$\psi(2S) \rightarrow \pi^0 p \bar{p}$

¹ From a fit of the $p \bar{p}$ and $p \pi^0$ mass distributions to a combination of $N_1^*(1440) \bar{p}$, $\pi^0 f_0(2100)$, and two other broad, unestablished resonances.

NODE=M071S51
NODE=M071S51

NODE=M071S51;LINKAGE=AL

$$\Gamma(\eta p \bar{p}) / \Gamma_{\text{total}} \quad \Gamma_{47}/\Gamma$$

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT
6.0 ± 0.4 OUR AVERAGE				

[(5.7 ± 0.6) × 10⁻⁵ OUR 2013 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

NEW

NODE=M071R56;LINKAGE=A
NODE=M071R56;LINKAGE=AB

$$\Gamma(\eta f_0(2100) \rightarrow \eta p \bar{p}) / \Gamma_{\text{total}} \quad \Gamma_{48}/\Gamma$$

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT
$1.2 \pm 0.4 \pm 0.1$	31	¹ ALEXANDER	10 CLEO	$\psi(2S) \rightarrow \eta p \bar{p}$

¹ From a fit of the $p \bar{p}$ and $p \eta$ distributions to a combination of $N^*(1535) \bar{p}$ and $\eta f_0(2100)$.

NODE=M071S52
NODE=M071S52

NODE=M071S52;LINKAGE=AL

$$\Gamma(N(1535)\bar{p} \rightarrow \eta p \bar{p}) / \Gamma_{\text{total}} \quad \Gamma_{49}/\Gamma$$

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT
$4.4 \pm 0.6 \pm 0.3$	123	¹ ALEXANDER	10 CLEO	$\psi(2S) \rightarrow \eta p \bar{p}$

¹ From a fit of the $p \bar{p}$ and $p \eta$ distributions to a combination of $N^*(1535) \bar{p}$ and $\eta f_0(2100)$.

NODE=M071S53
NODE=M071S53

NODE=M071S53;LINKAGE=AL

$$\Gamma(\omega p \bar{p}) / \Gamma_{\text{total}} \quad \Gamma_{50}/\Gamma$$

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

$\Gamma(\phi p \bar{p})/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<0.24	90	BRIERE	05 CLEO	$e^+ e^- \rightarrow \psi(2S) \rightarrow p \bar{p} K^+ K^-$

 Γ_{51}/Γ

NODE=M071R82
 NODE=M071R82

• • • 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;LINKAGE=B3

 $\Gamma(\pi^+ \pi^- p \bar{p})/\Gamma_{\text{total}}$

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	$e^+ e^-$

 Γ_{52}/Γ

NODE=M071R31
 NODE=M071R31

¹ Assuming entirely strong decay.

NODE=M071R;LINKAGE=K

 $\Gamma(p \bar{n} \pi^- \text{ or c.c.})/\Gamma_{\text{total}}$

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	$e^+ e^- \rightarrow \bar{p} \pi^+ X$

 Γ_{53}/Γ

NODE=M071R01
 NODE=M071R01

OCCUR=2

 $\Gamma(p \bar{n} \pi^- \pi^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
3.18±0.50±0.50	135 ± 21	ABLIKIM	06I BES2	$e^+ e^- \rightarrow p \pi^- \pi^0 X$

 Γ_{54}/Γ

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_{56}/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±0.7±1.5		¹ BRIERE	05 CLEO	$e^+ e^- \rightarrow \psi(2S) \rightarrow \text{hadr}$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
10.3±0.8±1.4	201.7	² BRIERE	05 CLEO	$e^+ e^- \rightarrow \psi(2S) \rightarrow \eta 3\pi(\eta \rightarrow \gamma\gamma)$
8.1±1.4±1.6	50.0	² BRIERE	05 CLEO	$e^+ e^- \rightarrow \psi(2S) \rightarrow \eta 3\pi(\eta \rightarrow 3\pi)$

 Γ_{57}/Γ

NODE=M071S07
 NODE=M071S07

OCCUR=2

OCCUR=3

¹ Average of $\eta \rightarrow \gamma\gamma$ and $\eta \rightarrow 3\pi$.

² Not independent from other values reported by BRIERE 05.

NODE=M071S07;LINKAGE=BR
 NODE=M071S07;LINKAGE=BI

 $\Gamma(2(\pi^+ \pi^-) \eta)/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.2±0.6±0.1	16	¹ AUBERT	07AU BABR	10.6 $e^+ e^- \rightarrow 2(\pi^+ \pi^-) \eta \gamma$
¹ AUBERT 07AU quotes $\Gamma_{ee}^{\psi(2S)} \cdot B(\psi(2S) \rightarrow 2(\pi^+ \pi^-) \eta) \cdot B(\eta \rightarrow \gamma\gamma) = 1.2 \pm 0.7 \pm 0.1 \text{ eV}$.				

 Γ_{58}/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±1.6±1.3	12.8	BRIERE	05 CLEO	$e^+ e^- \rightarrow \psi(2S) \rightarrow \text{hadr}$

 Γ_{59}/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±0.5±1.2	386	ABLIKIM	07D BES2	$e^+ e^- \rightarrow \psi(2S)$
12.2±2.2±0.7	37	¹ AUBERT	07AU BABR	10.6 $e^+ e^- \rightarrow \omega \pi^+ \pi^- \gamma$
8.2±0.5±0.7	391	BRIERE	05 CLEO	$e^+ e^- \rightarrow \psi(2S) \rightarrow 2(\pi^+ \pi^-) \pi^0$
4.8±0.6±0.7	100 ± 22	² BAI	03B BES	$\psi(2S) \rightarrow 2(\pi^+ \pi^-) \pi^0$

 Γ_{60}/Γ

NODE=M071R77
 NODE=M071R77

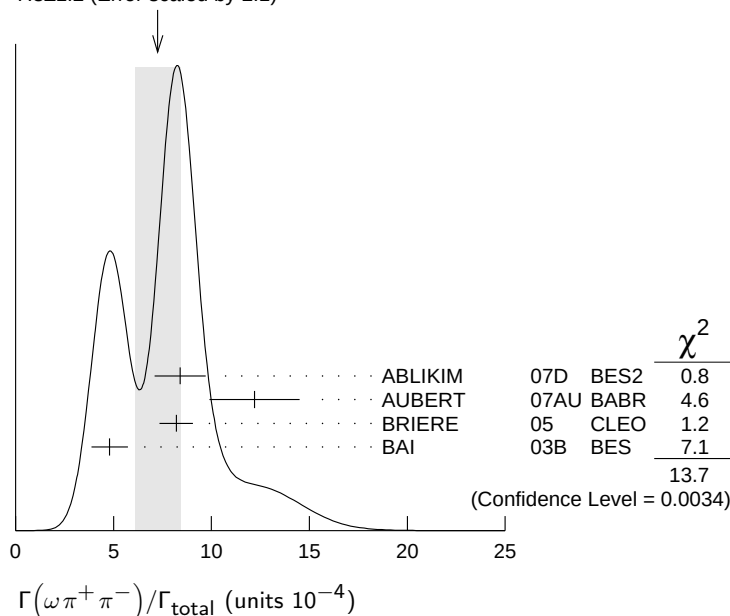
¹ AUBERT 07AU quotes $\Gamma_{ee}^{\psi(2S)} \cdot B(\psi(2S) \rightarrow \omega \pi^+ \pi^-) \cdot B(\omega \rightarrow 3\pi) = 2.69 \pm 0.73 \pm 0.16$ eV.

² Normalized to $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = 0.305 \pm 0.016$.

NODE=M071R77;LINKAGE=UB

NODE=M071R77;LINKAGE=B3

WEIGHTED AVERAGE
7.3±1.2 (Error scaled by 2.1)



$\Gamma(b_1^\pm \pi^\mp)/\Gamma_{\text{total}}$

Γ_{61}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
4.0 ± 0.6 OUR AVERAGE		Error includes scale factor of 1.1.		
5.1 ± 0.6 ± 0.8	202	ABLIKIM	07D BES2	$e^+ e^- \rightarrow \psi(2S)$
4.18 ^{+0.43} _{-0.42} ± 0.92	170	ADAM	05 CLEO	$e^+ e^- \rightarrow \psi(2S)$
3.2 ± 0.6 ± 0.5	61 ± 11	^{1,2} BAI	03B BES	$\psi(2S) \rightarrow 2(\pi^+ \pi^-) \pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
5.2 ± 0.8 ± 1.0		¹ BAI	99C BES	Repl. by BAI 03B

¹ Assuming $B(b_1 \rightarrow \omega \pi)=1$.

² Normalized to $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = 0.305 \pm 0.016$.

NODE=M071R40
NODE=M071R40

NODE=M071R;LINKAGE=M1
NODE=M071R40;LINKAGE=B3

$\Gamma(b_1^0 \pi^0)/\Gamma_{\text{total}}$

Γ_{62}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.35^{+0.47}_{-0.42} ± 0.40	45	ADAM	05 CLEO	$e^+ e^- \rightarrow \psi(2S)$

NODE=M071R21
NODE=M071R21

$\Gamma(\omega f_2(1270))/\Gamma_{\text{total}}$

Γ_{63}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
2.2 ± 0.4 OUR AVERAGE					
2.3 ± 0.5 ± 0.4		57	ABLIKIM	07D BES2	$e^+ e^- \rightarrow \psi(2S)$
2.05 ± 0.41 ± 0.38		62 ± 12	BAI	04C BES2	$\psi(2S) \rightarrow 2(\pi^+ \pi^-) \pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<1.5	90		¹ BAI	03B BES	$\psi(2S) \rightarrow 2(\pi^+ \pi^-) \pi^0$
<1.7	90		BAI	98J BES	Repl. by BAI 03B

¹ Normalized to $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = 0.305 \pm 0.016$.

NODE=M071R64
NODE=M071R64

NODE=M071R64;LINKAGE=B3

$\Gamma(\pi^+ \pi^- K^+ K^-)/\Gamma_{\text{total}}$

Γ_{64}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
7.5 ± 0.9 OUR AVERAGE		Error includes scale factor of 1.9. [(7.5 ± 0.9) × 10 ⁻⁴ OUR 2013 AVERAGE Scale factor = 1.9]		
10.9 ± 1.9 ± 0.2	85	¹ AUBERT	07AK 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		² TANENBAUM	78 MRK1	$e^+ e^-$

NODE=M071R24
NODE=M071R24

NEW

¹ AUBERT 07AK reports $[\Gamma(\psi(2S) \rightarrow \pi^+ \pi^- K^+ K^-)/\Gamma_{\text{total}}] \times [\Gamma(\psi(2S) \rightarrow e^+ e^-)] = (2.56 \pm 0.42 \pm 0.16) \times 10^{-3}$ keV which we divide by our best value $\Gamma(\psi(2S) \rightarrow e^+ e^-) = 2.36 \pm 0.04$ keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² Assuming entirely strong decay.

NODE=M071R24;LINKAGE=BE

NODE=M071R24;LINKAGE=K

$\Gamma(\rho^0 K^+ K^-)/\Gamma_{\text{total}}$					Γ_{65}/Γ
VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT	
$2.2 \pm 0.2 \pm 0.4$	223.8	BRIERE	05	CLEO	$e^+ e^- \rightarrow \psi(2S) \rightarrow K^+ K^- \pi^+ \pi^-$

NODE=M071S09
NODE=M071S09

$\Gamma(K^*(892)^0 \bar{K}_2^*(1430)^0)/\Gamma_{\text{total}}$					Γ_{66}/Γ
VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$1.86 \pm 0.32 \pm 0.43$	93 $\pm$ 16	BAI	04C		$\psi(2S) \rightarrow K^+ K^- \pi^+ \pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<1.2	90	BAI	98J	BES	$e^+ e^-$

NODE=M071R66
NODE=M071R66

$\Gamma(K^+ K^- \pi^+ \pi^- \eta)/\Gamma_{\text{total}}$					Γ_{67}/Γ
VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT	
$1.3 \pm 0.7 \pm 0.1$	7	¹ AUBERT	07AU	BABR	$10.6 e^+ e^- \rightarrow K^+ K^- \pi^+ \pi^- \eta \gamma$
¹ AUBERT 07AU quotes $\Gamma_{ee}^{\psi(2S)} \cdot B(\psi(2S) \rightarrow 2(\pi^+ \pi^-) \eta) \cdot B(\eta \rightarrow \gamma \gamma) = 1.2 \pm 0.7 \pm 0.1$ eV.					

NODE=M071S39
NODE=M071S39

NODE=M071S39;LINKAGE=UB

$\Gamma(K^+ K^- 2(\pi^+ \pi^-) \pi^0)/\Gamma_{\text{total}}$					Γ_{68}/Γ
VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT	
$10.0 \pm 2.5 \pm 1.8$	65	ABLIKIM	07D	BES2	$e^+ e^- \rightarrow \psi(2S)$

NODE=M071R09
NODE=M071R09

$\Gamma(K_1(1270)^\pm K^\mp)/\Gamma_{\text{total}}$					Γ_{70}/Γ
VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT		
$10.0 \pm 1.8 \pm 2.1$	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_{71}/Γ
VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT	
$2.20 \pm 0.25 \pm 0.37$	83 $\pm$ 9	ABLIKIM	050	BES2	$e^+ e^- \rightarrow \psi(2S)$

NODE=M071R49
NODE=M071R49

$\Gamma(\rho^0 p \bar{p})/\Gamma_{\text{total}}$					Γ_{72}/Γ
VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT	
$0.5 \pm 0.1 \pm 0.2$	61.1	BRIERE	05	CLEO	$e^+ e^- \rightarrow \psi(2S) \rightarrow p \bar{p} \pi^+ \pi^-$

NODE=M071S14
NODE=M071S14

$\Gamma(K^+ \bar{K}^*(892)^0 \pi^- + \text{c.c.})/\Gamma_{\text{total}}$					Γ_{73}/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_{74}/Γ
VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT	
2.4 ± 0.6 OUR AVERAGE	Error includes scale factor of 2.2.				
$2.2 \pm 0.2 \pm 0.2$	308	BRIERE	05	CLEO	$e^+ e^- \rightarrow \psi(2S) \rightarrow 2(\pi^+ \pi^-)$
4.5 ± 1.0		TANENBAUM	78	MRK1	$e^+ e^-$

NODE=M071R27
NODE=M071R27

$\Gamma(\rho^0 \pi^+ \pi^-)/\Gamma_{\text{total}}$					Γ_{75}/Γ
VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT	
2.2 ± 0.6 OUR AVERAGE	Error includes scale factor of 1.4.				
$2.0 \pm 0.2 \pm 0.4$	285.5	BRIERE	05	CLEO	$e^+ e^- \rightarrow \psi(2S) \rightarrow 2(\pi^+ \pi^-)$
4.2 ± 1.5		TANENBAUM	78	MRK1	$e^+ e^-$

NODE=M071R33
NODE=M071R33

$\Gamma(K^+ K^- \pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}$ Γ_{76}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
12.6±0.9 OUR AVERAGE				
18.6±5.7±0.3	32	¹ AUBERT	07AU BABR	$10.6 e^+ e^- \rightarrow K^+ K^- \pi^+ \pi^- \pi^0 \gamma$
11.7±1.0±1.5	597	ABLIKIM	06G BES2	$\psi(2S) \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$
12.7±0.5±1.0	711.6	BRIERE	05 CLEO	$e^+ e^- \rightarrow \psi(2S) \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$

¹ AUBERT 07AU reports $[\Gamma(\psi(2S) \rightarrow K^+ K^- \pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}] \times [\Gamma(\psi(2S) \rightarrow e^+ e^-)] = (44 \pm 13 \pm 3) \times 10^{-4}$ keV which we divide by our best value $\Gamma(\psi(2S) \rightarrow e^+ e^-) = 2.36 \pm 0.04$ keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M071S10
NODE=M071S10

NODE=M071S10;LINKAGE=UB

 $\Gamma(\omega f_0(1710) \rightarrow \omega K^+ K^-)/\Gamma_{\text{total}}$ Γ_{77}/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_{78}/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_{79}/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_{80}/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

 $\Gamma(K^*(892)^0 K^- \rho^+ + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{81}/Γ

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

 $\Gamma(\eta K^+ K^- , \text{no } \eta\phi)/\Gamma_{\text{total}}$ Γ_{82}/Γ

<u>VALUE (units 10^{-5})</u>	<u>CL%</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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

 $\Gamma(\omega K^+ K^-)/\Gamma_{\text{total}}$ Γ_{83}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.85±0.25 OUR AVERAGE				Error includes scale factor of 1.1.
2.38±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	23.0 ± 5.2	¹ BAI	03B BES	$\psi(2S) \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$

¹ Normalized to $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = 0.305 \pm 0.016$.

NODE=M071R78
NODE=M071R78

NODE=M071R78;LINKAGE=B3

 $\Gamma(\omega K^*(892)^+ K^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{84}/Γ

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

$\Gamma(\omega K_2^*(1430)^+ K^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{85}/Γ NODE=M071S68
NODE=M071S68

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
6.1 $\pm$ 1.2 OUR AVERAGE				
6.39 $\pm$ 1.50 $\pm$ 0.78	128	ABLIKIM	13M BES3	$\psi(2S) \rightarrow \omega K_S^0 K^- \pi^+$
5.86 $\pm$ 1.61 $\pm$ 0.83	143	ABLIKIM	13M BES3	$\psi(2S) \rightarrow \omega K^+ K^- \pi^0$

OCCUR=2

 $\Gamma(\omega \bar{K}^*(892)^0 K^0)/\Gamma_{\text{total}}$ Γ_{86}/Γ NODE=M071S69
NODE=M071S69

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
16.8 $\pm$ 2.5 $\pm$ 1.6	356	ABLIKIM	13M BES3	$\psi(2S) \rightarrow \omega K_S^0 K^- \pi^+$

 $\Gamma(\omega \bar{K}_2^*(1430)^0 K^0)/\Gamma_{\text{total}}$ Γ_{87}/Γ NODE=M071S70
NODE=M071S70

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
5.82 $\pm$ 2.08 $\pm$ 0.72	116	ABLIKIM	13M BES3	$\psi(2S) \rightarrow \omega K_S^0 K^- \pi^+$

 $\Gamma(\omega X(1440) \rightarrow \omega K_S^0 K^- \pi^+ + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{88}/Γ NODE=M071S71
NODE=M071S71

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
1.60 $\pm$ 0.27 $\pm$ 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;LINKAGE=AB

 $\Gamma(\omega X(1440) \rightarrow \omega K^+ K^- \pi^0)/\Gamma_{\text{total}}$ Γ_{89}/Γ NODE=M071S72
NODE=M071S72

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
1.09 $\pm$ 0.20 $\pm$ 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;LINKAGE=AB

 $\Gamma(\omega f_1(1285) \rightarrow \omega K_S^0 K^- \pi^+ + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{90}/Γ NODE=M071S73
NODE=M071S73

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
0.302 $\pm$ 0.098 $\pm$ 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;LINKAGE=AB

 $\Gamma(\omega f_1(1285) \rightarrow \omega K^+ K^- \pi^0)/\Gamma_{\text{total}}$ Γ_{91}/Γ NODE=M071S74
NODE=M071S74

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
0.125 $\pm$ 0.070 $\pm$ 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;LINKAGE=AB

 $\Gamma(3(\pi^+ \pi^-))/\Gamma_{\text{total}}$ Γ_{92}/Γ NODE=M071R32
NODE=M071R32

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 $\pm$ 1.0		¹ TANENBAUM	78 MRK1	$e^+ e^-$

¹ Assuming entirely strong decay.

NODE=M071R32;LINKAGE=K

 $\Gamma(p\bar{p}\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{93}/Γ NODE=M071S15
NODE=M071S15

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
7.3 $\pm$ 0.4 $\pm$ 0.6	434.9	BRIERE	05 CLEO	$e^+ e^- \rightarrow \psi(2S) \rightarrow p\bar{p}\pi^+\pi^-\pi^0$

 $\Gamma(K^+ K^-)/\Gamma_{\text{total}}$ Γ_{94}/Γ NODE=M071R23
NODE=M071R23

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
7.1 $\pm$ 0.5 OUR AVERAGE					Error includes scale factor of 1.5.
7.48 $\pm$ 0.23 $\pm$ 0.39		1.3k	¹ METREVELI	12	$\psi(2S) \rightarrow K^+ K^-$
6.3 $\pm$ 0.6 $\pm$ 0.3			DOBBS	06A CLEO	$e^+ e^-$
10 $\pm$ 7			BRANDELIK	79C DASP	$e^+ e^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 5 90 FELDMAN 77 MRK1 $e^+ e^-$ ¹ Obtained by analyzing CLEO-c data but not authored by the CLEO Collaboration.

NODE=M071R23;LINKAGE=ME

$\Gamma(K_S^0 K_L^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_{95}/Γ
5.34 ± 0.33 OUR AVERAGE					
$5.28 \pm 0.25 \pm 0.34$	478 ± 23	¹ METREVELI	12	$\psi(2S) \rightarrow K_S^0 K_L^0$	
$5.8 \pm 0.8 \pm 0.4$		DOBBS	06A CLEO	$e^+ e^-$	
$5.24 \pm 0.47 \pm 0.48$	156 ± 14	² BAI	04B BES2	$\psi(2S) \rightarrow K_S^0 K_L^0 \rightarrow \pi^+ \pi^- X$	

¹ Obtained by analyzing CLEO-c data but not authored by the CLEO Collaboration.

² Using $B(K_S^0 \rightarrow \pi^+ \pi^-) = 0.6860 \pm 0.0027$.

NODE=M071R87
NODE=M071R87

NODE=M071R87;LINKAGE=ME
NODE=M071R;LINKAGE=KZ

 $\Gamma(\pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_{96}/Γ
2.01 ± 0.17 OUR AVERAGE	Error includes scale factor of 1.7. See the ideogram below.				
$2.14 \pm 0.03^{+0.12}_{-0.11}$	7k	¹ ABLIKIM	12H BES3	$e^+ e^- \rightarrow \psi(2S)$	
$1.81 \pm 0.18 \pm 0.19$	260 ± 19	² ABLIKIM	05J BES2	$e^+ e^- \rightarrow \psi(2S)$	
$1.88^{+0.16}_{-0.15} \pm 0.28$	194	ADAM	05 CLEO	$e^+ e^- \rightarrow \psi(2S)$	
0.85 ± 0.46	4	FRANKLIN	83 MRK2	$e^+ e^- \rightarrow \text{hadrons}$	

¹ From $\psi(2S) \rightarrow \pi^+ \pi^- \pi^0$ events directly. The quoted systematic error includes a contribution of 4% (added in quadrature) from the uncertainty on the number of $\psi(2S)$ events.

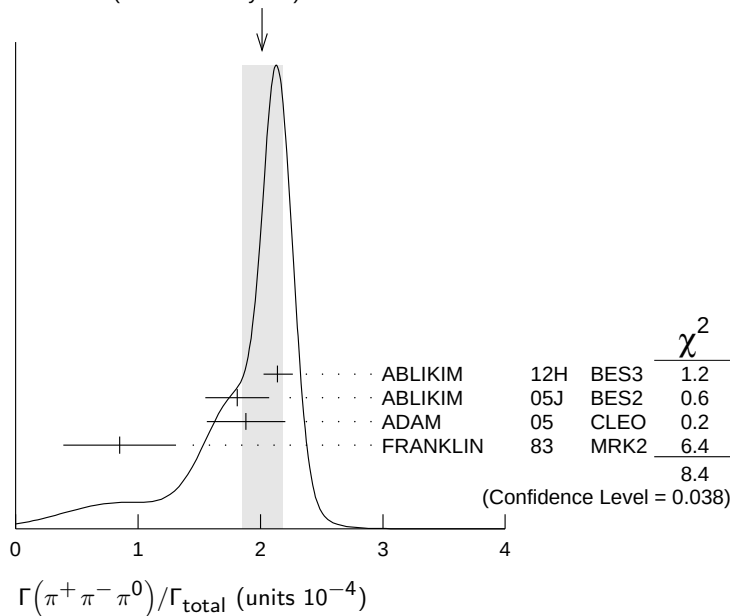
² From a PW analysis of $\psi(2S) \rightarrow \pi^+ \pi^- \pi^0$.

NODE=M071R36
NODE=M071R36

NODE=M071R36;LINKAGE=AB

NODE=M071R;LINKAGE=AK

WEIGHTED AVERAGE
 2.01 ± 0.17 (Error scaled by 1.7)

 $\Gamma(\rho(2150)\pi \rightarrow \pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT	Γ_{97}/Γ
$1.94 \pm 0.25^{+1.15}_{-0.34}$	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

 $\Gamma(\rho(770)\pi \rightarrow \pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_{98}/Γ
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_{99}/Γ

VALUE (units 10^{-5})	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
0.78±0.26 OUR AVERAGE					
0.76±0.25±0.06	30	1	METREVELI	12	$\psi(2S) \rightarrow \pi^+\pi^-$
8 ±5			BRANDELIK	79C	DASP e^+e^-
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<2.1	90		DOBBS	06A	CLEO $e^+e^- \rightarrow \psi(2S)$
<5	90		FELDMAN	77	MRK1 e^+e^-

¹ Obtained by analyzing CLEO-c data but not authored by the CLEO Collaboration. Using $\psi(3770) \rightarrow \pi^+\pi^-$ for continuum subtraction.

NODE=M071R20
NODE=M071R20

NODE=M071R20;LINKAGE=ME

 $\Gamma(K_1(1400)^\pm K^\mp)/\Gamma_{\text{total}}$ Γ_{100}/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_{101}/Γ

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT
7.12±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_{102}/Γ

VALUE (units 10^{-5})	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
4.07±0.16±0.26					
0.9k			ABLIKIM	12L	BES3 $e^+e^- \rightarrow \psi(2S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<8.9	90	1	FRANKLIN	83	MRK2 $e^+e^- \rightarrow \text{hadrons}$

NODE=M071R38
NODE=M071R38

 $\Gamma(K^+K^*(892)^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{103}/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±0.30 ^{+0.26} _{-0.31}	0.2k		ABLIKIM	12L	BES3 $e^+e^- \rightarrow \psi(2S)$
2.9 ^{+1.3} _{-1.7} ± 0.4	9.6 ± 4.2		ABLIKIM	05I	BES2 $e^+e^- \rightarrow \psi(2S)$
1.3 ^{+1.0} _{-0.7} ± 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_{104}/Γ

<u>VALUE (units 10^{-5})</u>	<u>EVTs</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
10.9±2.0 OUR AVERAGE				
13.3 ^{+2.4} _{-2.8} ±1.7	65.6 ± 9.0	ABLIKIM	05I BES2	$e^+e^- \rightarrow \psi(2S)$
9.2 ^{+2.7} _{-2.2} ±0.9	25	ADAM	05 CLEO	$e^+e^- \rightarrow \psi(2S)$

NODE=M071R30
NODE=M071R30

 $\Gamma(K^+K^*(892)^- + \text{c.c.})/\Gamma(K^*(892)^0 \bar{K}^0 + \text{c.c.})$ $\Gamma_{103}/\Gamma_{104}$

VALUE	DOCUMENT ID	TECN	COMMENT
0.16±0.06 OUR AVERAGE			
0.22 ^{+0.10} _{-0.14}	ABLIKIM	05I	BES2 $e^+e^- \rightarrow \psi(2S)$
0.14 ^{+0.08} _{-0.06}	ADAM	05	CLEO $e^+e^- \rightarrow \psi(2S)$

NODE=M071R46
NODE=M071R46

 $\Gamma(\phi\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{105}/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
1.17±0.29 OUR AVERAGE Error includes scale factor of 1.7.				
2.42±0.95±0.04	10 ± 4	^{1,2} AUBERT	07AK	BABR $10.6 e^+e^- \rightarrow \pi^+\pi^- K^+K^-\gamma$
0.9 ± 0.2 ± 0.1	47.6	BRIERE	05	CLEO $e^+e^- \rightarrow \psi(2S) \rightarrow K^+K^-\pi^+\pi^-$
1.5 ± 0.2 ± 0.2	51.5 ± 8.3	³ BAI	03B	BES $\psi(2S) \rightarrow K^+K^-\pi^+\pi^-$

¹ AUBERT 07AK reports $[\Gamma(\psi(2S) \rightarrow \phi\pi^+\pi^-)/\Gamma_{\text{total}}] \times [\Gamma(\psi(2S) \rightarrow e^+e^-)] = (0.57 \pm 0.22 \pm 0.04) \times 10^{-3}$ keV which we divide by our best value $\Gamma(\psi(2S) \rightarrow e^+e^-) = 2.36 \pm 0.04$ keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² Using $B(\phi \rightarrow K^+K^-) = (49.3 \pm 0.6)\%$.

³ Normalized to $B(\psi(2S) \rightarrow J/\psi\pi^+\pi^-) = 0.305 \pm 0.016$.

NODE=M071R80
NODE=M071R80

NODE=M071R80;LINKAGE=BE

NODE=M071R80;LINKAGE=UB
NODE=M071R80;LINKAGE=B3

$\Gamma(\phi f_0(980) \rightarrow \pi^+ \pi^-) / \Gamma_{\text{total}}$ Γ_{106}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
0.68 ± 0.24 OUR AVERAGE		Error includes scale factor of 1.1.		
$1.44 \pm 0.70 \pm 0.02$	6 ± 3	^{1,2} AUBERT	07AK BABR	$10.6 e^+ e^- \rightarrow \pi^+ \pi^- K^+ K^- \gamma$
$0.6 \pm 0.2 \pm 0.1$	18.4 ± 6.4	³ BAI	03B BES	$\psi(2S) \rightarrow K^+ K^- \pi^+ \pi^-$
¹ AUBERT 07AK reports $[\Gamma(\psi(2S) \rightarrow \phi f_0(980) \rightarrow \pi^+ \pi^-) / \Gamma_{\text{total}}] \times [\Gamma(\psi(2S) \rightarrow e^+ e^-)] = (0.34 \pm 0.16 \pm 0.04) \times 10^{-3}$ keV which we divide by our best value $\Gamma(\psi(2S) \rightarrow e^+ e^-) = 2.36 \pm 0.04$ keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.				
² Using $B(\phi \rightarrow K^+ K^-) = (49.3 \pm 0.6)\%$.				
³ Normalized to $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = 0.305 \pm 0.016$.				

NODE=M071R83
 NODE=M071R83

NODE=M071R83;LINKAGE=BE

NODE=M071R83;LINKAGE=UB
 NODE=M071R83;LINKAGE=B3

 $\Gamma(2(K^+ K^-)) / \Gamma_{\text{total}}$ Γ_{107}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$0.6 \pm 0.1 \pm 0.1$	59.2	BRIERE	05 CLEO	$e^+ e^- \rightarrow \psi(2S) \rightarrow 2(K^+ K^-)$

NODE=M071S12
 NODE=M071S12

 $\Gamma(\phi K^+ K^-) / \Gamma_{\text{total}}$ Γ_{108}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
0.70 ± 0.16 OUR AVERAGE				
$0.8 \pm 0.2 \pm 0.1$	36.8	BRIERE	05 CLEO	$e^+ e^- \rightarrow \psi(2S) \rightarrow 2(K^+ K^-)$
$0.6 \pm 0.2 \pm 0.1$	16.1 ± 5.0	¹ BAI	03B BES	$\psi(2S) \rightarrow 2(K^+ K^-)$
¹ Normalized to $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = 0.305 \pm 0.016$.				

NODE=M071R81
 NODE=M071R81

NODE=M071R81;LINKAGE=B3

 $\Gamma(2(K^+ K^-) \pi^0) / \Gamma_{\text{total}}$ Γ_{109}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.1 \pm 0.2 \pm 0.2$	44.7	BRIERE	05 CLEO	$e^+ e^- \rightarrow \psi(2S) \rightarrow 2(K^+ K^-) \pi^0$

NODE=M071S13
 NODE=M071S13

 $\Gamma(\phi \eta) / \Gamma_{\text{total}}$ Γ_{110}/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_{111}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
$3.1 \pm 1.4 \pm 0.7$	8	¹ ABLIKIM	04K BES	$e^+ e^- \rightarrow \psi(2S)$
¹ Calculated combining $\eta' \rightarrow \gamma \rho$ and $\eta \pi^+ \pi^-$ channels.				

NODE=M071R90
 NODE=M071R90

NODE=M071R90;LINKAGE=AI

 $\Gamma(\omega \eta') / \Gamma_{\text{total}}$ Γ_{112}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
$3.2^{+2.4}_{-2.0} \pm 0.7$	4	¹ ABLIKIM	04K BES	$e^+ e^- \rightarrow \psi(2S)$
¹ Calculated combining $\eta' \rightarrow \gamma \rho$ and $\eta \pi^+ \pi^-$ channels.				

NODE=M071R91
 NODE=M071R91

NODE=M071R91;LINKAGE=AI

 $\Gamma(\omega \pi^0) / \Gamma_{\text{total}}$ Γ_{113}/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_{114}/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_{115}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
2.2 ± 0.6 OUR AVERAGE		Error includes scale factor of 1.1.		

NODE=M071R94
 NODE=M071R94

$3.0^{+1.1}_{-0.9} \pm 0.2$	18	ADAM	05	CLEO	$e^+e^- \rightarrow \psi(2S)$
$1.78^{+0.67}_{-0.62} \pm 0.17$	13	ABLIKIM	04L	BES	$e^+e^- \rightarrow \psi(2S)$

 $\Gamma(\omega\eta)/\Gamma_{\text{total}}$ Γ_{116}/Γ

<u>VALUE (units 10^{-5})</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<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_{117}/Γ

<u>VALUE (units 10^{-5})</u>	<u>CL%</u>	<u>DOCUMENT ID</u>		<u>TECN</u>	<u>COMMENT</u>
<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_{118}/Γ

<u>VALUE (units 10^{-3})</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<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_{119}/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_{120}/Γ

<i>VALUE</i> (units 10^{-4})	<i>EVTS</i>	<i>DOCUMENT ID</i>	<i>TECN</i>	<i>COMMENT</i>
0.81±0.11±0.14	50	¹ ABLIKIM	08C	BES2
				$e^+e^- \rightarrow J/\psi$

NODE=M071R08
 NODE=M071R08

¹ Using $B(\bar{\Lambda} \rightarrow \bar{p}\pi^+) = 63.9\%$ and $B(K_S^0 \rightarrow \pi^+\pi^-) = 69.2\%$.

NODE=M071R08;LINKAGE=AB

 $\Gamma(\phi f_2'(1525))/\Gamma_{\text{total}}$ Γ_{121}/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_{122}/Γ

<u>VALUE (units 10⁻⁵)</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<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_{123}/Γ

<u>VALUE (units 10^{-5})</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<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_{124}/Γ

<u>VALUE (units 10^{-5})</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<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_{125}/Γ

<u>VALUE (units 10⁻⁵)</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<2.6	90	BAI	04G	BES2
				e ⁺ e ⁻

NODE=M071S04
 NODE=M071S04

 $\Gamma(\bar{\Theta}(1540)K_S^0p \rightarrow K_S^0pK^-\bar{n})/\Gamma_{\text{total}}$ Γ_{126}/Γ

<u>VALUE (units 10^{-5})</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<0.60	90	BAI	04G	BES2
				$e^+ e^-$

NODE=M071S05
 NODE=M071S05

$\Gamma(K_S^0 K_S^0)/\Gamma_{\text{total}}$ Γ_{127}/Γ VALUE (units 10^{-4})

DOCUMENT ID

TECN

COMMENT

<0.046

¹ BAI

04D

BES

 $e^+ e^-$ ¹ Forbidden by CP.NODE=M071R88
NODE=M071R88

NODE=M071R;LINKAGE=BA

NODE=M071315

NODE=M071R55
NODE=M071R55

NEW

NODE=M071R;LINKAGE=A

NODE=M071R58
NODE=M071R58

NEW

NODE=M071R;LINKAGE=G
NODE=M071R;LINKAGE=BNODE=M071R59
NODE=M071R59

NEW

NODE=M071R;LINKAGE=F
NODE=M071R59;LINKAGE=BNODE=M071R19
NODE=M071R19

NODE=M071R;LINKAGE=AH

NODE=M071R97
NODE=M071R97

NODE=M071R97;LINKAGE=AH

NODE=M071R98
NODE=M071R98

NODE=M071R98;LINKAGE=AH

NODE=M071R99
NODE=M071R99

NODE=M071R99;LINKAGE=AH

RADIATIVE DECAYS

 $\Gamma(\gamma\chi_{c0}(1P))/\Gamma_{\text{total}}$ Γ_{128}/Γ VALUE (units 10^{-2})

EVTS

DOCUMENT ID

TECN

COMMENT

9.99±0.27 OUR FIT[(9.84 ± 0.31) × 10⁻² OUR 2013 FIT]**9.2 ± 0.4 OUR AVERAGE**

9.22±0.11±0.46

72600

ATHAR

04

CLEO

 $e^+ e^- \rightarrow \gamma X$

9.9 ± 0.5 ± 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+cos²θ) assumed. $\Gamma(\gamma\chi_{c1}(1P))/\Gamma_{\text{total}}$ Γ_{129}/Γ VALUE (units 10^{-2})

EVTS

DOCUMENT ID

TECN

COMMENT

9.55±0.31 OUR FIT[(9.3 ± 0.4) × 10⁻² OUR 2013 FIT]**8.9 ± 0.5 OUR AVERAGE**

9.07±0.11±0.54

76700

ATHAR

04

CLEO

 $e^+ e^- \rightarrow \gamma X$

9.0 ± 0.5 ± 0.7

¹ GAISER

86

CBAL

 $e^+ e^- \rightarrow \gamma X$

7.1 ± 1.9

² BIDDICK

77

CNTR

 $e^+ e^- \rightarrow \gamma X$ ¹ Angular distribution (1-0.189 cos²θ) assumed.² Valid for isotropic distribution of the photon. $\Gamma(\gamma\chi_{c2}(1P))/\Gamma_{\text{total}}$ Γ_{130}/Γ VALUE (units 10^{-2})

EVTS

DOCUMENT ID

TECN

COMMENT

9.11±0.31 OUR FIT[(8.76 ± 0.34) × 10⁻² OUR 2013 FIT]**8.8 ± 0.5 OUR AVERAGE** Error includes scale factor of 1.1.

9.33±0.14±0.61

79300

ATHAR

04

CLEO

 $e^+ e^- \rightarrow \gamma X$

8.0 ± 0.5 ± 0.7

¹ GAISER

86

CBAL

 $e^+ e^- \rightarrow \gamma X$

7.0 ± 2.0

² BIDDICK

77

CNTR

 $e^+ e^- \rightarrow \gamma X$ ¹ Angular distribution (1-0.052 cos²θ) assumed.² Valid for isotropic distribution of the photon. $[\Gamma(\gamma\chi_{c0}(1P)) + \Gamma(\gamma\chi_{c1}(1P)) + \Gamma(\gamma\chi_{c2}(1P))]/\Gamma_{\text{total}} (\Gamma_{128} + \Gamma_{129} + \Gamma_{130})/\Gamma$

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(γχ_{cJ}). $\Gamma(\gamma\chi_{c0}(1P))/\Gamma(\gamma\chi_{c1}(1P))$ $\Gamma_{128}/\Gamma_{129}$

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(γχ_{cJ}). $\Gamma(\gamma\chi_{c2}(1P))/\Gamma(\gamma\chi_{c1}(1P))$ $\Gamma_{130}/\Gamma_{129}$

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(γχ_{cJ}). $\Gamma(\gamma\chi_{c0}(1P))/\Gamma(\gamma\chi_{c2}(1P))$ $\Gamma_{128}/\Gamma_{130}$

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(γχ_{cJ}).

$\Gamma(\gamma\eta_c(1S))/\Gamma_{\text{total}}$ Γ_{131}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
0.34 $\pm$ 0.05 OUR AVERAGE		Error includes scale factor of 1.3. See the ideogram below.		
0.432 $\pm$ 0.016 $\pm$ 0.060		MITCHELL	09 CLEO	$e^+e^- \rightarrow \gamma X$
0.32 $\pm$ 0.04 $\pm$ 0.06	2560	¹ ATHAR	04 CLEO	$e^+e^- \rightarrow \gamma X$
0.28 $\pm$ 0.06		² GAISER	86 CBAL	$e^+e^- \rightarrow \gamma X$

¹ ATHAR 04 used $\Gamma_{\eta_c(1S)} = 24.8 \pm 4.9$ MeV to obtain this result.

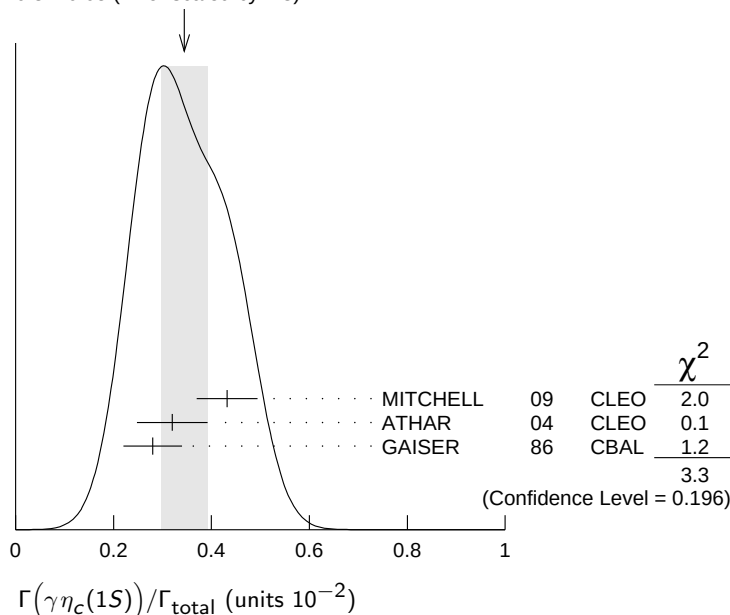
² GAISER 86 used $\Gamma_{\eta_c(1S)} = 11.5 \pm 4.5$ MeV to obtain this result.

NODE=M071R60
NODE=M071R60

NODE=M071R60;LINKAGE=AT

NODE=M071R60;LINKAGE=GA

WEIGHTED AVERAGE
0.34 $\pm$ 0.05 (Error scaled by 1.3)

 $\Gamma(\gamma\eta_c(2S))/\Gamma_{\text{total}}$ Γ_{132}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
7 $\pm$ 2 $\pm$ 4		¹ ABLIKIM	12G BES3	$\psi(2S) \rightarrow \gamma K^0 K \pi, K K \pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
< 8	90	² CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma K \bar{K} \pi$
< 20	90	ATHAR	04 CLEO	$e^+e^- \rightarrow \gamma X$
20-130	95	EDWARDS	82C CBAL	$e^+e^- \rightarrow \gamma X$

¹ ABLIKIM 12G reports $[\Gamma(\psi(2S) \rightarrow \gamma\eta_c(2S))/\Gamma_{\text{total}}] \times [B(\eta_c(2S) \rightarrow K\bar{K}\pi)] = (1.30 \pm 0.20 \pm 0.30) \times 10^{-5}$ which we divide by our best value $B(\eta_c(2S) \rightarrow K\bar{K}\pi) = (1.9 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² CRONIN-HENNESSY 10 reports $[\Gamma(\psi(2S) \rightarrow \gamma\eta_c(2S))/\Gamma_{\text{total}}] \times [B(\eta_c(2S) \rightarrow K\bar{K}\pi)] < 14.5 \times 10^{-6}$ which we divide by our best value $B(\eta_c(2S) \rightarrow K\bar{K}\pi) = 1.9 \times 10^{-2}$. This measurement assumes $\Gamma(\eta_c(2S)) = 14$ MeV. CRONIN-HENNESSY 10 gives the analytic dependence of limits on width.

NODE=M071R62
NODE=M071R62

NODE=M071R62;LINKAGE=AB

NODE=M071R62;LINKAGE=CR

 $\Gamma(\gamma\pi^0)/\Gamma_{\text{total}}$ Γ_{133}/Γ

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
1.58 $\pm$ 0.40 $\pm$ 0.13		37	ABLIKIM	10F BES3	$\psi(2S) \rightarrow \gamma\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 5	90		PEDLAR	09 CLE3	$\psi(2S) \rightarrow \gamma X$
< 5400	95		¹ LIBERMAN	75 SPEC	e^+e^-
< 1×10^4	90		WIIK	75 DASP	e^+e^-

¹ Restated by us using $B(\psi(2S) \rightarrow \mu^+\mu^-) = 0.0077$.

NODE=M071R42
NODE=M071R42

NODE=M071R;LINKAGE=U

$\Gamma(\gamma\eta'(958))/\Gamma_{\text{total}}$ Γ_{134}/Γ VALUE (units 10^{-4}) CL% EVTS

DOCUMENT ID

TECN

COMMENT

1.23±0.06 OUR AVERAGE

1.26±0.03±0.08	2226	¹ ABLIKIM	10F	BES3	$\psi(2S) \rightarrow 3\gamma\pi^+\pi^-$, $2\gamma\pi^+\pi^-$
1.19±0.08±0.03		PEDLAR	09	CLE3	$\psi(2S) \rightarrow \gamma X$
1.24±0.27±0.15	23	ABLIKIM	06R	BES2	$e^+e^- \rightarrow \psi(2S)$
1.54±0.31±0.20	~ 43	BAI	98F	BES	$\psi(2S) \rightarrow \pi^+\pi^-2\gamma$, $\pi^+\pi^-3\gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 60	90	² BRAUNSC...	77	DASP	e^+e^-
< 11	90	³ BARTEL	76	CNTR	e^+e^-

¹ Combining the results from $\eta' \rightarrow \pi^+\pi^-\eta$ and $\eta' \rightarrow \pi^+\pi^-\gamma$ decay modes.² Restated by us using total decay width 228 keV.³ The value is normalized to the branching ratio for $\Gamma(J/\psi(1S)\eta)/\Gamma_{\text{total}}$.NODE=M071R44
NODE=M071R44NODE=M071R44;LINKAGE=AB
NODE=M071R;LINKAGE=R
NODE=M071R;LINKAGE=C $\Gamma(\gamma f_2(1270))/\Gamma_{\text{total}}$ Γ_{135}/Γ VALUE (units 10^{-4}) EVTS

DOCUMENT ID

TECN

COMMENT

2.12±0.19±0.32

• • • We do not use the following data for averages, fits, limits, etc. • • •

2.08±0.19±0.33	200.6 ± 18.8	¹ BAI	03C	BES	$\psi(2S) \rightarrow \gamma\pi^+\pi^-$
2.90±1.08±1.07	29.9 ± 11.1	¹ BAI	03C	BES	$\psi(2S) \rightarrow \gamma\pi^0\pi^0$

¹ Normalized to $B(\psi(2S) \rightarrow J/\psi\pi^+\pi^-) = 0.305 \pm 0.016$.² Combining the results from $\pi^+\pi^-$ and $\pi^0\pi^0$ decay modes.NODE=M071R84
NODE=M071R84OCCUR=2
OCCUR=3NODE=M071R;LINKAGE=3B
NODE=M071R;LINKAGE=B9 $\Gamma(\gamma f_0(1710) \rightarrow \gamma\pi\pi)/\Gamma_{\text{total}}$ Γ_{137}/Γ VALUE (units 10^{-4}) EVTS

DOCUMENT ID

TECN

COMMENT

0.301±0.041±0.124

35.6 ± 4.8	¹ BAI	03C	BES	$\psi(2S) \rightarrow \gamma\pi^+\pi^-$

¹ Normalized to $B(\psi(2S) \rightarrow J/\psi\pi^+\pi^-) = 0.305 \pm 0.016$.NODE=M071R85
NODE=M071R85

NODE=M071R85;LINKAGE=3B

 $\Gamma(\gamma f_0(1710) \rightarrow \gamma K\bar{K})/\Gamma_{\text{total}}$ Γ_{138}/Γ VALUE (units 10^{-4}) CL% EVTS

DOCUMENT ID

TECN

COMMENT

0.604±0.090±0.132

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 1.56	90	6.8 ± 3.1	^{1,2} BAI	03C	BES	$\psi(2S) \rightarrow \gamma K_S^0 K_S^0$

¹ Includes unknown branching fractions to K^+K^- or $K_S^0 K_S^0$. We have multiplied the K^+K^- result by a factor of 2 and the $K_S^0 K_S^0$ result by a factor of 4 to obtain the $K\bar{K}$ result.² Normalized to $B(\psi(2S) \rightarrow J/\psi\pi^+\pi^-) = 0.305 \pm 0.016$.NODE=M071R86
NODE=M071R86

OCCUR=2

NODE=M071R;LINKAGE=CK

NODE=M071R86;LINKAGE=3B

 $\Gamma(\gamma\eta)/\Gamma_{\text{total}}$ Γ_{140}/Γ VALUE (units 10^{-6}) CL% EVTS

DOCUMENT ID

TECN

COMMENT

1.38±0.48±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_{141}/Γ VALUE (units 10^{-4}) EVTS

DOCUMENT ID

TECN

COMMENT

8.71±1.25±1.64

418	ABLIKIM	06R	BES2	$\psi(2S) \rightarrow \gamma\eta\pi^+\pi^-$

NODE=M071R04
NODE=M071R04 $\Gamma(\gamma\eta(1405) \rightarrow \gamma K\bar{K}\pi)/\Gamma_{\text{total}}$ Γ_{143}/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_{144}/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_{146}/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_{147}/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_{148}/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_{149}/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_{150}/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_{151}/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_{152}/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_{153}/Γ

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT
3.9 ± 0.5 OUR AVERAGE				Error includes scale factor of 2.0.
$4.18 \pm 0.26 \pm 0.18$	348	¹ ALEXANDER	10	CLEO $\psi(2S) \rightarrow \gamma p\bar{p}$
$2.9 \pm 0.4 \pm 0.4$	142	ABLIKIM	07D	BES2 $e^+e^- \rightarrow \psi(2S)$

NODE=M071S33
 NODE=M071S33

¹ From a fit of the $p\bar{p}$ mass distribution to a combination of $\gamma f_2(1950)$, $\gamma f_2(2150)$, and $\gamma p\bar{p}$ phase space, for $M(p\bar{p}) < 2.85$ GeV, and accounting for backgrounds from $\psi(2S) \rightarrow \pi^0 p\bar{p}$ and continuum.

NODE=M071S33;LINKAGE=AL

 $\Gamma(\gamma f_2(1950) \rightarrow \gamma p\bar{p})/\Gamma_{\text{total}}$ Γ_{154}/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_{155}/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_{156}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
$4.57 \pm 0.36 \pm 1.77$ $= 4.26$		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_{157}/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

 $\Gamma(\gamma \pi^+ \pi^- \rho \bar{\rho})/\Gamma_{\text{total}}$ Γ_{158}/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_{159}/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_{160}/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_{161}/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_{162}/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_{163}/Γ_6

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<2.0	90	LEES 13I	BABR	$B \rightarrow K^{(*)} \psi(2S)$

NODE=M071S64

NODE=M071S64

 $\psi(2S)$ CROSS-PARTICLE BRANCHING RATIOS

NODE=M071240

For measurements involving $B(\psi(2S) \rightarrow \gamma \chi_{cJ}(1P)) \times B(\chi_{cJ}(1P) \rightarrow X)$ see the corresponding entries in the $\chi_{cJ}(1P)$ sections.

NODE=M071240

MULTIPOLE AMPLITUDE RATIOS IN RADIATIVE DECAYS

NODE=M071250

 $\psi(2S) \rightarrow \gamma \chi_{cJ}(1P)$ and $\chi_{cJ} \rightarrow \gamma J/\psi(1S)$ $a_2(\chi_{c1})/a_2(\chi_{c2})$ Magnetic quadrupole transition amplitude ratio

NODE=M071QAR

NODE=M071QAR

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
67^{+19}_{-13}	59k	¹ ARTUSO 09	CLEO	$\psi(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$

¹ Statistical and systematic errors combined. Using values from fits with floating $M2$ amplitudes $a_2(\chi_{c1})$, $a_2(\chi_{c2})$, $b_2(\chi_{c1})$, $b_2(\chi_{c2})$ and fixed $E3$ amplitudes of $a_3(\chi_{c2}) = b_3(\chi_{c2}) = 0$. Not independent of values for $a_2(\chi_{c1}(1P))$ and $a_2(\chi_{c2}(1P))$ from ARTUSO 09.

NODE=M071QAR;LINKAGE=AR

 $b_2(\chi_{c2})/b_2(\chi_{c1})$ Magnetic quadrupole transition amplitude ratio

NODE=M071QBR

NODE=M071QBR

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
37^{+53}_{-47}	59k	¹ ARTUSO 09	CLEO	$\psi(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$

¹ Statistical and systematic errors combined. Using values from fits with floating $M2$ amplitudes $a_2(\chi_{c1})$, $a_2(\chi_{c2})$, $b_2(\chi_{c1})$, $b_2(\chi_{c2})$ and fixed $E3$ amplitudes of $a_3(\chi_{c2}) = b_3(\chi_{c2}) = 0$. Not independent of values for $b_2(\chi_{c1}(1P))$ and $b_2(\chi_{c2}(1P))$ from ARTUSO 09.

NODE=M071QBR;LINKAGE=AR

$\psi(2S)$ REFERENCES

NODE=M071

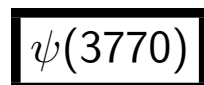
ABLIKIM	13A	PRL 110 022001	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=54834
ABLIKIM	13D	PR D87 012007	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=54879
ABLIKIM	13F	PR D87 052007	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=54920
ABLIKIM	13M	PR D87 092006	M. Ablikim <i>et al.</i>	(BES III 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
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	M. Andreotti <i>et al.</i>	(Femilab E835 Collab.)	REFID=51944
AUBERT	07AK	PR D76 012008	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51908
AUBERT	07AU	PR D76 092005	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52049
Also		PR D77 119902E (err.)	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52266
AUBERT	07BD	PR D76 092006	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52050
PDG	07	Unofficial 2007 WWW edition		(PDG Collab.)	REFID=52717; ERROR=1
PEDLAR	07	PR D75 011102	T.K. Pedlar <i>et al.</i>	(CLEO Collab.)	REFID=51630
ABLIKIM	06G	PR D73 052004	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51048
ABLIKIM	06I	PR D74 012004	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51126
ABLIKIM	06L	PRL 97 121801	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51129
ABLIKIM	06R	PR D74 072001	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51447
ABLIKIM	06W	PR D74 112003	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51560
ADAM	06	PRL 96 082004	N.E. Adam <i>et al.</i>	(CLEO Collab.)	REFID=50989
AUBERT	06B	PR D73 012005	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51026
AUBERT	06D	PR D73 052003	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51047
AUBERT,BE	06D	PR D74 091103	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51511
DOBBS	06A	PR D74 011105	S. Dobbs <i>et al.</i>	(CLEO Collab.)	REFID=51158
ABLIKIM	05E	PR D71 072006	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50757
ABLIKIM	05H	PR D72 012002	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50759
ABLIKIM	05I	PL B614 37	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50758
ABLIKIM	05J	PL B619 247	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50760
ABLIKIM	05O	PL B630 21	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50846
ADAM	05	PRL 94 012005	N.E. Adam <i>et al.</i>	(CLEO Collab.)	REFID=50451
ADAM	05A	PRL 94 232002	N.E. Adam <i>et al.</i>	(CLEO Collab.)	REFID=50763
ANDREOTTI	05	PR D71 032006	M. Andreotti <i>et al.</i>	(FNAL E835 Collab.)	REFID=50497
AUBERT	05D	PR D71 052001	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=50509
BRIERE	05	PRL 95 062001	R.A. Briere <i>et al.</i>	(CLEO Collab.)	REFID=50785
PEDLAR	05	PR D72 051108	T.K. Pedlar <i>et al.</i>	(CLEO Collab.)	REFID=50808
ROSNER	05	PRL 95 102003	J.L. Rosner <i>et al.</i>	(CLEO Collab.)	REFID=50812
ABLIKIM	04B	PR D70 012003	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=49741
ABLIKIM	04K	PR D70 112003	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50327
ABLIKIM	04L	PR D70 112007	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50328
ATHAR	04	PR D70 112002	S.B. Athar <i>et al.</i>	(CLEO Collab.)	REFID=50331
BAI	04B	PRL 92 052001	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49608
BAI	04C	PR D69 072001	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49749
BAI	04D	PL B589 7	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49750
BAI	04G	PR D70 012004	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49753
BAI	04I	PR D70 012006	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49755
PDG	04	PL B592 1	S. Eidelman <i>et al.</i>	(PDG Collab.)	REFID=49653
SETH	04	PR D69 097503	K.K. Seth		REFID=49779
AULCHENKO	03	PL B573 63	V.M. Aulchenko <i>et al.</i>	(KEDR Collab.)	REFID=49579
BAI	03B	PR D67 052002	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49186
BAI	03C	PR D67 032004	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49190
AUBERT	02B	PR D65 031101	B. Aubert <i>et al.</i>	(BaBar Collab.)	REFID=48548
BAI	02	PR D65 052004	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=48578
BAI	02B	PL B550 24	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49171
BAI	02C	PRL 88 101802	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=50506
PDG	02	PR D66 010001	K. Hagiwara <i>et al.</i>		REFID=48632
BAI	01	PR D63 032002	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=48003
AMBROGIANI	00A	PR D62 032004	M. Ambrogiani <i>et al.</i>	(FNAL E835 Collab.)	REFID=47939
ARTAMONOV	00	PL B474 427	A.S. Artamonov <i>et al.</i>		REFID=47424
BAI	00	PRL 84 594	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=50503
BAI	99C	PRL 83 1918	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=47420
BAI	98E	PR D57 3854	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=46339
BAI	98F	PR D58 097101	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=46340
BAI	98J	PRL 81 5080	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=46554
ARMSTRONG	97	PR D55 1153	T.A. Armstrong <i>et al.</i>	(E760 Collab.)	REFID=45416
GRIBUSHIN	96	PR D53 4723	A. Gribushin <i>et al.</i>	(E672 Collab., E706 Collab.)	REFID=44739
ARMSTRONG	93B	PR D47 772	T.A. Armstrong <i>et al.</i>	(FNAL E760 Collab.)	REFID=43307
ALEXANDER	89	NP B320 45	J.P. Alexander <i>et al.</i>	(LBL, MICH, SLAC)	REFID=40345
COHEN	87	RMP 59 1121	E.R. Cohen, B.N. Taylor	(RISC, NBS)	REFID=11616
GAISER	86	PR D34 711	J. Gaiser <i>et al.</i>	(Crystal Ball Collab.)	REFID=22012
KURAEV	85	SJNP 41 466	E.A. Kuraev, V.S. Fadin	(NOVO)	REFID=40033
Translated from YAF 41 733.					

FRANKLIN	83	PRL 51 963	M.E.B. Franklin <i>et al.</i>	(LBL, SLAC)
EDWARDS	82C	PRL 48 70	C. Edwards <i>et al.</i>	(CIT, HARV, PRIN+)
LEMOIGNE	82	PL 113B 509	Y. Lemoigne <i>et al.</i>	(SACL, LOIC, SHMP+)
HIMEL	80	PRL 44 920	T. Himel <i>et al.</i>	(LBL, SLAC)
OREGLIA	80	PRL 45 959	M.J. Oreglia <i>et al.</i>	(SLAC, CIT, HARV+)
SCHARRE	80	PL 97B 329	D.L. Scharre <i>et al.</i>	(SLAC, LBL)
ZHOLENTZ	80	PL 96B 214	A.A. Zholents <i>et al.</i>	(NOVO)
Also		SJNP 34 814	A.A. Zholents <i>et al.</i>	(NOVO)
		Translated from YAF 34 1471.		
BRANDELIK	79B	NP B160 426	R. Brandelik <i>et al.</i>	(DASP Collab.)
BRANDELIK	79C	ZPHY C1 233	R. Brandelik <i>et al.</i>	(DASP Collab.)
BARTEL	78B	PL 79B 492	W. Bartel <i>et al.</i>	(DESY, HEIDP)
TANENBAUM	78	PR D17 1731	W.M. Tanenbaum <i>et al.</i>	(SLAC, LBL)
BIDDICK	77	PRL 38 1324	C.J. Biddick <i>et al.</i>	(UCSD, UMD, PAVI+)
BRAUNSCH...	77	PL 67B 249	W. Braunschweig <i>et al.</i>	(DASP Collab.)
BURMESTER	77	PL 66B 395	J. Burmester <i>et al.</i>	(DESY, HAMB, SIEG+)
FELDMAN	77	PRPL 33C 285	G.J. Feldman, M.L. Perl	(LBL, SLAC)
YAMADA	77	Hamburg Conf. 69	S. Yamada	(DASP Collab.)
BARTEL	76	PL 64B 483	W. Bartel <i>et al.</i>	(DESY, HEIDP)
TANENBAUM	76	PRL 36 402	W.M. Tanenbaum <i>et al.</i>	(SLAC, LBL) IG
WHITAKER	76	PRL 37 1596	J.S. Whitaker <i>et al.</i>	(SLAC, LBL)
ABRAMS	75	Stanford Symp. 25	G.S. Abrams	(LBL)
ABRAMS	75B	PRL 34 1181	G.S. Abrams <i>et al.</i>	(LBL, SLAC)
BOYARSKI	75C	Palermo Conf. 54	A.M. Boyarski <i>et al.</i>	(SLAC, LBL)
HILGER	75	PRL 35 625	E. Hilger <i>et al.</i>	(STAN, PENN)
LIBERMAN	75	Stanford Symp. 55	A.D. Liberman	(STAN)
LUTH	75	PRL 35 1124	V. Luth <i>et al.</i>	(SLAC, LBL) JPC
WIJK	75	Stanford Symp. 69	B.H. Wiik	(DESY)

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NODE=M053



$$I^G(J^{PC}) = 0^-(1^--)$$

$\psi(3770)$ MASS (MeV)

NODE=M053M

OUR FIT includes measurements of $m_{\psi(2S)}$, $m_{\psi(3770)}$, and $m_{\psi(3770)} - m_{\psi(2S)}$.

NODE=M053M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
3773.15±0.33 OUR FIT				
3778.1 ±1.2 OUR AVERAGE				
3779.2 ± 1.8 $+0.6$ -1.7 -0.8		¹ ANASHIN	12A KEDR	$e^+e^- \rightarrow D\bar{D}$
3775.5 ± 2.4 ± 0.5	57	AUBERT	08B BABR	$B \rightarrow D\bar{D}K$
3776 ± 5 ± 4	68	BRODZICKA	08 BELL	$B^+ \rightarrow D^0\bar{D}^0K^+$
3778.8 ± 1.9 ± 0.9		AUBERT	07BE BABR	$e^+e^- \rightarrow D\bar{D}\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
3772.0 ± 1.9		^{2,3} ABLIKIM	08D BES2	$e^+e^- \rightarrow \text{hadrons}$
3778.4 ± 3.0 ± 1.3	34	CHISTOV	04 BELL	Sup. by BRODZICKA 08
¹ Taking into account interference between the resonant and non-resonant $D\bar{D}$ production.				
² Reanalysis of data presented in BAI 02C. From a global fit over the center-of-mass energy region 3.7–5.0 GeV covering the $\psi(3770)$, $\psi(4040)$, $\psi(4160)$, and $\psi(4415)$ resonances. Phase angle fixed in the fit to $\delta = 0^\circ$.				
³ Interference between the resonant and non-resonant $D\bar{D}$ production not taken into account.				

NODE=M053M;LINKAGE=AN
NODE=M053M;LINKAGE=AB

NODE=M053M;LINKAGE=NI

$m_{\psi(3770)} - m_{\psi(2S)}$

NODE=M053DM

OUR FIT includes measurements of $m_{\psi(2S)}$, $m_{\psi(3770)}$, and $m_{\psi(3770)} - m_{\psi(2S)}$.

NODE=M053DM

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
87.04±0.33 OUR FIT			
86.6 ±0.7 OUR AVERAGE Error includes scale factor of 2.0. See the ideogram below.			
86.9 ± 0.4	⁴ ABLIKIM	07E BES2	$e^+e^- \rightarrow \text{hadrons}$
86.7 ± 0.7	ABLIKIM	06L BES2	$e^+e^- \rightarrow \text{hadrons}$
80 ± 2	SCHINDLER	80 MRK2	e^+e^-
86 ± 2	⁵ BACINO	78 DLCO	e^+e^-
88 ± 3	RAPIDIS	77 LGW	e^+e^-

NODE=M053DM

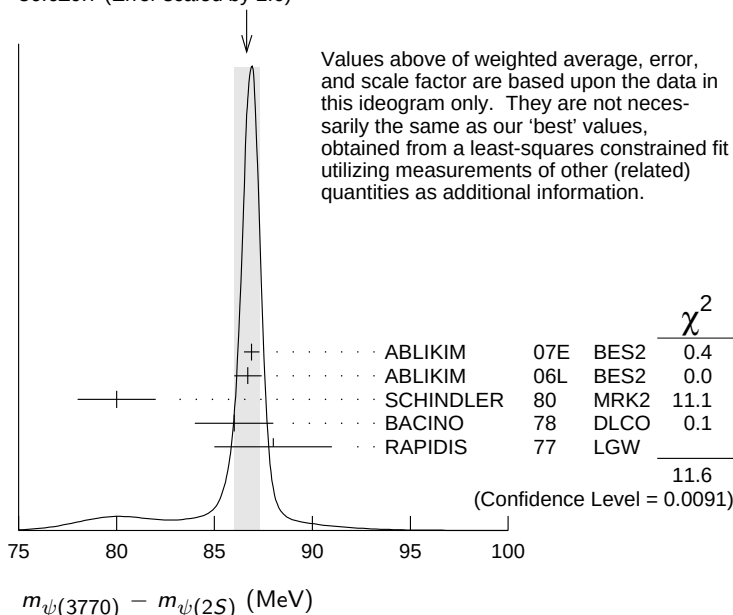
⁴ BES-II $\psi(2S)$ mass subtracted (see ABLIKIM 06L).

⁵ SPEAR $\psi(2S)$ mass subtracted (see SCHINDLER 80).

NODE=M053DM;LINKAGE=AK

NODE=M053DM;LINKAGE=S

WEIGHTED AVERAGE
86.6±0.7 (Error scaled by 2.0)



$\psi(3770)$ WIDTH

NODE=M053W

NODE=M053W

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
27.2± 1.0 OUR FIT				
27.5± 0.9 OUR AVERAGE				
24.9 ⁺ ₋ 4.6 ⁺ ₋ 4.0 ⁻ ₋ 1.1		⁶ ANASHIN	12A KEDR	$e^+e^- \rightarrow D\bar{D}$
30.4± 8.5		^{7,8} ABLIKIM	08D BES2	$e^+e^- \rightarrow \text{hadrons}$
27 ±10 ±5	68	BRODZICKA	08 BELL	$B^+ \rightarrow D^0\bar{D}^0 K^+$
28.5± 1.2±0.2		⁸ ABLIKIM	07E BES2	$e^+e^- \rightarrow \text{hadrons}$
23.5± 3.7±0.9		AUBERT	07BE BABR	$e^+e^- \rightarrow D\bar{D}\gamma$
26.9± 2.4±0.3		⁸ ABLIKIM	06L BES2	$e^+e^- \rightarrow \text{hadrons}$
24 ± 5		⁸ SCHINDLER	80 MRK2	e^+e^-
24 ± 5		⁸ BACINO	78 DLCO	e^+e^-
28 ± 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;LINKAGE=AN

NODE=M053W;LINKAGE=AB

NODE=M053W;LINKAGE=NI

$\psi(3770)$ DECAY MODES

NODE=M053220;NODE=M053

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).

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 ± 5) %	S=2.0
Γ_3 D^+D^-	(41 ± 4) %	S=2.0
Γ_4 $J/\psi\pi^+\pi^-$	(1.93±0.28) × 10 ⁻³	
Γ_5 $J/\psi\pi^0\pi^0$	(8.0 ± 3.0) × 10 ⁻⁴	
Γ_6 $J/\psi\eta$	(9 ± 4) × 10 ⁻⁴	
Γ_7 $J/\psi\pi^0$	< 2.8 × 10 ⁻⁴	CL=90%
Γ_8 e^+e^-	(9.6 ± 0.7) × 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

Г ₉	$b_1(1235)\pi$	< 1.4	$\times 10^{-5}$	CL=90%	DESIG=20
Г ₁₀	$\phi\eta'$	< 7	$\times 10^{-4}$	CL=90%	DESIG=17
Г ₁₁	$\omega\eta'$	< 4	$\times 10^{-4}$	CL=90%	DESIG=16
Г ₁₂	$\rho^0\eta'$	< 6	$\times 10^{-4}$	CL=90%	DESIG=15
Г ₁₃	$\phi\eta$	(3.1 $\pm$ 0.7)	$\times 10^{-4}$		DESIG=8
Г ₁₄	$\omega\eta$	< 1.4	$\times 10^{-5}$	CL=90%	DESIG=14
Г ₁₅	$\rho^0\eta$	< 5	$\times 10^{-4}$	CL=90%	DESIG=13
Г ₁₆	$\phi\pi^0$	< 3	$\times 10^{-5}$	CL=90%	DESIG=12
Г ₁₇	$\omega\pi^0$	< 6	$\times 10^{-4}$	CL=90%	DESIG=11
Г ₁₈	$\pi^+\pi^-\pi^0$	< 5	$\times 10^{-6}$	CL=90%	DESIG=9
Г ₁₉	$\rho\pi$	< 5	$\times 10^{-6}$	CL=90%	DESIG=10
Г ₂₀	$K^*(892)^+K^- + \text{c.c.}$	< 1.4	$\times 10^{-5}$	CL=90%	DESIG=19
Г ₂₁	$K^*(892)^0\bar{K}^0 + \text{c.c.}$	< 1.2	$\times 10^{-3}$	CL=90%	DESIG=18
Г ₂₂	$K_S^0 K_L^0$	< 1.2	$\times 10^{-5}$	CL=90%	DESIG=3
Г ₂₃	$2(\pi^+\pi^-)$	< 1.12	$\times 10^{-3}$	CL=90%	DESIG=21
Г ₂₄	$2(\pi^+\pi^-)\pi^0$	< 1.06	$\times 10^{-3}$	CL=90%	DESIG=22
Г ₂₅	$2(\pi^+\pi^-\pi^0)$	< 5.85	%	CL=90%	DESIG=208
Г ₂₆	$\omega\pi^+\pi^-$	< 6.0	$\times 10^{-4}$	CL=90%	DESIG=24
Г ₂₇	$3(\pi^+\pi^-)$	< 9.1	$\times 10^{-3}$		DESIG=52
Г ₂₈	$3(\pi^+\pi^-)\pi^0$	< 1.37	%		DESIG=55
Г ₂₉	$3(\pi^+\pi^-)2\pi^0$	< 11.74	%	CL=90%	DESIG=210
Г ₃₀	$\eta\pi^+\pi^-$	< 1.24	$\times 10^{-3}$	CL=90%	DESIG=23
Г ₃₁	$\pi^+\pi^-2\pi^0$	< 8.9	$\times 10^{-3}$	CL=90%	DESIG=206
Г ₃₂	$\rho^0\pi^+\pi^-$	< 6.9	$\times 10^{-3}$	CL=90%	DESIG=64
Г ₃₃	$\eta 3\pi$	< 1.34	$\times 10^{-3}$	CL=90%	DESIG=25
Г ₃₄	$\eta 2(\pi^+\pi^-)$	< 2.43	%		DESIG=53
Г ₃₅	$\eta\rho^0\pi^+\pi^-$	< 1.45	%	CL=90%	DESIG=221
Г ₃₆	$\eta' 3\pi$	< 2.44	$\times 10^{-3}$	CL=90%	DESIG=26
Г ₃₇	$K^+K^-\pi^+\pi^-$	< 9.0	$\times 10^{-4}$	CL=90%	DESIG=27
Г ₃₈	$\phi\pi^+\pi^-$	< 4.1	$\times 10^{-4}$	CL=90%	DESIG=28
Г ₃₉	$K^+K^-2\pi^0$	< 4.2	$\times 10^{-3}$	CL=90%	DESIG=207
Г ₄₀	$4(\pi^+\pi^-)$	< 1.67	%	CL=90%	DESIG=62
Г ₄₁	$4(\pi^+\pi^-)\pi^0$	< 3.06	%	CL=90%	DESIG=63
Г ₄₂	$\phi f_0(980)$	< 4.5	$\times 10^{-4}$	CL=90%	DESIG=29
Г ₄₃	$K^+K^-\pi^+\pi^-\pi^0$	< 2.36	$\times 10^{-3}$	CL=90%	DESIG=30
Г ₄₄	$K^+K^-\rho^0\pi^0$	< 8	$\times 10^{-4}$	CL=90%	DESIG=67
Г ₄₅	$K^+K^-\rho^+\pi^-$	< 1.46	%	CL=90%	DESIG=68
Г ₄₆	ωK^+K^-	< 3.4	$\times 10^{-4}$	CL=90%	DESIG=32
Г ₄₇	$\phi\pi^+\pi^-\pi^0$	< 3.8	$\times 10^{-3}$	CL=90%	DESIG=69
Г ₄₈	$K^{*0}K^-\pi^+\pi^0 + \text{c.c.}$	< 1.62	%	CL=90%	DESIG=70
Г ₄₉	$K^{*+}K^-\pi^+\pi^- + \text{c.c.}$	< 3.23	%	CL=90%	DESIG=71
Г ₅₀	$K^+K^-\pi^+\pi^-2\pi^0$	< 2.67	%	CL=90%	DESIG=209
Г ₅₁	$K^+K^-2(\pi^+\pi^-)$	< 1.03	%	CL=90%	DESIG=57
Г ₅₂	$K^+K^-2(\pi^+\pi^-)\pi^0$	< 3.60	%	CL=90%	DESIG=58
Г ₅₃	ηK^+K^-	< 4.1	$\times 10^{-4}$	CL=90%	DESIG=31
Г ₅₄	$\eta K^+K^-\pi^+\pi^-$	< 1.24	%	CL=90%	DESIG=222
Г ₅₅	$\rho^0 K^+K^-$	< 5.0	$\times 10^{-3}$	CL=90%	DESIG=65
Г ₅₆	$2(K^+K^-)$	< 6.0	$\times 10^{-4}$	CL=90%	DESIG=33
Г ₅₇	ϕK^+K^-	< 7.5	$\times 10^{-4}$	CL=90%	DESIG=34
Г ₅₈	$2(K^+K^-)\pi^0$	< 2.9	$\times 10^{-4}$	CL=90%	DESIG=35
Г ₅₉	$2(K^+K^-)\pi^+\pi^-$	< 3.2	$\times 10^{-3}$	CL=90%	DESIG=59
Г ₆₀	$K_S^0 K^-\pi^+$	< 3.2	$\times 10^{-3}$	CL=90%	DESIG=200
Г ₆₁	$K_S^0 K^-\pi^+\pi^0$	< 1.33	%	CL=90%	DESIG=201
Г ₆₂	$K_S^0 K^-\rho^+$	< 6.6	$\times 10^{-3}$	CL=90%	DESIG=214
Г ₆₃	$K_S^0 K^-2\pi^+\pi^-$	< 8.7	$\times 10^{-3}$	CL=90%	DESIG=202
Г ₆₄	$K_S^0 K^-\pi^+\rho^0$	< 1.6	%	CL=90%	DESIG=215
Г ₆₅	$K_S^0 K^-\pi^+\eta$	< 1.3	%	CL=90%	DESIG=216

Γ_{66}	$K_S^0 K^- 2\pi^+ \pi^- \pi^0$	< 4.18	%	CL=90%	DESIG=203
Γ_{67}	$K_S^0 K^- 2\pi^+ \pi^- \eta$	< 4.8	%	CL=90%	DESIG=217
Γ_{68}	$K_S^0 K^- \pi^+ 2(\pi^+ \pi^-)$	< 1.22	%	CL=90%	DESIG=204
Γ_{69}	$K_S^0 K^- \pi^+ 2\pi^0$	< 2.65	%	CL=90%	DESIG=205
Γ_{70}	$K_S^0 K^- K^+ K^- \pi^+$	< 4.9	$\times 10^{-3}$	CL=90%	DESIG=218
Γ_{71}	$K_S^0 K^- K^+ K^- \pi^+ \pi^0$	< 3.0	%	CL=90%	DESIG=219
Γ_{72}	$K_S^0 K^- K^+ K^- \pi^+ \eta$	< 2.2	%	CL=90%	DESIG=220
Γ_{73}	$K^{*0} K^- \pi^+ + \text{c.c.}$	< 9.7	$\times 10^{-3}$	CL=90%	DESIG=60
Γ_{74}	$p\bar{p}\pi^0$	< 1.2	$\times 10^{-3}$		DESIG=54
Γ_{75}	$p\bar{p}\pi^+ \pi^-$	< 5.8	$\times 10^{-4}$	CL=90%	DESIG=36
Γ_{76}	$\Lambda\bar{\Lambda}$	< 1.2	$\times 10^{-4}$	CL=90%	DESIG=42
Γ_{77}	$p\bar{p}\pi^+ \pi^- \pi^0$	< 1.85	$\times 10^{-3}$	CL=90%	DESIG=37
Γ_{78}	$\omega p\bar{p}$	< 2.9	$\times 10^{-4}$	CL=90%	DESIG=39
Γ_{79}	$\Lambda\bar{\Lambda}\pi^0$	< 7	$\times 10^{-5}$	CL=90%	DESIG=72
Γ_{80}	$p\bar{p}2(\pi^+ \pi^-)$	< 2.6	$\times 10^{-3}$	CL=90%	DESIG=61
Γ_{81}	$\eta p\bar{p}$	< 5.4	$\times 10^{-4}$	CL=90%	DESIG=38
Γ_{82}	$\eta p\bar{p}\pi^+ \pi^-$	< 3.3	$\times 10^{-3}$	CL=90%	DESIG=223
Γ_{83}	$\rho^0 p\bar{p}$	< 1.7	$\times 10^{-3}$	CL=90%	DESIG=66
Γ_{84}	$p\bar{p}K^+ K^-$	< 3.2	$\times 10^{-4}$	CL=90%	DESIG=40
Γ_{85}	$\eta p\bar{p}K^+ K^-$	< 6.9	$\times 10^{-3}$	CL=90%	DESIG=224
Γ_{86}	$\pi^0 p\bar{p}K^+ K^-$	< 1.2	$\times 10^{-3}$	CL=90%	DESIG=225
Γ_{87}	$\phi p\bar{p}$	< 1.3	$\times 10^{-4}$	CL=90%	DESIG=41
Γ_{88}	$\Lambda\bar{\Lambda}\pi^+ \pi^-$	< 2.5	$\times 10^{-4}$	CL=90%	DESIG=43
Γ_{89}	$\Lambda\bar{p}K^+$	< 2.8	$\times 10^{-4}$	CL=90%	DESIG=44
Γ_{90}	$\Lambda\bar{p}K^+ \pi^+ \pi^-$	< 6.3	$\times 10^{-4}$	CL=90%	DESIG=45
Γ_{91}	$\Lambda\bar{\Lambda}\eta$	< 1.9	$\times 10^{-4}$	CL=90%	DESIG=226
Γ_{92}	$\Sigma^+ \bar{\Sigma}^-$	< 1.0	$\times 10^{-4}$	CL=90%	DESIG=227
Γ_{93}	$\Sigma^0 \bar{\Sigma}^0$	< 4	$\times 10^{-5}$	CL=90%	DESIG=228
Γ_{94}	$\Xi^+ \bar{\Xi}^-$	< 1.5	$\times 10^{-4}$	CL=90%	DESIG=229
Γ_{95}	$\Xi^0 \bar{\Xi}^0$	< 1.4	$\times 10^{-4}$	CL=90%	DESIG=230

Radiative decays

Γ_{96}	$\gamma \chi_{c2}$	< 9	$\times 10^{-4}$	CL=90%	DESIG=51
Γ_{97}	$\gamma \chi_{c1}$	(2.9 $\pm$ 0.6)	$\times 10^{-3}$		DESIG=50
Γ_{98}	$\gamma \chi_{c0}$	(7.3 $\pm$ 0.9)	$\times 10^{-3}$		DESIG=49
Γ_{99}	$\gamma \eta'$	< 1.8	$\times 10^{-4}$	CL=90%	DESIG=213
Γ_{100}	$\gamma \eta$	< 1.5	$\times 10^{-4}$	CL=90%	DESIG=212
Γ_{101}	$\gamma \pi^0$	< 2	$\times 10^{-4}$	CL=90%	DESIG=211

NODE=M053;CLUMP=R

CONSTRAINED FIT INFORMATION

An overall fit to the total width, a partial width, and 3 branching ratios uses 23 measurements and one constraint to determine 5 parameters. The overall fit has a $\chi^2 = 20.0$ for 19 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta p_i \delta p_j \rangle / (\delta p_i \delta p_j)$, in percent, from the fit to parameters p_i , including the branching fractions, $x_i \equiv \Gamma_i / \Gamma_{\text{total}}$. The fit constrains the x_i whose labels appear in this array to sum to one.

x_3	98		
x_8	0	0	
Γ	0	0	-44
	x_2	x_3	x_8

	Mode	Rate (MeV)	Scale factor	
Γ_2	$D^0 \bar{D}^0$	14.1 $\pm$ 1.4	1.7	DESIG=5
Γ_3	$D^+ D^-$	11.2 $\pm$ 1.1	1.7	DESIG=6
Γ_8	$e^+ e^-$	(2.62 $\pm$ 0.18) $\times 10^{-4}$	1.4	DESIG=1

$\psi(3770)$ PARTIAL WIDTHS

NODE=M053225

 $\Gamma(e^+e^-)$ Γ_8

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
0.262±0.018 OUR FIT	Error includes scale factor of 1.4.			
0.256±0.016 OUR AVERAGE	Error includes scale factor of 1.2.			
0.154 ^{+0.079+0.021} _{-0.058-0.027}	9,10	ANASHIN	12A	KEDR $e^+e^- \rightarrow D\bar{D}$
0.22 ±0.05	11,12	ABLIKIM	08D	BES2 $e^+e^- \rightarrow$ hadrons
0.277±0.011±0.013	12	ABLIKIM	07E	BES2 $e^+e^- \rightarrow$ hadrons
0.203±0.003 ^{+0.041} _{-0.027}	1.4M 12,13	BESSION	06	CLEO $e^+e^- \rightarrow$ 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^-
⁹ Solution I of the two solutions.				
¹⁰ Taking into account interference between the resonant and non-resonant $D\bar{D}$ production.				
¹¹ Reanalysis of data presented in BAI 02C. From a global fit over the center-of-mass energy region 3.7–5.0 GeV covering the $\psi(3770)$, $\psi(4040)$, $\psi(4160)$, and $\psi(4415)$ resonances. Phase angle fixed in the fit to $\delta = 0^\circ$.				
¹² Interference between the resonant and non-resonant $D\bar{D}$ production not taken into account.				
¹³ BESSION 06 (as corrected in BESSION 10) measure $\sigma(e^+e^- \rightarrow \psi(3770) \rightarrow \text{hadrons}) = 6.36 \pm 0.08^{+0.41}_{-0.30}$ nb at $\sqrt{s} = 3773 \pm 1$ MeV, and obtain 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
NODE=M053W1

OCCUR=2

NODE=M053W1;LINKAGE=A1
NODE=M053W1;LINKAGE=AN
NODE=M053W1;LINKAGE=AB

NODE=M053W1;LINKAGE=NI

NODE=M053W1;LINKAGE=BE

NODE=M053W1;LINKAGE=A2
NODE=M053W1;LINKAGE=R $\psi(3770)$ BRANCHING RATIOS

NODE=M053230

 $\Gamma(D\bar{D})/\Gamma_{\text{total}}$ $\Gamma_1/\Gamma = (\Gamma_2 + \Gamma_3)/\Gamma$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.93^{+0.08}_{-0.09} OUR FIT	Error includes scale factor of 2.0.			
0.93^{+0.08}_{-0.09} OUR AVERAGE	Error includes scale factor of 2.1.			
0.849±0.056±0.018	16	ABLIKIM	08B	BES2 $e^+e^- \rightarrow \text{non-}D\bar{D}$
1.033±0.014 ^{+0.048} _{-0.066}	1.427M 17	BESSION	06	CLEO $e^+e^- \rightarrow$ hadrons
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.866±0.050±0.036	18,19	ABLIKIM	07K	BES2 $e^+e^- \rightarrow \text{non-}D\bar{D}$
0.836±0.073±0.042	19	ABLIKIM	06L	BES2 $e^+e^- \rightarrow D\bar{D}$
0.855±0.017±0.058	19,20	ABLIKIM	06N	BES2 $e^+e^- \rightarrow D\bar{D}$

NODE=M053R1
NODE=M053R1 $\Gamma(D^0\bar{D}^0)/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
0.52 ±0.05 OUR FIT	Error includes scale factor of 2.0.		
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
0.467 ± 0.047 ± 0.023	ABLIKIM	06L	BES2 $e^+e^- \rightarrow D^0\bar{D}^0$
0.499 ± 0.013 ± 0.038	20 ABLIKIM	06N	BES2 $e^+e^- \rightarrow D^0\bar{D}^0$

NODE=M053R46
NODE=M053R46 $\Gamma(D^+D^-)/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
0.41 ±0.04 OUR FIT	Error includes scale factor of 2.0.		
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
0.369±0.037±0.028	ABLIKIM	06L	BES2 $e^+e^- \rightarrow D^+D^-$
0.357±0.011±0.034	²⁰ ABLIKIM	06N	BES2 $e^+e^- \rightarrow D^+D^-$

NODE=M053R47
NODE=M053R47 $\Gamma(D^0\bar{D}^0)/\Gamma(D^+D^-)$ Γ_2/Γ_3

<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
1.260±0.021 OUR FIT					
1.260±0.021 OUR AVERAGE					
1.39 ±0.31 ±0.12		PAKHLOVA	08	BELL 10.6 $e^+e^- \rightarrow D\bar{D}\gamma$	
1.78 ±0.33 ±0.24		AUBERT	07BE	BABR $e^+e^- \rightarrow D\bar{D}\gamma$	
1.258±0.016±0.014		DOBBS	07	CLEO $e^+e^- \rightarrow D\bar{D}$	
1.27 ±0.12 ±0.08		ABLIKIM	06L	BES2 $e^+e^- \rightarrow D\bar{D}$	
2.43 ±1.50 ±0.43	34	21	CHISTOV	04	BELL $B^+ \rightarrow \psi(3770)K^+$

NODE=M053R5
NODE=M053R5

$\Gamma(J/\psi\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_4/Γ VALUE (units 10^{-3}) EVTS

DOCUMENT ID

TECN

COMMENT

1.93±0.28 OUR AVERAGE

1.89±0.20±0.20

231 ± 33

ADAM

06

CLEO

 $e^+e^- \rightarrow \psi(3770)$

3.4 ±1.4 ±0.9

17.8 ± 4.8

BAI

05

BES2

 $e^+e^- \rightarrow \psi(3770)$ NODE=M053R4
NODE=M053R4 $\Gamma(J/\psi\pi^0\pi^0)/\Gamma_{\text{total}}$ Γ_5/Γ VALUE (units 10^{-2}) EVTS

DOCUMENT ID

TECN

COMMENT

0.080±0.025±0.016

39 ± 14

ADAM

06

CLEO

 $e^+e^- \rightarrow \psi(3770)$ NODE=M053R7
NODE=M053R7 $\Gamma(J/\psi\eta)/\Gamma_{\text{total}}$ Γ_6/Γ VALUE (units 10^{-5}) EVTS

DOCUMENT ID

TECN

COMMENT

87±33±22

22 ± 10

ADAM

06

CLEO

 $e^+e^- \rightarrow \psi(3770)$ NODE=M053R8
NODE=M053R8 $\Gamma(J/\psi\pi^0)/\Gamma_{\text{total}}$ Γ_7/Γ VALUE (units 10^{-5}) CL% EVTS

DOCUMENT ID

TECN

COMMENT

<28

90

<10

ADAM

06

CLEO

 $e^+e^- \rightarrow \psi(3770)$ NODE=M053R9
NODE=M053R9 $\Gamma(e^+e^-)/\Gamma_{\text{total}}$ Γ_8/Γ VALUE (units 10^{-5})

DOCUMENT ID

TECN

COMMENT

0.96±0.07 OUR FIT Error includes scale factor of 1.3.**1.3 ±0.2**

RAPIDIS

77

LGW

 e^+e^- NODE=M053R2
NODE=M053R2¹⁶ Neglecting interference.¹⁷ Obtained by comparing a measurement of the total cross section (corrected in BESSON 10) with that of $D\bar{D}$ reported by CLEO in DOBBS 07.¹⁸ Using $\sigma^{obs} = 7.07 \pm 0.58$ nb and neglecting interference.¹⁹ Not independent of ABLIKIM 08B.²⁰ From a measurement of $\sigma(e^+e^- \rightarrow D\bar{D})$ at $\sqrt{s} = 3773$ MeV, using the $\psi(3770)$ resonance parameters measured by ABLIKIM 06L.²¹ See ADLER 88C for older measurements of this quantity.NODE=M053R1;LINKAGE=AI
NODE=M053R1;LINKAGE=BENODE=M053R1;LINKAGE=AL
NODE=M053R1;LINKAGE=SU
NODE=M053R;LINKAGE=AB

NODE=M053R5;LINKAGE=CH

————— DECAYS TO LIGHT HADRONS —————

NODE=M053250

 $\Gamma(b_1(1235)\pi)/\Gamma_{\text{total}}$ Γ_9/Γ VALUE (units 10^{-5}) CL%

DOCUMENT ID

TECN

COMMENT

<1.4

90

²²

ADAMS

06

CLEO

 $e^+e^- \rightarrow \psi(3770)$ NODE=M053R82
NODE=M053R82 $\Gamma(\phi\eta')/\Gamma_{\text{total}}$ Γ_{10}/Γ VALUE (units 10^{-4}) CL%

DOCUMENT ID

TECN

COMMENT

<7

90

²²

ADAMS

06

CLEO

 $e^+e^- \rightarrow \psi(3770)$ NODE=M053R83
NODE=M053R83 $\Gamma(\omega\eta')/\Gamma_{\text{total}}$ Γ_{11}/Γ VALUE (units 10^{-4}) CL%

DOCUMENT ID

TECN

COMMENT

<4

90

²²

ADAMS

06

CLEO

 $e^+e^- \rightarrow \psi(3770)$ NODE=M053R84
NODE=M053R84 $\Gamma(\rho^0\eta')/\Gamma_{\text{total}}$ Γ_{12}/Γ VALUE (units 10^{-4}) CL%

DOCUMENT ID

TECN

COMMENT

<6

90

²²

ADAMS

06

CLEO

 $e^+e^- \rightarrow \psi(3770)$ NODE=M053R85
NODE=M053R85 $\Gamma(\phi\eta)/\Gamma_{\text{total}}$ Γ_{13}/Γ VALUE (units 10^{-4})

DOCUMENT ID

TECN

COMMENT

3.1±0.6±0.3²²

ADAMS

06

CLEO

 $3.773 e^+e^- \rightarrow \phi\eta$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<19

²³

ABLIKIM

07B

BES2

 $e^+e^- \rightarrow \psi(3770)$ NODE=M053R6
NODE=M053R6 $\Gamma(\omega\eta)/\Gamma_{\text{total}}$ Γ_{14}/Γ VALUE (units 10^{-5}) CL%

DOCUMENT ID

TECN

COMMENT

<1.4

90

²²

ADAMS

06

CLEO

 $e^+e^- \rightarrow \psi(3770)$ NODE=M053R86
NODE=M053R86 $\Gamma(\rho^0\eta)/\Gamma_{\text{total}}$ Γ_{15}/Γ VALUE (units 10^{-4}) CL%

DOCUMENT ID

TECN

COMMENT

<5

90

²²

ADAMS

06

CLEO

 $e^+e^- \rightarrow \psi(3770)$ NODE=M053R87
NODE=M053R87

$\Gamma(\phi\pi^0)/\Gamma_{\text{total}}$ Γ_{16}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
< 3	90	22 ADAMS	06 CLEO	$e^+e^- \rightarrow \psi(3770)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<50		23 ABLIKIM	07B BES2	$e^+e^- \rightarrow \psi(3770)$

NODE=M053R11
 NODE=M053R11

 $\Gamma(\omega\pi^0)/\Gamma_{\text{total}}$ Γ_{17}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<6	90	22 ADAMS	06 CLEO	$e^+e^- \rightarrow \psi(3770)$

NODE=M053R88
 NODE=M053R88

 $\Gamma(\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{18}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<5	90	22,24 ADAMS	06 CLEO	$e^+e^- \rightarrow \psi(3770)$

NODE=M053R89
 NODE=M053R89

 $\Gamma(\rho\pi)/\Gamma_{\text{total}}$ Γ_{19}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<5	90	22,24 ADAMS	06 CLEO	$e^+e^- \rightarrow \psi(3770)$

NODE=M053R90
 NODE=M053R90

 $\Gamma(K^*(892)^+K^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{20}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<1.4	90	22 ADAMS	06 CLEO	$e^+e^- \rightarrow \psi(3770)$

NODE=M053R91
 NODE=M053R91

 $\Gamma(K^*(892)^0\bar{K}^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{21}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<1.2	90	22 ADAMS	06 CLEO	$e^+e^- \rightarrow \psi(3770)$

NODE=M053R92
 NODE=M053R92

 $\Gamma(K_S^0 K_L^0)/\Gamma_{\text{total}}$ Γ_{22}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
< 1.2	90	25 CRONIN-HEN..06	CLEO	$e^+e^- \rightarrow \psi(3770)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<21	90	26 ABLIKIM	04F BES	$e^+e^- \rightarrow \psi(3770)$

NODE=M053R3
 NODE=M053R3

 $\Gamma(2(\pi^+\pi^-))/\Gamma_{\text{total}}$ Γ_{23}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<11.2	90	27 HUANG	06A CLEO	$e^+e^- \rightarrow \psi(3770)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<48		23 ABLIKIM	07B BES2	$e^+e^- \rightarrow \psi(3770)$

NODE=M053R21
 NODE=M053R21

 $\Gamma(2(\pi^+\pi^-\pi^0))/\Gamma_{\text{total}}$ Γ_{24}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<10.6	90	27 HUANG	06A CLEO	$e^+e^- \rightarrow \psi(3770)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<62		23 ABLIKIM	07B BES2	$e^+e^- \rightarrow \psi(3770)$

NODE=M053R22
 NODE=M053R22

 $\Gamma(2(\pi^+\pi^-\pi^0))/\Gamma_{\text{total}}$ Γ_{25}/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_{26}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 6.0	90	27 HUANG	06A CLEO	$e^+e^- \rightarrow \psi(3770)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<55	90	23 ABLIKIM	07I BES2	$3.77 e^+e^-$

NODE=M053R24
 NODE=M053R24

 $\Gamma(3(\pi^+\pi^-))/\Gamma_{\text{total}}$ Γ_{27}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
<91	23 ABLIKIM	07B BES2	$e^+e^- \rightarrow \psi(3770)$

NODE=M053R07
 NODE=M053R07

 $\Gamma(3(\pi^+\pi^-\pi^0))/\Gamma_{\text{total}}$ Γ_{28}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
<137	23 ABLIKIM	07B BES2	$e^+e^- \rightarrow \psi(3770)$

NODE=M053R10
 NODE=M053R10

$\Gamma(3(\pi^+\pi^-)2\pi^0)/\Gamma_{\text{total}}$ Γ_{29}/Γ NODE=M053R74
NODE=M053R74

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<117.4	90	59	ABLIKIM	08N	BES2 $e^+e^- \rightarrow \psi(3770)$

 $\Gamma(\eta\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{30}/Γ NODE=M053R23
NODE=M053R23

<u>VALUE (units 10^{-3})</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<1.24	90	²⁷ HUANG	06A	CLEO $e^+ e^- \rightarrow \psi(3770)$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
<2.3	90	²³ ABLIKIM	10D	BES2 $e^+ e^- \rightarrow \psi(3770)$

 $\Gamma(\pi^+\pi^-2\pi^0)/\Gamma_{\text{total}}$ Γ_{31}/Γ NODE=M053R70
NODE=M053R70

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<8.9	90	218	ABLIKIM	08N	BES2 $e^+e^- \rightarrow \psi(3770)$

 $\Gamma(\rho^0\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{32}/Γ NODE=M053R53
NODE=M053R53

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<6.9	90	23 ABLIKIM	07F	BES2 $e^+e^- \rightarrow \psi(3770)$

 $\Gamma(\eta 3\pi)/\Gamma_{\text{total}}$ Γ_{33}/Γ NODE=M053R25
NODE=M053R25

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<13.4	90	27 HUANG	06A	CLEO $e^+e^- \rightarrow \psi(3770)$

 $\Gamma(\eta 2(\pi^+\pi^-))/\Gamma_{\text{total}}$ Γ_{34}/Γ NODE=M053R08
NODE=M053R08

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
<243	23 ABLIKIM	07B	BES2 $e^+e^- \rightarrow \psi(3770)$

 $\Gamma(\eta\rho^0\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{35}/Γ NODE=M053R77
NODE=M053R77

VALUE (units 10^{-2})	CL%	DOCUMENT ID	TECN	COMMENT
<1.45	90	23 ABLIKIM	10D	BES2 $e^+e^- \rightarrow \psi(3770)$

 $\Gamma(\eta' 3\pi)/\Gamma_{\text{total}}$ Γ_{36}/Γ NODE=M053R26
NODE=M053R26

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<24.4	90	27 HUANG	06A	CLEO $e^+e^- \rightarrow \psi(3770)$

 $\Gamma(K^+K^-\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{37}/Γ NODE=M053R27
NODE=M053R27

<u>VALUE (units 10^{-4})</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
< 9.0	90	²⁷ HUANG	06A	CLEO $e^+e^- \rightarrow \psi(3770)$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
<48		²³ ABLIKIM	07B	BES2 $e^+e^- \rightarrow \psi(3770)$

 $\Gamma(\phi\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{38}/Γ NODE=M053R28
NODE=M053R28

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 4.1	90	27 HUANG	06A	CLEO $e^+e^- \rightarrow \psi(3770)$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
<16		23 ABLIKIM	07B	BES2 $e^+e^- \rightarrow \psi(3770)$

 $\Gamma(K^+K^-2\pi^0)/\Gamma_{\text{total}}$ Γ_{39}/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_{40}/Γ NODE=M053R50
NODE=M053R50

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<16.7	90	23 ABLIKIM	07F	BES2 $e^+e^- \rightarrow \psi(3770)$

 $\Gamma(4(\pi^+\pi^-)\pi^0)/\Gamma_{\text{total}}$ Γ_{41}/Γ NODE=M053R52
NODE=M053R52

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<30.6	90	23 ABLIKIM	07F	BES2 $e^+e^- \rightarrow \psi(3770)$

 $\Gamma(\phi f_0(980))/\Gamma_{\text{total}}$ Γ_{42}/Γ NODE=M053R29
NODE=M053R29

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<4.5	90	27 HUANG	06A	CLEO $e^+e^- \rightarrow \psi(3770)$

$$\Gamma(K^+ K^- \pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}$$

 Γ_{43}/Γ

 NODE=M053R30
 NODE=M053R30

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 23.6	90	27 HUANG 06A	CLEO	$e^+ e^- \rightarrow \psi(3770)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<111		23 ABLIKIM 07B	BES2	$e^+ e^- \rightarrow \psi(3770)$

$$\Gamma(K^+ K^- \rho^0 \pi^0)/\Gamma_{\text{total}}$$

 Γ_{44}/Γ

 NODE=M053R58
 NODE=M053R58

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<8	90	23 ABLIKIM 07I	BES2	$3.77 e^+ e^-$

$$\Gamma(K^+ K^- \rho^+ \pi^-)/\Gamma_{\text{total}}$$

 Γ_{45}/Γ

 NODE=M053R59
 NODE=M053R59

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<146	90	23 ABLIKIM 07I	BES2	$3.77 e^+ e^-$

$$\Gamma(\omega K^+ K^-)/\Gamma_{\text{total}}$$

 Γ_{46}/Γ

 NODE=M053R32
 NODE=M053R32

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 3.4	90	27 HUANG 06A	CLEO	$e^+ e^- \rightarrow \psi(3770)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<66	90	23 ABLIKIM 07I	BES2	$3.77 e^+ e^-$

$$\Gamma(\phi \pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}$$

 Γ_{47}/Γ

 NODE=M053R60
 NODE=M053R60

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<38	90	23 ABLIKIM 07I	BES2	$3.77 e^+ e^-$

$$\Gamma(K^{*0} K^- \pi^+ \pi^0 + \text{c.c.})/\Gamma_{\text{total}}$$

 Γ_{48}/Γ

 NODE=M053R61
 NODE=M053R61

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<162	90	23 ABLIKIM 07I	BES2	$3.77 e^+ e^-$

$$\Gamma(K^{*+} K^- \pi^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}}$$

 Γ_{49}/Γ

 NODE=M053R62
 NODE=M053R62

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<323	90	23 ABLIKIM 07I	BES2	$3.77 e^+ e^-$

$$\Gamma(K^+ K^- \pi^+ \pi^- 2\pi^0)/\Gamma_{\text{total}}$$

 Γ_{50}/Γ

 NODE=M053R73
 NODE=M053R73

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<26.7	90	24	ABLIKIM 08N	BES2	$e^+ e^- \rightarrow \psi(3770)$

$$\Gamma(K^+ K^- 2(\pi^+ \pi^-))/\Gamma_{\text{total}}$$

 Γ_{51}/Γ

 NODE=M053R57
 NODE=M053R57

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<10.3	90	23 ABLIKIM 07F	BES2	$e^+ e^- \rightarrow \psi(3770)$

$$\Gamma(K^+ K^- 2(\pi^+ \pi^-) \pi^0)/\Gamma_{\text{total}}$$

 Γ_{52}/Γ

 NODE=M053R51
 NODE=M053R51

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<36.0	90	23 ABLIKIM 07F	BES2	$e^+ e^- \rightarrow \psi(3770)$

$$\Gamma(\eta K^+ K^-)/\Gamma_{\text{total}}$$

 Γ_{53}/Γ

 NODE=M053R31
 NODE=M053R31

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 4.1	90	27 HUANG 06A	CLEO	$e^+ e^- \rightarrow \psi(3770)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<31	90	23 ABLIKIM 10D	BES2	$e^+ e^- \rightarrow \psi(3770)$

$$\Gamma(\eta K^+ K^- \pi^+ \pi^-)/\Gamma_{\text{total}}$$

 Γ_{54}/Γ

 NODE=M053R78
 NODE=M053R78

VALUE (units 10^{-2})	CL%	DOCUMENT ID	TECN	COMMENT
<1.24	90	23 ABLIKIM 10D	BES2	$e^+ e^- \rightarrow \psi(3770)$

$$\Gamma(\rho^0 K^+ K^-)/\Gamma_{\text{total}}$$

 Γ_{55}/Γ

 NODE=M053R54
 NODE=M053R54

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<5.0	90	23 ABLIKIM 07F	BES2	$e^+ e^- \rightarrow \psi(3770)$

$$\Gamma(2(K^+ K^-))/\Gamma_{\text{total}}$$

 Γ_{56}/Γ

 NODE=M053R33
 NODE=M053R33

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 6.0	90	27 HUANG 06A	CLEO	$e^+ e^- \rightarrow \psi(3770)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<17		23 ABLIKIM 07B	BES2	$e^+ e^- \rightarrow \psi(3770)$

$\Gamma(\phi K^+ K^-)/\Gamma_{\text{total}}$ Γ_{57}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 7.5	90	27 HUANG 06A	CLEO	$e^+ e^- \rightarrow \psi(3770)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<24		23 ABLIKIM 07B	BES2	$e^+ e^- \rightarrow \psi(3770)$

NODE=M053R34
 NODE=M053R34

 $\Gamma(2(K^+ K^-)\pi^0)/\Gamma_{\text{total}}$ Γ_{58}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 2.9	90	27 HUANG 06A	CLEO	$e^+ e^- \rightarrow \psi(3770)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<46		23 ABLIKIM 07B	BES2	$e^+ e^- \rightarrow \psi(3770)$

NODE=M053R35
 NODE=M053R35

 $\Gamma(2(K^+ K^-)\pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{59}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<3.2	90	23 ABLIKIM 07F	BES2	$e^+ e^- \rightarrow \psi(3770)$

NODE=M053R48
 NODE=M053R48

 $\Gamma(K_S^0 K^- \pi^+)/\Gamma_{\text{total}}$ Γ_{60}/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_{61}/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_{62}/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_{63}/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_{64}/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_{65}/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_{66}/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_{67}/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_{68}/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_{69}/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_{70}/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_{71}/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_{72}/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_{73}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<9.7	90	²³ ABLIKIM	07F	BES2 $e^+ e^- \rightarrow \psi(3770)$

NODE=M053R55
NODE=M053R55

$$\Gamma(\rho \bar{\rho} \pi^0)/\Gamma_{\text{total}}$$

 Γ_{74}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<12		²³ ABLIKIM	07B	BES2 $e^+ e^- \rightarrow \psi(3770)$

NODE=M053R09
NODE=M053R09

$$\Gamma(\rho \bar{\rho} \pi^+ \pi^-)/\Gamma_{\text{total}}$$

 Γ_{75}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 5.8	90	²⁷ HUANG	06A	CLEO $e^+ e^- \rightarrow \psi(3770)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<16		²³ ABLIKIM	07B	BES2 $e^+ e^- \rightarrow \psi(3770)$

NODE=M053R36
NODE=M053R36

$$\Gamma(\Lambda \bar{\Lambda})/\Gamma_{\text{total}}$$

 Γ_{76}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.2	90	²⁷ HUANG	06A	CLEO $e^+ e^- \rightarrow \psi(3770)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<4	90	²³ ABLIKIM	07F	BES2 $e^+ e^- \rightarrow \psi(3770)$

NODE=M053R42
NODE=M053R42

$$\Gamma(\rho \bar{\rho} \pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}$$

 Γ_{77}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<18.5	90	²⁷ HUANG	06A	CLEO $e^+ e^- \rightarrow \psi(3770)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<73		²³ ABLIKIM	07B	BES2 $e^+ e^- \rightarrow \psi(3770)$

NODE=M053R37
NODE=M053R37

$$\Gamma(\omega \rho \bar{\rho})/\Gamma_{\text{total}}$$

 Γ_{78}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 2.9	90	²⁷ HUANG	06A	CLEO $e^+ e^- \rightarrow \psi(3770)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<30	90	²⁸ ABLIKIM	07I	BES2 $3.77 e^+ e^-$

NODE=M053R39
NODE=M053R39

$$\Gamma(\Lambda \bar{\Lambda} \pi^0)/\Gamma_{\text{total}}$$

 Γ_{79}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 0.7 (CL = 90%)		[<12 $\times 10^{-4}$ (CL = 90%) OUR 2013 BEST LIMIT]		
< 0.7	90	²⁹ ABLIKIM	13Q	BES3 $e^+ e^- \rightarrow \psi(3770)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<12	90	²³ ABLIKIM	07I	BES2 $3.77 e^+ e^-$

NODE=M053R63
NODE=M053R63

$$\Gamma(\rho \bar{\rho} 2(\pi^+ \pi^-))/\Gamma_{\text{total}}$$

 Γ_{80}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<2.6	90	²³ ABLIKIM	07F	BES2 $e^+ e^- \rightarrow \psi(3770)$

NODE=M053R49
NODE=M053R49

$$\Gamma(\eta \rho \bar{\rho})/\Gamma_{\text{total}}$$

 Γ_{81}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 5.4	90	²⁷ HUANG	06A	CLEO $e^+ e^- \rightarrow \psi(3770)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<11	90	²³ ABLIKIM	10D	BES2 $e^+ e^- \rightarrow \psi(3770)$

NODE=M053R38
NODE=M053R38

$$\Gamma(\eta \rho \bar{\rho} \pi^+ \pi^-)/\Gamma_{\text{total}}$$

 Γ_{82}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<3.3	90	²³ ABLIKIM	10D	BES2 $e^+ e^- \rightarrow \psi(3770)$

NODE=M053R79
NODE=M053R79

$\Gamma(\rho^0 \rho \bar{\rho})/\Gamma_{\text{total}}$ Γ_{83}/Γ NODE=M053R56
NODE=M053R56

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<1.7	90	23 ABLIKIM	07F BES2	$e^+ e^- \rightarrow \psi(3770)$

 $\Gamma(\rho \bar{\rho} K^+ K^-)/\Gamma_{\text{total}}$ Γ_{84}/Γ NODE=M053R40
NODE=M053R40

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 3.2	90	27 HUANG	06A CLEO	$e^+ e^- \rightarrow \psi(3770)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<11		23 ABLIKIM	07B BES2	$e^+ e^- \rightarrow \psi(3770)$

 $\Gamma(\eta \rho \bar{\rho} K^+ K^-)/\Gamma_{\text{total}}$ Γ_{85}/Γ NODE=M053R80
NODE=M053R80

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<6.9	90	23 ABLIKIM	10D BES2	$e^+ e^- \rightarrow \psi(3770)$

 $\Gamma(\pi^0 \rho \bar{\rho} K^+ K^-)/\Gamma_{\text{total}}$ Γ_{86}/Γ NODE=M053R81
NODE=M053R81

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<1.2	90	23 ABLIKIM	10D BES2	$e^+ e^- \rightarrow \psi(3770)$

 $\Gamma(\phi \rho \bar{\rho})/\Gamma_{\text{total}}$ Γ_{87}/Γ NODE=M053R41
NODE=M053R41

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.3	90	27 HUANG	06A CLEO	$e^+ e^- \rightarrow \psi(3770)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<9		23 ABLIKIM	07B BES2	$e^+ e^- \rightarrow \psi(3770)$

 $\Gamma(\Lambda \bar{\Lambda} \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{88}/Γ NODE=M053R43
NODE=M053R43

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 2.5	90	27 HUANG	06A CLEO	$e^+ e^- \rightarrow \psi(3770)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
< 4.7	90	29 ABLIKIM	13Q BES3	$e^+ e^- \rightarrow \psi(3770)$
<39	90	23 ABLIKIM	07F BES2	$e^+ e^- \rightarrow \psi(3770)$

 $\Gamma(\Lambda \bar{\rho} K^+)/\Gamma_{\text{total}}$ Γ_{89}/Γ NODE=M053R44
NODE=M053R44

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<2.8	90	27 HUANG	06A CLEO	$e^+ e^- \rightarrow \psi(3770)$

 $\Gamma(\Lambda \bar{\rho} K^+ \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{90}/Γ NODE=M053R45
NODE=M053R45

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<6.3	90	27 HUANG	06A CLEO	$e^+ e^- \rightarrow \psi(3770)$

 $\Gamma(\Lambda \bar{\Lambda} \eta)/\Gamma_{\text{total}}$ Γ_{91}/Γ NODE=M053R93
NODE=M053R93

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.9	90	29 ABLIKIM	13Q BES3	$e^+ e^- \rightarrow \psi(3770)$

 $\Gamma(\Sigma^+ \bar{\Sigma}^-)/\Gamma_{\text{total}}$ Γ_{92}/Γ NODE=M053R94
NODE=M053R94

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.0	90	29 ABLIKIM	13Q BES3	$e^+ e^- \rightarrow \psi(3770)$

 $\Gamma(\Sigma^0 \bar{\Sigma}^0)/\Gamma_{\text{total}}$ Γ_{93}/Γ NODE=M053R95
NODE=M053R95

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<0.4	90	29 ABLIKIM	13Q BES3	$e^+ e^- \rightarrow \psi(3770)$

 $\Gamma(\Xi^+ \bar{\Xi}^-)/\Gamma_{\text{total}}$ Γ_{94}/Γ NODE=M053R96
NODE=M053R96

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.5	90	29 ABLIKIM	13Q BES3	$e^+ e^- \rightarrow \psi(3770)$

 $\Gamma(\Xi^0 \bar{\Xi}^0)/\Gamma_{\text{total}}$ Γ_{95}/Γ NODE=M053R97
NODE=M053R97

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.4	90	29 ABLIKIM	13Q BES3	$e^+ e^- \rightarrow \psi(3770)$

- 22 Comparing cross sections at $\sqrt{s} = 3.773$ GeV and $\sqrt{s} = 3.671$ GeV, neglecting interference, and using $\sigma(\psi(3770) \rightarrow D\bar{D}) = 6.39 \pm 0.20$ nb.
- 23 Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{obs}(e^+e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.
- 24 Data suggest possible destructive interference with continuum.
- 25 Using $\sigma(e^+e^- \rightarrow \psi(3770) \rightarrow \text{hadrons}) = (6.38 \pm 0.08^{+0.41}_{-0.30})$ nb from BESSON 06 and $B(K_S^0 \rightarrow \pi^+\pi^-) = 0.6895 \pm 0.0014$.
- 26 Using $B(K_S^0 \rightarrow \pi^+\pi^-) = 0.6860 \pm 0.0027$.
- 27 Using $\sigma_{tot}(e^+e^- \rightarrow \psi(3770)) = 7.9 \pm 0.6$ nb at the resonance.
- 28 Using $\sigma^{obs} = 7.15 \pm 0.27 \pm 0.27$ nb and neglecting interference.
- 29 Assuming that interference effects between resonance and continuum can be neglected.

NODE=M053R6;LINKAGE=AD

NODE=M053R10;LINKAGE=AK

NODE=M053R89;LINKAGE=AD

NODE=M053R3;LINKAGE=CR

NODE=M053R3;LINKAGE=AB

NODE=M053R;LINKAGE=HU

NODE=M053R24;LINKAGE=AB

NODE=M053R43;LINKAGE=A

NODE=M053240

RADIATIVE DECAYS

$\Gamma(\gamma\chi_{c2})/\Gamma_{\text{total}}$ Γ_{96}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<0.9	90	30 COAN	06A CLEO	$e^+e^- \rightarrow \psi(3770) \rightarrow \gamma\gamma J/\psi$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<2.0	90	31 BRIERE	06 CLEO	$e^+e^- \rightarrow \psi(3770) \rightarrow \gamma + \text{hadrons}$

NODE=M053R03

NODE=M053R03

$\Gamma(\gamma\chi_{c1})/\Gamma_{\text{total}}$ Γ_{97}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$2.9 \pm 0.5 \pm 0.4$		32 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. • • •				
$3.9 \pm 1.4 \pm 0.6$	54 ± 17	33 BRIERE	06 CLEO	$e^+e^- \rightarrow \psi(3770) \rightarrow \gamma + \text{hadrons}$
$2.8 \pm 0.5 \pm 0.4$	53 ± 10	30 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_{97}/Γ_4

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
$1.49 \pm 0.31 \pm 0.26$	53 ± 10	34 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_{98}/Γ

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$7.3 \pm 0.7 \pm 0.6$		274 ± 27	35 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	30 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_{98}/Γ_{96}

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
>8	90	36 BRIERE	06 CLEO	$e^+e^- \rightarrow \psi(3770)$

NODE=M053R06

NODE=M053R06

$\Gamma(\gamma\chi_{c0})/\Gamma(\gamma\chi_{c1})$ Γ_{98}/Γ_{97}

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
2.5 ± 0.6	36 BRIERE	06 CLEO	$e^+e^- \rightarrow \psi(3770)$

NODE=M053R05

NODE=M053R05

$\Gamma(\gamma\eta')/\Gamma_{\text{total}}$ Γ_{99}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.8	90	37 PEDLAR	09 CLE3	$\psi(2S) \rightarrow \gamma X$

NODE=M053R14

NODE=M053R14

$\Gamma(\gamma\eta)/\Gamma_{\text{total}}$ Γ_{100}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.5	90	37 PEDLAR	09 CLE3	$\psi(2S) \rightarrow \gamma X$

NODE=M053R13

NODE=M053R13

$\Gamma(\gamma\pi^0)/\Gamma_{\text{total}}$ Γ_{101}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<2	90	PEDLAR 09	CLE3	$\psi(2S) \rightarrow \gamma X$
30 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 $\sigma(e^+e^- \rightarrow \psi(3770))$.				
31 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.				
32 Averages the two measurements from COAN 06A and BRIERE 06.				
33 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.				
34 Using $B(\psi(3770) \rightarrow J/\psi\pi^+\pi^-) = (1.89 \pm 0.20 \pm 0.20) \times 10^{-3}$ from ADAM 06.				
35 Uses $B(\psi(2S) \rightarrow \gamma\chi_{c0}) = 9.33 \pm 0.14 \pm 0.61\%$ from ATHAR 04, $\psi(2S)$ mass and width from PDG 04, and $\Gamma_{ee}(\psi(2S)) = 2.54 \pm 0.03 \pm 0.11$ keV from ADAM 06.				
36 Not independent of other results in BRIERE 06.				
37 Assuming maximal destructive interference between $\psi(3770)$ and continuum sources.				

NODE=M053R12
 NODE=M053R12

NODE=M053R0;LINKAGE=CO

NODE=M053R03;LINKAGE=BR

NODE=M053R02;LINKAGE=BI

NODE=M053R02;LINKAGE=BR

NODE=M053R04;LINKAGE=CO

NODE=M053R01;LINKAGE=BR

NODE=M053R05;LINKAGE=BR

NODE=M053R13;LINKAGE=PE

 $\psi(3770)$ REFERENCES

NODE=M053

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 159901E	D. Besson <i>et al.</i>	(CLEO Collab.)	REFID=53245
ABLIKIM	09C	EPJ C64 243	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=53134
PEDLAR	09	PR D79 111101	T.K. Pedlar <i>et al.</i>	(CLEO Collab.)	REFID=52998
ABLIKIM	08B	PL B659 74	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52129
ABLIKIM	08D	PL B660 315	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52142
ABLIKIM	08M	PL B670 179	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52569
ABLIKIM	08N	PL B670 184	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52570
AUBERT	08B	PR D77 011102	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52120
BRODZICKA	08	PRL 100 092001	J. Brodzicka <i>et al.</i>	(BELLE Collab.)	REFID=52144
PAKHLOVA	08	PR D77 011103	G. Pakhlova <i>et al.</i>	(BELLE Collab.)	REFID=52132
ABLIKIM	07B	PL B650 111	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51704
ABLIKIM	07E	PL B652 238	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51882
ABLIKIM	07F	PL B656 30	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51940
ABLIKIM	07I	EPJ C52 805	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52045
ABLIKIM	07K	PR D76 122002	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52073
AUBERT	07BE	PR D76 111105	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52074
DOBBS	07	PR D76 112001	S. Dobbs <i>et al.</i>	(CLEO Collab.)	REFID=52075
ABLIKIM	06L	PRL 97 121801	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51129
ABLIKIM	06N	PL B641 145	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51131
ADAM	06	PRL 96 082004	N.E. Adam <i>et al.</i>	(CLEO Collab.)	REFID=50989
ADAMS	06	PR D73 012002	G.S. Adams <i>et al.</i>	(CLEO Collab.)	REFID=50990
BESSION	06	PRL 96 092002	D. Besson <i>et al.</i>	(CLEO Collab.)	REFID=51041
Also		PRL 104 159901E	D. Besson <i>et al.</i>	(CLEO Collab.)	REFID=53245
BRIERE	06	PR D74 031106	R.A. Briere <i>et al.</i>	(CLEO Collab.)	REFID=51149
COAN	06A	PRL 96 182002	T.E. Coan <i>et al.</i>	(CLEO Collab.)	REFID=51155
CRONIN-HEN...	06	PR D74 012005	D. Cronin-Hennessy <i>et al.</i>	(CLEO Collab.)	REFID=51156
HUANG	06A	PRL 96 032003	G.S. Huang <i>et al.</i>	(CLEO Collab.)	REFID=50999
BAI	05	PL B605 63	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=50332
HE	05	PRL 95 121801	Q. He <i>et al.</i>	(CLEO Collab.)	REFID=50924
Also		PRL 96 199903 (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

X(3823)

$$J^{PC} = ?^{?}(??-)$$

NODE=M212

OMITTED FROM SUMMARY TABLE

Seen by BHARDWAJ 13 in $B \rightarrow \chi_{c1} \gamma K$ 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

X(3823) MASS

NODE=M212M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
3823.1 ± 1.8 ± 0.7	33 ± 10	¹ BHARDWAJ	13	BELL $B \rightarrow \chi_{c1} \gamma K$
¹ 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

NODE=M212M;LINKAGE=A

X(3823) WIDTH

NODE=M212W

VALUE (MeV)	CL%	DOCUMENT ID	TECN	COMMENT
<24	90	¹ BHARDWAJ	13	BELL $B \rightarrow \chi_{c1} \gamma K$
¹ From a simultaneous fit to $B^\pm \rightarrow (\chi_{c1} \gamma) K^\pm$ and $B^0 \rightarrow (\chi_{c1} \gamma) K_S^0$ with significance 4.0σ including systematics.				

NODE=M212W

NODE=M212W;LINKAGE=A

X(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

X(3823) BRANCHING RATIOS

NODE=M212225

$\Gamma(\chi_{c1} \gamma)/\Gamma_{\text{total}}$	VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_1/Γ
seen	33 ± 10	¹ BHARDWAJ	13	BELL	$B^+ \rightarrow \chi_{c1} \gamma K^+$	
¹ Reported $B(B^\pm \rightarrow X(3823) K^\pm) \times B(X(3823) \rightarrow \gamma \chi_{c1}) = (9.7 \pm 2.8 \pm 1.1) \times 10^{-6}$ with statistical significance 3.8σ .						

NODE=M212R01
NODE=M212R01

NODE=M212R01;LINKAGE=A

$\Gamma(\chi_{c2} \gamma)/\Gamma_{\text{total}}$	VALUE	DOCUMENT ID	TECN	COMMENT	Γ_2/Γ
not seen		¹ BHARDWAJ	13	BELL $B^+ \rightarrow \chi_{c2} \gamma K^+$	
¹ Reported $B(B^\pm \rightarrow X(3823) K^\pm) \times B(X(3823) \rightarrow \gamma \chi_{c2}) < 3.6 \times 10^{-6}$ at 90% CL.					

NODE=M212R02
NODE=M212R02

NODE=M212R02;LINKAGE=A

$\Gamma(\chi_{c2} \gamma)/\Gamma(\chi_{c1} \gamma)$	VALUE	CL%	DOCUMENT ID	TECN	COMMENT	Γ_2/Γ_1
<0.41	90		BHARDWAJ	13	BELL $B^+ \rightarrow \chi_{c1/c2} \gamma K^+$	

NODE=M212R03
NODE=M212R03**X(3823) REFERENCES**

NODE=M212

BHARDWAJ 13 PRL 111 032001 V. Bhardwaj *et al.* (BELLE Collab.)

REFID=55412

$X(3872)$

$$J^{PC} = 0^+(1^{++})$$

First observed by CHOI 03 in $B \rightarrow K \pi^+ \pi^- J/\psi(1S)$ decays as a narrow peak in the invariant mass distribution of the $\pi^+ \pi^- J/\psi(1S)$ final state. Isovector hypothesis excluded by AUBERT 05B and CHOI 11.

AAIJ 13Q perform a full five-dimensional amplitude analysis of the angular correlations between the decay products in $B^+ \rightarrow X(3872) K^+$ decays, where $X(3872) \rightarrow J/\psi \pi^+ \pi^-$ and $J/\psi \rightarrow \mu^+ \mu^-$, which unambiguously gives the $J^{PC} = 1^{++}$ assignment.

See our note on "Developments in Heavy Quarkonium Spectroscopy".

NODE=M176

NODE=M176

$X(3872)$ MASS FROM $J/\psi X$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
3871.69 ± 0.17 OUR AVERAGE				
[3871.68 ± 0.17 MeV OUR 2013 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 $p p \rightarrow J/\psi \pi^+ \pi^- X$
3871.85 ± 0.27 ± 0.19	~ 170	¹ CHOI	11	BELL $B \rightarrow K \pi^+ \pi^- J/\psi$
3873 $^{+1.8}_{-1.6}$ ± 1.3	27 ± 8	² DEL-AMO-SA.10B	BABR	$B \rightarrow \omega J/\psi K$
3871.61 ± 0.16 ± 0.19	6k	^{2,3} AALTONEN	09AU	CDF2 $p \bar{p} \rightarrow J/\psi \pi^+ \pi^- X$
3871.4 ± 0.6 ± 0.1	93.4	AUBERT	08Y	BABR $B^+ \rightarrow K^+ J/\psi \pi^+ \pi^-$
3868.7 ± 1.5 ± 0.4	9.4	AUBERT	08Y	BABR $B^0 \rightarrow K_S^0 J/\psi \pi^+ \pi^-$
3871.8 ± 3.1 ± 3.0	522	^{2,4} ABAZOV	04F	D0 $p \bar{p} \rightarrow J/\psi \pi^+ \pi^- X$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
3868.6 ± 1.2 ± 0.2	8	⁵ AUBERT	06	BABR $B^0 \rightarrow K_S^0 J/\psi \pi^+ \pi^-$
3871.3 ± 0.6 ± 0.1	61	⁵ AUBERT	06	BABR $B^- \rightarrow K^- J/\psi \pi^+ \pi^-$
3873.4 ± 1.4	25	⁶ AUBERT	05R	BABR $B^+ \rightarrow K^+ J/\psi \pi^+ \pi^-$
3871.3 ± 0.7 ± 0.4	730	^{2,7} ACOSTA	04	CDF2 $p \bar{p} \rightarrow J/\psi \pi^+ \pi^- X$
3872.0 ± 0.6 ± 0.5	36	⁸ CHOI	03	BELL $B \rightarrow K \pi^+ \pi^- J/\psi$
3836 ± 13	58	^{2,9} ANTONIAZZI	94	E705 $300 \pi^\pm \text{Li} \rightarrow J/\psi \pi^+ \pi^- X$

NODE=M176M

NODE=M176M
NEW

OCCUR=2

OCCUR=2

¹ The mass difference for the $X(3872)$ produced in B^+ and B^0 decays is $(-0.71 \pm 0.96 \pm 0.19)$ MeV.

² Width consistent with detector resolution.

³ A possible equal mixture of two states with a mass difference greater than 3.6 MeV/ c^2 is excluded at 95% CL.

⁴ Calculated from the corresponding $m_{X(3872)} - m_{J/\psi}$ using $m_{J/\psi} = 3096.916$ MeV.

⁵ Calculated from the corresponding $m_{X(3872)} - m_{\psi(2S)}$ using $m_{\psi(2S)} = 3686.093$ MeV. Superseded by AUBERT 08Y.

⁶ Calculated from the corresponding $m_{X(3872)} - m_{\psi(2S)}$ using $m_{\psi(2S)} = 3685.96$ MeV. Superseded by AUBERT 06.

⁷ Superseded by AALTONEN 09AU.

⁸ Superseded by CHOI 11.

⁹ A lower mass value can be due to an incorrect momentum scale for soft pions.

NODE=M176M;LINKAGE=CO

NODE=M176M;LINKAGE=AC
NODE=M176M;LINKAGE=AANODE=M176M;LINKAGE=AB
NODE=M176M;LINKAGE=AE

NODE=M176M;LINKAGE=AU

NODE=M176M;LINKAGE=AT
NODE=M176M;LINKAGE=CH
NODE=M176M;LINKAGE=AN

$X(3872)$ MASS FROM $\bar{D}^{*0} D^0$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
3872.9 $^{+0.6+0.4}_{-0.4-0.5}$	50 ^{10,11}	AUSHEV	10	BELL $B \rightarrow \bar{D}^{*0} D^0 K$
3875.1 $^{+0.7}_{-0.5} \pm 0.5$	33 ± 6	¹¹ AUBERT	08B	BABR $B \rightarrow \bar{D}^{*0} D^0 K$
3875.2 ± 0.7 $^{+0.9}_{-1.8}$	24 ± 6 ^{11,12}	GOKHROO	06	BELL $B \rightarrow D^0 \bar{D}^0 \pi^0 K$

¹⁰ Calculated from the measured $m_{X(3872)} - m_{D^{*0}} - m_{\bar{D}^0} = 1.1^{+0.6+0.1}_{-0.4-0.3}$ MeV.

¹¹ Experiments report $D^{*0} \bar{D}^0$ invariant mass above $D^{*0} \bar{D}^0$ threshold because D^{*0} decay products are kinematically constrained to the D^{*0} mass, even though the D^{*0} may decay off-shell.

¹² Superseded by AUSHEV 10.

NODE=M176MD0

NODE=M176MD0

NODE=M176MD0;LINKAGE=AS
NODE=M176MD0;LINKAGE=AU

NODE=M176MD0;LINKAGE=GO

$m_{X(3872)} - m_{J/\psi}$

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$774.9 \pm 3.1 \pm 3.0$	522	ABAZOV	04F D0	$\rho \bar{p} \rightarrow J/\psi \pi^+ \pi^- X$

NODE=M176207

NODE=M176DM

 $m_{X(3872)} - m_{\psi(2S)}$

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

187.4 $\pm$ 1.4 25 ¹³ AUBERT 05R BABR $B^+ \rightarrow K^+ J/\psi \pi^+ \pi^-$

¹³ Superseded by AUBERT 06.

NODE=M176DM2

NODE=M176DM2

NODE=M176DM2;LINKAGE=AU

 $X(3872)$ WIDTH

VALUE (MeV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT

<1.2 90 CHOI 11 BELL $B \rightarrow K \pi^+ \pi^- J/\psi$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<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 ¹⁴CHOI 03 BELL $B \rightarrow K \pi^+ \pi^- J/\psi$

¹⁴ Superseded by CHOI 11.

NODE=M176W

NODE=M176W

NODE=M176W;LINKAGE=CH

 $X(3872)$ WIDTH FROM $\bar{D}^{*0} D^0$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

3.9 $^{+2.8+0.2}_{-1.4-1.1}$ 50 ¹⁵ AUSHEV 10 BELL $B \rightarrow \bar{D}^{*0} D^0 K$

3.0 $^{+1.9}_{-1.4} \pm 0.9$ 33 $\pm$ 6 AUBERT 08B BABR $B \rightarrow \bar{D}^{*0} D^0 K$

¹⁵ With a measured value of $B(B \rightarrow X(3872) K) \times B(X(3872) \rightarrow D^{*0} \bar{D}^0) = (0.80 \pm 0.20 \pm 0.10) \times 10^{-4}$, assumed to be equal for both charged and neutral modes.

NODE=M176WD0

NODE=M176WD0

NODE=M176WD0;LINKAGE=AU

 $X(3872)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $e^+ e^-$	
Γ_2 $\pi^+ \pi^- J/\psi(1S)$	> 2.6 %
Γ_3 $\rho^0 J/\psi(1S)$	
Γ_4 $\omega J/\psi(1S)$	> 1.9 %
Γ_5 $D^0 \bar{D}^0 \pi^0$	> 32 %
Γ_6 $\bar{D}^{*0} D^0$	> 24 %
Γ_7 $\gamma \gamma$	
Γ_8 $D^0 \bar{D}^0$	
Γ_9 $D^+ D^-$	
Γ_{10} $\gamma \chi_{c1}$	
Γ_{11} $\gamma \chi_{c2}$	
Γ_{12} $\eta J/\psi$	
Γ_{13} $\gamma J/\psi$	> 6 $\times 10^{-3}$
Γ_{14} $\gamma \psi(2S)$	[a] > 3.0 %
Γ_{15} $\pi^+ \pi^- \eta_c(1S)$	not seen
Γ_{16} $\rho \bar{p}$	not seen

NODE=M176215;NODE=M176

DESIG=1

DESIG=2

DESIG=10

DESIG=13

DESIG=8

DESIG=12

DESIG=5

DESIG=6

DESIG=7

DESIG=3

DESIG=15

DESIG=4

DESIG=9

DESIG=11

DESIG=14;OUR EVAL;→ UNCHECKED ←

DESIG=16;OUR EVAL;→ UNCHECKED ←

[a] BHARDWAJ 11 does not observe this decay and presents a stronger 90% CL limit than this value. See measurements listings for details.

LINKAGE=BBL

X(3872) PARTIAL WIDTHS **$\Gamma(e^+e^-)$** **Γ_1**

VALUE (keV)	CL%	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.28	90	16 YUAN	04	RVUE $e^+e^- \rightarrow \pi^+\pi^- J/\psi$

¹⁶ Using BAI 98E data on $e^+e^- \rightarrow \pi^+\pi^-\ell^+\ell^-$. Assuming that $\Gamma(\pi^+\pi^- J/\psi)$ of X(3872) is the same as that of $\psi(2S)$ (85.4 keV).

NODE=M176220

 NODE=M176W1
 NODE=M176W1

NODE=M176W1;LINKAGE=A

X(3872) $\Gamma(i)\Gamma(e^+e^-)/\Gamma(\text{total})$ **$\Gamma(\pi^+\pi^- J/\psi(1S)) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$** **$\Gamma_2\Gamma_1/\Gamma$**

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT

< 6.2	90	17,18 AUBERT	05D	BABR $10.6 e^+e^- \rightarrow K^+K^-\pi^+\pi^-\gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 8.3	90	18 DOBBS	05	CLE3 $e^+e^- \rightarrow \pi^+\pi^- J/\psi$

<10	90	19 YUAN	04	RVUE $e^+e^- \rightarrow \pi^+\pi^- J/\psi$

¹⁷ Using $B(X(3872) \rightarrow J/\psi \pi^+\pi^-) \cdot B(J/\psi \rightarrow \mu^+\mu^-) \cdot \Gamma(X(3872) \rightarrow e^+e^-) < 0.37$ eV from AUBERT 05D and $B(J/\psi \rightarrow \mu^+\mu^-) = 0.0588 \pm 0.0010$ from the PDG 04.

¹⁸ Assuming X(3872) has $J^{PC} = 1^{--}$.

¹⁹ Using BAI 98E data on $e^+e^- \rightarrow \pi^+\pi^-\ell^+\ell^-$. From theoretical calculation of the production cross section and using $B(J/\psi \rightarrow \mu^+\mu^-) = (5.88 \pm 0.10)\%$.

NODE=M176230

 NODE=M176G1
 NODE=M176G1

NODE=M176G1;LINKAGE=AU

 NODE=M176G1;LINKAGE=DO
 NODE=M176G1;LINKAGE=A
X(3872) $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$ **$\Gamma(\pi^+\pi^- J/\psi(1S)) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$** **$\Gamma_2\Gamma_7/\Gamma$**

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

<12.9	90	20 DOBBS	05	CLE3 $e^+e^- \rightarrow \pi^+\pi^- J/\psi\gamma$

²⁰ Assuming X(3872) has positive C parity and spin 0.

NODE=M176232

 NODE=M176H1
 NODE=M176H1

NODE=M176H1;LINKAGE=DO

 $\Gamma(\omega J/\psi(1S)) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ **$\Gamma_4\Gamma_7/\Gamma$**

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

<1.7	90	21 LEES	12AD	BABR $e^+e^- \rightarrow e^+e^-\omega J/\psi$

²¹ Assuming X(3872) has spin 2.

 NODE=M176G01
 NODE=M176G01

NODE=M176G01;LINKAGE=LE

 $\Gamma(\pi^+\pi^-\eta_c(1S)) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ **$\Gamma_{15}\Gamma_7/\Gamma$**

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 **$\Gamma(\pi^+\pi^- J/\psi(1S))/\Gamma_{\text{total}}$** **$\Gamma_2/\Gamma$**

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

>0.026	93 ± 17	22 AUBERT	08Y	BABR $B \rightarrow X(3872)K$

• • • We do not use the following data for averages, fits, limits, etc. • • •

>0.04	30	23 AUBERT	05R	BABR $B^+ \rightarrow K^+ J/\psi \pi^+\pi^-$

>0.04	36 ± 7	24 CHOI	03	BABR $B^+ \rightarrow K^+ J/\psi \pi^+\pi^-$

²² AUBERT 08Y reports $[\Gamma(X(3872) \rightarrow \pi^+\pi^- J/\psi(1S))/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow X(3872)K^+)] = (8.4 \pm 1.5 \pm 0.7) \times 10^{-6}$ which we divide by our best value $B(B^+ \rightarrow X(3872)K^+) < 3.2 \times 10^{-4}$.

²³ Superseded by AUBERT 08Y. AUBERT 05R reports $[\Gamma(X(3872) \rightarrow \pi^+\pi^- J/\psi(1S))/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow X(3872)K^+)] = (1.28 \pm 0.41) \times 10^{-5}$ which we divide by our best value $B(B^+ \rightarrow X(3872)K^+) < 3.2 \times 10^{-4}$.

²⁴ CHOI 03 reports $[\Gamma(X(3872) \rightarrow \pi^+\pi^- J/\psi(1S))/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow X(3872)K^+)] / [B(B^+ \rightarrow \psi(2S)K^+)] / [B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)] = 0.063 \pm 0.012 \pm 0.007$ which we multiply or divide by our best values $B(B^+ \rightarrow X(3872)K^+) < 3.2 \times 10^{-4}$, $B(B^+ \rightarrow \psi(2S)K^+) = (6.27 \pm 0.24) \times 10^{-4}$, $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (34.45 \pm 0.30) \times 10^{-2}$.

NODE=M176235

 NODE=M176R6
 NODE=M176R6

NODE=M176R6;LINKAGE=AB

NODE=M176R6;LINKAGE=AE

NODE=M176R6;LINKAGE=CH

$\Gamma(\omega J/\psi(1S))/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
>0.019	21 ± 7	25 DEL-AMO-SA..10B	BABR	$B^+ \rightarrow \omega J/\psi K^+$
25 DEL-AMO-SANCHEZ 10B reports $[\Gamma(X(3872) \rightarrow \omega J/\psi(1S))/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow X(3872)K^+)] = (6 \pm 2 \pm 1) \times 10^{-6}$ which we divide by our best value $B(B^+ \rightarrow X(3872)K^+) < 3.2 \times 10^{-4}$. DEL-AMO-SANCHEZ 10B also reports $B(B^0 \rightarrow X(3872)K^0) \times B(X(3872) \rightarrow J/\psi \omega) = (6 \pm 3 \pm 1) \times 10^{-6}$.				

NODE=M176R14
 NODE=M176R14

NODE=M176R14;LINKAGE=DE

 $\Gamma(\omega J/\psi(1S))/\Gamma(\pi^+\pi^- J/\psi(1S))$ Γ_4/Γ_2

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
0.8 ± 0.3		26 DEL-AMO-SA..10B	BABR	$B \rightarrow \omega J/\psi K$
26 Statistical and systematic errors added in quadrature. Uses the values of $B(B \rightarrow X(3872)K) \times B(X(3872) \rightarrow J/\psi \pi^+\pi^-)$ reported in AUBERT 08Y, taking into account the common systematics.				

NODE=M176R15
 NODE=M176R15

NODE=M176R15;LINKAGE=DE

 $\Gamma(D^0\bar{D}^0\pi^0)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
>0.32	17 ± 5	27 GOKHROO 06	BELL	$B^+ \rightarrow D^0\bar{D}^0\pi^0 K^+$
27 GOKHROO 06 reports $[\Gamma(X(3872) \rightarrow D^0\bar{D}^0\pi^0)/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow X(3872)K^+)] = (1.02 \pm 0.31^{+0.21}_{-0.29}) \times 10^{-4}$ which we divide by our best value $B(B^+ \rightarrow X(3872)K^+) < 3.2 \times 10^{-4}$.				

NODE=M176R12
 NODE=M176R12

NODE=M176R12;LINKAGE=GO

 $\Gamma(\bar{D}^{*0}D^0)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
>0.24	41 ⁺⁹ ₋₈	28 AUSHEV 10	BELL	$B^+ \rightarrow \bar{D}^{*0}D^0 K^+$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
>0.5	27 ± 6	29 AUBERT 08B	BABR	$B^+ \rightarrow \bar{D}^{*0}D^0 K^+$
28 AUSHEV 10 reports $[\Gamma(X(3872) \rightarrow \bar{D}^{*0}D^0)/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow X(3872)K^+)] = (0.77 \pm 0.16 \pm 0.10) \times 10^{-4}$ which we divide by our best value $B(B^+ \rightarrow X(3872)K^+) < 3.2 \times 10^{-4}$.				
29 AUBERT 08B reports $[\Gamma(X(3872) \rightarrow \bar{D}^{*0}D^0)/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow X(3872)K^+)] = (1.67 \pm 0.36 \pm 0.47) \times 10^{-4}$ which we divide by our best value $B(B^+ \rightarrow X(3872)K^+) < 3.2 \times 10^{-4}$.				

NODE=M176R13
 NODE=M176R13

NODE=M176R13;LINKAGE=AS

NODE=M176R13;LINKAGE=AU

 $\Gamma(D^0\bar{D}^0\pi^0)/\Gamma(\pi^+\pi^- J/\psi(1S))$ Γ_5/Γ_2

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
seen		30 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	$B \rightarrow D^0\bar{D}^0\pi^0 K$
30 May not necessarily be the same state as that observed in the $J/\psi \pi^+\pi^-$ mode. Supersedes CHISTOV 04.				

NODE=M176R5
 NODE=M176R5

NODE=M176R5;LINKAGE=GO

 $\Gamma(D^0\bar{D}^0)/\Gamma(\pi^+\pi^- J/\psi(1S))$ Γ_8/Γ_2

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
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	EVTs	DOCUMENT ID	TECN	COMMENT
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		31 BHARDWAJ 13	BELL	$B^+ \rightarrow \chi_{c1}\gamma K^+$
<0.89	90	CHOI 03	BELL	$B \rightarrow K \pi^+\pi^- J/\psi$
31 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	CL%	DOCUMENT ID	TECN	COMMENT
not seen		32 BHARDWAJ 13	BELL	$B^\pm \rightarrow \chi_{c2}\gamma K^\pm$
32 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

$\Gamma(\eta J/\psi)/\Gamma(\pi^+\pi^- J/\psi(1S))$ Γ_{12}/Γ_2

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.6	90	AUBERT	04Y BABR	$B \rightarrow K \eta J/\psi$

NODE=M176R2
 NODE=M176R2

 $\Gamma(\gamma J/\psi)/\Gamma_{\text{total}}$ Γ_{13}/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
>6 $\times 10^{-3}$		³³ 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	³⁴ AUBERT	09B BABR	$B^+ \rightarrow \gamma J/\psi K^+$
>0.010	19	³⁵ AUBERT, BE	06M BABR	$B^+ \rightarrow \gamma J/\psi K^+$
³³ 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 $B(B^+ \rightarrow X(3872)K^+) < 3.2 \times 10^{-4}$.				
³⁴ 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 $B(B^+ \rightarrow X(3872)K^+) < 3.2 \times 10^{-4}$.				
³⁵ 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
 NODE=M176R7

NODE=M176R7;LINKAGE=BA

NODE=M176R7;LINKAGE=AB

NODE=M176R7;LINKAGE=AU

 $\Gamma(\gamma\psi(2S))/\Gamma_{\text{total}}$ Γ_{14}/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
not seen		³⁶ BHARDWAJ	11 BELL	$B^+ \rightarrow \gamma\psi(2S)K^+$
>0.030	25 $\pm$ 7	³⁷ AUBERT	09B BABR	$B^+ \rightarrow \gamma\psi(2S)K^+$
³⁶ BHARDWAJ 11 reports $B(B^+ \rightarrow K^+ X(3872)) \times B(X \rightarrow \gamma\psi(2S)) < 3.45 \times 10^{-6}$ at 90% CL.				
³⁷ AUBERT 09B reports $[\Gamma(X(3872) \rightarrow \gamma\psi(2S))/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow X(3872)K^+)] = (9.5 \pm 2.7 \pm 0.6) \times 10^{-6}$ which we divide by our best value $B(B^+ \rightarrow X(3872)K^+) < 3.2 \times 10^{-4}$.				

NODE=M176R10
 NODE=M176R10

NODE=M176R10;LINKAGE=BH

NODE=M176R10;LINKAGE=AU

 $\Gamma(\gamma\psi(2S))/\Gamma(\gamma J/\psi)$ Γ_{14}/Γ_{13}

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<2.1	90	BHARDWAJ	11 BELL	$B^+ \rightarrow K^+ \psi(2S) \gamma$
3.4 $\pm$ 1.4		AUBERT	09B BABR	$B^+ \rightarrow \gamma c \bar{c} K'$

NODE=M176R11
 NODE=M176R11

 $\Gamma(p\bar{p})/\Gamma(\pi^+\pi^- J/\psi(1S))$ Γ_{16}/Γ_2

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<2.0 $\times 10^{-3}$	95	³⁸ AAIJ	13S LHCB	$B^+ \rightarrow p\bar{p}K^+$
³⁸ AAIJ 13s reports $[\Gamma(X(3872) \rightarrow p\bar{p})/\Gamma(X(3872) \rightarrow \pi^+\pi^- J/\psi(1S))] \times [B(B^+ \rightarrow X(3872)K^+, X \rightarrow J/\psi\pi^+\pi^-)] < 1.7 \times 10^{-8}$ which we divide by our best value $B(B^+ \rightarrow X(3872)K^+, X \rightarrow J/\psi\pi^+\pi^-) = 8.6 \times 10^{-6}$.				

NODE=M176R02
 NODE=M176R02

NODE=M176R02;LINKAGE=A

X(3872) REFERENCES

NODE=M176

ABLIKIM	14	PRL 112 092001	M. Ablikim <i>et al.</i>	(BES III Collab.)	REFID=55647
AAIJ	13Q	PRL 110 222001	R. Aaij <i>et al.</i>	(LHCb Collab.)	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

$X(3900)^\pm$

$$I(J^P) = ?(1^+)$$

Seen as a peak in the invariant mass distribution of the $J/\psi\pi^\pm$ system by BES3 (ABLIKIM 13T) in $e^+e^- \rightarrow \pi^+\pi^- J/\psi$ at c.m. energy of 4.42 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 favors the $J^P = 1^+$ assignment. Needs confirmation.

NODE=M210

NODE=M210

 $X(3900)^\pm$ MASS

NODE=M210M

NODE=M210M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
3888.7 ± 3.4 OUR AVERAGE		Error includes scale factor of 1.3. See the ideogram below.		
$3883.9 \pm 1.5 \pm 4.2$	1.2k	^{1,2} ABLIKIM	14A	BES3 $e^+e^- \rightarrow \pi^\pm (D\bar{D}^*)^\mp$
$3899.0 \pm 3.6 \pm 4.9$	307 ± 48	¹ ABLIKIM	13T	BES3 $e^+e^- \rightarrow \pi^+\pi^- J/\psi$
$3894.5 \pm 6.6 \pm 4.5$	159 ± 49	¹ LIU	13B	BELL $e^+e^- \rightarrow \gamma\pi^+\pi^- J/\psi$
$3886 \pm 4 \pm 2$	81 ± 16	³ XIAO	13A	4.17 $e^+e^- \rightarrow \pi^+\pi^- J/\psi$

¹ Neglecting interference between the $X(3900)$ and non-resonant continuum.

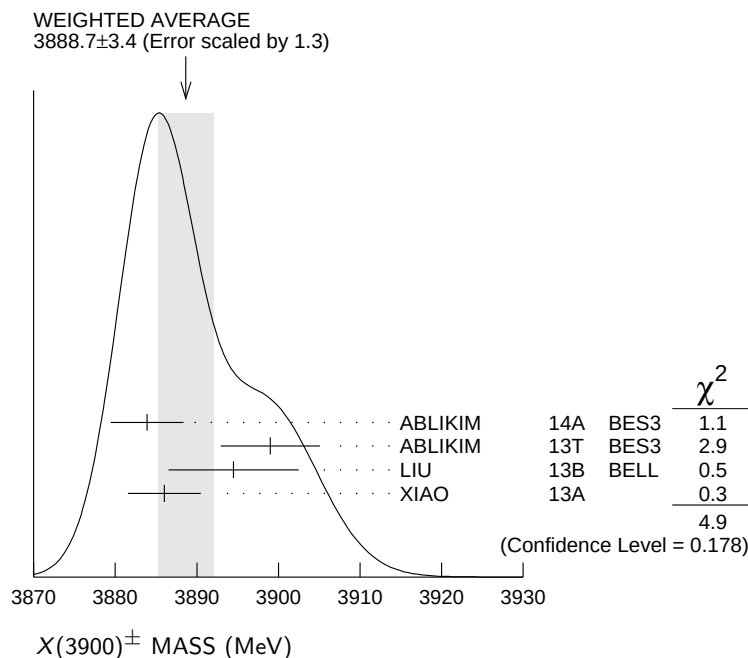
² With estimated statistical significance of more than 18σ .

³ For $M^2(\pi^+\pi^-) < 0.65 \text{ GeV}^2$. Signal has 5.7σ significance including systematic uncertainties. Obtained by analyzing CLEO-c data but not authored by the CLEO Collaboration.

NODE=M210M;LINKAGE=A

NODE=M210M;LINKAGE=C

NODE=M210M;LINKAGE=B

 **$X(3900)^\pm$ WIDTH**

NODE=M210W

NODE=M210W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
35 ± 7 OUR AVERAGE				
$24.8 \pm 3.3 \pm 11.0$	1.2k	^{1,2} ABLIKIM	14A	BES3 $e^+e^- \rightarrow \pi^\pm (D\bar{D}^*)^\mp$
$46 \pm 10 \pm 20$	307 ± 48	¹ ABLIKIM	13T	BES3 $e^+e^- \rightarrow \pi^+\pi^- J/\psi$
$63 \pm 24 \pm 26$	159 ± 49	¹ LIU	13B	BELL $e^+e^- \rightarrow \gamma\pi^+\pi^- J/\psi$
$37 \pm 4 \pm 8$	81 ± 16	³ XIAO	13A	4.17 $e^+e^- \rightarrow \pi^+\pi^- J/\psi$

¹ Neglecting interference between the $X(3900)$ and non-resonant continuum.

² With estimated statistical significance of more than 18σ .

³ For $M^2(\pi^+\pi^-) < 0.65 \text{ GeV}^2$. Signal has 5.7σ significance including systematic uncertainties. Obtained by analyzing CLEO-c data but not authored by the CLEO Collaboration.

NODE=M210W;LINKAGE=A

NODE=M210W;LINKAGE=C

NODE=M210W;LINKAGE=B

$X(3900)^\pm$ DECAY MODES

NODE=M210215;NODE=M210

Mode	Fraction (Γ_i/Γ)
Γ_1 $J/\psi \pi^\pm$	seen
Γ_2 $h_c \pi^\pm$	not seen
Γ_3 $(D\bar{D}^*)^\pm$	seen

DESIG=1

DESIG=2

DESIG=3;OUR EVAL;→ UNCHECKED ←

 $X(3900)^\pm$ BRANCHING RATIOS

NODE=M210225

$\Gamma(J/\psi \pi^\pm)/\Gamma_{\text{total}}$	Γ_1/Γ
<u>VALUE</u> <u>EVTS</u> <u>DOCUMENT ID</u> <u>TECN</u> <u>COMMENT</u>	
seen 307 ± 48 ABLIKIM 13T BES3 $e^+ e^- \rightarrow \pi^+ \pi^- J/\psi$	
$\Gamma(h_c \pi^\pm)/\Gamma_{\text{total}}$	Γ_2/Γ
<u>VALUE</u> <u>DOCUMENT ID</u> <u>TECN</u> <u>COMMENT</u>	
not seen ABLIKIM 13X BES3 $e^+ e^- \rightarrow h_c \pi^\pm$	
$\Gamma((D\bar{D}^*)^\pm)/\Gamma(J/\psi \pi^\pm)$	Γ_3/Γ_1
<u>VALUE</u> <u>EVTS</u> <u>DOCUMENT ID</u> <u>TECN</u> <u>COMMENT</u>	
$6.2 \pm 1.1 \pm 2.7$ 1.2k ¹ ABLIKIM 14A BES3 $e^+ e^- \rightarrow \pi^\pm (D\bar{D}^*)^\mp$	
¹ Assuming the same origin of the $(D\bar{D}^*)^\pm$ and $\pi^\pm J/\psi$ decay modes.	

NODE=M210R01
NODE=M210R01NODE=M210R02
NODE=M210R02NODE=M210R03
NODE=M210R03

NODE=M210R03;LINKAGE=A

 $X(3900)^\pm$ REFERENCES

NODE=M210

ABLIKIM 14A PRL 112 022001	M. Ablikim <i>et al.</i>	(BES III Collab.) JP
ABLIKIM 13T PRL 110 252001	M. Ablikim <i>et al.</i>	(BES III Collab.)
ABLIKIM 13X PRL 111 242001	M. Ablikim <i>et al.</i>	(BES III Collab.)
LIU 13B PRL 110 252002	Z.Q. Liu <i>et al.</i>	(BELLE Collab.)
XIAO 13A PL B727 366	T. Xiao <i>et al.</i>	(NWES)

REFID=55648
REFID=55409
REFID=55635
REFID=55410
REFID=55593

NODE=M211

 $X(3900)^0$

$$I(J^P) = ?(??)$$

OMITTED FROM SUMMARY TABLE

Seen by XIAO 13A in $e^+ e^- \rightarrow \pi^0 X^0$, $X^0 \rightarrow \pi^0 J/\psi$ at $\sqrt{s} = 4170$ MeV. Likely the isospin partner of the $X(3900)^\pm$.

NODE=M211

 $X(3900)^0$ MASS

NODE=M211M

<u>VALUE (MeV)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>COMMENT</u>
$3904 \pm 9 \pm 5$	25 ± 7	¹ XIAO 13A	$4.17 e^+ e^- \rightarrow \pi^+ \pi^- J/\psi$
¹ For $M^2(\pi^0 \pi^0) < 0.65 \text{ GeV}^2$ and fixed width of 37 MeV. The signal has 3.5σ significance including systematic uncertainties. Obtained by analyzing CLEO-c data but not authored by the CLEO Collaboration.			

NODE=M211M

NODE=M211M;LINKAGE=A

 $X(3900)^0$ DECAY MODES

NODE=M211215;NODE=M211

Mode	Fraction (Γ_i/Γ)
Γ_1 $J/\psi \pi^0$	seen

DESIG=1

 $X(3900)^0$ BRANCHING RATIOS

NODE=M211225

$\Gamma(J/\psi \pi^0)/\Gamma_{\text{total}}$	Γ_1/Γ
<u>VALUE</u> <u>EVTS</u> <u>DOCUMENT ID</u> <u>COMMENT</u>	
seen 25 ± 7 ¹ XIAO 13A $4.17 e^+ e^- \rightarrow \pi^+ \pi^- J/\psi$	
¹ Obtained by analyzing CLEO-c data but not authored by the CLEO Collaboration.	

NODE=M211R01
NODE=M211R01

NODE=M211R01;LINKAGE=A

 $X(3900)^0$ REFERENCES

NODE=M211

XIAO 13A PL B727 366	T. Xiao <i>et al.</i>	(NWES)

REFID=55593

$\chi_{c0}(2P)$
was $X(3915)$

$$J^{PC} = 0^+(0^+)$$

NODE=M159

 $\chi_{c0}(2P)$ MASS

NODE=M159M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
3918.4 ± 1.9 OUR AVERAGE				
3919.4 ± 2.2 ± 1.6	59 ± 10	LEES	12AD BABR	$e^+e^- \rightarrow e^+e^-\omega J/\psi$
3919.1 ⁺ _{3.8} ⁻ ± 3.4	2.0	DEL-AMO-SA..10B	BABR	$B \rightarrow \omega J/\psi K$
3915 ± 3 ± 2	49 ± 15	UEHARA	10 BELL	10.6 $e^+e^- \rightarrow e^+e^-\omega J/\psi$
3943 ± 11 ± 13	58 ± 11	¹ CHOI	05 BELL	$B \rightarrow \omega J/\psi K$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
3914.6 ⁺ _{3.8} ⁻ ± 3.4	2.0	¹ AUBERT	08W BABR	Superseded by DEL-AMO-SANCHEZ 10B
¹ $\omega J/\psi$ threshold enhancement fitted as an S-wave Breit-Wigner resonance.				

NODE=M159M

NODE=M159M;LINKAGE=CH

 $\chi_{c0}(2P)$ WIDTH

NODE=M159W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
20 ± 5 OUR AVERAGE	Error includes scale factor of 1.1.			
13 ± 6 ± 3	59 ± 10	LEES	12AD BABR	$e^+e^- \rightarrow e^+e^-\omega J/\psi$
31 ⁺ ₁₀ ⁻ ± 8	5	DEL-AMO-SA..10B	BABR	$B \rightarrow \omega J/\psi K$
17 ± 10 ± 3	49 ± 15	UEHARA	10 BELL	10.6 $e^+e^- \rightarrow e^+e^-\omega J/\psi$
87 ± 22 ± 26	58 ± 11	² CHOI	05 BELL	$B \rightarrow \omega J/\psi K$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
34 ⁺ ₁₂ ⁻ ± 8	5	² AUBERT	08W BABR	Superseded by DEL-AMO-SANCHEZ 10B
² $\omega J/\psi$ threshold enhancement fitted as an S-wave Breit-Wigner resonance.				

NODE=M159W

NODE=M159W;LINKAGE=CH

 $\chi_{c0}(2P)$ DECAY MODES

NODE=M159215;NODE=M159

Mode	Fraction (Γ_i/Γ)
Γ_1 $\omega J/\psi$	seen
Γ_2 $\bar{D}^{*0} D^0$	
Γ_3 $\pi^+ \pi^- \eta_c(1S)$	not seen
Γ_4 $K \bar{K}$	not seen
Γ_5 $\gamma\gamma$	seen

DESIG=1;OUR EST;→ UNCHECKED ←
DESIG=3
DESIG=4;OUR EVAL;→ UNCHECKED ←
DESIG=5;OUR EVAL;→ UNCHECKED ←
DESIG=2

 $\chi_{c0}(2P)$ $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

NODE=M159220

$\Gamma(\omega J/\psi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$					$\Gamma_1\Gamma_5/\Gamma$
VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT	
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=M159G01
NODE=M159G01

OCCUR=2

NODE=M159G01;LINKAGE=UH
NODE=M159G01;LINKAGE=UR

$\Gamma(\pi^+\pi^-\eta_c(1S)) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$					$\Gamma_3\Gamma_5/\Gamma$
VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT	
<16	90	LEES	12AE BABR	$e^+e^- \rightarrow e^+e^-\pi^+\pi^-\eta_c$	

$\Gamma(K\bar{K}) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$					$\Gamma_4\Gamma_5/\Gamma$
VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT	
<1.96	90	UEHARA	13	BELL $\gamma\gamma \rightarrow K_S^0 K_S^0$	

NODE=M159G02
NODE=M159G02

NODE=M159G03
NODE=M159G03

$\chi_{c0}(2P)$ BRANCHING RATIOS

$\Gamma(\gamma\gamma)/\Gamma_{\text{total}}$					Γ_5/Γ
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
seen	59 $\pm$ 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=M159225

NODE=M159R01
NODE=M159R01

$\Gamma(\omega J/\psi)/\Gamma(\bar{D}^{*0} D^0)$					Γ_1/Γ_2
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
>0.71	90	⁵ AUSHEV	10 BELL	$B \rightarrow \bar{D}^{*0} D^0 K$	

NODE=M159R02
NODE=M159R02

⁵ By combining the upper limit $B(B \rightarrow X(3915)K) \times B(X(3915) \rightarrow D^{*0} \bar{D}^0) < 0.67 \times 10^{-4}$ from AUSHEV 10 with the average of CHOI 05 and AUBERT 08W measurements $B(B \rightarrow X(3915)K) \times B(X(3915) \rightarrow \omega J/\psi) = (0.51 \pm 0.11) \times 10^{-4}$.

NODE=M159R02;LINKAGE=AU

$\Gamma(\omega J/\psi)/\Gamma_{\text{total}}$					Γ_1/Γ
VALUE		DOCUMENT ID	TECN	COMMENT	
seen		⁶ DEL-AMO-SA...10B	BABR	$B \rightarrow \omega J/\psi K$	
seen		⁷ CHOI	05 BELL	$B \rightarrow \omega J/\psi K$	

NODE=M159R03
NODE=M159R03

⁶ DEL-AMO-SANCHEZ 10B reports $B(B^\pm \rightarrow X(3915)K^\pm) \times B(X(3915) \rightarrow J/\psi \omega) = (3.0_{-0.6-0.3}^{+0.7+0.5}) \times 10^{-5}$ 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

⁷ CHOI 05 reports $B(B \rightarrow X(3915)K) \times B(X(3915) \rightarrow J/\psi \omega) = (7.1 \pm 1.3 \pm 3.1) \times 10^{-5}$.

NODE=M159R03;LINKAGE=CH

 $\chi_{c0}(2P)$ REFERENCES

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=55592
REFID=54751
REFID=54752
REFID=53225
REFID=53362
REFID=53232
REFID=52263
REFID=50737

$$\chi_{c2}(2P) \quad I^G(J^{PC}) = 0^+(2^{++})$$

NODE=M050

 $\chi_{c2}(2P)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
3927.2 $\pm$ 2.6 OUR AVERAGE				
3926.7 $\pm$ 2.7 $\pm$ 1.1	76 $\pm$ 17	AUBERT	10G BABR	10.6 $e^+e^- \rightarrow e^+e^- D\bar{D}$
3929 $\pm$ 5 $\pm$ 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 $\pm$ 6 OUR AVERAGE				
21.3 $\pm$ 6.8 $\pm$ 3.6	76 $\pm$ 17	AUBERT	10G BABR	10.6 $e^+e^- \rightarrow e^+e^- D\bar{D}$
29 $\pm$ 10 $\pm$ 2	64	UEHARA	06 BELL	10.6 $e^+e^- \rightarrow e^+e^- D\bar{D}$

NODE=M050W

NODE=M050W

 $\chi_{c2}(2P)$ DECAY MODES

NODE=M050215;NODE=M050

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \gamma\gamma$	seen
$\Gamma_2 \quad K\bar{K}\pi$	
$\Gamma_3 \quad K^+K^-\pi^+\pi^-\pi^0$	
$\Gamma_4 \quad D\bar{D}$	seen
$\Gamma_5 \quad D^+D^-$	seen
$\Gamma_6 \quad D^0\bar{D}^0$	seen
$\Gamma_7 \quad \pi^+\pi^-\eta_c(1S)$	not seen
$\Gamma_8 \quad K\bar{K}$	not seen

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

NODE=M050220

 $\chi_{c2}(2P) \Gamma(i) \Gamma(\gamma\gamma) / \Gamma(\text{total})$

NODE=M050222

$\Gamma(K\bar{K}\pi) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$		$\Gamma_2 \Gamma_1 / \Gamma$			
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=M050G01
NODE=M050G01

$\Gamma(K^+ K^- \pi^+ \pi^- \pi^0) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$		$\Gamma_3 \Gamma_1 / \Gamma$			
VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT	
<3.4	90	DEL-AMO-SA...11M	BABR	$\gamma\gamma \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$	

NODE=M050G02
NODE=M050G02

$\Gamma(D\bar{D}) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$					$\Gamma_4\Gamma_1/\Gamma$	
VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT		
0.21±0.04 OUR AVERAGE						
0.24±0.05±0.04	76 ± 17	AUBERT	10G	BABR	10.6 $e^+e^- \rightarrow e^+e^- D\bar{D}$	
0.18±0.05±0.03	64	¹ UEHARA	06	BELL	10.6 $e^+e^- \rightarrow e^+e^- D\bar{D}$	
¹ Assuming $B(D^+D^-) = 0.89 B(D^0\bar{D}^0)$.						

NODE=M050G1
NODE=M050G1¹ Assuming $B(D^+ D^-) = 0.89 B(D^0 \bar{D}^0)$.

NODE=M050G1;LINKAGE=UE

$\Gamma(\pi^+ \pi^- \eta_c(1S)) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$		$\Gamma_7 \Gamma_1 / \Gamma$			
VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT	
<18	90	LEES	12AE	BABR	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^- \eta_c$

NODE=M050G03
NODE=M050G03

$\Gamma(K\bar{K}) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$		$\Gamma_8 \Gamma_1 / \Gamma$			
VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT	
<0.256	90	UEHARA	13	BELL	$\gamma\gamma \rightarrow K_S^0 K_S^0$

NODE=M050G04
NODE=M050G04 $\chi_{c2}(2P)$ BRANCHING RATIOS

NODE=M050225

$\Gamma(D^+ D^-) / \Gamma(D^0 \bar{D}^0)$		Γ_5 / Γ_6			
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
0.74±0.43±0.16	64	UEHARA	06	BELL	10.6 $e^+ e^- \rightarrow e^+ e^- D\bar{D}$

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

Mode	Fraction (Γ_i/Γ)
Γ_1 $D\bar{D}^* + \text{c.c.}$	seen
Γ_2 $D\bar{D}$	not seen
Γ_3 $J/\psi\omega$	not seen

NODE=M029215;NODE=M029

DESIG=1;OUR EVAL;→ UNCHECKED ←
 DESIG=2;OUR EVAL;→ UNCHECKED ←
 DESIG=3;OUR EVAL;→ UNCHECKED ←

X(3940) BRANCHING RATIOS

$\Gamma(D\bar{D}^* + \text{c.c.})/\Gamma_{\text{total}}$	Γ_1/Γ
VALUE	CL% EVTS DOCUMENT ID TECN COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

>0.45 90 25 ^{3,4} ABE 07 BELL $e^+e^- \rightarrow J/\psi X$

³ For X(3940) decaying to final states with more than two tracks.

⁴ PAKHLOV 08 finds that the inclusive peak near 3940 MeV/c² may consist of several states.

NODE=M029225

NODE=M029R01
 NODE=M029R01

NODE=M029R01;LINKAGE=AB
 NODE=M029R01;LINKAGE=AE

$\Gamma(D\bar{D})/\Gamma_{\text{total}}$	Γ_2/Γ
VALUE	CL% EVTS DOCUMENT ID TECN COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.41 90 ^{5,6} ABE 07 BELL $e^+e^- \rightarrow J/\psi X$

⁵ For X(3940) decaying to final states with more than two tracks.

⁶ PAKHLOV 08 finds that the inclusive peak near 3940 MeV/c² may consist of several states.

NODE=M029R02
 NODE=M029R02

NODE=M029R02;LINKAGE=AB
 NODE=M029R02;LINKAGE=AE

$\Gamma(J/\psi\omega)/\Gamma_{\text{total}}$	Γ_3/Γ
VALUE	CL% EVTS DOCUMENT ID TECN COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.26 90 ^{7,8} ABE 07 BELL $e^+e^- \rightarrow J/\psi X$

⁷ For X(3940) decaying to final states with more than two tracks.

⁸ PAKHLOV 08 finds that the inclusive peak near 3940 MeV/c² may consist of several states.

NODE=M029R03
 NODE=M029R03

NODE=M029R03;LINKAGE=AB
 NODE=M029R03;LINKAGE=AE

X(3940) REFERENCES

PAKHLOV 08 PRL 100 202001	P. Pakhlov <i>et al.</i>	(BELLE Collab.)
ABE 07 PRL 98 082001	K. Abe <i>et al.</i>	(BELLE Collab.)

NODE=M029

REFID=52302
 REFID=51627

NODE=M213

X(4020)[±]

$$I(J^P) = ?(?)$$

OMITTED FROM SUMMARY TABLE

Seen by ABLIKIM 13X in $e^+e^- \rightarrow \pi^+\pi^-h_c$ at c.m. energy from 3.90 to 4.42 GeV as a peak in the invariant mass distribution of the $h_c\pi^\pm$ system. Needs confirmation.

NODE=M213

X(4020)[±] MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
4023.9±2.4 OUR AVERAGE				
4026.3±2.6±3.7	0.4k	¹ ABLIKIM 14B	BES3	$e^+e^- \rightarrow (D^*\bar{D}^*)^\pm\pi^\mp$
4022.9±0.8±2.7	253	ABLIKIM 13X	BES3	$e^+e^- \rightarrow \pi^+\pi^-h_c$

¹ Neglecting interference between the X(4020) and non-resonant continuum. Assuming the same origin of the $(D^*\bar{D}^*)^+$ and $h_c\pi^+$ decay modes.

NODE=M213M

NODE=M213M

NODE=M213M;LINKAGE=A

X(4020)[±] WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
10 ±6 OUR AVERAGE				Error includes scale factor of 1.7.
24.8±5.6±7.7	0.4k	¹ ABLIKIM 14B	BES3	$e^+e^- \rightarrow (D^*\bar{D}^*)^\pm\pi^\mp$
7.9±2.7±2.6	253	ABLIKIM 13X	BES3	$e^+e^- \rightarrow \pi^+\pi^-h_c$

¹ Neglecting interference between the X(4020) and non-resonant continuum. Assuming the same origin of the $(D^*\bar{D}^*)^+$ and $h_c\pi^+$ decay modes.

NODE=M213W

NODE=M213W

NODE=M213W;LINKAGE=A

$X(4020)^\pm$ DECAY MODES

NODE=M213215;NODE=M213

Mode	Fraction (Γ_i/Γ)
Γ_1 $h_c \pi^\pm$	seen
Γ_2 $D^* \bar{D}^*$	seen

DESIG=1

DESIG=2

 $X(4020)^\pm$ BRANCHING RATIOS

NODE=M213225

$\Gamma(h_c \pi^\pm)/\Gamma_{\text{total}}$					Γ_1/Γ
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
seen	253	ABLIKIM	13x	BES3	$e^+ e^- \rightarrow \pi^+ \pi^- h_c$

NODE=M213R01

NODE=M213R01

$\Gamma(D^*\bar{D}^*)/\Gamma_{\text{total}}$					Γ_2/Γ
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
seen	0.4k	¹ ABLIKIM	14B	BES3	$e^+e^- \rightarrow (D^*\bar{D}^*)^\pm\pi^\mp$

NODE=M213R02

NODE=M213R02

¹ Neglecting interference between the $X(4020)$ and non-resonant continuum.

NODE=M213R02;LINKAGE=A

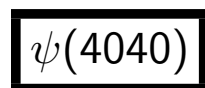
 $X(4020)^\pm$ REFERENCES

ABLIKIM	14B	PRL 112 132001	M. Ablikim <i>et al.</i>	(BES III Collab.)
ABLIKIM	13X	PRL 111 242001	M. Ablikim <i>et al.</i>	(BES III Collab.)

NODE=M213

REFID=55654

REFID=55635



$$J^{PC} = 0^-(1^{--})$$

NODE=M072

 $\psi(4040)$ MASS

NODE=M072M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
4039 $\pm$ 1 OUR ESTIMATE			
4039.6 $\pm$ 4.3	¹ ABLIKIM	08D	BES2 $e^+ e^- \rightarrow$ hadrons
• • • We do not use the following data for averages, fits, limits, etc. • • •			
4034 $\pm$ 6	² MO	10	RVUE $e^+ e^- \rightarrow$ hadrons
4037 $\pm$ 2	³ SETH	05A	RVUE $e^+ e^- \rightarrow$ hadrons
4040 $\pm$ 1	⁴ SETH	05A	RVUE $e^+ e^- \rightarrow$ hadrons
4040 $\pm$ 10	BRANDELIK	78C	DASP $e^+ e^-$

NODE=M072M

→ UNCHECKED ←

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.

OCCUR=2

NODE=M072M;LINKAGE=AB

NODE=M072M;LINKAGE=MO

NODE=M072M;LINKAGE=ST

NODE=M072M;LINKAGE=SE

 $\psi(4040)$ WIDTH

NODE=M072W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
80 $\pm$ 10 OUR ESTIMATE			
84.5 $\pm$ 12.3	⁵ ABLIKIM	08D	BES2 $e^+ e^- \rightarrow$ hadrons
• • • We do not use the following data for averages, fits, limits, etc. • • •			
87 $\pm$ 11	⁶ MO	10	RVUE $e^+ e^- \rightarrow$ hadrons
85 $\pm$ 10	⁷ SETH	05A	RVUE $e^+ e^- \rightarrow$ hadrons
89 $\pm$ 6	⁸ SETH	05A	RVUE $e^+ e^- \rightarrow$ hadrons
52 $\pm$ 10	BRANDELIK	78C	DASP $e^+ e^-$

NODE=M072W

→ UNCHECKED ←

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.

OCCUR=2

NODE=M072W;LINKAGE=AB

NODE=M072W;LINKAGE=MO

NODE=M072W;LINKAGE=ST

NODE=M072W;LINKAGE=SE

$\psi(4040)$ DECAY MODES

Due to the complexity of the $c\bar{c}$ threshold region, in this listing, "seen" ("not seen") means that a cross section for the mode in question has been measured at effective $\sqrt{s}$ near this particle's central mass value, more (less) than 2σ above zero, without regard to any peaking behavior in $\sqrt{s}$ or absence thereof. See mode listing(s) for details and references.

NODE=M072215;NODE=M072

NODE=M072

	Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1	e^+e^-	$(1.07 \pm 0.16) \times 10^{-5}$	
Γ_2	$D\bar{D}$	seen	
Γ_3	$D^0\bar{D}^0$	seen	
Γ_4	D^+D^-	seen	
Γ_5	$D^*\bar{D} + \text{c.c.}$	seen	
Γ_6	$D^*(2007)^0\bar{D}^0 + \text{c.c.}$	seen	
Γ_7	$D^*(2010)^+D^- + \text{c.c.}$	seen	
Γ_8	$D^*\bar{D}^*$	seen	
Γ_9	$D^*(2007)^0\bar{D}^*(2007)^0$	seen	
Γ_{10}	$D^*(2010)^+D^*(2010)^-$	seen	
Γ_{11}	$D\bar{D}\pi$ (excl. $D^*\bar{D}$)		
Γ_{12}	$D^0D^-\pi^+ + \text{c.c.}$ (excl. $D^*(2007)^0\bar{D}^0 + \text{c.c.}$, $D^*(2010)^+D^- + \text{c.c.}$)	not seen	
Γ_{13}	$D\bar{D}^*\pi$ (excl. $D^*\bar{D}^*$)	not seen	
Γ_{14}	$D^0\bar{D}^{*-}\pi^+ + \text{c.c.}$ (excl. $D^*(2010)^+D^*(2010)^-$)	seen	
Γ_{15}	$D_s^+D_s^-$	seen	
Γ_{16}	$J/\psi(1S)$ hadrons		
Γ_{17}	$J/\psi\pi^+\pi^-$	$< 4 \times 10^{-3}$	90%
Γ_{18}	$J/\psi\pi^0\pi^0$	$< 2 \times 10^{-3}$	90%
Γ_{19}	$J/\psi\eta$	$(5.2 \pm 0.7) \times 10^{-3}$	
Γ_{20}	$J/\psi\pi^0$	$< 2.8 \times 10^{-4}$	90%
Γ_{21}	$J/\psi\pi^+\pi^-\pi^0$	$< 2 \times 10^{-3}$	90%
Γ_{22}	$\chi_{c1}\gamma$	$< 1.1\%$	90%
Γ_{23}	$\chi_{c2}\gamma$	$< 1.7\%$	90%
Γ_{24}	$\chi_{c1}\pi^+\pi^-\pi^0$	$< 1.1\%$	90%
Γ_{25}	$\chi_{c2}\pi^+\pi^-\pi^0$	$< 3.2\%$	90%
Γ_{26}	$h_c(1P)\pi^+\pi^-$	$< 3 \times 10^{-3}$	90%
Γ_{27}	$\phi\pi^+\pi^-$	$< 3 \times 10^{-3}$	90%
Γ_{28}	$\Lambda\bar{\Lambda}\pi^+\pi^-$	$< 2.9 \times 10^{-4}$	90%
Γ_{29}	$\Lambda\bar{\Lambda}\pi^0$	$< 9 \times 10^{-5}$	90%
Γ_{30}	$\Lambda\bar{\Lambda}\eta$	$< 3.0 \times 10^{-4}$	90%
Γ_{31}	$\Sigma^+\bar{\Sigma}^-$	$< 1.3 \times 10^{-4}$	90%
Γ_{32}	$\Sigma^0\bar{\Sigma}^0$	$< 7 \times 10^{-5}$	90%
Γ_{33}	$\Xi^+\bar{\Xi}^-$	$< 1.6 \times 10^{-4}$	90%
Γ_{34}	$\Xi^0\bar{\Xi}^0$	$< 1.8 \times 10^{-4}$	90%
Γ_{35}	$\mu^+\mu^-$		

DESIG=5

DESIG=17;OUR EST;→ UNCHECKED ←

DESIG=1

DESIG=18

DESIG=19;OUR EST;→ UNCHECKED ←

DESIG=2

DESIG=20

DESIG=21;OUR EST;→ UNCHECKED ←

DESIG=3

DESIG=22

DESIG=23

DESIG=24

DESIG=25

DESIG=26

DESIG=27

DESIG=4

DESIG=7

DESIG=8

DESIG=9

DESIG=10

DESIG=11

DESIG=12

DESIG=13

DESIG=14

DESIG=15

DESIG=28

DESIG=16

DESIG=29

DESIG=30

DESIG=31

DESIG=32

DESIG=33

DESIG=34

DESIG=35

DESIG=6

 $\psi(4040)$ PARTIAL WIDTHS

NODE=M072220

 $\Gamma(e^+e^-)$ **Γ_1**

VALUE (keV)

DOCUMENT ID

TECN

COMMENT

 0.86 ± 0.07 OUR ESTIMATE **0.83 ± 0.20** ⁹ ABLIKIM

08D

BES2

 $e^+e^- \rightarrow$ hadrons

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.6 to 1.4

¹⁰ MO

10

RVUE

 $e^+e^- \rightarrow$ hadrons 0.88 ± 0.11 ¹¹ SETH

05A

RVUE

 $e^+e^- \rightarrow$ hadrons 0.91 ± 0.13 ¹² SETH

05A

RVUE

 $e^+e^- \rightarrow$ hadrons 0.75 ± 0.15

BRANDELIK

78C

DASP

 e^+e^-

NODE=M072W5

NODE=M072W5

→ UNCHECKED ←

OCCUR=2

⁹ Reanalysis of data presented in BAI 02C. From a global fit over the center-of-mass energy region 3.7–5.0 GeV covering the $\psi(3770)$, $\psi(4040)$, $\psi(4160)$, and $\psi(4415)$ resonances. Phase angle fixed in the fit to $\delta = (130 \pm 46)^\circ$.

¹⁰ Reanalysis of data presented in BAI 00 and BAI 02C. From a global fit over the center-of-mass energy 3.8–4.8 GeV covering the $\psi(4040)$, $\psi(4160)$ and $\psi(4415)$ resonances and including interference effects. Four sets of solutions are obtained with the same fit quality, mass and total width, but with different e^+e^- partial widths. We quote only the range of values.

¹¹ From a fit to Crystal Ball (OSTERHELD 86) data.

¹² From a fit to BES (BAI 02C) data.

NODE=M072W5;LINKAGE=AB

NODE=M072W5;LINKAGE=MO

NODE=M072W5;LINKAGE=ST

NODE=M072W5;LINKAGE=SE

$\psi(4040) \Gamma(i) \Gamma(e^+e^-) / \Gamma^2(\text{total})$

$\Gamma(J/\psi\eta) / \Gamma_{\text{total}} \times \Gamma(e^+e^-) / \Gamma_{\text{total}} \quad \Gamma_{19} / \Gamma \times \Gamma_1 / \Gamma$

VALUE (units 10^{-8})	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

$5.1 \pm 1.4 \pm 1.5$	¹³ WANG	13B	BELL $e^+e^- \rightarrow J/\psi\eta\gamma$

$12.8 \pm 2.1 \pm 1.9$	¹⁴ WANG	13B	BELL $e^+e^- \rightarrow J/\psi\eta\gamma$

¹³ Solution I of two equivalent solutions in a fit using two interfering resonances. Mass and width fixed at 4039 MeV and 80 MeV, respectively.

¹⁴ Solution II of two equivalent solutions in a fit using two interfering resonances. Mass and width fixed at 4039 MeV and 80 MeV, respectively.

NODE=M072230

NODE=M072R25
NODE=M072R25

OCCUR=2

NODE=M072R25;LINKAGE=A

NODE=M072R25;LINKAGE=B

$\psi(4040)$ BRANCHING RATIOS

$\Gamma(e^+e^-) / \Gamma_{\text{total}} \quad \Gamma_1 / \Gamma$

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

~ 1.0	FELDMAN	77	MRK1 e^+e^-

$\Gamma(D^0\bar{D}^0) / \Gamma_{\text{total}} \quad \Gamma_3 / \Gamma$

VALUE	DOCUMENT ID	TECN	COMMENT

seen	AUBERT	09M	BABR $e^+e^- \rightarrow D^0\bar{D}^0\gamma$

seen	CRONIN-HEN..09	CLEO	$e^+e^- \rightarrow D^0\bar{D}^0$

seen	PAKHLOVA	08	BELL $e^+e^- \rightarrow D^0\bar{D}^0\gamma$

NODE=M072R14
NODE=M072R14

$\Gamma(D^+D^-) / \Gamma_{\text{total}} \quad \Gamma_4 / \Gamma$

VALUE	DOCUMENT ID	TECN	COMMENT

seen	AUBERT	09M	BABR $e^+e^- \rightarrow D^+D^-\gamma$

seen	CRONIN-HEN..09	CLEO	$e^+e^- \rightarrow D^+D^-$

seen	PAKHLOVA	08	BELL $e^+e^- \rightarrow D^+D^-\gamma$

NODE=M072R15
NODE=M072R15

$\Gamma(D\bar{D}) / \Gamma(D^*\bar{D} + \text{c.c.}) \quad \Gamma_2 / \Gamma_5$

VALUE	DOCUMENT ID	TECN	COMMENT

$0.24 \pm 0.05 \pm 0.12$	AUBERT	09M	BABR $e^+e^- \rightarrow \gamma D^{(*)}\bar{D}$

NODE=M072R12
NODE=M072R12

$\Gamma(D^0\bar{D}^0) / \Gamma(D^*(2007)^0\bar{D}^0 + \text{c.c.}) \quad \Gamma_3 / \Gamma_6$

VALUE	DOCUMENT ID	TECN	COMMENT

0.05 ± 0.03	¹⁵ GOLDBABER	77	MRK1 e^+e^-

¹⁵ Phase-space factor (p^3) explicitly removed.

NODE=M072R1
NODE=M072R1

NODE=M072R;LINKAGE=P

$\Gamma(D^*(2007)^0\bar{D}^0 + \text{c.c.}) / \Gamma_{\text{total}} \quad \Gamma_6 / \Gamma$

VALUE	DOCUMENT ID	TECN	COMMENT

seen	AUBERT	09M	BABR $e^+e^- \rightarrow D^{*0}\bar{D}^0\gamma$

seen	CRONIN-HEN..09	CLEO	$e^+e^- \rightarrow D^{*0}\bar{D}^0$

NODE=M072R16
NODE=M072R16

$\Gamma(D^*(2010)^+D^- + \text{c.c.}) / \Gamma_{\text{total}} \quad \Gamma_7 / \Gamma$

VALUE	DOCUMENT ID	TECN	COMMENT

seen	AUBERT	09M	BABR $e^+e^- \rightarrow D^{*+}D^-\gamma$

seen	CRONIN-HEN..09	CLEO	$e^+e^- \rightarrow D^{*+}D^-$

seen	PAKHLOVA	07	BELL $e^+e^- \rightarrow D^{*+}D^-\gamma$

NODE=M072R17
NODE=M072R17

$\Gamma(D^*(2010)^+D^- + \text{c.c.}) / \Gamma(D^*(2007)^0\bar{D}^0 + \text{c.c.}) \quad \Gamma_7 / \Gamma_6$

VALUE	DOCUMENT ID	TECN	COMMENT

$0.95 \pm 0.09 \pm 0.10$	AUBERT	09M	BABR $e^+e^- \rightarrow \gamma D^*\bar{D}$

NODE=M072R11
NODE=M072R11

$$\Gamma(D^*\bar{D}^*)/\Gamma(D^*\bar{D} + \text{c.c.})$$

 Γ_8/Γ_5

VALUE	DOCUMENT ID	TECN	COMMENT
0.18±0.14±0.03	AUBERT	09M BABR	$e^+e^- \rightarrow \gamma D(^*)\bar{D}(^*)$

NODE=M072R13
NODE=M072R13

$$\Gamma(D^*(2007)^0\bar{D}^*(2007)^0)/\Gamma_{\text{total}}$$

 Γ_9/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	AUBERT	09M BABR	$e^+e^- \rightarrow D^{*0}\bar{D}^{*0}\gamma$
seen	CRONIN-HEN..09	CLEO	$e^+e^- \rightarrow D^{*0}\bar{D}^{*0}$

NODE=M072R18
NODE=M072R18

$$\Gamma(D^*(2007)^0\bar{D}^*(2007)^0)/\Gamma(D^*(2007)^0\bar{D}^0 + \text{c.c.})$$

 Γ_9/Γ_6

VALUE	DOCUMENT ID	TECN	COMMENT
32.0±12.0	¹⁶ GOLDHABER	77 MRK1	e^+e^-

NODE=M072R2
NODE=M072R2

¹⁶ Phase-space factor (p^3) explicitly removed.

NODE=M072R2;LINKAGE=P

$$\Gamma(D^*(2010)^+D^*(2010)^-)/\Gamma_{\text{total}}$$

 Γ_{10}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	AUBERT	09M BABR	$e^+e^- \rightarrow D^{*+}D^{*-}\gamma$
seen	CRONIN-HEN..09	CLEO	$e^+e^- \rightarrow D^{*+}D^{*-}$
seen	PAKHLOVA	07 BELL	$e^+e^- \rightarrow D^{*+}D^{*-}\gamma$

NODE=M072R19
NODE=M072R19

$$\Gamma(D^0D^-\pi^+ + \text{c.c. (excl. } D^*(2007)^0\bar{D}^0 + \text{c.c., } D^*(2010)^+D^- + \text{c.c.}))/\Gamma_{\text{total}}$$

 Γ_{12}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	PAKHLOVA	08A BELL	$e^+e^- \rightarrow D^0D^-\pi^+\gamma$

NODE=M072R20
NODE=M072R20

$$\Gamma(D\bar{D}^*\pi(\text{excl. } D^*\bar{D}^*))/\Gamma_{\text{total}}$$

 Γ_{13}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	CRONIN-HEN..09	CLEO	$e^+e^- \rightarrow D\bar{D}^*\pi$

NODE=M072R21
NODE=M072R21

$$\Gamma(D^0\bar{D}^{*-}\pi^+ + \text{c.c. (excl. } D^*(2010)^+D^*(2010)^-))/\Gamma_{\text{total}}$$

 Γ_{14}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	PAKHLOVA	09 BELL	$e^+e^- \rightarrow D^0D^{*-}\pi^+\gamma$

NODE=M072R22
NODE=M072R22

$$\Gamma(D_s^+D_s^-)/\Gamma_{\text{total}}$$

 Γ_{15}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	PAKHLOVA	11 BELL	$e^+e^- \rightarrow D_s^+D_s^-\gamma$
seen	DEL-AMO-SA..10N	BABR	$e^+e^- \rightarrow D_s^+D_s^-\gamma$
seen	CRONIN-HEN..09	CLEO	$e^+e^- \rightarrow D_s^+D_s^-$

NODE=M072R23
NODE=M072R23

$$\Gamma(J/\psi\pi^+\pi^-)/\Gamma_{\text{total}}$$

 Γ_{17}/Γ

VALUE (units 10 ⁻³)	CL%	DOCUMENT ID	TECN	COMMENT
<4	90	COAN	06 CLEO	3.97–4.06 $e^+e^- \rightarrow$ hadrons

NODE=M072R01
NODE=M072R01

$$\Gamma(J/\psi\pi^0\pi^0)/\Gamma_{\text{total}}$$

 Γ_{18}/Γ

VALUE (units 10 ⁻³)	CL%	DOCUMENT ID	TECN	COMMENT
<2	90	COAN	06 CLEO	3.97–4.06 $e^+e^- \rightarrow$ hadrons

NODE=M072R02
NODE=M072R02

$$\Gamma(J/\psi\eta)/\Gamma_{\text{total}}$$

 Γ_{19}/Γ

VALUE (units 10 ⁻³)	CL%	DOCUMENT ID	TECN	COMMENT
5.2±0.5±0.5		¹⁷ ABLIKIM	12K BES3	$e^+e^- \rightarrow \ell^+\ell^-2\gamma$

NODE=M072R03
NODE=M072R03

• • • We do not use the following data for averages, fits, limits, etc. • • •

<7	90	COAN	06 CLEO	3.97–4.06 $e^+e^- \rightarrow$ hadrons

¹⁷ 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;LINKAGE=AB

$$\Gamma(J/\psi\pi^0)/\Gamma_{\text{total}}$$

 Γ_{20}/Γ

VALUE (units 10 ⁻³)	CL%	DOCUMENT ID	TECN	COMMENT
<0.28	90	¹⁸ ABLIKIM	12K BES3	$e^+e^- \rightarrow \ell^+\ell^-2\gamma$

NODE=M072R04
NODE=M072R04

• • • We do not use the following data for averages, fits, limits, etc. • • •

<2	90	COAN	06 CLEO	3.97–4.06 $e^+e^- \rightarrow$ hadrons

¹⁸ 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;LINKAGE=AB

$\Gamma(J/\psi\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{21}/Γ NODE=M072R05
NODE=M072R05

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<2	90	COAN	06	CLEO 3.97–4.06 $e^+e^- \rightarrow$ hadrons

 $\Gamma(\chi_{c1}\gamma)/\Gamma_{\text{total}}$ Γ_{22}/Γ NODE=M072R06
NODE=M072R06

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<11	90	COAN	06	CLEO 3.97–4.06 $e^+e^- \rightarrow$ hadrons

 $\Gamma(\chi_{c2}\gamma)/\Gamma_{\text{total}}$ Γ_{23}/Γ NODE=M072R07
NODE=M072R07

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<17	90	COAN	06	CLEO 3.97–4.06 $e^+e^- \rightarrow$ hadrons

 $\Gamma(\chi_{c1}\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{24}/Γ NODE=M072R08
NODE=M072R08

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<11	90	COAN	06	CLEO 3.97–4.06 $e^+e^- \rightarrow$ hadrons

 $\Gamma(\chi_{c2}\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{25}/Γ NODE=M072R09
NODE=M072R09

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<32	90	COAN	06	CLEO 3.97–4.06 $e^+e^- \rightarrow$ hadrons

 $\Gamma(h_c(1P)\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{26}/Γ NODE=M072R24
NODE=M072R24

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<3	90	¹⁹ PEDLAR	11	CLEO $e^+e^- \rightarrow h_c(1P)\pi^+\pi^-$

¹⁹ From several values of $\sqrt{s}$ near the peak of the $\psi(4040)$, PEDLAR 11 measures $\sigma(e^+e^- \rightarrow h_c(1P)\pi^+\pi^-) = 1.0 \pm 8.0 \pm 5.4 \pm 0.2$ pb, where the errors are statistical, systematic, and due to uncertainty in $B(\psi(2S) \rightarrow \pi^0 h_c(1P))$, respectively.

NODE=M072R24;LINKAGE=PE

 $\Gamma(\phi\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{27}/Γ NODE=M072R10
NODE=M072R10

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<3	90	COAN	06	CLEO 3.97–4.06 $e^+e^- \rightarrow$ hadrons

 $\Gamma(\Lambda\bar{\Lambda}\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{28}/Γ NODE=M072R26
NODE=M072R26

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<2.9	90	²⁰ ABLIKIM	13Q	BES3 $e^+e^- \rightarrow \psi(4040)$

²⁰ 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 NODE=M072R27
NODE=M072R27

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<0.9	90	²¹ ABLIKIM	13Q	BES3 $e^+e^- \rightarrow \psi(4040)$

²¹ 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 NODE=M072R28
NODE=M072R28

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<3.0	90	²² ABLIKIM	13Q	BES3 $e^+e^- \rightarrow \psi(4040)$

²² 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 NODE=M072R29
NODE=M072R29

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.3	90	²³ ABLIKIM	13Q	BES3 $e^+e^- \rightarrow \psi(4040)$

²³ 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 NODE=M072R30
NODE=M072R30

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<0.7	90	²⁴ ABLIKIM	13Q	BES3 $e^+e^- \rightarrow \psi(4040)$

²⁴ 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 NODE=M072R31
NODE=M072R31

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.6	90	²⁵ ABLIKIM	13Q	BES3 $e^+e^- \rightarrow \psi(4040)$

²⁵ Assuming that interference effects between resonance and continuum can be neglected.

NODE=M072R31;LINKAGE=A

$\Gamma(\Xi^0 \Xi^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.8	90	²⁶ ABLIKIM	13Q BES3	$e^+ e^- \rightarrow \psi(4040)$

²⁶ Assuming that interference effects between resonance and continuum can be neglected.

NODE=M072R32
NODE=M072R32

NODE=M072R32;LINKAGE=A

$\psi(4040)$ REFERENCES

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=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}	² MIZUK	08 BELL	$\bar{B}^0 \rightarrow K^- \pi^+ \chi_{c1}(1P)$

² 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

$\Gamma(\pi^+ \chi_{c1}(1P))/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT
seen	³ MIZUK	08 BELL	$\bar{B}^0 \rightarrow K^- \pi^+ \chi_{c1}(1P)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

not seen ⁴ LEES 12B BABR $B \rightarrow K \pi \chi_{c1}(1P)$

³ With a product branching fraction measurement of $B(\bar{B}^0 \rightarrow K^- X(4050)^+) \times B(X(4050)^+ \rightarrow \pi^+ \chi_{c1}(1P)) = (3.0^{+1.5+3.7}_{-0.8-1.6}) \times 10^{-5}$.

⁴ With a product branching fraction limit of $B(\bar{B}^0 \rightarrow X(4050)^+ K^-) \times B(X(4050)^+ \rightarrow \chi_{c1} \pi^+) < 1.8 \times 10^{-5}$ at 90% CL.

NODE=M191R01
NODE=M191R01

NODE=M191R01;LINKAGE=MI

NODE=M191R01;LINKAGE=LE

$X(4050)^\pm$ REFERENCES

LEES 12B PR D85 052003 J.P. Lees *et al.* (BABAR Collab.)
MIZUK 08 PR D78 072004 R. Mizuk *et al.* (BELLE Collab.)

NODE=M191

REFID=54042
REFID=52535

NODE=M193

 $X(4140)$

$$I^G(J^{PC}) = 0^+(?^{?+})$$

OMITTED FROM SUMMARY TABLE

Needs confirmation.

Seen by AALTONEN 09AH and ABAZOV 14A in the $B^+ \rightarrow X K^+$,
 $X \rightarrow J/\psi \phi$. Not seen by SHEN 10 in $\gamma\gamma \rightarrow J/\psi \phi$ or AAIJ 12AA
in $B^+ \rightarrow J/\psi \phi K^+$.

NODE=M193

 $X(4140)$ MASS

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$4159.0 \pm 4.3 \pm 6.6$	52 ± 19	¹ ABAZOV	14A D0	$B^+ \rightarrow J/\psi \phi K^+$
$4143.0 \pm 2.9 \pm 1.2$	14 ± 5	² AALTONEN	09AH CDF	$B^+ \rightarrow J/\psi \phi K^+$
¹ Statistical significance of 3.1 σ . ² Statistical significance of 3.8 σ .				

NODE=M193M

NODE=M193M

NODE=M193M;LINKAGE=A
NODE=M193M;LINKAGE=AA **$X(4140)$ WIDTH**

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$20 \pm 13 \begin{smallmatrix} +3 \\ -8 \end{smallmatrix}$	52 ± 19	³ ABAZOV	14A D0	$B^+ \rightarrow J/\psi \phi K^+$
$11.7 \begin{smallmatrix} +8.3 \\ -5.0 \end{smallmatrix} \pm 3.7$	14 ± 5	⁴ AALTONEN	09AH CDF	$B^+ \rightarrow J/\psi \phi K^+$
³ Statistical significance of 3.1 σ . ⁴ Statistical significance of 3.8 σ .				

NODE=M193W

NODE=M193W

NODE=M193W;LINKAGE=A
NODE=M193W;LINKAGE=AA **$X(4140)$ DECAY MODES**

Mode	Fraction (Γ_i/Γ)
Γ_1 $J/\psi \phi$	not seen
Γ_2 $\gamma\gamma$	not seen

DESIG=1

DESIG=2

 $X(4140)$ $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

$\Gamma(\gamma\gamma) \times \Gamma(J/\psi\phi)/\Gamma_{\text{total}}$					$\Gamma_2\Gamma_1/\Gamma$
VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT	
<41	90	⁵ 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	⁶ SHEN	10	BELL	$10.6\ e^+e^- \rightarrow e^+e^- J/\psi\phi$
⁵ For $J^P = 0^+$.					
⁶ For $J^P = 2^+$.					

NODE=M193220

NODE=M193G01
NODE=M193G01

OCCUR=2

NODE=M193G01;LINKAGE=S0
NODE=M193G01;LINKAGE=S2 **$X(4140)$ BRANCHING RATIOS**

$\Gamma(J/\psi\phi)/\Gamma_{\text{total}}$				Γ_1/Γ
VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
not seen		⁷ AAIJ	12AA LHCB	$pp \rightarrow B^+ X$ at 7 TeV
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
seen	52 ± 19	⁸ ABAZOV	14A D0	$B^+ \rightarrow J/\psi\phi K^+$
seen	14 ± 5	⁹ AALTONEN	09AH CDF	$B^+ \rightarrow J/\psi\phi K^+$
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.				
⁸ 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 3.1 σ significance.				
⁹ Statistical significance of 3.8 σ .				

NODE=M193225

NODE=M193R01
NODE=M193R01

NODE=M193R01;LINKAGE=AI

NODE=M193R01;LINKAGE=A

NODE=M193R01;LINKAGE=AA

$\Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	SHEN	10	BELL 10.6 $e^+e^- \rightarrow e^+e^- J/\psi\phi$

NODE=M193R02
 NODE=M193R02

X(4140) REFERENCES

ABAZOV	14A	PR D89 012004	V.M. Abazov <i>et al.</i>	(D0 Collab.)
AAIJ	12AA	PR D85 091103	R. Aaij <i>et al.</i>	(LHCb Collab.)
SHEN	10	PRL 104 112004	C.P. Shen <i>et al.</i>	(BELLE Collab.)
AALTONEN	09AH	PRL 102 242002	T. Aaltonen <i>et al.</i>	(CDF Collab.)

NODE=M193

REFID=55650
 REFID=54263
 REFID=53235
 REFID=52968

NODE=M025

 $\psi(4160)$

$$J^{PC} = 0^-(1^--)$$

 $\psi(4160)$ MASS

NODE=M025M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

4191 $\pm$ 5 OUR AVERAGE[4192 $\pm$ 7 MeV OUR 2013 AVERAGE]

4191 $\pm$ 9 - 8	AAIJ	13BC	LHCb $B^+ \rightarrow K^+ \mu^+ \mu^-$
4191.7 $\pm$ 6.5	¹ ABLIKIM	08D	BES2 $e^+e^- \rightarrow$ hadrons
• • • We do not use the following data for averages, fits, limits, etc. • • •			
4193 $\pm$ 7	² MO	10	RVUE $e^+e^- \rightarrow$ hadrons
4151 $\pm$ 4	³ SETH	05A	RVUE $e^+e^- \rightarrow$ hadrons
4155 $\pm$ 5	⁴ SETH	05A	RVUE $e^+e^- \rightarrow$ hadrons
4159 $\pm$ 20	BRANDELIK	78C	DASP e^+e^-

OCCUR=2

¹ Reanalysis of data presented in BAI 02C. From a global fit over the center-of-mass energy region 3.7–5.0 GeV covering the $\psi(3770)$, $\psi(4040)$, $\psi(4160)$, and $\psi(4415)$ resonances. Phase angle fixed in the fit to $\delta = (293 \pm 57)^\circ$.

² Reanalysis of data presented in BAI 00 and BAI 02C. From a global fit over the center-of-mass energy 3.8–4.8 GeV covering the $\psi(4040)$, $\psi(4160)$ and $\psi(4415)$ resonances and including interference effects.

³ From a fit to Crystal Ball (OSTERHELD 86) data.

⁴ From a fit to BES (BAI 02C) data.

NODE=M025M;LINKAGE=AB

NODE=M025M;LINKAGE=MO

NODE=M025M;LINKAGE=ST

NODE=M025M;LINKAGE=SE

 $\psi(4160)$ WIDTH

NODE=M025W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

70 $\pm$ 10 OUR AVERAGE[72 $\pm$ 12 MeV OUR 2013 AVERAGE]

65 $\pm$ 22 - 16	AAIJ	13BC	LHCb $B^+ \rightarrow K^+ \mu^+ \mu^-$
71.8 $\pm$ 12.3	⁵ ABLIKIM	08D	BES2 $e^+e^- \rightarrow$ hadrons
• • • We do not use the following data for averages, fits, limits, etc. • • •			
79 $\pm$ 14	⁶ MO	10	RVUE $e^+e^- \rightarrow$ hadrons
107 $\pm$ 10	⁷ SETH	05A	RVUE $e^+e^- \rightarrow$ hadrons
107 $\pm$ 16	⁸ SETH	05A	RVUE $e^+e^- \rightarrow$ hadrons
78 $\pm$ 20	BRANDELIK	78C	DASP e^+e^-

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 $\delta = (293 \pm 57)^\circ$.

⁶ Reanalysis of data presented in BAI 00 and BAI 02C. From a global fit over the center-of-mass energy 3.8–4.8 GeV covering the $\psi(4040)$, $\psi(4160)$ and $\psi(4415)$ resonances and including interference effects.

⁷ From a fit to Crystal Ball (OSTERHELD 86) data.

⁸ From a fit to BES (BAI 02C) data.

NODE=M025W;LINKAGE=AB

NODE=M025W;LINKAGE=MO

NODE=M025W;LINKAGE=ST

NODE=M025W;LINKAGE=SE

$\psi(4160)$ DECAY MODES

Due to the complexity of the $c\bar{c}$ threshold region, in this listing, “seen” (“not seen”) means that a cross section for the mode in question has been measured at effective $\sqrt{s}$ near this particle’s central mass value, more (less) than 2σ above zero, without regard to any peaking behavior in $\sqrt{s}$ or absence thereof. See mode listing(s) for details and references.

NODE=M025215;NODE=M025

NODE=M025

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 e^+e^-	$(6.9 \pm 3.3) \times 10^{-6}$	
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} $D^0D^-\pi^+ + \text{c.c. (excl. } D^*(2007)^0\bar{D}^0 + \text{c.c., } D^*(2010)^+D^- + \text{c.c.})$	not seen	
Γ_{13} $D\bar{D}^*\pi + \text{c.c. (excl. } D^*\bar{D}^*)$	seen	
Γ_{14} $D^0D^{*-}\pi^+ + \text{c.c. (excl. } D^*(2010)^+D^*(2010)^-)$	not seen	
Γ_{15} D^+D^-	not seen	
Γ_{16} $D_s^{*+}\bar{D}_s^- + \text{c.c.}$	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} $\chi_{c1}\gamma$	$< 7 \times 10^{-3}$	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

 $\psi(4160)$ PARTIAL WIDTHS

NODE=M025220

$\Gamma(e^+e^-)$				Γ_1
VALUE (keV)	DOCUMENT ID	TECN	COMMENT	
0.48 ± 0.22	⁹ ABLIKIM	08D BES2	$e^+e^- \rightarrow \text{hadrons}$	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.4 to 1.1	¹⁰ MO	10 RVUE	$e^+e^- \rightarrow \text{hadrons}$	
0.83 ± 0.08	¹¹ SETH	05A RVUE	$e^+e^- \rightarrow \text{hadrons}$	
0.84 ± 0.13	¹² SETH	05A RVUE	$e^+e^- \rightarrow \text{hadrons}$	
0.77 ± 0.23	BRANDELIK	78C DASP	e^+e^-	
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 $\delta = (293 \pm 57)^\circ$.				
¹⁰ Reanalysis of data presented in BAI 00 and BAI 02C. From a global fit over the center-of-mass energy 3.8–4.8 GeV covering the $\psi(4040)$, $\psi(4160)$ and $\psi(4415)$ resonances and including interference effects. Four sets of solutions are obtained with the same fit quality, mass and total width, but with different e^+e^- partial widths. We quote only the range of values.				
¹¹ From a fit to Crystal Ball (OSTERHELD 86) data.				
¹² From a fit to BES (BAI 02C) data.				

NODE=M025W1
NODE=M025W1

OCCUR=2

NODE=M025W1;LINKAGE=AB

NODE=M025W1;LINKAGE=MO

NODE=M025W1;LINKAGE=ST
NODE=M025W1;LINKAGE=SE

$\psi(4160) \Gamma(i) \Gamma(e^+ e^-) / \Gamma^2(\text{total})$

NODE=M025230

 $\Gamma(J/\psi\eta) / \Gamma_{\text{total}} \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$ $\Gamma_{20} / \Gamma \times \Gamma_1 / \Gamma$ NODE=M025R32
NODE=M025R32VALUE (units 10^{-8})

DOCUMENT ID

TECN

COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

 $2.8 \pm 0.9 \pm 0.9$ ¹³ WANG

13B

BELL

 $e^+ e^- \rightarrow J/\psi \eta \gamma$ $12.8 \pm 1.7 \pm 2.0$ ¹⁴ WANG

13B

BELL

 $e^+ e^- \rightarrow J/\psi \eta \gamma$

OCCUR=2

¹³ 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

¹⁴ 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

 $\psi(4160) \text{ BRANCHING RATIOS}$

NODE=M025225

 $\Gamma(\mu^+ \mu^-) / \Gamma_{\text{total}}$ Γ_2 / Γ

VALUE

DOCUMENT ID

TECN

COMMENT

seen

¹⁵ AAIJ

13BC

LHCB

 $B^+ \rightarrow K^+ \mu^+ \mu^-$ ¹⁵ AAIJ 13BC report $B(B^+ \rightarrow K^+ \psi(4160)) B(\psi(4160) \rightarrow \mu^+ \mu^-) = (3.5^{+0.9}_{-0.8}) \times 10^{-9}$.NODE=M025R31
NODE=M025R31

NODE=M025R31;LINKAGE=A

 $\Gamma(D\bar{D}) / \Gamma(D^* \bar{D}^*)$ Γ_3 / Γ_9

VALUE

DOCUMENT ID

TECN

COMMENT

 $0.02 \pm 0.03 \pm 0.02$

AUBERT

09M

BABR

 $e^+ e^- \rightarrow \gamma D^{(*)} \bar{D}^{(*)}$ NODE=M025R14
NODE=M025R14 $\Gamma(D^0 \bar{D}^0) / \Gamma_{\text{total}}$ Γ_4 / Γ

VALUE

DOCUMENT ID

TECN

COMMENT

seen

CRONIN-HEN..09

CLEO

 $e^+ e^- \rightarrow D^0 \bar{D}^0$

seen

PAKHLOVA 08

BELL

 $e^+ e^- \rightarrow D^0 \bar{D}^0 \gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

not seen

AUBERT

09M

BABR

 $e^+ e^- \rightarrow D^0 \bar{D}^0 \gamma$ NODE=M025R16
NODE=M025R16 $\Gamma(D^+ D^-) / \Gamma_{\text{total}}$ Γ_5 / Γ

VALUE

DOCUMENT ID

TECN

COMMENT

seen

CRONIN-HEN..09

CLEO

 $e^+ e^- \rightarrow D^+ D^-$

seen

PAKHLOVA 08

BELL

 $e^+ e^- \rightarrow D^+ D^- \gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

not seen

AUBERT

09M

BABR

 $e^+ e^- \rightarrow D^+ D^- \gamma$ NODE=M025R17
NODE=M025R17 $\Gamma(D^*(2007)^0 \bar{D}^0 + \text{c.c.}) / \Gamma_{\text{total}}$ Γ_7 / Γ

VALUE

DOCUMENT ID

TECN

COMMENT

seen

AUBERT

09M

BABR

 $e^+ e^- \rightarrow D^{*0} \bar{D}^0 \gamma$

seen

CRONIN-HEN..09

CLEO

 $e^+ e^- \rightarrow D^{*0} \bar{D}^0$ NODE=M025R18
NODE=M025R18 $\Gamma(D^*(2010)^+ D^- + \text{c.c.}) / \Gamma_{\text{total}}$ Γ_8 / Γ

VALUE

DOCUMENT ID

TECN

COMMENT

seen

AUBERT

09M

BABR

 $e^+ e^- \rightarrow D^{*+} D^- \gamma$

seen

CRONIN-HEN..09

CLEO

 $e^+ e^- \rightarrow D^{*+} D^-$

seen

PAKHLOVA 07

BELL

 $e^+ e^- \rightarrow D^{*+} D^- \gamma$ NODE=M025R19
NODE=M025R19 $\Gamma(D^* \bar{D} + \text{c.c.}) / \Gamma(D^* \bar{D}^*)$ Γ_6 / Γ_9

VALUE

DOCUMENT ID

TECN

COMMENT

 $0.34 \pm 0.14 \pm 0.05$

AUBERT

09M

BABR

 $e^+ e^- \rightarrow \gamma D^{(*)} \bar{D}^{(*)}$ NODE=M025R15
NODE=M025R15 $\Gamma(D^*(2007)^0 \bar{D}^{*0} (2007)^0) / \Gamma_{\text{total}}$ Γ_{10} / Γ

VALUE

DOCUMENT ID

TECN

COMMENT

seen

AUBERT

09M

BABR

 $e^+ e^- \rightarrow D^{*0} \bar{D}^{*0} \gamma$

seen

CRONIN-HEN..09

CLEO

 $e^+ e^- \rightarrow D^{*0} \bar{D}^{*0}$ NODE=M025R20
NODE=M025R20 $\Gamma(D^*(2010)^+ D^*(2010)^-) / \Gamma_{\text{total}}$ Γ_{11} / Γ

VALUE

DOCUMENT ID

TECN

COMMENT

seen

AUBERT

09M

BABR

 $e^+ e^- \rightarrow D^{*+} D^{*-} \gamma$

seen

CRONIN-HEN..09

CLEO

 $e^+ e^- \rightarrow D^{*+} D^{*-}$

seen

PAKHLOVA 07

BELL

 $e^+ e^- \rightarrow D^{*+} D^{*-} \gamma$ NODE=M025R21
NODE=M025R21

$$\Gamma(D^0 D^- \pi^+ + \text{c.c. (excl. } D^*(2007)^0 \bar{D}^0 + \text{c.c., } D^*(2010)^+ D^- + \text{c.c.}))/\Gamma_{\text{total}}$$

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_{12}/Γ
not seen	PAKHLOVA	08A	BELL $e^+ e^- \rightarrow D^0 D^- \pi^+ \gamma$	

NODE=M025R22
NODE=M025R22

$$\Gamma(D \bar{D}^* \pi + \text{c.c. (excl. } D^* \bar{D}^*))/\Gamma_{\text{total}}$$

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_{13}/Γ
seen	CRONIN-HEN..09	CLEO	$e^+ e^- \rightarrow D \bar{D}^* \pi$	

NODE=M025R23
NODE=M025R23

$$\Gamma(D^0 D^{*-} \pi^+ + \text{c.c. (excl. } D^*(2010)^+ D^*(2010)^-))/\Gamma_{\text{total}}$$

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_{14}/Γ
not seen	PAKHLOVA	09	BELL $e^+ e^- \rightarrow D^0 D^{*-} \pi^+ \gamma$	

NODE=M025R24
NODE=M025R24

$$\Gamma(D_s^+ D_s^-)/\Gamma_{\text{total}}$$

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_{15}/Γ
not seen	PAKHLOVA	11	BELL $e^+ e^- \rightarrow D_s^+ D_s^- \gamma$	
not seen	DEL-AMO-SA..10N	BABR	$e^+ e^- \rightarrow D_s^+ D_s^- \gamma$	
not seen	CRONIN-HEN..09	CLEO	$e^+ e^- \rightarrow D_s^+ D_s^-$	

NODE=M025R25
NODE=M025R25

$$\Gamma(D_s^{*+} D_s^- + \text{c.c.})/\Gamma_{\text{total}}$$

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_{16}/Γ
seen	PAKHLOVA	11	BELL $e^+ e^- \rightarrow D_s^{*+} D_s^- \gamma$	
seen	DEL-AMO-SA..10N	BABR	$e^+ e^- \rightarrow D_s^{*+} D_s^- \gamma$	
seen	CRONIN-HEN..09	CLEO	$e^+ e^- \rightarrow D_s^{*+} D_s^-$	

NODE=M025R26
NODE=M025R26

$$\Gamma(J/\psi \pi^+ \pi^-)/\Gamma_{\text{total}}$$

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT	Γ_{17}/Γ
<3	90	COAN	06	CLEO 4.12-4.2 $e^+ e^- \rightarrow$ hadrons	

NODE=M025R01
NODE=M025R01

$$\Gamma(J/\psi \pi^0 \pi^0)/\Gamma_{\text{total}}$$

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT	Γ_{18}/Γ
<3	90	COAN	06	CLEO 4.12-4.2 $e^+ e^- \rightarrow$ hadrons	

NODE=M025R02
NODE=M025R02

$$\Gamma(J/\psi K^+ K^-)/\Gamma_{\text{total}}$$

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT	Γ_{19}/Γ
<2	90	COAN	06	CLEO 4.12-4.2 $e^+ e^- \rightarrow$ hadrons	

NODE=M025R03
NODE=M025R03

$$\Gamma(J/\psi \eta)/\Gamma_{\text{total}}$$

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT	Γ_{20}/Γ
<8	90	COAN	06	CLEO 4.12-4.2 $e^+ e^- \rightarrow$ hadrons	

NODE=M025R04
NODE=M025R04

$$\Gamma(J/\psi \pi^0)/\Gamma_{\text{total}}$$

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT	Γ_{21}/Γ
<1	90	COAN	06	CLEO 4.12-4.2 $e^+ e^- \rightarrow$ hadrons	

NODE=M025R05
NODE=M025R05

$$\Gamma(J/\psi \eta')/\Gamma_{\text{total}}$$

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT	Γ_{22}/Γ
<5	90	COAN	06	CLEO 4.12-4.2 $e^+ e^- \rightarrow$ hadrons	

NODE=M025R06
NODE=M025R06

$$\Gamma(J/\psi \pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}$$

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT	Γ_{23}/Γ
<1	90	COAN	06	CLEO 4.12-4.2 $e^+ e^- \rightarrow$ hadrons	

NODE=M025R07
NODE=M025R07

$$\Gamma(\psi(2S) \pi^+ \pi^-)/\Gamma_{\text{total}}$$

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT	Γ_{24}/Γ
<4	90	COAN	06	CLEO 4.12-4.2 $e^+ e^- \rightarrow$ hadrons	

NODE=M025R08
NODE=M025R08

$$\Gamma(\chi_{c1} \gamma)/\Gamma_{\text{total}}$$

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT	Γ_{25}/Γ
<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
$\Gamma(\chi_{c1}\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$					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
$\Gamma(\chi_{c2}\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$					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
$\Gamma(h_c(1P)\pi^+\pi^-)/\Gamma_{\text{total}}$					Γ_{29}/Γ
VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT	
<5	90	16 PEDLAR	11	CLEO	$e^+e^- \rightarrow h_c(1P)\pi^+\pi^-$
16 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.					
$\Gamma(h_c(1P)\pi^0\pi^0)/\Gamma_{\text{total}}$					Γ_{30}/Γ
VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT	
<2	90	17 PEDLAR	11	CLEO	$e^+e^- \rightarrow h_c(1P)\pi^0\pi^0$
17 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.					
$\Gamma(h_c(1P)\eta)/\Gamma_{\text{total}}$					Γ_{31}/Γ
VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT	
<2	90	18 PEDLAR	11	CLEO	$e^+e^- \rightarrow h_c(1P)\eta$
18 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.					
$\Gamma(h_c(1P)\pi^0)/\Gamma_{\text{total}}$					Γ_{32}/Γ
VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT	
<0.4	90	19 PEDLAR	11	CLEO	$e^+e^- \rightarrow h_c(1P)\pi^0$
19 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.					
$\Gamma(\phi\pi^+\pi^-)/\Gamma_{\text{total}}$					Γ_{33}/Γ
VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT	
<2	90	COAN	06	CLEO	4.12–4.2 $e^+e^- \rightarrow$ hadrons

NODE=M025R10
NODE=M025R10

NODE=M025R11
NODE=M025R11

NODE=M025R12
NODE=M025R12

NODE=M025R27
NODE=M025R27

NODE=M025R27;LINKAGE=PE

NODE=M025R28
NODE=M025R28

NODE=M025R28;LINKAGE=PE

NODE=M025R29
NODE=M025R29

NODE=M025R29;LINKAGE=PE

NODE=M025R30
NODE=M025R30

NODE=M025R30;LINKAGE=PE

NODE=M025R13
NODE=M025R13

$\psi(4160)$ REFERENCES

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.)
PAKHLOVA	11	PR D83 011101	G. Pakhlova <i>et al.</i>	(BELLE Collab.)
PEDLAR	11	PRL 107 041803	T. Pedlar <i>et al.</i>	(CLEO Collab.)
DEL-AMO-SA...	10N	PR D82 052004	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)
MO	10	PR D82 077501	X.H. Mo, C.Z. Yuan, P. Wang	(BHEP)
AUBERT	09M	PR D79 092001	B. Aubert <i>et al.</i>	(BABAR Collab.)
CRONIN-HEN...	09	PR D80 072001	D. Cronin-Hennessy <i>et al.</i>	(CLEO Collab.)
PAKHLOVA	09	PR D80 091101	G. Pakhlova <i>et al.</i>	(BELLE Collab.)
ABLIKIM	08D	PL B660 315	M. Ablikim <i>et al.</i>	(BES Collab.)
PAKHLOVA	08	PR D77 011103	G. Pakhlova <i>et al.</i>	(BELLE Collab.)
PAKHLOVA	08A	PRL 100 062001	G. Pakhlova <i>et al.</i>	(BELLE Collab.)
PAKHLOVA	07	PRL 98 092001	G. Pakhlova <i>et al.</i>	(BELLE Collab.)
COAN	06	PRL 96 162003	T.E. Coan <i>et al.</i>	(CLEO Collab.)
SETH	05A	PR D72 017501	K.K. Seth	
BAI	02C	PRL 88 101802	J.Z. Bai <i>et al.</i>	(BES Collab.)
BAI	00	PRL 84 594	J.Z. Bai <i>et al.</i>	(BES Collab.)
OSTERHELD	86	SLAC-PUB-4160	A. Osterheld <i>et al.</i>	(SLAC Crystal Ball Collab.)
BRANDELIK	78C	PL 76B 361	R. Brandelik <i>et al.</i>	(DASP Collab.)

NODE=M025

REFID=55229
REFID=55377
REFID=53638
REFID=16787
REFID=53532
REFID=53540
REFID=52724
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REFID=53143
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REFID=52132
REFID=52134
REFID=51628
REFID=51075
REFID=50813
REFID=50506
REFID=50503
REFID=51064
REFID=22232

X(4160)

$I^G(J^{PC}) = ?^?(??)$

OMITTED FROM SUMMARY TABLE
Seen by PAKHLOV 08 in $e^+e^- \rightarrow J/\psi X, X \rightarrow D^*\bar{D}^*$

X(4160) MASS					
VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT	
4156 ⁺²⁵ ₋₂₀ ±15	24	PAKHLOV	08	BELL	$e^+e^- \rightarrow J/\psi X$

X(4160) WIDTH					
VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT	
139 ⁺¹¹¹ ₋₆₁ ±21	24	PAKHLOV	08	BELL	$e^+e^- \rightarrow J/\psi X$

X(4160) DECAY MODES		
Mode	Fraction (Γ_i/Γ)	
$\Gamma_1 \quad D\bar{D}$	not seen	
$\Gamma_2 \quad D^*\bar{D} + \text{c.c.}$	not seen	
$\Gamma_3 \quad D^*D^*$	seen	

X(4160) BRANCHING RATIOS					
$\Gamma(D\bar{D})/\Gamma(D^*\bar{D}^*)$					Γ_1/Γ_3
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
<0.09	90	PAKHLOV	08	BELL	$e^+e^- \rightarrow J/\psi X$
$\Gamma(D^*\bar{D} + \text{c.c.})/\Gamma(D^*\bar{D}^*)$					Γ_2/Γ_3
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
<0.22	90	PAKHLOV	08	BELL	$e^+e^- \rightarrow J/\psi X$

X(4160) REFERENCES					
PAKHLOV	08	PRL 100 202001	P. Pakhlov <i>et al.</i>		(BELLE Collab.)

X(4250)[±]

$I(J^P) = ?(??)$

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.

X(4250) [±] MASS				
VALUE (MeV)	DOCUMENT ID	TECN	COMMENT	
4248 ⁺⁴⁴ ₋₂₉ ⁺¹⁸⁰ ₋₃₅	¹ MIZUK	08	BELL	$\bar{B}^0 \rightarrow K^- \pi^+ \chi_{c1}(1P)$
¹ From a Dalitz plot analysis with two Breit-Wigner amplitudes.				

X(4250) [±] WIDTH				
VALUE (MeV)	DOCUMENT ID	TECN	COMMENT	
177 ⁺⁵⁴ ₋₃₉ ⁺³¹⁶ ₋₆₁	² MIZUK	08	BELL	$\bar{B}^0 \rightarrow K^- \pi^+ \chi_{c1}(1P)$
² From a Dalitz plot analysis with two Breit-Wigner amplitudes.				

NODE=M190

NODE=M190

NODE=M190M

NODE=M190M

NODE=M190W

NODE=M190W

NODE=M190215;NODE=M190

DESIG=1;OUR EVAL;→ UNCHECKED ←
DESIG=2;OUR EVAL;→ UNCHECKED ←
DESIG=3;OUR EVAL;→ UNCHECKED ←

NODE=M190225

NODE=M190R01
NODE=M190R01

NODE=M190R02
NODE=M190R02

NODE=M190

REFID=52302

NODE=M192

NODE=M192

NODE=M192M

NODE=M192M

NODE=M192M;LINKAGE=MI

NODE=M192W

NODE=M192W

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	DOCUMENT ID	TECN	COMMENT	
seen	³ MIZUK	08	BELL $\bar{B}^0 \rightarrow K^- \pi^+ \chi_{c1}(1P)$	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
not seen	⁴ LEES	12B	BABR $B \rightarrow K \pi \chi_{c1}(1P)$	
³ With a product branching fraction measurement of $B(\bar{B}^0 \rightarrow K^- X(4250)^+) \times B(X(4250)^+ \rightarrow \pi^+ \chi_{c1}(1P)) = (4.0^{+2.3+19.7}_{-0.9-0.5}) \times 10^{-5}$.				
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

NODE=M074

 $X(4260)$

$$J^G(J^{PC}) = ?^?(1^{--})$$

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.)

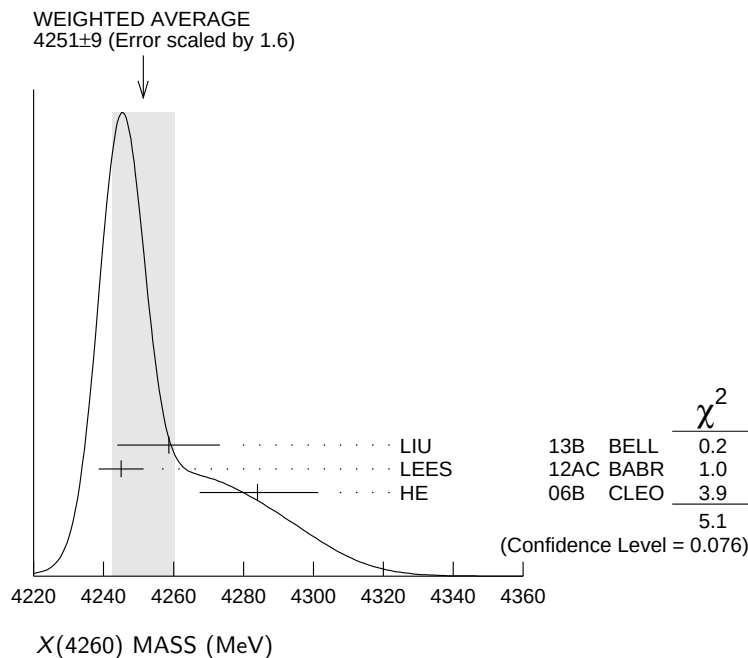
NODE=M074

 $X(4260)$ MASS

NODE=M074M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
4251 ± 9 OUR AVERAGE				Error includes scale factor of 1.6. See the ideogram below. [4250 $\pm$ 9 MeV OUR 2013 AVERAGE Scale factor = 1.6]
$4258.6 \pm 8.3 \pm 12.1$	¹	LIU	13B	BELL $e^+e^- \rightarrow \gamma \pi^+ \pi^- J/\psi$
$4245 \pm 5 \pm 4$	²	LEES	12AC	BABR $10.58 e^+e^- \rightarrow \gamma \pi^+ \pi^- J/\psi$
$4284^{+17}_{-16} \pm 413.6$		HE	06B	CLEO $9.4\text{--}10.6 e^+e^- \rightarrow \gamma \pi^+ \pi^- J/\psi$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$4247 \pm 12^{+17}_{-32}$	^{1,3}	YUAN	07	BELL $10.58 e^+e^- \rightarrow \gamma \pi^+ \pi^- J/\psi$
$4259 \pm 8^{+2}_{-6} \pm 125$	⁴	AUBERT,B	05I	BABR $10.58 e^+e^- \rightarrow \gamma \pi^+ \pi^- J/\psi$

NODE=M074M
NEW¹ From a two-resonance fit.² From a single-resonance fit. Supersedes AUBERT,B 05I.³ Superseded by LIU 13B.⁴ From a single-resonance fit. Two interfering resonances are not excluded. Superseded by LEES 12AC.NODE=M074M;LINKAGE=YU
NODE=M074M;LINKAGE=LE
NODE=M074M;LINKAGE=YN
NODE=M074M;LINKAGE=AU



X(4260) WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
120 ± 12 OUR AVERAGE		Error includes scale factor of 1.1. [108 ± 12 MeV OUR 2013 AVERAGE]		
134.1 ± 16.4 ± 5.5	5.5	¹ LIU	13B BELL	$e^+e^- \rightarrow \gamma\pi^+\pi^- J/\psi$
114 $^{+16}_{-15}$ ± 7	7	² LEES	12AC BABR	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^- J/\psi$
73 $^{+39}_{-25}$ ± 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 ± 19 ± 10	10	^{1,3} YUAN	07 BELL	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^- J/\psi$
88 ± 23 $^{+6}_{-4}$	125	⁴ AUBERT,B	05I BABR	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^- J/\psi$

¹ From a two-resonance fit.

² From a single-resonance fit. Supersedes AUBERT,B 05I.

³ Superseded by LIU 13B.

⁴ From a single-resonance fit. Two interfering resonances are not excluded. Superseded by LEES 12AC.

NODE=M074W

NODE=M074W

NEW

NODE=M074W;LINKAGE=YU

NODE=M074W;LINKAGE=LE

NODE=M074W;LINKAGE=YN

NODE=M074W;LINKAGE=AU

X(4260) DECAY MODES

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 $X(3872)\gamma$	seen
Γ_8 $J/\psi\eta$	not seen
Γ_9 $J/\psi\pi^0$	not seen
Γ_{10} $J/\psi\eta'$	not seen
Γ_{11} $J/\psi\pi^+\pi^-\pi^0$	not seen
Γ_{12} $J/\psi\eta\eta$	not seen
Γ_{13} $\psi(2S)\pi^+\pi^-$	not seen
Γ_{14} $\psi(2S)\eta$	not seen
Γ_{15} $\chi_{c0}\omega$	not seen
Γ_{16} $\chi_{c1}\gamma$	not seen
Γ_{17} $\chi_{c2}\gamma$	not seen
Γ_{18} $\chi_{c1}\pi^+\pi^-\pi^0$	not seen
Γ_{19} $\chi_{c2}\pi^+\pi^-\pi^0$	not seen

NODE=M074215;NODE=M074

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=42

DESIG=6;OUR EVAL;→ UNCHECKED ←

DESIG=7;OUR EVAL;→ UNCHECKED ←

DESIG=8;OUR EVAL;→ UNCHECKED ←

DESIG=9;OUR EVAL;→ UNCHECKED ←

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 ←

Γ ₂₀	$h_c(1P)\pi^+\pi^-$	not seen	DESIG=40;OUR EVAL;→ UNCHECKED ←
Γ ₂₁	$\phi\pi^+\pi^-$	not seen	DESIG=18;OUR EVAL;→ UNCHECKED ←
Γ ₂₂	$\phi\bar{\phi}(980) \rightarrow \phi\pi^+\pi^-$	not seen	DESIG=22;OUR EVAL;→ UNCHECKED ←
Γ ₂₃	$D\bar{D}$	not seen	DESIG=19;OUR EVAL;→ UNCHECKED ←
Γ ₂₄	$D^0\bar{D}^0$	not seen	DESIG=31
Γ ₂₅	D^+D^-	not seen	DESIG=32
Γ ₂₆	$D^*\bar{D}^+ + c.c.$	not seen	DESIG=23;OUR EVAL;→ UNCHECKED ←
Γ ₂₇	$D^*(2007)^0\bar{D}^0 + c.c.$	not seen	DESIG=33
Γ ₂₈	$D^*(2010)^+D^- + c.c.$	not seen	DESIG=34
Γ ₂₉	$D^*\bar{D}^*$	not seen	DESIG=24;OUR EVAL;→ UNCHECKED ←
Γ ₃₀	$D^*(2007)^0\bar{D}^*(2007)^0$	not seen	DESIG=35
Γ ₃₁	$D^*(2010)^+D^*(2010)^-$	not seen	DESIG=36
Γ ₃₂	$D\bar{D}\pi + c.c.$		DESIG=37
Γ ₃₃	$D^0D^-\pi^+ + c.c. \text{ (excl. } D^*(2007)^0\bar{D}^{*0} + c.c., D^*(2010)^+D^- + c.c.)$	not seen	DESIG=38
Γ ₃₄	$D\bar{D}^*\pi + c.c. \text{ (excl. } D^*\bar{D}^*)$	not seen	DESIG=25
Γ ₃₅	$D^0D^{*-}\pi^+ + c.c. \text{ (excl. } D^*(2010)^+D^*(2010)^-)$	not seen	DESIG=39
Γ ₃₆	$D^0D^*(2010)^-\pi^+ + c.c.$	not seen	DESIG=30;OUR EVAL;→ UNCHECKED ←
Γ ₃₇	$D^*\bar{D}^*\pi$	not seen	DESIG=26
Γ ₃₈	$D_s^+D_s^-$	not seen	DESIG=27
Γ ₃₉	$D_s^{*+}D_s^- + c.c.$	not seen	DESIG=28
Γ ₄₀	$D_s^{*+}D_s^{*-}$	not seen	DESIG=29
Γ ₄₁	$p\bar{p}$	not seen	DESIG=3;OUR EVAL;→ UNCHECKED ←
Γ ₄₂	$K_S^0K^\pm\pi^\mp$	not seen	DESIG=20;OUR EVAL;→ UNCHECKED ←
Γ ₄₃	$K^+K^-\pi^0$	not seen	DESIG=21;OUR EVAL;→ UNCHECKED ←

$X(4260)\Gamma(i)\Gamma(e^+e^-)/\Gamma(\text{total})$

$\Gamma(J/\psi\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_2\Gamma_1/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
9.2±1.0 OUR AVERAGE				
[9.0 ^{+1.0} _{-0.8} eV OUR 2013 AVERAGE]				
9.2±0.8±0.7	1	LEES	12AC BABR	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^- J/\psi$
8.9 ^{+3.9} _{-3.1} ±1.8	8.1	HE	06B CLEO	9.4-10.6 $e^+e^- \rightarrow \gamma\pi^+\pi^- J/\psi$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
6.4±0.8±0.6	2	LIU	13B BELL	$e^+e^- \rightarrow \gamma\pi^+\pi^- J/\psi$
20.5±1.4±2.0	3	LIU	13B BELL	$e^+e^- \rightarrow \gamma\pi^+\pi^- J/\psi$
6.0±1.2 ^{+4.7} _{-0.5}	2,4	YUAN	07 BELL	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^- J/\psi$
20.6±2.3 ^{+9.1} _{-1.7}	3,4	YUAN	07 BELL	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^- J/\psi$
5.5±1.0 ^{+0.8} _{-0.7}	125	5 AUBERT,B	05I BABR	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^- J/\psi$

¹ From a single-resonance fit. Supersedes AUBERT,B 05I.

² Solution I of two equivalent solutions in a fit using two interfering resonances.

³ Solution II of two equivalent solutions in a fit using two interfering resonances.

⁴ Superseded by LIU 13B.

⁵ From a single-resonance fit. Two interfering resonances are not excluded. Superseded by LEES 12AC.

$\Gamma(J/\psi K^+K^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_6\Gamma_1/\Gamma$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<1.2	90	1 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 YUAN 07.

$\Gamma(J/\psi\eta) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_8\Gamma_1/\Gamma$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<14.2	90	WANG	13B BELL	$e^+e^- \rightarrow J/\psi\eta\gamma$

NODE=M074230

NODE=M074G1
NODE=M074G1
NEW

OCCUR=2

OCCUR=2

NODE=M074G1;LINKAGE=LE
NODE=M074G1;LINKAGE=YU
NODE=M074G1;LINKAGE=YA
NODE=M074G1;LINKAGE=YN
NODE=M074G1;LINKAGE=AU

NODE=M074G3
NODE=M074G3

NODE=M074G3;LINKAGE=YU

NODE=M074G01
NODE=M074G01

$$\Gamma(\psi(2S)\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{13}\Gamma_1/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

<4.3	90	¹ LIU	08H RVUE	10.58 $e^+e^- \rightarrow \psi(2S)\pi^+\pi^-\gamma$
$7.4^{+2.1}_{-1.7}$		² LIU	08H RVUE	10.58 $e^+e^- \rightarrow \psi(2S)\pi^+\pi^-\gamma$

¹ For constructive interference with the X(4360) in a combined fit of AUBERT 07S and WANG 07D data with three resonances.

² For destructive interference with the X(4360) in a combined fit of AUBERT 07S and WANG 07D data with three resonances.

$$\Gamma(\phi\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{21}\Gamma_1/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT

<0.4	90	AUBERT,BE	06D BABR	10.6 $e^+e^- \rightarrow K^+K^-\pi^+\pi^-\gamma$

$$\Gamma(\phi f_0(980) \rightarrow \phi\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{22}\Gamma_1/\Gamma$$

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 $B(\phi(1020) \rightarrow K^+K^-) = 48.9 \times 10^{-2}$.

$$\Gamma(K_S^0 K^\pm \pi^\mp) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{42}\Gamma_1/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.5	90	AUBERT	08S BABR	10.6 $e^+e^- \rightarrow K_S^0 K^\pm \pi^\mp \gamma$

$$\Gamma(K^+K^-\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{43}\Gamma_1/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.6	90	AUBERT	08S BABR	10.6 $e^+e^- \rightarrow K^+K^-\pi^0 \gamma$

X(4260) BRANCHING RATIOS

$$\Gamma(J/\psi f_0(980), f_0(980) \rightarrow \pi^+\pi^-)/\Gamma(J/\psi\pi^+\pi^-) \quad \Gamma_3/\Gamma_2$$

VALUE	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.17 ± 0.13	¹ LEES	12AC BABR	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^-J/\psi$

¹ Systematic uncertainties not estimated.

$$\Gamma(X(3900)^\pm \pi^\mp, X^\pm \rightarrow J/\psi\pi^\pm)/\Gamma(J/\psi\pi^+\pi^-) \quad \Gamma_4/\Gamma_2$$

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.

$$\Gamma(h_c(1P)\pi^+\pi^-)/\Gamma(J/\psi\pi^+\pi^-) \quad \Gamma_{20}/\Gamma_2$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<1.0	90	¹ PEDLAR	11 CLEO	$e^+e^- \rightarrow h_c(1P)\pi^+\pi^-$

¹ At $\sqrt{s} = 4260$ MeV, PEDLAR 11 measures $\sigma(e^+e^- \rightarrow h_c(1P)\pi^+\pi^-) = 32 \pm 17 \pm 6 \pm 6$ pb, where the errors are statistical, systematic, and due to uncertainty in $B(\psi(2S) \rightarrow \pi^0 h_c(1P))$, respectively.

$$\Gamma(X(3872)\gamma)/\Gamma_{\text{total}} \quad \Gamma_7/\Gamma$$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

seen	20 ± 5	ABLIKIM	14 BES3	$e^+e^- \rightarrow J/\psi\pi^+\pi^-\gamma$

NODE=M074G7
NODE=M074G7

OCCUR=2

NODE=M074G7;LINKAGE=LI

NODE=M074G7;LINKAGE=LU

NODE=M074G2
NODE=M074G2

NODE=M074G6
NODE=M074G6

NODE=M074G6;LINKAGE=AU

NODE=M074G4
NODE=M074G4

NODE=M074G5
NODE=M074G5

NODE=M074240

NODE=M074R02
NODE=M074R02

NODE=M074R02;LINKAGE=LE

NODE=M074R01
NODE=M074R01

NODE=M074R01;LINKAGE=AB
NODE=M074R01;LINKAGE=A

NODE=M074R25
NODE=M074R25

NODE=M074R25;LINKAGE=PE

NODE=M074R26
NODE=M074R26

$\Gamma(D\bar{D})/\Gamma(J/\psi\pi^+\pi^-)$ Γ_{23}/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_{24}/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_{25}/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 $\Gamma(D^*\bar{D}+c.c.)/\Gamma(J/\psi\pi^+\pi^-)$ Γ_{26}/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 $\Gamma(D^*(2007)^0\bar{D}^0+c.c.)/\Gamma_{\text{total}}$ Γ_{27}/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 $\Gamma(D^*(2010)^+D^-+c.c.)/\Gamma_{\text{total}}$ Γ_{28}/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_{29}/Γ_2

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<11	90	CRONIN-HEN..09	CLEO	e^+e^-
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<40	90	AUBERT	09M BABR	$e^+e^- \rightarrow \gamma D^*\bar{D}^*$

NODE=M074R04
NODE=M074R04 $\Gamma(D^*(2007)^0\bar{D}^*(2007)^0)/\Gamma_{\text{total}}$ Γ_{30}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	CRONIN-HEN..09	CLEO	$e^+e^- \rightarrow D^{*0}\bar{D}^{*0}$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
not seen	AUBERT	09M BABR	$e^+e^- \rightarrow D^{*0}\bar{D}^{*0}\gamma$

NODE=M074R17
NODE=M074R17 $\Gamma(D^*(2010)^+D^*(2010)^-)/\Gamma_{\text{total}}$ Γ_{31}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	CRONIN-HEN..09	CLEO	$e^+e^- \rightarrow D^{*+}D^{*-}$
not seen	PAKHLOVA	07 BELL	$e^+e^- \rightarrow D^{*+}D^{*-}\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
not seen	AUBERT	09M BABR	$e^+e^- \rightarrow D^{*+}D^{*-}\gamma$

NODE=M074R18
NODE=M074R18 $\Gamma(D^0D^-\pi^++c.c. (\text{excl. } D^*(2007)^0\bar{D}^{*0}+c.c., D^*(2010)^+D^-+c.c.))/\Gamma_{\text{total}}$ Γ_{33}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	PAKHLOVA	08A BELL	$10.6 e^+e^- \rightarrow D^0D^-\pi^+\gamma$

NODE=M074R16
NODE=M074R16

$$\Gamma(D\bar{D}^*\pi + \text{c.c. (excl. } D^*\bar{D}^*)) / \Gamma_{\text{total}} \quad \Gamma_{34}/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	CRONIN-HEN..09	CLEO	$e^+e^- \rightarrow D^*\bar{D}\pi$

NODE=M074R22
NODE=M074R22

$$\Gamma(D\bar{D}^*\pi + \text{c.c. (excl. } D^*\bar{D}^*)) / \Gamma(J/\psi\pi^+\pi^-) \quad \Gamma_{34}/\Gamma_2$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<15	90	CRONIN-HEN..09	CLEO	e^+e^-

NODE=M074R05
NODE=M074R05

$$\Gamma(D^0 D^{*-}\pi^+ + \text{c.c. (excl. } D^*(2010)^+ D^*(2010)^-) / \Gamma_{\text{total}} \quad \Gamma_{35}/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	PAKHLOVA 09	BELL	$e^+e^- \rightarrow D^0 D^{*-}\pi^+ \gamma$

NODE=M074R23
NODE=M074R23

$$\Gamma(D^0 D^*(2010)^-\pi^+ + \text{c.c.}) / \Gamma(J/\psi\pi^+\pi^-) \quad \Gamma_{36}/\Gamma_2$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<9	90	PAKHLOVA 09	BELL	$e^+e^- \rightarrow D^0 D^{*-}\pi^+$

NODE=M074R10
NODE=M074R10

$$\Gamma(D^0 D^*(2010)^-\pi^+ + \text{c.c.}) / \Gamma_{\text{total}} \times \Gamma(e^+e^-) / \Gamma_{\text{total}} \quad \Gamma_{36}/\Gamma \times \Gamma_1/\Gamma$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.42 × 10 ⁻⁶	90	¹ PAKHLOVA 09	BELL	$e^+e^- \rightarrow D^0 D^{*-}\pi^+$

NODE=M074R11
NODE=M074R11

¹ Using 4263⁺⁸₋₉ MeV for the mass of X(4260).

NODE=M074R11;LINKAGE=PA

$$\Gamma(D^*\bar{D}^*\pi) / \Gamma_{\text{total}} \quad \Gamma_{37}/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	CRONIN-HEN..09	CLEO	$e^+e^- \rightarrow D^*\bar{D}^*\pi$

NODE=M074R24
NODE=M074R24

$$\Gamma(D^*\bar{D}^*\pi) / \Gamma(J/\psi\pi^+\pi^-) \quad \Gamma_{37}/\Gamma_2$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<8.2	90	CRONIN-HEN..09	CLEO	e^+e^-

NODE=M074R06
NODE=M074R06

$$\Gamma(D_s^+ D_s^-) / \Gamma_{\text{total}} \quad \Gamma_{38}/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	DEL-AMO-SA..10N	BABR	$e^+e^- \rightarrow D_s^+ D_s^- \gamma$
not seen	CRONIN-HEN..09	CLEO	$e^+e^- \rightarrow D_s^+ D_s^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
not seen	PAKHLOVA 11	BELL	$e^+e^- \rightarrow D_s^+ D_s^- \gamma$

NODE=M074R19
NODE=M074R19

$$\Gamma(D_s^+ D_s^-) / \Gamma(J/\psi\pi^+\pi^-) \quad \Gamma_{38}/\Gamma_2$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.7	95	DEL-AMO-SA..10N	BABR	10.6 e^+e^-
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<1.3	90	CRONIN-HEN..09	CLEO	e^+e^-

NODE=M074R07
NODE=M074R07

$$\Gamma(D_s^{*+} D_s^- + \text{c.c.}) / \Gamma_{\text{total}} \quad \Gamma_{39}/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	DEL-AMO-SA..10N	BABR	$e^+e^- \rightarrow D_s^{*+} D_s^- \gamma$
not seen	CRONIN-HEN..09	CLEO	$e^+e^- \rightarrow D_s^{*+} D_s^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
not seen	PAKHLOVA 11	BELL	$e^+e^- \rightarrow D_s^{*+} D_s^- \gamma$

NODE=M074R20
NODE=M074R20

$$\Gamma(D_s^{*+} D_s^- + \text{c.c.}) / \Gamma(J/\psi\pi^+\pi^-) \quad \Gamma_{39}/\Gamma_2$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
< 0.8	90	CRONIN-HEN..09	CLEO	e^+e^-
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<44	95	DEL-AMO-SA..10N	BABR	10.6 e^+e^-

NODE=M074R08
NODE=M074R08

$$\Gamma(D_s^{*+} D_s^{*-}) / \Gamma_{\text{total}} \quad \Gamma_{40}/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	CRONIN-HEN..09	CLEO	$e^+e^- \rightarrow D_s^{*+} D_s^{*-}$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
not seen	PAKHLOVA 11	BELL	$e^+e^- \rightarrow D_s^{*+} D_s^{*-} \gamma$
not seen	DEL-AMO-SA..10N	BABR	$e^+e^- \rightarrow D_s^{*+} D_s^{*-} \gamma$

NODE=M074R21
NODE=M074R21

$\Gamma(D_s^{*+} D_s^{*-})/\Gamma(J/\psi \pi^+ \pi^-)$					Γ_{40}/Γ_2
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
< 9.5	90	CRONIN-HEN..09	CLEO	$e^+ e^-$	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<30	95	DEL-AMO-SA...10N	BABR	$10.6 e^+ e^-$	

NODE=M074R09
NODE=M074R09

$\Gamma(p\bar{p})/\Gamma(J/\psi \pi^+ \pi^-)$					Γ_{41}/Γ_2
VALUE	CL%	DOCUMENT ID	COMMENT		
<0.13	90	¹ AUBERT	06B	$e^+ e^- \rightarrow p\bar{p}\gamma$	
¹ Using 4259 ± 10 MeV for the mass and 88 ± 24 MeV for the width of X(4260).					

NODE=M074R1
NODE=M074R1

NODE=M074R1;LINKAGE=AU

X(4260) REFERENCES

NODE=M074

ABLIKIM	14	PRL 112 092001	M. Ablikim <i>et al.</i>	(BES III Collab.)
ABLIKIM	13T	PRL 110 252001	M. Ablikim <i>et al.</i>	(BES III Collab.)
LIU	13B	PRL 110 252002	Z.Q. Liu <i>et al.</i>	(BELLE Collab.)
WANG	13B	PR D87 051101	X.L. Wang <i>et al.</i>	(BELLE Collab.)
LEES	12AC	PR D86 051102	J.P. Lees <i>et al.</i>	(BABAR Collab.)
PAKHLOVA	11	PR D83 011101	G. Pakhlova <i>et al.</i>	(BELLE Collab.)
PEDLAR	11	PRL 107 041803	T. Pedlar <i>et al.</i>	(CLEO Collab.)
DEL-AMO-SA...	10N	PR D82 052004	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)
AUBERT	09M	PR D79 092001	B. Aubert <i>et al.</i>	(BABAR Collab.)
CRONIN-HEN...	09	PR D80 072001	D. Cronin-Hennessy <i>et al.</i>	(CLEO Collab.)
PAKHLOVA	09	PR D80 091101	G. Pakhlova <i>et al.</i>	(BELLE Collab.)
AUBERT	08S	PR D77 092002	B. Aubert <i>et al.</i>	(BABAR Collab.)
LIU	08H	PR D78 014032	Z.Q. Liu, X.S. Qin, C.Z. Yuan	
PAKHLOVA	08	PR D77 011103	G. Pakhlova <i>et al.</i>	(BELLE Collab.)
PAKHLOVA	08A	PRL 100 062001	G. Pakhlova <i>et al.</i>	(BELLE Collab.)
YUAN	08	PR D77 011105	C.Z. Yuan <i>et al.</i>	(BELLE Collab.)
AUBERT	07AK	PR D76 012008	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT	07BE	PR D76 111105	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT	07S	PRL 98 212001	B. Aubert <i>et al.</i>	(BABAR Collab.)
PAKHLOVA	07	PRL 98 092001	G. Pakhlova <i>et al.</i>	(BELLE Collab.)
WANG	07D	PRL 99 142002	X.L. Wang <i>et al.</i>	(BELLE Collab.)
YUAN	07	PRL 99 182004	C.Z. Yuan <i>et al.</i>	(BELLE Collab.)
AUBERT	06	PR D73 011101	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT	06B	PR D73 012005	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT,BE	06D	PR D74 091103	B. Aubert <i>et al.</i>	(BABAR Collab.)
COAN	06	PRL 96 162003	T.E. Coan <i>et al.</i>	(CLEO Collab.)
HE	06B	PR D74 091104	Q. He <i>et al.</i>	(CLEO Collab.)
AUBERT,B	05I	PRL 95 142001	B. Aubert <i>et al.</i>	(BABAR Collab.)

REFID=55647
REFID=55409
REFID=55410
REFID=55377
REFID=54750
REFID=53638
REFID=16787
REFID=53532
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REFID=51960
REFID=51017
REFID=51026
REFID=51511
REFID=51075
REFID=51523
REFID=50776

X(4350)

$I^G(J^{PC}) = 0^{+}(??^{+})$

NODE=M194

OMITTED FROM SUMMARY TABLE
Seen by SHEN 10 in the $\gamma\gamma \rightarrow J/\psi\phi$. Needs confirmation.

NODE=M194

X(4350) MASS

NODE=M194M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$4350.6^{+4.6}_{-5.1} \pm 0.7$	$8.8^{+4.2}_{-3.2}$	¹ SHEN	10	BELL $10.6 e^+ e^- \rightarrow e^+ e^- J/\psi\phi$
¹ Statistical significance of 3.2 σ .				

NODE=M194M

NODE=M194M;LINKAGE=SH

X(4350) WIDTH

NODE=M194W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$13^{+18}_{-9} \pm 4$	$8.8^{+4.2}_{-3.2}$	² SHEN	10	BELL $10.6 e^+ e^- \rightarrow e^+ e^- J/\psi\phi$
² Statistical significance of 3.2 σ .				

NODE=M194W

NODE=M194W;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) $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

$\Gamma(\gamma\gamma) \times \Gamma(J/\psi\phi)/\Gamma_{\text{total}}$						$\Gamma_2\Gamma_1/\Gamma$
VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT		
$6.7^{+3.2}_{-2.4} \pm 1.1$	$8.8^{+4.2}_{-3.2}$	³ SHEN	10	BELL	$10.6 e^+ e^- \rightarrow e^+ e^- J/\psi\phi$	
• • • We do not use the following data for averages, fits, limits, etc. • • •						
$1.5^{+0.7}_{-0.6} \pm 0.3$	$8.8^{+4.2}_{-3.2}$	⁴ SHEN	10	BELL	$10.6 e^+ e^- \rightarrow e^+ e^- J/\psi\phi$	
³ For $J^P = 0^+$. Statistical significance of 3.2 σ .						
⁴ For $J^P = 2^+$. Statistical significance of 3.2 σ .						

NODE=M194220

NODE=M194G01
NODE=M194G01

OCCUR=2

NODE=M194G01;LINKAGE=S0
NODE=M194G01;LINKAGE=S2**X(4350) BRANCHING RATIOS**

$\Gamma(J/\psi\phi)/\Gamma_{\text{total}}$						Γ_1/Γ
VALUE		DOCUMENT ID	TECN	COMMENT		
seen		⁵ SHEN	10	BELL	$10.6 e^+ e^- \rightarrow e^+ e^- J/\psi\phi$	
⁵ Statistical significance of 3.2 σ .						
$\Gamma(\gamma\gamma)/\Gamma_{\text{total}}$						Γ_2/Γ
VALUE		DOCUMENT ID	TECN	COMMENT		
seen		⁶ SHEN	10	BELL	$10.6 e^+ e^- \rightarrow e^+ e^- J/\psi\phi$	
⁶ Statistical significance of 3.2 σ .						

NODE=M194225

NODE=M194R01
NODE=M194R01

NODE=M194R01;LINKAGE=SH

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 and WANG 07D. See also the review under the X(3872) particle listings. (See the index for the page number.)

NODE=M181

X(4360) MASS

VALUE (MeV)		DOCUMENT ID	TECN	COMMENT
4361 $\pm$ 9 $\pm$ 9	¹	WANG	07D	BELL $10.58 e^+ e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$4355^{+9}_{-10} \pm 9$	²	LIU	08H	RVUE $10.58 e^+ e^- \rightarrow \psi(2S)\pi^+\pi^-\gamma$
4324 ± 24	³	AUBERT	07S	BABR $10.58 e^+ e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$
¹ From a two-resonance fit.				
² From a combined fit of AUBERT 07S and WANG 07D data with two resonances.				
³ From a single-resonance fit. Systematic errors not estimated.				

NODE=M181M

NODE=M181M

NODE=M181M;LINKAGE=WA
NODE=M181M;LINKAGE=LI
NODE=M181M;LINKAGE=AU**X(4360) WIDTH**

VALUE (MeV)		DOCUMENT ID	TECN	COMMENT
74 $\pm$ 15 $\pm$ 10	⁴	WANG	07D	BELL $10.58 e^+ e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$103^{+17}_{-15} \pm 11$	⁵	LIU	08H	RVUE $10.58 e^+ e^- \rightarrow \psi(2S)\pi^+\pi^-\gamma$
172 ± 33	⁶	AUBERT	07S	BABR $10.58 e^+ e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$
⁴ From a two-resonance fit.				
⁵ From a combined fit of AUBERT 07S and WANG 07D data with two resonances.				
⁶ From a single-resonance fit. Systematic errors not estimated.				

NODE=M181W

NODE=M181W

NODE=M181W;LINKAGE=WA
NODE=M181W;LINKAGE=LI
NODE=M181W;LINKAGE=AU

X(4360) DECAY MODES

NODE=M181215;NODE=M181

Mode	Fraction (Γ_i/Γ)
Γ_1 e^+e^-	
Γ_2 $\psi(2S)\pi^+\pi^-$	seen
Γ_3 $J/\psi\eta$	
Γ_4 $D^0D^{*-}\pi^+$	

DESIG=1

DESIG=2;OUR EVAL;→ UNCHECKED ←

DESIG=4

DESIG=3

X(4360) $\Gamma(i)\Gamma(e^+e^-)/\Gamma(\text{total})$

NODE=M181230

$\Gamma(\psi(2S)\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$	$\Gamma_2\Gamma_1/\Gamma$
VALUE (eV)	DOCUMENT ID TECN COMMENT

NODE=M181G1

NODE=M181G1

• • • We do not use the following data for averages, fits, limits, etc. • • •

$11.1^{+1.3}_{-1.2}$	⁷ LIU	08H	RVUE	$10.58 e^+e^- \rightarrow \psi(2S)\pi^+\pi^-\gamma$
12.3 ± 1.2	⁸ LIU	08H	RVUE	$10.58 e^+e^- \rightarrow \psi(2S)\pi^+\pi^-\gamma$
$10.4 \pm 1.7 \pm 1.5$	⁹ WANG	07D	BELL	$10.58 e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$
$11.8 \pm 1.8 \pm 1.4$	¹⁰ WANG	07D	BELL	$10.58 e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$

OCCUR=2

OCCUR=2

⁷ Solution I in a combined fit of AUBERT 07S and WANG 07D data with two resonances.⁸ Solution II in a combined fit of AUBERT 07S and WANG 07D data with two resonances.⁹ Solution I of two equivalent solutions in a fit using two interfering resonances.¹⁰ Solution II of two equivalent solutions in a fit using two interfering resonances.

NODE=M181G1;LINKAGE=LI

NODE=M181G1;LINKAGE=LU

NODE=M181G1;LINKAGE=WA

NODE=M181G1;LINKAGE=WN

$\Gamma(J/\psi\eta) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$	$\Gamma_3\Gamma_1/\Gamma$
VALUE (eV)	CL% DOCUMENT ID TECN COMMENT

NODE=M181G01

NODE=M181G01

• • • We do not use the following data for averages, fits, limits, etc. • • •

<6.8	90	WANG	13B	BELL	$e^+e^- \rightarrow J/\psi\eta\gamma$

X(4360) BRANCHING RATIOS

NODE=M181225

$\Gamma(D^0 D^{*-} \pi^+)/\Gamma(\psi(2S) \pi^+ \pi^-)$					Γ_4/Γ_2
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
<8	90	PAKHLOVA	09	BELL	$e^+ e^- \rightarrow X(4360) \rightarrow D^0 D^{*-} \pi^+$

NODE=M181R01

NODE=M181R01

$\Gamma(D^0 D^{*-} \pi^+)/\Gamma_{\text{total}} \times \Gamma(e^+ e^-)/\Gamma_{\text{total}}$					$\Gamma_4/\Gamma \times \Gamma_1/\Gamma$
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
$<0.72 \times 10^{-6}$	90	¹¹ PAKHLOVA	09	BELL	$e^+ e^- \rightarrow X(4360) \rightarrow D^0 D^{*-} \pi^+$

NODE=M181R02

NODE=M181R02

¹¹ Using $4355^{+9}_{-10} \pm 9$ MeV for the mass of X(4360).

NODE=M181R02;LINKAGE=PA

X(4360) REFERENCES

NODE=M181

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	
AUBERT	07S	PRL 98 212001	B. Aubert <i>et al.</i>	(BABAR Collab.)
WANG	07D	PRL 99 142002	X.L. Wang <i>et al.</i>	(BELLE Collab.)

REFID=55377

REFID=53143

REFID=52296

REFID=51724

REFID=51959

$\psi(4415)$

$$J^{PC} = 0^-(1^{--})$$

NODE=M073

 $\psi(4415)$ MASS

NODE=M073M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
4421 ± 4 OUR ESTIMATE			
4415.1 ± 7.9	¹ ABLIKIM	08D BES2	$e^+e^- \rightarrow \text{hadrons}$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
4412 ± 15	² MO	10 RVUE	$e^+e^- \rightarrow \text{hadrons}$
4411 ± 7	³ PAKHLOVA	08A BELL	$10.6 e^+e^- \rightarrow D^0 D^- \pi^+ \gamma$
4425 ± 6	⁴ SETH	05A RVUE	$e^+e^- \rightarrow \text{hadrons}$
4429 ± 9	⁵ SETH	05A RVUE	$e^+e^- \rightarrow \text{hadrons}$
4417 ± 10	BRANDELIK	78C DASP	e^+e^-
4414 ± 7	SIEGRIST	76 MRK1	e^+e^-
¹ Reanalysis of data presented in BAI 02C. From a global fit over the center-of-mass energy region 3.7–5.0 GeV covering the $\psi(3770)$, $\psi(4040)$, $\psi(4160)$, and $\psi(4415)$ resonances. Phase angle fixed in the fit to $\delta = (234 \pm 88)^\circ$.			
² Reanalysis of data presented in BAI 00 and BAI 02C. From a global fit over the center-of-mass energy 3.8–4.8 GeV covering the $\psi(4040)$, $\psi(4160)$ and $\psi(4415)$ resonances and including interference effects.			
³ Systematic uncertainties not estimated.			
⁴ From a fit to Crystal Ball (OSTERHELD 86) data.			
⁵ From a fit to BES (BAI 02C) data.			

NODE=M073M

→ 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

NODE=M073W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
62 ± 20 OUR ESTIMATE			
71.5 ± 19.0	⁶ ABLIKIM	08D BES2	$e^+e^- \rightarrow \text{hadrons}$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
118 ± 32	⁷ MO	10 RVUE	$e^+e^- \rightarrow \text{hadrons}$
77 ± 20	⁸ PAKHLOVA	08A BELL	$10.6 e^+e^- \rightarrow D^0 D^- \pi^+ \gamma$
119 ± 16	⁹ SETH	05A RVUE	$e^+e^- \rightarrow \text{hadrons}$
118 ± 35	¹⁰ SETH	05A RVUE	$e^+e^- \rightarrow \text{hadrons}$
66 ± 15	BRANDELIK	78C DASP	e^+e^-
33 ± 10	SIEGRIST	76 MRK1	e^+e^-
⁶ Reanalysis of data presented in BAI 02C. From a global fit over the center-of-mass energy region 3.7–5.0 GeV covering the $\psi(3770)$, $\psi(4040)$, $\psi(4160)$, and $\psi(4415)$ resonances. Phase angle fixed in the fit to $\delta = (234 \pm 88)^\circ$.			
⁷ Reanalysis of data presented in BAI 00 and BAI 02C. From a global fit over the center-of-mass energy 3.8–4.8 GeV covering the $\psi(4040)$, $\psi(4160)$ and $\psi(4415)$ resonances and including interference effects.			
⁸ Systematic uncertainties not estimated.			
⁹ From a fit to Crystal Ball (OSTERHELD 86) data.			
¹⁰ From a fit to BES (BAI 02C) data.			

NODE=M073W

→ 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

NODE=M073215;NODE=M073

NODE=M073

Due to the complexity of the $c\bar{c}$ threshold region, in this listing, “seen” (“not seen”) means that a cross section for the mode in question has been measured at effective $\sqrt{s}$ near this particle’s central mass value, more (less) than 2σ above zero, without regard to any peaking behavior in $\sqrt{s}$ or absence thereof. See mode listing(s) for details and references.

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 $D\bar{D}$	not seen	
Γ_2 $D^0\bar{D}^0$	seen	
Γ_3 D^+D^-	seen	
Γ_4 $D^*\bar{D} + \text{c.c.}$	not seen	
Γ_5 $D^*(2007)^0\bar{D}^0 + \text{c.c.}$	seen	
Γ_6 $D^*(2010)^+D^- + \text{c.c.}$	seen	
Γ_7 $D^*\bar{D}^*$	not seen	
Γ_8 $D^*(2007)^0\bar{D}^*(2007)^0 + \text{c.c.}$	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

Γ_9	$D^*(2010)^+ D^*(2010)^- + \text{c.c.}$	seen			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}	$D_s^{*+} D_s^- + \text{c.c.}$	seen			DESIG=17
Γ_{15}	$D_s^{*+} D_s^{*-}$	not seen			DESIG=18
Γ_{16}	$J/\psi \eta$	< 6	$\times 10^{-3}$	90%	DESIG=19
Γ_{17}	$e^+ e^-$	$(9.4 \pm 3.2) \times 10^{-6}$			DESIG=1

 $\psi(4415)$ PARTIAL WIDTHS

NODE=M073220

 $\Gamma(e^+ e^-)$ **Γ_{17}**

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

 $\psi(4415) \Gamma(i) \Gamma(e^+ e^-) / \Gamma(\text{total})$

NODE=M073230

 $\Gamma(J/\psi \eta) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$ **$\Gamma_{16} \Gamma_{17} / \Gamma$**

VALUE (eV)

CL%

DOCUMENT ID

TECN

COMMENT

<3.6

90

WANG

13B

BELL

 $e^+ e^- \rightarrow J/\psi \eta \gamma$

NODE=M073G01

NODE=M073G01

 $\psi(4415)$ BRANCHING RATIOS

NODE=M073225

 $\Gamma(D^0 \bar{D}^0) / \Gamma_{\text{total}}$ **Γ_2 / Γ**

VALUE

DOCUMENT ID

TECN

COMMENT

seen

PAKHOLOVA

08

BELL

 $e^+ e^- \rightarrow D^0 \bar{D}^0 \gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

not seen

AUBERT

09M

BABR

 $e^+ e^- \rightarrow D^0 \bar{D}^0 \gamma$ **$\Gamma(D^+ D^-) / \Gamma_{\text{total}}$** **$\Gamma_3 / \Gamma$**

VALUE

DOCUMENT ID

TECN

COMMENT

seen

PAKHOLOVA

08

BELL

 $e^+ e^- \rightarrow D^+ D^- \gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

not seen

AUBERT

09M

BABR

 $e^+ e^- \rightarrow D^+ D^- \gamma$ **$\Gamma(D \bar{D}) / \Gamma(D^* \bar{D}^*)$** **$\Gamma_1 / \Gamma_7$**

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

 $\Gamma(D^*(2007)^0 \bar{D}^0 + \text{c.c.}) / \Gamma_{\text{total}}$ **Γ_5 / Γ**

VALUE

DOCUMENT ID

TECN

COMMENT

seen

AUBERT

09M

BABR

 $e^+ e^- \rightarrow D^{*0} \bar{D}^0 \gamma$

NODE=M073R06

NODE=M073R06

$\Gamma(D^*(2010)^+ D^- + \text{c.c.})/\Gamma_{\text{total}}$
 Γ_6/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	AUBERT	09M BABR	$e^+ e^- \rightarrow D^{*+} D^- \gamma$
seen	PAKHLOVA	07 BELL	$e^+ e^- \rightarrow D^{*+} D^- \gamma$

NODE=M073R07
NODE=M073R07

 $\Gamma(D^* \bar{D} + \text{c.c.})/\Gamma(D^* \bar{D}^*)$
 Γ_4/Γ_7

VALUE	DOCUMENT ID	TECN	COMMENT
$0.17 \pm 0.25 \pm 0.03$	AUBERT	09M BABR	$e^+ e^- \rightarrow \gamma D^{(*)} \bar{D}^{(*)}$

NODE=M073R03
NODE=M073R03

 $\Gamma(D^*(2007)^0 \bar{D}^*(2007)^0 + \text{c.c.})/\Gamma_{\text{total}}$
 Γ_8/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	AUBERT	09M BABR	$e^+ e^- \rightarrow D^{*0} \bar{D}^{*0} \gamma$

NODE=M073R08
NODE=M073R08

 $\Gamma(D^*(2010)^+ D^*(2010)^- + \text{c.c.})/\Gamma_{\text{total}}$
 Γ_9/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	AUBERT	09M BABR	$e^+ e^- \rightarrow D^{*+} D^{*-} \gamma$
seen	PAKHLOVA	07 BELL	$e^+ e^- \rightarrow D^{*+} D^{*-} \gamma$

NODE=M073R09
NODE=M073R09

 $\Gamma(D \bar{D}_2^*(2460) \rightarrow D^0 D^- \pi^+ + \text{c.c.})/\Gamma_{\text{total}}$
 Γ_{11}/Γ

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
$10.5 \pm 2.4 \pm 3.8$	15 PAKHLOVA	08A BELL	$10.6 e^+ e^- \rightarrow D^0 D^- \pi^+ \gamma$

NODE=M073R3
NODE=M073R3

¹⁵ Using 4421 ± 4 MeV for the mass and 62 ± 20 MeV for the width of $\psi(4415)$.

NODE=M073R3;LINKAGE=PA

 $\Gamma(D^0 D^- \pi^+ (\text{excl. } D^*(2007)^0 \bar{D}^0 + \text{c.c.}, D^*(2010)^+ D^- + \text{c.c.})/$
 $\Gamma(D \bar{D}_2^*(2460) \rightarrow D^0 D^- \pi^+ + \text{c.c.})$
 Γ_{10}/Γ_{11}

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.22	90	16 PAKHLOVA	08A BELL	$10.6 e^+ e^- \rightarrow D^0 D^- \pi^+ \gamma$

NODE=M073R4
NODE=M073R4

¹⁶ Using 4421 ± 4 MeV for the mass and 62 ± 20 MeV for the width of $\psi(4415)$.

NODE=M073R4;LINKAGE=PA

 $\Gamma(D^0 D^{*-} \pi^+ + \text{c.c.})/\Gamma_{\text{total}} \times \Gamma(e^+ e^-)/\Gamma_{\text{total}}$
 $\Gamma_{12}/\Gamma \times \Gamma_{17}/\Gamma$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<0.99 \times 10^{-6}$	90	17 PAKHLOVA	09 BELL	$e^+ e^- \rightarrow D^0 D^{*-} \pi^+$

NODE=M073R01
NODE=M073R01

¹⁷ Using 4421 ± 4 MeV for the mass of $\psi(4415)$.

NODE=M073R01;LINKAGE=PA

 $\Gamma(D_s^+ D_s^-)/\Gamma_{\text{total}}$
 Γ_{13}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	PAKHLOVA	11 BELL	$e^+ e^- \rightarrow D_s^+ D_s^- \gamma$
not seen	DEL-AMO-SA...10N	BABR	$e^+ e^- \rightarrow D_s^+ D_s^- \gamma$

NODE=M073R10
NODE=M073R10

 $\Gamma(D_s^{*+} D_s^- + \text{c.c.})/\Gamma_{\text{total}}$
 Γ_{14}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	PAKHLOVA	11 BELL	$e^+ e^- \rightarrow D_s^{*+} D_s^- \gamma$
seen	DEL-AMO-SA...10N	BABR	$e^+ e^- \rightarrow D_s^{*+} D_s^- \gamma$

NODE=M073R11
NODE=M073R11

 $\Gamma(D_s^{*+} D_s^{*-})/\Gamma_{\text{total}}$
 Γ_{15}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	PAKHLOVA	11 BELL	$e^+ e^- \rightarrow D_s^{*+} D_s^{*-} \gamma$
not seen	DEL-AMO-SA...10N	BABR	$e^+ e^- \rightarrow D_s^{*+} D_s^{*-} \gamma$

NODE=M073R12
NODE=M073R12

$\psi(4415)$ REFERENCES

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=55377
REFID=53638
REFID=53532
REFID=53540
REFID=52724
REFID=53143
REFID=52142
REFID=52132
REFID=52134
REFID=51628
REFID=50813
REFID=50506
REFID=50503
REFID=51064
REFID=22232
REFID=22243

$X(4430)^\pm$

$$I(J^P) = ?(1^+)$$

OMITTED FROM SUMMARY TABLE

Spin and parity assignment $J^P = 1^+$ is favored over $0^-, 1^-, 2^-$, and 2^+ at the levels of 3.4σ , 3.7σ , 4.7σ , and 5.1σ , respectively, according to the four-dimensional amplitude analysis of CHILIKIN 13. Seen by CHOI 08 in $B \rightarrow K \pi^+ \psi(2S)$ decays and confirmed by reanalysis of the same data sample in MIZUK 09. Not seen by AUBERT 09AA.

NODE=M195

NODE=M195

 $X(4430)^\pm$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

4485^{+40}_{-25} OUR AVERAGE [4443 $^{+24}_{-18}$ MeV OUR 2013 AVERAGE]

$4485 \pm 22^{+28}_{-11}$ ¹ CHILIKIN 13 BELL $B^0 \rightarrow \psi(2S) K^+ \pi^-$

• • • 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

NEW

NODE=M195M;LINKAGE=A
NODE=M195M;LINKAGE=MI
NODE=M195M;LINKAGE=CH

 $X(4430)^\pm$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

200^{+50}_{-60} OUR AVERAGE [107 $^{+110}_{-70}$ MeV OUR 2013 AVERAGE]

200^{+41+26}_{-46-35} ⁴ CHILIKIN 13 BELL $B^0 \rightarrow \psi(2S) K^+ \pi^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

107 $^{+86+74}_{-43-56}$ ⁵ MIZUK 09 BELL $B \rightarrow K \pi^+ \psi(2S)$

45 $^{+18+30}_{-13-13}$ ⁶ CHOI 08 BELL $B \rightarrow K \pi^+ \psi(2S)$

⁴ From a four-dimensional amplitude analysis.

⁵ From a Dalitz plot analysis. Superseded by CHILIKIN 13.

⁶ Superseded by MIZUK 09 and CHILIKIN 13.

NODE=M195W

NODE=M195W

NEW

NODE=M195W;LINKAGE=A
NODE=M195W;LINKAGE=MI
NODE=M195W;LINKAGE=CH

 $X(4430)^\pm$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $\pi^+ \psi(2S)$	seen
Γ_2 $\pi^+ J/\psi$	not seen

NODE=M195215;NODE=M195

DESIG=1

DESIG=2

 $X(4430)^\pm$ BRANCHING RATIOS

$\Gamma(\pi^+ \psi(2S))/\Gamma_{\text{total}}$	DOCUMENT ID	TECN	COMMENT	Γ_1/Γ

seen ⁷ CHILIKIN 13 BELL $B^0 \rightarrow \psi(2S) K^+ \pi^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

not seen ⁸ AUBERT 09AA BABR $B \rightarrow K \pi^+ \psi(2S)$

seen ⁹ MIZUK 09 BELL $B \rightarrow K \pi^+ \psi(2S)$

⁷ From a four-dimensional amplitude analysis. Measured a product of branching fractions $B(B^0 \rightarrow X(4430)^- K^+) \times B(X(4430)^- \rightarrow \psi(2S) \pi^-) = (6.0^{+1.7+2.5}_{-2.0-1.4}) \times 10^{-5}$.

⁸ 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.

⁹ 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=M195225

NODE=M195R01
NODE=M195R01

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
not seen	¹⁰ AUBERT	09AA BABR	$B \rightarrow K \pi^+ J/\psi$
¹⁰ AUBERT 09AA quotes $B(B^+ \rightarrow \bar{K}^0 X(4430)^+) \times B(X(4430)^+ \rightarrow \pi^+ J/\psi) < 1.5 \times 10^{-5}$ and $B(\bar{B}^0 \rightarrow K^- X(4430)^+) \times B(X(4430)^+ \rightarrow \pi^+ J/\psi) < 0.4 \times 10^{-5}$ at 95% CL.			

NODE=M195R02
 NODE=M195R02

NODE=M195R02;LINKAGE=AU

 $X(4430)^\pm$ REFERENCES

CHILIKIN	13	PR D88 074026	K. Chilikin <i>et al.</i>	(BELLE Collab.)
AUBERT	09AA	PR D79 112001	B. Aubert <i>et al.</i>	(BABAR Collab.)
MIZUK	09	PR D80 031104	R. Mizuk <i>et al.</i>	(BELLE Collab.)
CHOI	08	PRL 100 142001	S.-K. Choi <i>et al.</i>	(BELLE Collab.)

NODE=M195

REFID=55551
 REFID=52940
 REFID=52960
 REFID=52178

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 and AUBERT 07S. See also the review under the $X(3872)$ particle listings. (See the index for the page number.)

NODE=M189

 $X(4660)$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$4664 \pm 11 \pm 5$	WANG	07D BELL	$10.58 e^+e^- \rightarrow \psi(2S)\pi^+\pi^-\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$4661^{+9}_{-8} \pm 6$	¹ LIU	08H RVUE	$10.58 e^+e^- \rightarrow \psi(2S)\pi^+\pi^-\gamma$
¹ From a combined fit of AUBERT 07S and WANG 07D data with two resonances.			

NODE=M189M

NODE=M189M

NODE=M189M;LINKAGE=LI

 $X(4660)$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$48 \pm 15 \pm 3$	WANG	07D BELL	$10.58 e^+e^- \rightarrow \psi(2S)\pi^+\pi^-\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$42^{+17}_{-12} \pm 6$	² LIU	08H RVUE	$10.58 e^+e^- \rightarrow \psi(2S)\pi^+\pi^-\gamma$
² From a combined fit of AUBERT 07S and WANG 07D data with two resonances.			

NODE=M189W

NODE=M189W

NODE=M189W;LINKAGE=LI

 $X(4660)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 e^+e^-	
Γ_2 $\psi(2S)\pi^+\pi^-$	seen
Γ_3 $J/\psi\eta$	
Γ_4 $D^0 D^{*-} \pi^+$	

NODE=M189215;NODE=M189

DESIG=1

DESIG=2;OUR EVAL;→ UNCHECKED ←

DESIG=4

DESIG=3

 $X(4660) \Gamma(i)\Gamma(e^+e^-)/\Gamma(\text{total})$ $\Gamma(\psi(2S)\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_2\Gamma_1/\Gamma$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$2.2^{+0.7}_{-0.6}$	³ LIU	08H RVUE	$10.58 e^+e^- \rightarrow \psi(2S)\pi^+\pi^-\gamma$
5.9 ± 1.6	⁴ LIU	08H RVUE	$10.58 e^+e^- \rightarrow \psi(2S)\pi^+\pi^-\gamma$
$3.0 \pm 0.9 \pm 0.3$	⁵ WANG	07D BELL	$10.58 e^+e^- \rightarrow \psi(2S)\pi^+\pi^-\gamma$
$7.6 \pm 1.8 \pm 0.8$	⁶ WANG	07D BELL	$10.58 e^+e^- \rightarrow \psi(2S)\pi^+\pi^-\gamma$

NODE=M189230

NODE=M189G1
 NODE=M189G1

OCCUR=2

OCCUR=2

³ Solution I in a combined fit of AUBERT 07S and WANG 07D data with two resonances.⁴ Solution II in a combined fit of AUBERT 07S and WANG 07D data with two resonances.⁵ Solution I of two equivalent solutions in a fit using two interfering resonances.⁶ Solution II of two equivalent solutions in a fit using two interfering resonances.

NODE=M189G1;LINKAGE=LI
 NODE=M189G1;LINKAGE=LU
 NODE=M189G1;LINKAGE=WA
 NODE=M189G1;LINKAGE=WN

$$\Gamma(J/\psi\eta) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$$

$$\Gamma_3\Gamma_1/\Gamma$$

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 $e^+e^- \rightarrow J/\psi\eta\gamma$

NODE=M189G01
NODE=M189G01

X(4660) BRANCHING RATIOS

NODE=M189225

$$\Gamma(D^0 D^{*-} \pi^+)/\Gamma(\psi(2S)\pi^+\pi^-)$$

$$\Gamma_4/\Gamma_2$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<10	90	PAKHLOVA	09	BELL $e^+e^- \rightarrow X(4660) \rightarrow D^0 D^{*-} \pi^+$

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 × 10 ⁻⁶	90	⁷ PAKHLOVA	09	BELL $e^+e^- \rightarrow X(4660) \rightarrow D^0 D^{*-} \pi^+$

NODE=M189R02
NODE=M189R02

⁷ Using 4664 ± 11 ± 5 MeV for the mass of X(4660).

NODE=M189R02;LINKAGE=PA

X(4660) REFERENCES

NODE=M189

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	
AUBERT	07S	PRL 98 212001	B. Aubert <i>et al.</i>	(BABAR Collab.)
WANG	07D	PRL 99 142002	X.L. Wang <i>et al.</i>	(BELLE Collab.)

REFID=55377
REFID=53143
REFID=52296
REFID=51724
REFID=51959

$b\bar{b}$ MESONS

NODE=MXXX030

A REVIEW GOES HERE – Check our WWW List of Reviews

NODE=M849

A REVIEW GOES HERE – Check our WWW List of Reviews

NODE=M849

$\eta_b(1S)$

$$J^{PC} = 0^+(0^-+)$$

NODE=M171

OMITTED FROM SUMMARY TABLE

Quantum numbers shown are quark-model predictions. Observed in radiative decay of the $\Upsilon(3S)$, therefore $C = +$.

NODE=M171

$\eta_b(1S)$ MASS

NODE=M171M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

9398.0 ± 3.2 OUR AVERAGE Error includes scale factor of 1.8. See the ideogram below.

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	2.3 ± 0.5k	² BONVICINI	10	CLEO $\Upsilon(3S) \rightarrow \gamma X$

9394.2 ⁺ _{-4.9} ± 4.8 ± 2.0	13 ± 5k	² AUBERT	09AQ	BABR $\Upsilon(2S) \rightarrow \gamma X$

9388.9 ⁺ _{-2.3} ± 3.1 ± 2.7	19 ± 3k	² AUBERT	08v	BABR $\Upsilon(3S) \rightarrow \gamma X$

• • • We do not use the following data for averages, fits, limits, etc. • • •

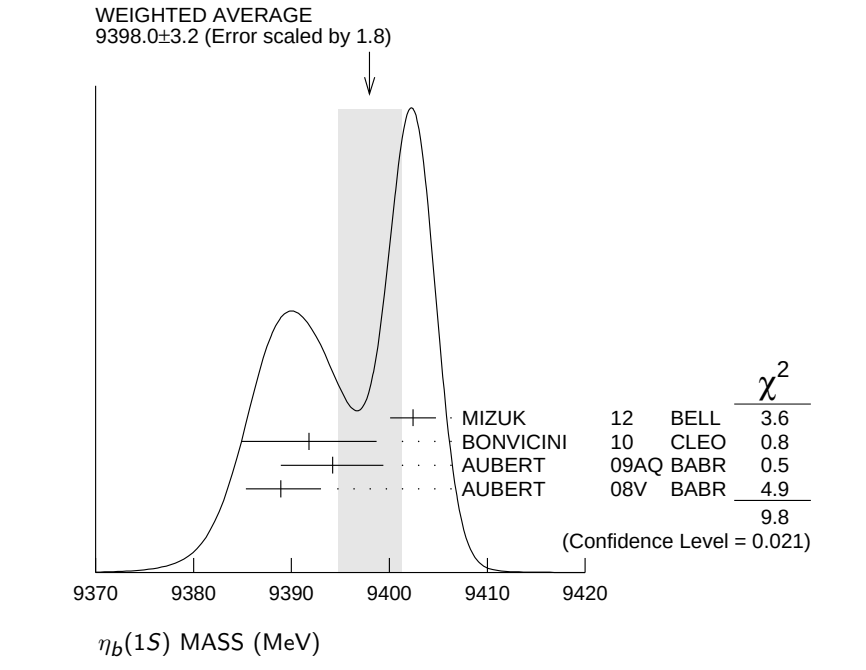
9393.2 ± 3.4 ± 2.3	10 ⁺ ₋₄	^{2,3} DOBBS	12	$\Upsilon(2S) \rightarrow \gamma \text{hadrons}$

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



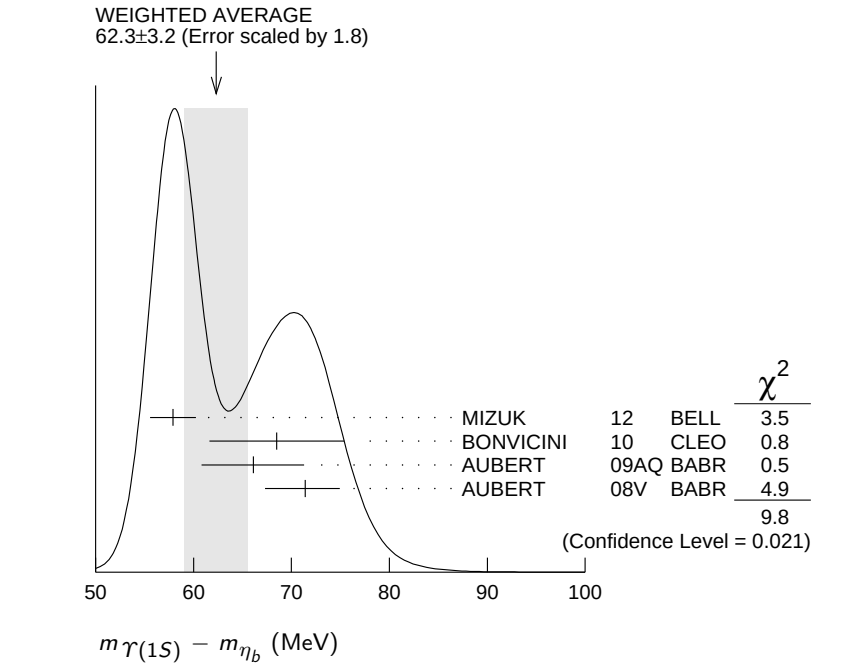
$m_{\Upsilon(1S)} - m_{\eta_b}$

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	$e^+e^- \rightarrow \gamma\pi^+\pi^-$ + hadrons
68.5±6.6±2.0	2.3 ± 0.5k	⁵ BONVICINI	10 CLEO	$\Upsilon(3S) \rightarrow \gamma X$
66.1 ^{+4.8} _{-4.9} ±2.0	13 ± 5k	⁵ AUBERT	09AQ BABR	$\Upsilon(2S) \rightarrow \gamma X$
71.4 ^{+2.3} _{-3.1} ±2.7	19 ± 3k	⁵ AUBERT	08V BABR	$\Upsilon(3S) \rightarrow \gamma X$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
67.1±3.4±2.3	10 ⁺⁵ ₋₄	^{5,6} DOBBS	12	$\Upsilon(2S) \rightarrow \gamma$ hadrons

⁴ With floating width. Not independent of the corresponding mass measurement.
⁵ Assuming $\Gamma_{\eta_b(1S)} = 10$ MeV. Not independent of the corresponding γ energy or mass measurements.
⁶ Obtained by analyzing CLEO III data but not authored by the CLEO Collaboration.

NODE=M171M2;LINKAGE=MI
NODE=M171M2;LINKAGE=AU
NODE=M171M2;LINKAGE=DO



γ ENERGY IN $\Upsilon(3S)$ DECAY

NODE=M171DM

VALUE (MeV) EVTS DOCUMENT ID TECN COMMENT

NODE=M171DM

920.6^{+2.8}_{-3.2} OUR AVERAGE

918.6±6.0±1.9 2.3±0.5k ⁷ BONVICINI 10 CLEO $\Upsilon(3S) \rightarrow \gamma X$
921.2^{+2.1}_{-2.8}±2.4 19±3k ⁷ AUBERT 08v BABR $\Upsilon(3S) \rightarrow \gamma X$

⁷ Assuming $\Gamma_{\eta_b(1S)} = 10$ MeV. Not independent of the corresponding mass or mass difference measurements.

NODE=M171DM;LINKAGE=BO

γ ENERGY IN $\Upsilon(2S)$ DECAY

NODE=M171U2S

VALUE (MeV) EVTS DOCUMENT ID TECN COMMENT

NODE=M171U2S

609.3^{+4.6}_{-4.5}±1.9 13±5k ⁸ AUBERT 09AQ BABR $\Upsilon(2S) \rightarrow \gamma X$

⁸ Assuming $\Gamma_{\eta_b(1S)} = 10$ MeV. Not independent of the corresponding mass or mass difference measurements.

NODE=M171U2S;LINKAGE=AU

$\eta_b(1S)$ WIDTH

NODE=M171W

VALUE (MeV) EVTS DOCUMENT ID TECN COMMENT

NODE=M171W

10.8^{+4.0}_{-3.7}^{+4.5}_{-2.0} 34k ⁹ MIZUK 12 BELL $e^+e^- \rightarrow \gamma \pi^+ \pi^- +$
hadrons

⁹ With floating mass.

NODE=M171W;LINKAGE=MI

$\eta_b(1S)$ DECAY MODES

NODE=M171225;NODE=M171

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 hadrons	seen	
Γ_2 $3h^+ 3h^-$	not seen	
Γ_3 $2h^+ 2h^-$	not seen	
Γ_4 $4h^+ 4h^-$		
Γ_5 $\gamma\gamma$	not seen	
Γ_6 $\mu^+ \mu^-$	$<9 \times 10^{-3}$	90%
Γ_7 $\tau^+ \tau^-$	$<8 \%$	90%

DESIG=7
DESIG=1;OUR EST;→ UNCHECKED ←
DESIG=2;OUR EST;→ UNCHECKED ←
DESIG=4
DESIG=3;OUR EST;→ UNCHECKED ←
DESIG=5
DESIG=6

$\eta_b(1S) \Gamma(i) \Gamma(\gamma\gamma) / \Gamma(\text{total})$

NODE=M171230

 $\Gamma(3h^+3h^-) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}} \quad \Gamma_2 \Gamma_5 / \Gamma$

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 $\Gamma(2h^+2h^-) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}} \quad \Gamma_3 \Gamma_5 / \Gamma$

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 $\Gamma(4h^+4h^-) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}} \quad \Gamma_4 \Gamma_5 / \Gamma$

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

NODE=M171235

 $\Gamma(\text{hadrons}) / \Gamma_{\text{total}} \quad \Gamma_1 / \Gamma$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

seen	34k	MIZUK	12	BELL $e^+e^- \rightarrow \gamma\pi^+\pi^- + \text{hadrons}$

NODE=M171R03
NODE=M171R03 $\Gamma(\mu^+\mu^-) / \Gamma_{\text{total}} \quad \Gamma_6 / \Gamma$

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

 $\Gamma(\tau^+\tau^-) / \Gamma_{\text{total}} \quad \Gamma_7 / \Gamma$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

$<8 \times 10^{-2}$	90	AUBERT	09P	BABR $e^+e^- \rightarrow \gamma\tau^+\tau^-$

NODE=M171R02
NODE=M171R02 $\eta_b(1S)$ REFERENCES

NODE=M171

DOBBS	12	PRL 109 082001	S. Dobbs <i>et al.</i>	
MIZUK	12	PRL 109 232002	R. Mizuk <i>et al.</i>	(BELLE Collab.)
BONVICINI	10	PR D81 031104	G. Bonvicini <i>et al.</i>	(CLEO Collab.)
AUBERT	09AQ	PRL 103 161801	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT	09P	PRL 103 181801	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT	09Z	PRL 103 081803	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT	08V	PRL 101 071801	B. Aubert <i>et al.</i>	(BABAR Collab.)
ABDALLAH	06	PL B634 340	J.M. Abdallah <i>et al.</i>	(DELPHI Collab.)
HEISTER	02D	PL B530 56	A. Heister <i>et al.</i>	(ALEPH Collab.)

REFID=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

NODE=M049M

NODE=M049M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
9460.30±0.26 OUR AVERAGE	Error includes scale factor of 3.3.		
9460.51±0.09±0.05	¹ ARTAMONOV 00	MD1	$e^+e^- \rightarrow \text{hadrons}$
9459.97±0.11±0.07	MACKAY 84	REDE	$e^+e^- \rightarrow \text{hadrons}$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
9460.60±0.09±0.05	^{2,3} BARU 92B	REDE	$e^+e^- \rightarrow \text{hadrons}$
9460.59±0.12	BARU 86	REDE	$e^+e^- \rightarrow \text{hadrons}$
9460.6 ±0.4	^{3,4} ARTAMONOV 84	REDE	$e^+e^- \rightarrow \text{hadrons}$
¹ Reanalysis of BARU 92B and ARTAMONOV 84 using new electron mass (COHEN 87).			
² Superseding BARU 86.			
³ Superseded by ARTAMONOV 00.			
⁴ Value includes data of ARTAMONOV 82.			

NODE=M049M;LINKAGE=AR
 NODE=M049M;LINKAGE=A
 NODE=M049M;LINKAGE=RZ
 NODE=M049M;LINKAGE=G

 $\Upsilon(1S)$ WIDTH

NODE=M049W

NODE=M049W
 → UNCHECKED ←

VALUE (keV)	DOCUMENT ID
54.02±1.25 OUR EVALUATION	See the Note on "Width Determinations of the Υ States"

 $\Upsilon(1S)$ DECAY MODES

NODE=M049215;NODE=M049

Mode	Fraction (Γ_i/Γ)	Confidence level
$\Gamma_1 \quad \tau^+ \tau^-$	(2.60 ±0.10) %	
$\Gamma_2 \quad e^+ e^-$	(2.38 ±0.11) %	
$\Gamma_3 \quad \mu^+ \mu^-$	(2.48 ±0.05) %	

DESIG=3
 DESIG=2
 DESIG=1

Hadronic decays

NODE=M049;CLUMP=A

$\Gamma_4 \quad g g g$	(81.7 ±0.7) %		DESIG=117
$\Gamma_5 \quad \gamma g g$	(2.2 ±0.6) %		DESIG=118
$\Gamma_6 \quad \eta'(958) \text{ anything}$	(2.94 ±0.24) %		DESIG=73
$\Gamma_7 \quad J/\psi(1S) \text{ anything}$	(6.5 ±0.7) × 10 ⁻⁴		DESIG=12
$\Gamma_8 \quad \chi_{c0} \text{ anything}$	< 5 × 10 ⁻³	90%	DESIG=5
$\Gamma_9 \quad \chi_{c1} \text{ anything}$	(2.3 ±0.7) × 10 ⁻⁴		DESIG=6
$\Gamma_{10} \quad \chi_{c2} \text{ anything}$	(3.4 ±1.0) × 10 ⁻⁴		DESIG=7
$\Gamma_{11} \quad \psi(2S) \text{ anything}$	(2.7 ±0.9) × 10 ⁻⁴		DESIG=8
$\Gamma_{12} \quad \rho \pi$	< 3.68 × 10 ⁻⁶	90%	DESIG=11
$\Gamma_{13} \quad \omega \pi^0$	< 3.90 × 10 ⁻⁶	90%	DESIG=131
$\Gamma_{14} \quad \pi^+ \pi^-$	< 5 × 10 ⁻⁴	90%	DESIG=23
$\Gamma_{15} \quad K^+ K^-$	< 5 × 10 ⁻⁴	90%	DESIG=24
$\Gamma_{16} \quad p \bar{p}$	< 5 × 10 ⁻⁴	90%	DESIG=25
$\Gamma_{17} \quad \pi^+ \pi^- \pi^0$	(2.1 ±0.8) × 10 ⁻⁶		DESIG=72
$\Gamma_{18} \quad \phi K^+ K^-$	(2.4 ±0.5) × 10 ⁻⁶		DESIG=136
$\Gamma_{19} \quad \omega \pi^+ \pi^-$	(4.5 ±1.0) × 10 ⁻⁶		DESIG=137
$\Gamma_{20} \quad K^*(892)^0 K^- \pi^+ + \text{c.c.}$	(4.4 ±0.8) × 10 ⁻⁶		DESIG=138
$\Gamma_{21} \quad \phi f'_2(1525)$	< 1.63 × 10 ⁻⁶	90%	DESIG=139
$\Gamma_{22} \quad \omega f_2(1270)$	< 1.79 × 10 ⁻⁶	90%	DESIG=140
$\Gamma_{23} \quad \rho(770) a_2(1320)$	< 2.24 × 10 ⁻⁶	90%	DESIG=141
$\Gamma_{24} \quad K^*(892)^0 \bar{K}_2^*(1430)^0 + \text{c.c.}$	(3.0 ±0.8) × 10 ⁻⁶		DESIG=142
$\Gamma_{25} \quad K_1(1270)^\pm K^\mp$	< 2.41 × 10 ⁻⁶	90%	DESIG=143
$\Gamma_{26} \quad K_1(1400)^\pm K^\mp$	(1.0 ±0.4) × 10 ⁻⁶		DESIG=144
$\Gamma_{27} \quad b_1(1235)^\pm \pi^\mp$	< 1.25 × 10 ⁻⁶	90%	DESIG=145
$\Gamma_{28} \quad \pi^+ \pi^- \pi^0 \pi^0$	(1.28 ±0.30) × 10 ⁻⁵		DESIG=132
$\Gamma_{29} \quad K_S^0 K^+ \pi^- + \text{c.c.}$	(1.6 ±0.4) × 10 ⁻⁶		DESIG=133
$\Gamma_{30} \quad K^*(892)^0 \bar{K}^0 + \text{c.c.}$	(2.9 ±0.9) × 10 ⁻⁶		DESIG=134
$\Gamma_{31} \quad K^*(892)^- K^+ + \text{c.c.}$	< 1.11 × 10 ⁻⁶	90%	DESIG=135
$\Gamma_{32} \quad D^*(2010)^\pm \text{ anything}$	(2.52 ±0.20) %		DESIG=30
$\Gamma_{33} \quad \bar{d} \text{ anything}$	(2.86 ±0.28) × 10 ⁻⁵		DESIG=107
$\Gamma_{34} \quad \text{Sum of 100 exclusive modes}$	(1.200±0.017) %		DESIG=128

Radiative decays

NODE=M049;CLUMP=B

Γ ₃₅	$\gamma \pi^+ \pi^-$	(6.3 ± 1.8) × 10 ⁻⁵			DESIG=70
Γ ₃₆	$\gamma \pi^0 \pi^0$	(1.7 ± 0.7) × 10 ⁻⁵			DESIG=71
Γ ₃₇	$\gamma \pi^0 \eta$	< 2.4 × 10 ⁻⁶	90%		DESIG=111
Γ ₃₈	$\gamma K^+ K^-$	[a] (1.14 ± 0.13) × 10 ⁻⁵			DESIG=102
Γ ₃₉	$\gamma p \bar{p}$	[b] < 6 × 10 ⁻⁶	90%		DESIG=103
Γ ₄₀	$\gamma 2h^+ 2h^-$	(7.0 ± 1.5) × 10 ⁻⁴			DESIG=20
Γ ₄₁	$\gamma 3h^+ 3h^-$	(5.4 ± 2.0) × 10 ⁻⁴			DESIG=21
Γ ₄₂	$\gamma 4h^+ 4h^-$	(7.4 ± 3.5) × 10 ⁻⁴			DESIG=22
Γ ₄₃	$\gamma \pi^+ \pi^- K^+ K^-$	(2.9 ± 0.9) × 10 ⁻⁴			DESIG=14
Γ ₄₄	$\gamma 2\pi^+ 2\pi^-$	(2.5 ± 0.9) × 10 ⁻⁴			DESIG=13
Γ ₄₅	$\gamma 3\pi^+ 3\pi^-$	(2.5 ± 1.2) × 10 ⁻⁴			DESIG=17
Γ ₄₆	$\gamma 2\pi^+ 2\pi^- K^+ K^-$	(2.4 ± 1.2) × 10 ⁻⁴			DESIG=18
Γ ₄₇	$\gamma \pi^+ \pi^- p \bar{p}$	(1.5 ± 0.6) × 10 ⁻⁴			DESIG=15
Γ ₄₈	$\gamma 2\pi^+ 2\pi^- p \bar{p}$	(4 ± 6) × 10 ⁻⁵			DESIG=19
Γ ₄₉	$\gamma 2K^+ 2K^-$	(2.0 ± 2.0) × 10 ⁻⁵			DESIG=16
Γ ₅₀	$\gamma \eta'(958)$	< 1.9 × 10 ⁻⁶	90%		DESIG=55
Γ ₅₁	$\gamma \eta$	< 1.0 × 10 ⁻⁶	90%		DESIG=54
Γ ₅₂	$\gamma f_0(980)$	< 3 × 10 ⁻⁵	90%		DESIG=105
Γ ₅₃	$\gamma f'_2(1525)$	(3.8 ± 0.9) × 10 ⁻⁵			DESIG=52
Γ ₅₄	$\gamma f_2(1270)$	(1.01 ± 0.09) × 10 ⁻⁴			DESIG=51
Γ ₅₅	$\gamma \eta(1405)$	< 8.2 × 10 ⁻⁵	90%		DESIG=65
Γ ₅₆	$\gamma f_0(1500)$	< 1.5 × 10 ⁻⁵	90%		DESIG=108
Γ ₅₇	$\gamma f_0(1710)$	< 2.6 × 10 ⁻⁴	90%		DESIG=53
Γ ₅₈	$\gamma f_0(1710) \rightarrow \gamma K^+ K^-$	< 7 × 10 ⁻⁶	90%		DESIG=112
Γ ₅₉	$\gamma f_0(1710) \rightarrow \gamma \pi^0 \pi^0$	< 1.4 × 10 ⁻⁶	90%		DESIG=109
Γ ₆₀	$\gamma f_0(1710) \rightarrow \gamma \eta \eta$	< 1.8 × 10 ⁻⁶	90%		DESIG=110
Γ ₆₁	$\gamma f_4(2050)$	< 5.3 × 10 ⁻⁵	90%		DESIG=104
Γ ₆₂	$\gamma f_0(2200) \rightarrow \gamma K^+ K^-$	< 2 × 10 ⁻⁴	90%		DESIG=69
Γ ₆₃	$\gamma f_J(2220) \rightarrow \gamma K^+ K^-$	< 8 × 10 ⁻⁷	90%		DESIG=60
Γ ₆₄	$\gamma f_J(2220) \rightarrow \gamma \pi^+ \pi^-$	< 6 × 10 ⁻⁷	90%		DESIG=61
Γ ₆₅	$\gamma f_J(2220) \rightarrow \gamma p \bar{p}$	< 1.1 × 10 ⁻⁶	90%		DESIG=62
Γ ₆₆	$\gamma \eta(2225) \rightarrow \gamma \phi \phi$	< 3 × 10 ⁻³	90%		DESIG=68
Γ ₆₇	$\gamma \eta_c(1S)$	< 5.7 × 10 ⁻⁵	90%		DESIG=119
Γ ₆₈	$\gamma \chi_{c0}$	< 6.5 × 10 ⁻⁴	90%		DESIG=120
Γ ₆₉	$\gamma \chi_{c1}$	< 2.3 × 10 ⁻⁵	90%		DESIG=121
Γ ₇₀	$\gamma \chi_{c2}$	< 7.6 × 10 ⁻⁶	90%		DESIG=122
Γ ₇₁	$\gamma X(3872) \rightarrow \pi^+ \pi^- J/\psi$	< 1.6 × 10 ⁻⁶	90%		DESIG=123
Γ ₇₂	$\gamma X(3872) \rightarrow \pi^+ \pi^- \pi^0 J/\psi$	< 2.8 × 10 ⁻⁶	90%		DESIG=124
Γ ₇₃	$\gamma \chi_{c0}(2P) \rightarrow \omega J/\psi$	< 3.0 × 10 ⁻⁶	90%		DESIG=125
Γ ₇₄	$\gamma X(4140) \rightarrow \phi J/\psi$	< 2.2 × 10 ⁻⁶	90%		DESIG=126
Γ ₇₅	γX	[c] < 4.5 × 10 ⁻⁶	90%		DESIG=66
Γ ₇₆	$\gamma X \bar{X} (m_X < 3.1 \text{ GeV})$	[d] < 1 × 10 ⁻³	90%		DESIG=67
Γ ₇₇	$\gamma X \bar{X} (m_X < 4.5 \text{ GeV})$	[e] < 2.4 × 10 ⁻⁴	90%		DESIG=127
Γ ₇₈	$\gamma X \rightarrow \gamma + \geq 4 \text{ prongs}$	[f] < 1.78 × 10 ⁻⁴	95%		DESIG=113
Γ ₇₉	$\gamma a_1^0 \rightarrow \gamma \mu^+ \mu^-$	[g] < 9 × 10 ⁻⁶	90%		DESIG=114
Γ ₈₀	$\gamma a_1^0 \rightarrow \gamma \tau^+ \tau^-$	[a] < 1.30 × 10 ⁻⁴	90%		DESIG=115
Γ ₈₁	$\gamma a_1^0 \rightarrow \gamma g g$	[h] < 1 %	90%		DESIG=129
Γ ₈₂	$\gamma a_1^0 \rightarrow \gamma s \bar{s}$	[h] < 1 × 10 ⁻³	90%		DESIG=130

Lepton Family number (LF) violating modes

NODE=M049;CLUMP=C

Γ ₈₃	$\mu^\pm \tau^\mp$	LF	< 6.0 × 10 ⁻⁶	95%	DESIG=116

Other decays
 Γ_{84} invisible $< 3.0 \times 10^{-4}$ 90%

 NODE=M049;CLUMP=D
 DESIG=106
[a] $2m_\tau < M(\tau^+\tau^-) < 9.2$ GeV

LINKAGE=E49

[b] $2 \text{ GeV} < m_{K^+K^-} < 3$ GeV

LINKAGE=G49

[c] $X = \text{scalar with } m < 8.0$ GeV

LINKAGE=A49

[d] $X\bar{X} = \text{vectors with } m < 3.1$ GeV

LINKAGE=B49

[e] X and $\bar{X} = \text{zero spin with } m < 4.5$ GeV

LINKAGE=F49

[f] $1.5 \text{ GeV} < m_X < 5.0$ GeV

LINKAGE=C49

[g] $201 \text{ MeV} < M(\mu^+\mu^-) < 3565$ MeV

LINKAGE=D49

[h] $0.5 \text{ GeV} < m_X < 9.0$ GeV, where m_X is the invariant mass of the hadronic final state.

LINKAGE=I49

 $\Upsilon(1S) \Gamma(i) \Gamma(e^+e^-) / \Gamma(\text{total})$

NODE=M049218

 $\Gamma(e^+e^-) \times \Gamma(\mu^+\mu^-) / \Gamma_{\text{total}}$ **$\Gamma_2 \Gamma_3 / \Gamma$**

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
31.2±1.6±1.7	KOBEL	92	CBAL $e^+e^- \rightarrow \mu^+\mu^-$

 NODE=M049G1
 NODE=M049G1
 $\Gamma(\text{hadrons}) \times \Gamma(e^+e^-) / \Gamma_{\text{total}}$ **$\Gamma_0 \Gamma_2 / \Gamma$**

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
1.240±0.016 OUR AVERAGE			
1.252±0.004±0.019	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
 $\Upsilon(1S)$ PARTIAL WIDTHS

NODE=M049220

 $\Gamma(e^+e^-)$ **Γ_2**

VALUE (keV)	DOCUMENT ID
1.340±0.018 OUR EVALUATION	

 NODE=M049W2
 NODE=M049W2
 → UNCHECKED ←
 $\Upsilon(1S)$ BRANCHING RATIOS

NODE=M049225

 $\Gamma(\tau^+\tau^-) / \Gamma_{\text{total}}$ **Γ_1 / Γ**

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
2.60±0.10 OUR AVERAGE				
2.53±0.13±0.05	60k	⁸ BESSON	07	CLEO $e^+e^- \rightarrow \Upsilon(1S) \rightarrow \tau^+\tau^-$
2.61±0.12 ^{+0.09} _{-0.13}	25k	CINABRO	94B	CLE2 $e^+e^- \rightarrow \tau^+\tau^-$
2.7 ±0.4 ±0.2		⁹ ALBRECHT	85C	ARG $\Upsilon(2S) \rightarrow \pi^+\pi^-\tau^+\tau^-$
3.4 ±0.4 ±0.4		GILES	83	CLEO $e^+e^- \rightarrow \tau^+\tau^-$

 NODE=M049R3
 NODE=M049R3

⁸ BESSON 07 reports $[\Gamma(\Upsilon(1S) \rightarrow \tau^+\tau^-) / \Gamma_{\text{total}}] / [B(\Upsilon(1S) \rightarrow \mu^+\mu^-)] = 1.02 \pm 0.02 \pm 0.05$ which we multiply by our best value $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.05) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M049R3;LINKAGE=BE

⁹ Using $B(\Upsilon(1S) \rightarrow ee) = B(\Upsilon(1S) \rightarrow \mu\mu) = 0.0256$; not used for width evaluations.

NODE=M049R3;LINKAGE=A

 $\Gamma(e^+e^-) / \Gamma_{\text{total}}$ **Γ_2 / Γ**

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
2.38±0.11 OUR AVERAGE				
2.29±0.08±0.11		ALEXANDER	98	CLE2 $\Upsilon(2S) \rightarrow \pi^+\pi^-e^+e^-$
2.42±0.14±0.14	307	ALBRECHT	87	ARG $\Upsilon(2S) \rightarrow \pi^+\pi^-e^+e^-$
2.8 ±0.3 ±0.2	826	BESSON	84	CLEO $\Upsilon(2S) \rightarrow \pi^+\pi^-e^+e^-$
5.1 ±3.0		BERGER	80C	PLUT $e^+e^- \rightarrow e^+e^-$

 NODE=M049R2
 NODE=M049R2

$\Gamma(\mu^+\mu^-)/\Gamma_{\text{total}}$ Γ_3/Γ

NODE=M049R1
 NODE=M049R1

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.0248±0.0005 OUR AVERAGE				
0.0249±0.0002±0.0007	345k	ADAMS	05	CLEO $e^+e^- \rightarrow \mu^+\mu^-$
0.0249±0.0008±0.0013		ALEXANDER	98	CLE2 $\Upsilon(2S) \rightarrow \pi^+\pi^-\mu^+\mu^-$
0.0212±0.0020±0.0010		¹⁰ BARU	92	MD1 $e^+e^- \rightarrow \mu^+\mu^-$
0.0231±0.0012±0.0010		¹⁰ KOBEL	92	CBAL $e^+e^- \rightarrow \mu^+\mu^-$
0.0252±0.0007±0.0007		CHEN	89B	CLEO $e^+e^- \rightarrow \mu^+\mu^-$
0.0261±0.0009±0.0011		KAARSBERG	89	CSB2 $e^+e^- \rightarrow \mu^+\mu^-$
0.0230±0.0025±0.0013	86	ALBRECHT	87	ARG $\Upsilon(2S) \rightarrow \pi^+\pi^-\mu^+\mu^-$
0.029 ±0.003 ±0.002	864	BESSION	84	CLEO $\Upsilon(2S) \rightarrow \pi^+\pi^-\mu^+\mu^-$
0.027 ±0.003 ±0.003		ANDREWS	83	CLEO $e^+e^- \rightarrow \mu^+\mu^-$
0.032 ±0.013 ±0.003		ALBRECHT	82	DASP $e^+e^- \rightarrow \mu^+\mu^-$
0.038 ±0.015 ±0.002		NICZYPORUK	82	LENA $e^+e^- \rightarrow \mu^+\mu^-$
0.014 +0.034 -0.014		BOCK	80	CNTR $e^+e^- \rightarrow \mu^+\mu^-$
0.022 ±0.020		BERGER	79	PLUT $e^+e^- \rightarrow \mu^+\mu^-$

¹⁰ Taking into account interference between the resonance and continuum.

NODE=M049R1;LINKAGE=G

 $\Gamma(\tau^+\tau^-)/\Gamma(\mu^+\mu^-)$ Γ_1/Γ_3

NODE=M049R43
 NODE=M049R43

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
1.008±0.023 OUR AVERAGE				
1.005±0.013±0.022	0.7M	¹¹ DEL-AMO-SA...10c	BABR	$\Upsilon(3S) \rightarrow \pi^+\pi^- \Upsilon(1S)$
1.02 ±0.02 ±0.05	60k	BESSION	07	CLEO $e^+e^- \rightarrow \Upsilon(1S)$

¹¹ Allows any number of extra photons with total energy < 500 MeV.

NODE=M049R43;LINKAGE=DE

 $\Gamma(gg)/\Gamma_{\text{total}}$ Γ_4/Γ

NODE=M049R35
 NODE=M049R35

VALUE (units 10 ⁻²)	EVTS	DOCUMENT ID	TECN	COMMENT
81.7±0.7	20M	¹² BESSION	06A	CLEO $\Upsilon(1S) \rightarrow \text{hadrons}$

¹² Calculated using the value $\Gamma(\gamma gg)/\Gamma(gg) = (2.70 \pm 0.01 \pm 0.13 \pm 0.24)\%$ from BESSION 06A and PDG 08 values of $B(\mu^+\mu^-) = (2.48 \pm 0.05)\%$ and $R_{\text{hadrons}} = 3.51$. The statistical error is negligible and the systematic error is partially correlated with that of $\Gamma(\gamma gg)/\Gamma_{\text{total}}$ measurement of BESSION 06A.

NODE=M049R35;LINKAGE=BE

 $\Gamma(\gamma gg)/\Gamma_{\text{total}}$ Γ_5/Γ

NODE=M049R36
 NODE=M049R36

VALUE (units 10 ⁻²)	EVTS	DOCUMENT ID	TECN	COMMENT
2.20±0.60	400k	¹³ BESSION	06A	CLEO $\Upsilon(1S) \rightarrow \gamma + \text{hadrons}$

¹³ Calculated using BESSION 06A values of $\Gamma(\gamma gg)/\Gamma(gg) = (2.70 \pm 0.01 \pm 0.13 \pm 0.24)\%$ and $\Gamma(gg)/\Gamma_{\text{total}}$. The statistical error is negligible and the systematic error is partially correlated with that of $\Gamma(gg)/\Gamma_{\text{total}}$ measurement of BESSION 06A.

NODE=M049R36;LINKAGE=BE

 $\Gamma(\gamma gg)/\Gamma(gg)$ Γ_5/Γ_4

NODE=M049R37
 NODE=M049R37

VALUE (units 10 ⁻²)	EVTS	DOCUMENT ID	TECN	COMMENT
2.70±0.01±0.27	20M	BESSION	06A	CLEO $\Upsilon(1S) \rightarrow (\gamma +) \text{hadrons}$

 $\Gamma(\eta'(958) \text{ anything})/\Gamma_{\text{total}}$ Γ_6/Γ

NODE=M049R73
 NODE=M049R73

VALUE	DOCUMENT ID	TECN	COMMENT
0.0294±0.0024 OUR AVERAGE			
0.030 ±0.002 ±0.002	AQUINES	06A	CLE3 $\Upsilon(1S) \rightarrow \eta' \text{ anything}$
0.028 ±0.004 ±0.002	ARTUSO	03	CLE2 $\Upsilon(1S) \rightarrow \eta' \text{ anything}$

 $\Gamma(J/\psi(1S) \text{ anything})/\Gamma_{\text{total}}$ Γ_7/Γ

NODE=M049R12
 NODE=M049R12

VALUE (units 10 ⁻³)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
0.65±0.07 OUR AVERAGE					
0.64±0.04±0.06		730 ± 40	BRIERE	04	CLEO $e^+e^- \rightarrow J/\psi X$
1.1 ±0.4 ±0.2			¹⁴ FULTON	89	CLEO $e^+e^- \rightarrow \mu^+\mu^- X$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.68	90		ALBRECHT	92J	ARG $e^+e^- \rightarrow e^+e^- X, \mu^+\mu^- X$
<1.7	90		MASCHMANN	90	CBAL $e^+e^- \rightarrow \text{hadrons}$
<20	90		NICZYPORUK	83	LENA

¹⁴ Using $B((J/\psi) \rightarrow \mu^+\mu^-) = (6.9 \pm 0.9)\%$.

NODE=M049R12;LINKAGE=K

$\Gamma(\chi_{c0} \text{ anything})/\Gamma(J/\psi(1S) \text{ anything})$ Γ_8/Γ_7

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<7.4	90	BRIERE	04	CLEO $e^+e^- \rightarrow J/\psi X$

NODE=M049R25
 NODE=M049R25

 $\Gamma(\chi_{c1} \text{ anything})/\Gamma(J/\psi(1S) \text{ anything})$ Γ_9/Γ_7

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
$0.35 \pm 0.08 \pm 0.06$	52 ± 12	BRIERE	04	CLEO $e^+e^- \rightarrow J/\psi X$

NODE=M049R26
 NODE=M049R26

 $\Gamma(\chi_{c2} \text{ anything})/\Gamma(J/\psi(1S) \text{ anything})$ Γ_{10}/Γ_7

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
$0.52 \pm 0.12 \pm 0.09$	47 ± 11	BRIERE	04	CLEO $e^+e^- \rightarrow J/\psi X$

NODE=M049R27
 NODE=M049R27

 $\Gamma(\psi(2S) \text{ anything})/\Gamma(J/\psi(1S) \text{ anything})$ Γ_{11}/Γ_7

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
$0.41 \pm 0.11 \pm 0.08$	42 ± 11	BRIERE	04	CLEO $e^+e^- \rightarrow J/\psi \pi^+ \pi^- X$

NODE=M049R28
 NODE=M049R28

 $\Gamma(\rho\pi)/\Gamma_{\text{total}}$ Γ_{12}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<3.68 (CL = 90%)		[<2 × 10 ⁻⁴ (CL = 90%) OUR 2013 BEST LIMIT]		

<3.68	90	SHEN	13	BELL $\Upsilon(1S) \rightarrow \pi^+ \pi^- \pi^0$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<1 × 10 ³	90	BLINOV	90	MD1 $\Upsilon(1S) \rightarrow \rho^0 \pi^0$
<2 × 10 ²	90	FULTON	90B	$\Upsilon(1S) \rightarrow \rho^0 \pi^0$
<2.1 × 10 ³	90	NICZYPORUK	83	LENA $\Upsilon(1S) \rightarrow \rho^0 \pi^0$

NODE=M049R11
 NODE=M049R11

 $\Gamma(\omega\pi^0)/\Gamma_{\text{total}}$ Γ_{13}/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_{14}/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_{15}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<5	90	BARU	92	MD1 $\Upsilon(1S) \rightarrow K^+ K^-$

NODE=M049R58
 NODE=M049R58

 $\Gamma(\rho\bar{\rho})/\Gamma_{\text{total}}$ Γ_{16}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<5	90	¹⁵ BARU	96	MD1 $\Upsilon(1S) \rightarrow \rho\bar{\rho}$

NODE=M049R59
 NODE=M049R59

¹⁵Supersedes BARU 92 in this node.

NODE=M049R59;LINKAGE=A

 $\Gamma(\pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}$ Γ_{17}/Γ

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$2.14 \pm 0.72 \pm 0.34$		26 ± 9	SHEN	13	BELL $\Upsilon(1S) \rightarrow \pi^+ \pi^- \pi^0$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<18.4	90	ANASTASSOV	99	CLE2 $e^+e^- \rightarrow \text{hadrons}$

NODE=M049R72
 NODE=M049R72

 $\Gamma(\phi K^+ K^-)/\Gamma_{\text{total}}$ Γ_{18}/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_{19}/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_{20}/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_{21}/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_{22}/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_{23}/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_{24}/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_{25}/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_{26}/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_{27}/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_{28}/Γ

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
$12.8 \pm 2.0 \pm 2.3$	143 $\pm$ 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_{29}/Γ

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$1.59 \pm 0.33 \pm 0.18$		37 $\pm$ 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_{30}/Γ

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
$2.92 \pm 0.85 \pm 0.37$	16 $\pm$ 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_{31}/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_{32}/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	$\Upsilon(2S) \rightarrow \pi^+ \pi^- \Upsilon(1S)$

• • • 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

$\Gamma(\bar{d} \text{ anything})/\Gamma_{\text{total}}$ Γ_{33}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
$2.86 \pm 0.19 \pm 0.21$	455	ASNER	07 CLEO	$e^+ e^- \rightarrow \bar{d} X$

NODE=M049R33
NODE=M049R33

$\Gamma(\text{Sum of 100 exclusive modes})/\Gamma_{\text{total}}$ Γ_{34}/Γ

VALUE (units 10^{-2})	DOCUMENT ID	COMMENT
1.200 ± 0.017	^{19,20} DOBBS	12A $\Upsilon(1S) \rightarrow \text{hadrons}$

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

$\Gamma(ggg, \gamma gg \rightarrow \bar{d} \text{ anything})/\Gamma(ggg, \gamma gg \rightarrow \text{anything})$

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT
$3.36 \pm 0.23 \pm 0.25$	455	ASNER	07	CLEO $e^+ e^- \rightarrow \bar{d} X$

NODE=M049R34
NODE=M049R34

 $\Gamma(\gamma \pi^+ \pi^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
$6.3 \pm 1.2 \pm 1.3$	21 ANASTASSOV 99	CLE2	$e^+ e^- \rightarrow \text{hadrons}$

²¹ For $m_{\pi\pi} > 1$ GeV.

 Γ_{35}/Γ

NODE=M049R70
NODE=M049R70

NODE=M049R70;LINKAGE=A

 $\Gamma(\gamma \pi^0 \pi^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
$1.7 \pm 0.6 \pm 0.3$	22 ANASTASSOV 99	CLE2	$e^+ e^- \rightarrow \text{hadrons}$

²² For $m_{\pi\pi} > 1$ GeV.

 Γ_{36}/Γ

NODE=M049R71
NODE=M049R71

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 $e^+ e^- \rightarrow \Upsilon(1S)$

²³ BESSON 07A obtained this limit for $0.7 < m_{\pi^0 \eta} < 3$ GeV.

 Γ_{37}/Γ

NODE=M049R47
NODE=M049R47

NODE=M049R47;LINKAGE=BE

 $\Gamma(\gamma K^+ K^-)/\Gamma_{\text{total}}$

($2 < m_{K^+ K^-} < 3$ GeV)

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
$1.14 \pm 0.08 \pm 0.10$	90	ATHAR	06	CLE3 $\Upsilon(1S) \rightarrow \gamma K^+ K^-$

 Γ_{38}/Γ

NODE=M049R24

NODE=M049R24
NODE=M049R24

 $\Gamma(\gamma \rho \bar{\rho})/\Gamma_{\text{total}}$

($2 < m_{\rho \bar{\rho}} < 3$ GeV)

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
< 0.6	90	ATHAR	06	CLE3 $\Upsilon(1S) \rightarrow \gamma \rho \bar{\rho}$

 Γ_{39}/Γ

NODE=M049R29

NODE=M049R29
NODE=M049R29

 $\Gamma(\gamma 2h^+ 2h^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
$7.0 \pm 1.1 \pm 1.0$	80 ± 12	FULTON	90B	CLEO $e^+ e^- \rightarrow \text{hadrons}$

 Γ_{40}/Γ

NODE=M049R20
NODE=M049R20

 $\Gamma(\gamma 3h^+ 3h^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
$5.4 \pm 1.5 \pm 1.3$	39 ± 11	FULTON	90B	CLEO $e^+ e^- \rightarrow \text{hadrons}$

 Γ_{41}/Γ

NODE=M049R21
NODE=M049R21

 $\Gamma(\gamma 4h^+ 4h^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
$7.4 \pm 2.5 \pm 2.5$	36 ± 12	FULTON	90B	CLEO $e^+ e^- \rightarrow \text{hadrons}$

 Γ_{42}/Γ

NODE=M049R22
NODE=M049R22

 $\Gamma(\gamma \pi^+ \pi^- K^+ K^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
$2.9 \pm 0.7 \pm 0.6$	29 ± 8	FULTON	90B	CLEO $e^+ e^- \rightarrow \text{hadrons}$

 Γ_{43}/Γ

NODE=M049R14
NODE=M049R14

 $\Gamma(\gamma 2\pi^+ 2\pi^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
$2.5 \pm 0.7 \pm 0.5$	26 ± 7	FULTON	90B	CLEO $e^+ e^- \rightarrow \text{hadrons}$

 Γ_{44}/Γ

NODE=M049R13
NODE=M049R13

 $\Gamma(\gamma 3\pi^+ 3\pi^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
$2.5 \pm 0.9 \pm 0.8$	17 ± 5	FULTON	90B	CLEO $e^+ e^- \rightarrow \text{hadrons}$

 Γ_{45}/Γ

NODE=M049R17
NODE=M049R17

 $\Gamma(\gamma 2\pi^+ 2\pi^- K^+ K^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
$2.4 \pm 0.9 \pm 0.8$	18 ± 7	FULTON	90B	CLEO $e^+ e^- \rightarrow \text{hadrons}$

 Γ_{46}/Γ

NODE=M049R18
NODE=M049R18

 $\Gamma(\gamma \pi^+ \pi^- \rho \bar{\rho})/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
$1.5 \pm 0.5 \pm 0.3$	22 ± 6	FULTON	90B	CLEO $e^+ e^- \rightarrow \text{hadrons}$

 Γ_{47}/Γ

NODE=M049R15
NODE=M049R15

$\Gamma(\gamma 2\pi^+ 2\pi^- \rho \bar{\rho})/\Gamma_{\text{total}}$ Γ_{48}/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_{49}/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_{50}/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_{51}/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_{52}/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_{53}/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	$\Upsilon(1S) \rightarrow \gamma K^+ K^-$	
• • • 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	$\Upsilon(1S) \rightarrow \gamma K^+ K^-$	

NODE=M049R52
 NODE=M049R52

NODE=M049R52;LINKAGE=BE

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 $B(f'_2(1525) \rightarrow K \bar{K}) = 4 B(f'_2(1525) \rightarrow K_S^0 K_S^0)$.

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_{54}/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_{55}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
< 8.2	90	²⁹ FULTON	90B CLEO	$\Upsilon(1S) \rightarrow \gamma K^\pm \pi^\mp K_S^0$

NODE=M049R23
 NODE=M049R23

²⁹ Includes unknown branching ratio of $\eta(1405) \rightarrow K^\pm \pi^\mp K_S^0$.

NODE=M049R23;LINKAGE=J

$\Gamma(\gamma f_0(1500))/\Gamma_{\text{total}}$ Γ_{56}/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_{57}/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_{58}/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_{59}/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_{60}/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_{61}/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_{62}/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_{63}/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_{64}/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_{65}/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_{66}/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_{67}/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_{68}/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_{69}/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_{70}/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_{71}/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_{72}/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

 $\Gamma(\gamma\chi_{c0}(2P) \rightarrow \omega J/\psi)/\Gamma_{\text{total}}$ Γ_{73}/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_{74}/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_{75}/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	$e^+ e^- \rightarrow \gamma + X$

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
NODE=M049R60
NODE=M049R60

NODE=M049R60;LINKAGE=DA
NODE=M049R60;LINKAGE=A

 $\Gamma(\gamma X \bar{X}(m_X < 3.1 \text{ GeV}))/\Gamma_{\text{total}}$ Γ_{76}/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_{77}/Γ

X and $\bar{X}$ = zero spin with $m < 4.5$ 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 $m < 4.5$ GeV.

NODE=M049R01
NODE=M049R01
NODE=M049R01

NODE=M049R01;LINKAGE=DA

 $\Gamma(\gamma X \rightarrow \gamma + \geq 4 \text{ prongs})/\Gamma_{\text{total}}$ Γ_{78}/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

$\Gamma(\gamma a_1^0 \rightarrow \gamma \mu^+ \mu^-)/\Gamma_{\text{total}}$ (201 < M($\mu^+ \mu^-$) < 3565 MeV) Γ_{79}/Γ

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 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 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

 $\Gamma(\gamma a_1^0 \Rightarrow \gamma \tau^+ \tau^-)/\Gamma_{\text{total}}$ (2 m_τ < M($\tau^+ \tau^-$) < 9.2 GeV) Γ_{80}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<130 (CL = 90%)		[<50 $\times 10^{-6}$ (CL = 90%) OUR 2013 BEST LIMIT]		

<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 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 GeV, and 13×10^{-5} at M(a_1^0) = 9.2 GeV.

43 For a narrow scalar or pseudoscalar a_1^0 with $2m_\tau$ < M(a_1^0) < 7.5 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 GeV.

NODE=M049R66

NODE=M049R66

NODE=M049R66

NODE=M049R66;LINKAGE=A

NODE=M049R66;LINKAGE=LO

 $\Gamma(\gamma a_1^0 \rightarrow \gamma g g)/\Gamma_{\text{total}}$

(0.5 GeV < m < 9.0 GeV)

 Γ_{81}/Γ

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 GeV < m_X < 9.0 GeV. Measured 90% CL limit as a function of m_X range from 10^{-6} to 10^{-2} .

NODE=M049R03

NODE=M049R03

NODE=M049R03

NODE=M049R03;LINKAGE=A

 $\Gamma(\gamma a_1^0 \rightarrow \gamma s \bar{s})/\Gamma_{\text{total}}$

(0.5 GeV < m < 9.0 GeV)

 Γ_{82}/Γ

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 GeV < m_X < 9.0 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

 $\Gamma(\mu^\pm \tau^\mp)/\Gamma_{\text{total}}$ Γ_{83}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<6.0	95	LOVE	08A CLEO	$e^+ e^- \rightarrow \mu^\pm \tau^\mp$

NODE=M049230

NODE=M049R67

NODE=M049R67

OTHER DECAYS

 $\Gamma(\text{invisible})/\Gamma_{\text{total}}$ Γ_{84}/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

T(1S) REFERENCES

NODE=M049

LEES	13C	PR D87 031102	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=54949
LEES	13L	PR D88 031701	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=55167
LEES	13R	PR D88 071102	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=55451
SHEN	13	PR D88 011102	C.P. Shen <i>et al.</i>	(BELLE Collab.)	REFID=55395
DOBBS	12A	PR D86 052003	S. Dobbs <i>et al.</i>		REFID=54746
SHEN	12A	PR D86 031102	C.P. Shen <i>et al.</i>	(BELLE Collab.)	REFID=54314
BESSION	11	PR D83 037101	D. Besson <i>et al.</i>	(CLEO Collab.)	REFID=16737
DEL-AMO-SA...	11J	PRL 107 021804	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)	REFID=16495
AUBERT	10C	PR D81 011102	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=53211
DEL-AMO-SA...	10C	PRL 104 191801	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)	REFID=53354
SHEN	10A	PR D82 051504	C.P. Shen <i>et al.</i>	(BELLE Collab.)	REFID=53545
AUBERT	09AX	PRL 103 251801	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=53201
LOVE	08	PRL 101 151802	W. Love <i>et al.</i>	(CLEO Collab.)	REFID=52565
LOVE	08A	PRL 101 201601	W. Love <i>et al.</i>	(CLEO Collab.)	REFID=52592
PDG	08	PL B667 1	C. Amsler <i>et al.</i>	(PDG Collab.)	REFID=52166
ASNER	07	PR D75 012009	D.M. Asner <i>et al.</i>	(CLEO Collab.)	REFID=51617
ATHAR	07A	PR D76 072003	S.B. Athar <i>et al.</i>	(CLEO Collab.)	REFID=51945
BESSION	07	PRL 98 052002	D. Besson <i>et al.</i>	(CLEO Collab.)	REFID=51620
BESSION	07A	PR D75 072001	D. Besson <i>et al.</i>	(CLEO Collab.)	REFID=51638
ROSNER	07A	PR D76 117102	J.L. Rosner <i>et al.</i>	(CLEO Collab.)	REFID=52079
RUBIN	07	PR D75 031104	P. Rubin <i>et al.</i>	(CLEO Collab.)	REFID=51629
TAJIMA	07	PRL 98 132001	O. Tajima <i>et al.</i>	(BELLE Collab.)	REFID=51645
AQUINES	06A	PR D74 092006	O. Aquines <i>et al.</i>	(CLEO Collab.)	REFID=51510
ATHAR	06	PR D73 032001	S.B. Athar <i>et al.</i>	(CLEO Collab.)	REFID=50993
BESSION	06A	PR D74 012003	D. Besson <i>et al.</i>	(CLEO Collab.)	REFID=51147
ROSNER	06	PRL 96 092003	J.L. Rosner <i>et al.</i>	(CLEO Collab.)	REFID=51035
ADAMS	05	PRL 94 012001	G.S. Adams <i>et al.</i>	(CLEO Collab.)	REFID=50452
BRIERE	04	PR D70 072001	R.A. Briere <i>et al.</i>	(CLEO Collab.)	REFID=50183
ARTUSO	03	PR D67 052003	M. Artuso <i>et al.</i>	(CLEO Collab.)	REFID=49395
MASEK	02	PR D65 072002	G. Masek <i>et al.</i>	(CLEO Collab.)	REFID=48846
RICHICHI	01B	PRL 87 141801	S.J. Richichi <i>et al.</i>	(CLEO Collab.)	REFID=48345
ARTAMONOV	00	PL B474 427	A.S. Artamonov <i>et al.</i>		REFID=47424
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 ←

 γ ENERGY IN $\Upsilon(2S)$ DECAY

VALUE (MeV)

DOCUMENT ID

TECN

COMMENT

162.5 ± 0.4 OUR AVERAGE

162.56 ± 0.19 ± 0.42

ARTUSO

05

CLEO

 $\Upsilon(2S) \rightarrow \gamma X$

162.0 ± 0.8 ± 1.2

EDWARDS

99

CLE2

 $\Upsilon(2S) \rightarrow \gamma \chi(1P)$

162.1 ± 0.5 ± 1.4

ALBRECHT

85E

ARG

 $\Upsilon(2S) \rightarrow \text{conv.} \gamma X$

163.8 ± 1.6 ± 2.7

NERNST

85

CBAL

 $\Upsilon(2S) \rightarrow \gamma X$

158.0 ± 7 ± 1

HAAS

84

CLEO

 $\Upsilon(2S) \rightarrow \text{conv.} \gamma X$

• • • We do not use the following data for averages, fits, limits, etc. • • •

149.4 ± 0.7 ± 5.0

KLOPFEN...

83

CUSB

 $\Upsilon(2S) \rightarrow \gamma X$

NODE=M076DM

NODE=M076DM

 $\chi_{b0}(1P)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)	Confidence level
$\Gamma_1 \quad \gamma \Upsilon(1S)$	(1.76 ± 0.35) %	
$\Gamma_2 \quad D^0 X$	< 10.4 %	90%
$\Gamma_3 \quad \pi^+ \pi^- K^+ K^- \pi^0$	< 1.6 × 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

1.76 ± 0.30 ± 0.18

87

1,2

KORNICER

11

CLEO

 $e^+ e^- \rightarrow \gamma \gamma \ell^+ \ell^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 4.6

90

3

LEES

11J

BABR

 $\Upsilon(2S) \rightarrow X \gamma$

< 6

90

WALK

86

CBAL

 $\Upsilon(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$

< 11

90

PAUSS

83

CUSB

 $\Upsilon(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$

¹ Assuming $B(\Upsilon(1S) \rightarrow \ell^+ \ell^-) = (2.48 \pm 0.05)\%$.

² KORNICER 11 reports $[\Gamma(\chi_{b0}(1P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))] = (6.59 \pm 0.96 \pm 0.60) \times 10^{-4}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P)) = (3.8 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

³ LEES 11J quotes a central value of $\Gamma(\chi_{b0}(1P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))/\Gamma_{\text{total}} = (8.3 \pm 5.6^{+3.7}_{-2.6}) \times 10^{-4}$.

NODE=M076220

NODE=M076R1

NODE=M076R1

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	4,5 BRIERE	08 CLEO	$\Upsilon(2S) \rightarrow \gamma D^0 X$

⁴ For $p_{D^0} > 2.5$ GeV/c.⁵ The authors also present their result as $(5.6 \pm 3.6 \pm 0.5) \times 10^{-2}$.

NODE=M076R01
 NODE=M076R01

NODE=M076R01;LINKAGE=BR
 NODE=M076R01;LINKAGE=RI

 $\Gamma(\pi^+ \pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE (units 10 ⁻⁴)	CL%	DOCUMENT ID	TECN	COMMENT
<1.6	90	⁶ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^- \pi^0$

⁶ ASNER 08A reports $[\Gamma(\chi_{b0}(1P) \rightarrow \pi^+ \pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))] < 6 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P)) = 3.8 \times 10^{-2}$.

NODE=M076R02
 NODE=M076R02

NODE=M076R02;LINKAGE=AS

 $\Gamma(2\pi^+ \pi^- K^- K_S^0)/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE (units 10 ⁻⁴)	CL%	DOCUMENT ID	TECN	COMMENT
<0.5	90	⁷ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+ \pi^- K^- K_S^0$

⁷ ASNER 08A reports $[\Gamma(\chi_{b0}(1P) \rightarrow 2\pi^+ \pi^- K^- K_S^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))] < 2 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P)) = 3.8 \times 10^{-2}$.

NODE=M076R03
 NODE=M076R03

NODE=M076R03;LINKAGE=AS

 $\Gamma(2\pi^+ \pi^- K^- K_S^0 2\pi^0)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE (units 10 ⁻⁴)	CL%	DOCUMENT ID	TECN	COMMENT
<5	90	⁸ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+ \pi^- K^- 2\pi^0$

⁸ ASNER 08A reports $[\Gamma(\chi_{b0}(1P) \rightarrow 2\pi^+ \pi^- K^- K_S^0 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))] < 18 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P)) = 3.8 \times 10^{-2}$.

NODE=M076R04
 NODE=M076R04

NODE=M076R04;LINKAGE=AS

 $\Gamma(2\pi^+ 2\pi^- 2\pi^0)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE (units 10 ⁻⁴)	CL%	DOCUMENT ID	TECN	COMMENT
<2.1	90	⁹ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+ 2\pi^- 2\pi^0$

⁹ ASNER 08A reports $[\Gamma(\chi_{b0}(1P) \rightarrow 2\pi^+ 2\pi^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))] < 8 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P)) = 3.8 \times 10^{-2}$.

NODE=M076R05
 NODE=M076R05

NODE=M076R05;LINKAGE=AS

 $\Gamma(2\pi^+ 2\pi^- K^+ K^-)/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE (units 10 ⁻⁴)	EVTS	DOCUMENT ID	TECN	COMMENT
1.1 ± 0.6 ± 0.1	7	¹⁰ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+ 2\pi^- K^+ K^-$

¹⁰ ASNER 08A reports $[\Gamma(\chi_{b0}(1P) \rightarrow 2\pi^+ 2\pi^- K^+ K^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))] = (4 \pm 2 \pm 1) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P)) = (3.8 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M076R06
 NODE=M076R06

NODE=M076R06;LINKAGE=AS

 $\Gamma(2\pi^+ 2\pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE (units 10 ⁻⁴)	CL%	DOCUMENT ID	TECN	COMMENT
<2.7	90	¹¹ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+ 2\pi^- K^+ K^- \pi^0$

¹¹ ASNER 08A reports $[\Gamma(\chi_{b0}(1P) \rightarrow 2\pi^+ 2\pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))] < 10 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P)) = 3.8 \times 10^{-2}$.

NODE=M076R07
 NODE=M076R07

NODE=M076R07;LINKAGE=AS

 $\Gamma(2\pi^+ 2\pi^- K^+ K^- 2\pi^0)/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE (units 10 ⁻⁴)	CL%	DOCUMENT ID	TECN	COMMENT
<5	90	¹² ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+ 2\pi^- K^+ K^- 2\pi^0$

¹² ASNER 08A reports $[\Gamma(\chi_{b0}(1P) \rightarrow 2\pi^+ 2\pi^- K^+ K^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))] < 20 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P)) = 3.8 \times 10^{-2}$.

NODE=M076R08
 NODE=M076R08

NODE=M076R08;LINKAGE=AS

 $\Gamma(3\pi^+ 2\pi^- K^- K_S^0 \pi^0)/\Gamma_{\text{total}}$ Γ_{10}/Γ

VALUE (units 10 ⁻⁴)	CL%	DOCUMENT ID	TECN	COMMENT
<1.6	90	¹³ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+ 2\pi^- K^- K_S^0 \pi^0$

¹³ ASNER 08A reports $[\Gamma(\chi_{b0}(1P) \rightarrow 3\pi^+ 2\pi^- K^- K_S^0 \pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))] < 6 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P)) = 3.8 \times 10^{-2}$.

NODE=M076R09
 NODE=M076R09

NODE=M076R09;LINKAGE=AS

$\Gamma(3\pi^+3\pi^-)/\Gamma_{\text{total}}$ Γ_{11}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<0.8	90	14 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+ 3\pi^-$
14 ASNER 08A reports $[\Gamma(\chi_{b0}(1P) \rightarrow 3\pi^+ 3\pi^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))]$ $< 3 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P)) = 3.8 \times 10^{-2}$.				

NODE=M076R10
 NODE=M076R10

NODE=M076R10;LINKAGE=AS

 $\Gamma(3\pi^+3\pi^-2\pi^0)/\Gamma_{\text{total}}$ Γ_{12}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<6	90	15 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+ 3\pi^- 2\pi^0$
15 ASNER 08A reports $[\Gamma(\chi_{b0}(1P) \rightarrow 3\pi^+ 3\pi^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))]$ $< 22 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P)) = 3.8 \times 10^{-2}$.				

NODE=M076R11
 NODE=M076R11

NODE=M076R11;LINKAGE=AS

 $\Gamma(3\pi^+3\pi^-K^+K^-)/\Gamma_{\text{total}}$ Γ_{13}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
2.4±1.2±0.2	9	16 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+ 3\pi^- K^+ K^-$
16 ASNER 08A reports $[\Gamma(\chi_{b0}(1P) \rightarrow 3\pi^+ 3\pi^- K^+ K^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))]$ $= (9 \pm 4 \pm 2) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P)) = (3.8 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M076R12
 NODE=M076R12

NODE=M076R12;LINKAGE=AS

 $\Gamma(3\pi^+3\pi^-K^+K^-\pi^0)/\Gamma_{\text{total}}$ Γ_{14}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<10	90	17 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+ 3\pi^- K^+ K^-\pi^0$
17 ASNER 08A reports $[\Gamma(\chi_{b0}(1P) \rightarrow 3\pi^+ 3\pi^- K^+ K^-\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))]$ $< 37 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P)) = 3.8 \times 10^{-2}$.				

NODE=M076R13
 NODE=M076R13

NODE=M076R13;LINKAGE=AS

 $\Gamma(4\pi^+4\pi^-)/\Gamma_{\text{total}}$ Γ_{15}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<0.8	90	18 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 4\pi^+ 4\pi^-$
18 ASNER 08A reports $[\Gamma(\chi_{b0}(1P) \rightarrow 4\pi^+ 4\pi^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))]$ $< 3 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P)) = 3.8 \times 10^{-2}$.				

NODE=M076R14
 NODE=M076R14

NODE=M076R14;LINKAGE=AS

 $\Gamma(4\pi^+4\pi^-2\pi^0)/\Gamma_{\text{total}}$ Γ_{16}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<21	90	19 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 4\pi^+ 4\pi^- 2\pi^0$
19 ASNER 08A reports $[\Gamma(\chi_{b0}(1P) \rightarrow 4\pi^+ 4\pi^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))]$ $< 77 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P)) = 3.8 \times 10^{-2}$.				

NODE=M076R15
 NODE=M076R15

NODE=M076R15;LINKAGE=AS

 $\Gamma(J/\psi J/\psi)/\Gamma_{\text{total}}$ Γ_{17}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<7	90	20 SHEN	12 BELL	$\Upsilon(2S) \rightarrow \gamma \psi X$
20 SHEN 12 reports $< 7.1 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{b0}(1P) \rightarrow J/\psi J/\psi)/\Gamma_{\text{total}}]$ $\times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))]$ assuming $B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P)) = (3.8 \pm 0.4) \times 10^{-2}$.				

NODE=M076R16
 NODE=M076R16

NODE=M076R16;LINKAGE=SH

 $\Gamma(J/\psi\psi(2S))/\Gamma_{\text{total}}$ Γ_{18}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<12	90	21 SHEN	12 BELL	$\Upsilon(2S) \rightarrow \gamma \psi X$
21 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	22 SHEN	12 BELL	$\Upsilon(2S) \rightarrow \gamma \psi X$
22 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

$$\Gamma(\chi_{b0}(1P) \rightarrow \gamma \Upsilon(1S)) / \Gamma_{\text{total}} \times \Gamma(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P)) / \Gamma_{\text{total}} \times \Gamma_{33}^{\Upsilon(2S)} / \Gamma \Upsilon(2S)$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<1.7 × 10⁻³	90	²³ LEES	11J BABR	$\Upsilon(2S) \rightarrow X\gamma$
²³ LEES 11J quotes a central value of $\Gamma(\chi_{b0}(1P) \rightarrow \gamma \Upsilon(1S)) / \Gamma_{\text{total}} \times \Gamma(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P)) / \Gamma_{\text{total}} = (8.3 \pm 5.6^{+3.7}_{-2.6}) \times 10^{-4}$ and derives a 90% CL upper limit of $\Gamma(\gamma \Upsilon(1S)) / \Gamma_{\text{total}} < 4.6\%$ using $B(\Upsilon(4S) \rightarrow \gamma \chi_{b0}(1P)) = (3.8 \pm 0.4)\%$.				

$$B(\chi_{b0}(1P) \rightarrow \gamma \Upsilon(1S)) \times B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P)) \times B(\Upsilon(1S) \rightarrow \ell^+ \ell^-)$$

VALUE (units 10 ⁻⁵)	EVT5	DOCUMENT ID	TECN	COMMENT
1.63 ± 0.24 ± 0.15	87	KORNICER	11 CLEO	$e^+ e^- \rightarrow \gamma \gamma \ell^+ \ell^-$

 $\chi_{b0}(1P)$ REFERENCES

SHEN	12	PR D85 071102	C.P. Shen <i>et al.</i>	(BELLE Collab.)
KORNICER	11	PR D83 054003	M. Kornicer <i>et al.</i>	(CLEO Collab.)
LEES	11J	PR D84 072002	J.P. Lees <i>et al.</i>	(BABAR Collab.)
ASNER	08A	PR D78 091103	D.M. Asner <i>et al.</i>	(CLEO Collab.)
BRIERE	08	PR D78 092007	R.A. Briere <i>et al.</i>	(CLEO Collab.)
ARTUSO	05	PRL 94 032001	M. Artuso <i>et al.</i>	(CLEO Collab.)
EDWARDS	99	PR D59 032003	K.W. Edwards <i>et al.</i>	(CLEO Collab.)
WALK	86	PR D34 2611	W.S. Walk <i>et al.</i>	(Crystal Ball Collab.)
ALBRECHT	85E	PL 160B 331	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
NERNST	85	PRL 54 2195	R. Nernst <i>et al.</i>	(Crystal Ball Collab.)
HAAS	84	PRL 52 799	J. Haas <i>et al.</i>	(CLEO Collab.)
KLOPFEN...	83	PRL 51 160	C. Klopfenstein <i>et al.</i>	(CUSB Collab.)
PAUSS	83	PL 130B 439	F. Pauss <i>et al.</i>	(MPIM, COLU, CORN, LSU+)

 $\chi_{b1}(1P)$

$$J^G(J^{PC}) = 0^+(1^{++})$$

J needs confirmation.

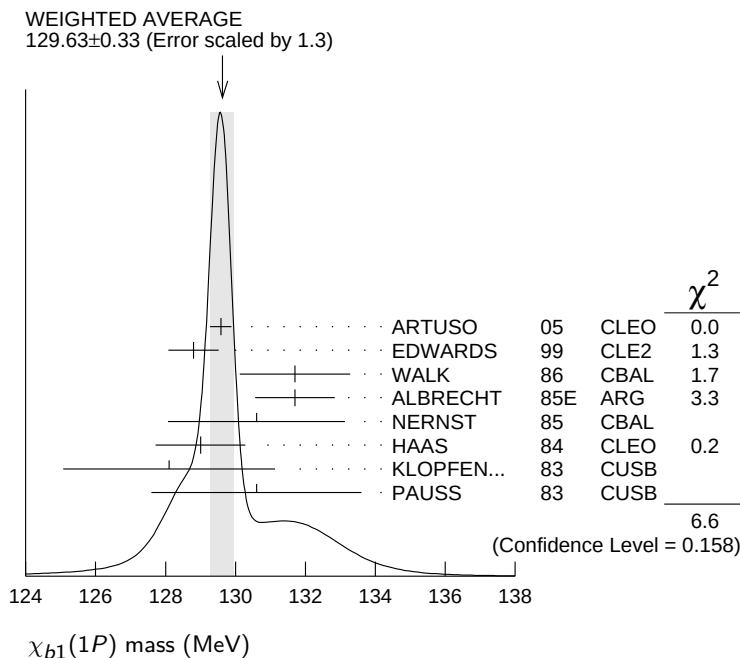
Observed in radiative decay of the $\Upsilon(2S)$, therefore $C = +$. Branching ratio requires E1 transition, M1 is strongly disfavored, therefore $P = +$. $J = 1$ from SKWARNICKI 87.

 $\chi_{b1}(1P)$ 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

 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	$\Upsilon(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$



$\chi_{b1}(1P)$ DECAY MODES

NODE=M077215;NODE=M077

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 $\gamma \Upsilon(1S)$	(33.9±2.2) %	
Γ_2 $D^0 X$	(12.6±2.2) %	
Γ_3 $\pi^+ \pi^- K^+ K^- \pi^0$	(2.0±0.6) × 10 ⁻⁴	
Γ_4 $2\pi^+ \pi^- K^- K_S^0$	(1.3±0.5) × 10 ⁻⁴	
Γ_5 $2\pi^+ \pi^- K^- K_S^0 2\pi^0$	< 6 × 10 ⁻⁴	90%
Γ_6 $2\pi^+ 2\pi^- 2\pi^0$	(8.0±2.5) × 10 ⁻⁴	
Γ_7 $2\pi^+ 2\pi^- K^+ K^-$	(1.5±0.5) × 10 ⁻⁴	
Γ_8 $2\pi^+ 2\pi^- K^+ K^- \pi^0$	(3.5±1.2) × 10 ⁻⁴	
Γ_9 $2\pi^+ 2\pi^- K^+ K^- 2\pi^0$	(8.6±3.2) × 10 ⁻⁴	
Γ_{10} $3\pi^+ 2\pi^- K^- K_S^0 \pi^0$	(9.3±3.3) × 10 ⁻⁴	
Γ_{11} $3\pi^+ 3\pi^-$	(1.9±0.6) × 10 ⁻⁴	
Γ_{12} $3\pi^+ 3\pi^- 2\pi^0$	(1.7±0.5) × 10 ⁻³	
Γ_{13} $3\pi^+ 3\pi^- K^+ K^-$	(2.6±0.8) × 10 ⁻⁴	
Γ_{14} $3\pi^+ 3\pi^- K^+ K^- \pi^0$	(7.5±2.6) × 10 ⁻⁴	
Γ_{15} $4\pi^+ 4\pi^-$	(2.6±0.9) × 10 ⁻⁴	
Γ_{16} $4\pi^+ 4\pi^- 2\pi^0$	(1.4±0.6) × 10 ⁻³	
Γ_{17} $J/\psi J/\psi$	< 2.7 × 10 ⁻⁵	90%
Γ_{18} $J/\psi \psi(2S)$	< 1.7 × 10 ⁻⁵	90%
Γ_{19} $\psi(2S) \psi(2S)$	< 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

$\chi_{b1}(1P)$ BRANCHING RATIOS

NODE=M077220

$\Gamma(\gamma \Upsilon(1S))/\Gamma_{\text{total}}$	Γ_1/Γ
VALUE	TECN
0.339±0.022 OUR AVERAGE	
0.331±0.018±0.017	11 CLEO
0.350±0.023±0.018	11J BABR
0.32 ±0.06 ±0.07	86 CBAL
0.47 ±0.18	83 CUSB

NODE=M077R1
NODE=M077R1

¹ Assuming $B(\Upsilon(1S) \rightarrow \ell^+ \ell^-) = (2.48 \pm 0.05)\%$.

² KORNICER 11 reports $[\Gamma(\chi_{b1}(1P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))]$
 $= (22.8 \pm 0.4 \pm 1.2) \times 10^{-3}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))$
 $= (6.9 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

³ LEES 11J reports $[\Gamma(\chi_{b1}(1P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))]$
 $= (24.1 \pm 0.6 \pm 1.5) \times 10^{-3}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))$
 $= (6.9 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M077R1;LINKAGE=KA
NODE=M077R1;LINKAGE=KR

NODE=M077R1;LINKAGE=LE

$\Gamma(D^0 X)/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE (units 10^{-2})	EVTs	DOCUMENT ID	TECN	COMMENT
$12.6 \pm 1.9 \pm 1.1$	2310	⁴ BRIERE	08 CLEO	$\Upsilon(2S) \rightarrow \gamma D^0 X$

⁴ For $p_{D^0} > 2.5$ GeV/c.NODE=M077R01
NODE=M077R01

NODE=M077R01;LINKAGE=BR

 $\Gamma(\pi^+ \pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
$2.0 \pm 0.6 \pm 0.1$	18	⁵ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^- \pi^0$

⁵ ASNER 08A reports $[\Gamma(\chi_{b1}(1P) \rightarrow \pi^+ \pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))] = (14 \pm 3 \pm 3) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M077R02
NODE=M077R02

NODE=M077R02;LINKAGE=AS

 $\Gamma(2\pi^+ \pi^- K^- K_S^0)/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
$1.3 \pm 0.5 \pm 0.1$	11	⁶ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+ \pi^- K^- K_S^0$

⁶ ASNER 08A reports $[\Gamma(\chi_{b1}(1P) \rightarrow 2\pi^+ \pi^- K^- K_S^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))] = (9 \pm 3 \pm 2) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M077R03
NODE=M077R03

NODE=M077R03;LINKAGE=AS

 $\Gamma(2\pi^+ \pi^- K^- K_S^0 2\pi^0)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 6	90	⁷ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+ \pi^- K^- 2\pi^0$

⁷ ASNER 08A reports $[\Gamma(\chi_{b1}(1P) \rightarrow 2\pi^+ \pi^- K^- K_S^0 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))] < 42 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = 6.9 \times 10^{-2}$.

NODE=M077R04
NODE=M077R04

NODE=M077R04;LINKAGE=AS

 $\Gamma(2\pi^+ 2\pi^- 2\pi^0)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
$8.0 \pm 2.4 \pm 0.4$	46	⁸ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+ 2\pi^- 2\pi^0$

⁸ ASNER 08A reports $[\Gamma(\chi_{b1}(1P) \rightarrow 2\pi^+ 2\pi^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))] = (55 \pm 9 \pm 14) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M077R05
NODE=M077R05

NODE=M077R05;LINKAGE=AS

 $\Gamma(2\pi^+ 2\pi^- K^+ K^-)/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
$1.5 \pm 0.5 \pm 0.1$	18	⁹ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+ 2\pi^- K^+ K^-$

⁹ ASNER 08A reports $[\Gamma(\chi_{b1}(1P) \rightarrow 2\pi^+ 2\pi^- K^+ K^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))] = (10 \pm 3 \pm 2) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M077R06
NODE=M077R06

NODE=M077R06;LINKAGE=AS

 $\Gamma(2\pi^+ 2\pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
$3.5 \pm 1.2 \pm 0.2$	22	¹⁰ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+ 2\pi^- K^+ K^- \pi^0$

¹⁰ ASNER 08A reports $[\Gamma(\chi_{b1}(1P) \rightarrow 2\pi^+ 2\pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))] = (24 \pm 6 \pm 6) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M077R07
NODE=M077R07

NODE=M077R07;LINKAGE=AS

 $\Gamma(2\pi^+ 2\pi^- K^+ K^- 2\pi^0)/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
$8.6 \pm 3.2 \pm 0.4$	26	¹¹ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+ 2\pi^- K^+ K^- 2\pi^0$

¹¹ ASNER 08A reports $[\Gamma(\chi_{b1}(1P) \rightarrow 2\pi^+ 2\pi^- K^+ K^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))] = (59 \pm 14 \pm 17) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M077R08
NODE=M077R08

NODE=M077R08;LINKAGE=AS

$\Gamma(3\pi^+ 2\pi^- K^- K_S^0 \pi^0)/\Gamma_{\text{total}}$ Γ_{10}/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
$9.3 \pm 3.3 \pm 0.5$	21	12 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+ 2\pi^- K^- K_S^0 \pi^0$

NODE=M077R09
 NODE=M077R09

¹²ASNER 08A reports $[\Gamma(\chi_{b1}(1P) \rightarrow 3\pi^+ 2\pi^- K^- K_S^0 \pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))]$ = $(64 \pm 16 \pm 16) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M077R09;LINKAGE=AS

 $\Gamma(3\pi^+ 3\pi^-)/\Gamma_{\text{total}}$ Γ_{11}/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
$1.9 \pm 0.6 \pm 0.1$	25	13 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+ 3\pi^-$

NODE=M077R10
 NODE=M077R10

¹³ASNER 08A reports $[\Gamma(\chi_{b1}(1P) \rightarrow 3\pi^+ 3\pi^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))]$ = $(13 \pm 3 \pm 3) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M077R10;LINKAGE=AS

 $\Gamma(3\pi^+ 3\pi^- 2\pi^0)/\Gamma_{\text{total}}$ Γ_{12}/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
$17 \pm 5 \pm 1$	56	14 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+ 3\pi^- 2\pi^0$

NODE=M077R11
 NODE=M077R11

¹⁴ASNER 08A reports $[\Gamma(\chi_{b1}(1P) \rightarrow 3\pi^+ 3\pi^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))]$ = $(119 \pm 18 \pm 32) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M077R11;LINKAGE=AS

 $\Gamma(3\pi^+ 3\pi^- K^+ K^-)/\Gamma_{\text{total}}$ Γ_{13}/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
$2.6 \pm 0.8 \pm 0.1$	21	15 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+ 3\pi^- K^+ K^-$

NODE=M077R12
 NODE=M077R12

¹⁵ASNER 08A reports $[\Gamma(\chi_{b1}(1P) \rightarrow 3\pi^+ 3\pi^- K^+ K^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))]$ = $(18 \pm 4 \pm 4) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M077R12;LINKAGE=AS

 $\Gamma(3\pi^+ 3\pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}$ Γ_{14}/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
$7.5 \pm 2.6 \pm 0.4$	28	16 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+ 3\pi^- K^+ K^- \pi^0$

NODE=M077R13
 NODE=M077R13

¹⁶ASNER 08A reports $[\Gamma(\chi_{b1}(1P) \rightarrow 3\pi^+ 3\pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))]$ = $(52 \pm 11 \pm 14) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M077R13;LINKAGE=AS

 $\Gamma(4\pi^+ 4\pi^-)/\Gamma_{\text{total}}$ Γ_{15}/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
$2.6 \pm 0.9 \pm 0.1$	24	17 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 4\pi^+ 4\pi^-$

NODE=M077R14
 NODE=M077R14

¹⁷ASNER 08A reports $[\Gamma(\chi_{b1}(1P) \rightarrow 4\pi^+ 4\pi^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))]$ = $(18 \pm 4 \pm 5) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M077R14;LINKAGE=AS

 $\Gamma(4\pi^+ 4\pi^- 2\pi^0)/\Gamma_{\text{total}}$ Γ_{16}/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
$14 \pm 5 \pm 1$	26	18 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 4\pi^+ 4\pi^- 2\pi^0$

NODE=M077R15
 NODE=M077R15

¹⁸ASNER 08A reports $[\Gamma(\chi_{b1}(1P) \rightarrow 4\pi^+ 4\pi^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))]$ = $(96 \pm 24 \pm 29) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M077R15;LINKAGE=AS

 $\Gamma(J/\psi J/\psi)/\Gamma_{\text{total}}$ Γ_{17}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
< 2.7	90	19 SHEN	12 BELL	$\Upsilon(2S) \rightarrow \gamma \psi X$

NODE=M077R16
 NODE=M077R16

¹⁹SHEN 12 reports $< 2.7 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{b1}(1P) \rightarrow J/\psi J/\psi)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))]$ assuming $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$.

NODE=M077R16;LINKAGE=SH

$\Gamma(J/\psi\psi(2S))/\Gamma_{\text{total}}$ Γ_{18}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<1.7	90	²⁰ SHEN	12 BELL	$\Upsilon(2S) \rightarrow \gamma\psi X$
²⁰ 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	²¹ SHEN	12 BELL	$\Upsilon(2S) \rightarrow \gamma\psi X$
²¹ 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

$$\Gamma(\chi_{b1}(1P) \rightarrow \gamma\Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(2S) \rightarrow \gamma\chi_{b1}(1P))/\Gamma_{\text{total}}$$

$$\Gamma_1/\Gamma \times \Gamma_{31}^{\Upsilon(2S)}/\Gamma\Upsilon(2S)$$

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
$5.65 \pm 0.11 \pm 0.27$	3222	KORNICER	11 CLEO	$e^+e^- \rightarrow \gamma\gamma\ell^+\ell^-$

NODE=M077B01
 NODE=M077B01

$$B(\chi_{b1}(1P) \rightarrow \gamma\Upsilon(1S)) \times B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(1P)) \times B(\Upsilon(1S) \rightarrow \ell^+\ell^-)$$

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT
$1.33 \pm 0.30 \pm 0.23$	50	KORNICER	11 CLEO	$e^+e^- \rightarrow \gamma\gamma\ell^+\ell^-$

NODE=M077B02
 NODE=M077B02

$$B(\chi_{b2}(1P) \rightarrow \rho X + \bar{\rho} X)/B(\chi_{b1}(1P) \rightarrow \rho X + \bar{\rho} X)$$

VALUE	DOCUMENT ID	TECN	COMMENT
$1.068 \pm 0.010 \pm 0.040$	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

NODE=M077

SHEN	12	PR D85 071102	C.P. Shen <i>et al.</i>	(BELLE Collab.)
KORNICER	11	PR D83 054003	M. Kornicer <i>et al.</i>	(CLEO Collab.)
LEES	11J	PR D84 072002	J.P. Lees <i>et al.</i>	(BABAR Collab.)
ASNER	08A	PR D78 091103	D.M. Asner <i>et al.</i>	(CLEO Collab.)
BRIERE	08	PR D78 092007	R.A. Briere <i>et al.</i>	(CLEO Collab.)
BRIERE	07	PR D76 012005	R.A. Briere <i>et al.</i>	(CLEO Collab.)
ARTUSO	05	PRL 94 032001	M. Artuso <i>et al.</i>	(CLEO Collab.)
EDWARDS	99	PR D59 032003	K.W. Edwards <i>et al.</i>	(CLEO Collab.)
SKWARNICKI	87	PRL 58 972	T. Skwarnicki <i>et al.</i>	(Crystal Ball Collab.)
WALK	86	PR D34 2611	W.S. Walk <i>et al.</i>	(Crystal Ball Collab.)
ALBRECHT	85E	PL 160B 331	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
NERNST	85	PRL 54 2195	R. Nernst <i>et al.</i>	(Crystal Ball Collab.)
HAAS	84	PRL 52 799	J. Haas <i>et al.</i>	(CLEO Collab.)
KLOPFEN...	83	PRL 51 160	C. Klopfenstein <i>et al.</i>	(CUSP Collab.)
PAUSS	83	PL 130B 439	F. Pauss <i>et al.</i>	(MPIM, COLU, CORN, LSU+)

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

$h_b(1P)$

$$I^G(J^{PC}) = ?^?(1^{+-})$$

Quantum numbers are quark model predictions, $C = -$ established by $\eta_b \gamma$ decay.

 $h_b(1P)$ MASS

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
9899.3±1.0 OUR AVERAGE				
9899.1±0.4±1.0	70k	MIZUK	12 BELL	$e^+e^- \rightarrow \pi^+\pi^-$ 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.				

 $h_b(1P)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \eta_b(1S)\gamma$	(49 ⁺⁸ ₋₇) %

 $h_b(1P)$ BRANCHING RATIOS

$\Gamma(\eta_b(1S)\gamma)/\Gamma_{\text{total}}$					Γ_1/Γ
<u>VALUE (units 10^{-2})</u>	<u>EVTs</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
$49.2 \pm 5.7^{+5.6}_{-3.3}$	24k	MIZUK	12	BELL	$e^+e^- \rightarrow (\gamma)\pi^+\pi^-$ hadrons
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
seen	10.8k	LEES	11k	BABR	$\Upsilon(3S) \rightarrow \eta_b \gamma \pi^0$

 $h_b(1P)$ 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.)
LEES	11K	PR D84 091101	J.P. Lees <i>et al.</i>	(BABAR Collab.)

 $\chi_{b2}(1P)$

$$I^G(J^{PC}) = 0^+(2^{++})$$

J needs confirmation.

Observed in radiative decay of the $\Upsilon(2S)$, therefore $C = +$. Branching ratio requires E1 transition, M1 is strongly disfavored, therefore $P = +$. $J = 2$ from SKWARNICKI 87.

 $\chi_{b2}(1P)$ MASS

VALUE (MeV)	DOCUMENT ID
9912.21±0.26±0.31 OUR EVALUATION	
From average γ energy below, using $\Upsilon(2S)$ mass = 10023.26 ± 0.31 MeV	

 γ ENERGY IN $\Upsilon(2S)$ DECAY

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
110.44±0.29 OUR AVERAGE			
Error includes scale factor of 1.1.			
110.58±0.08±0.30	ARTUSO	05 CLEO	$\Upsilon(2S) \rightarrow \gamma X$
110.8 ±0.3 ±0.6	EDWARDS	99 CLE2	$\Upsilon(2S) \rightarrow \gamma \chi(1P)$
107.0 ±1.1 ±1.3	WALK	86 CBAL	$\Upsilon(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$
110.6 ±0.3 ±0.9	ALBRECHT	85E ARG	$\Upsilon(2S) \rightarrow \text{conv.} \gamma X$
110.4 ±0.8 ±2.2	NERNST	85 CBAL	$\Upsilon(2S) \rightarrow \gamma X$
109.5 ±0.7 ±1.0	HAAS	84 CLEO	$\Upsilon(2S) \rightarrow \text{conv.} \gamma X$
108.2 ±0.3 ±2.0	KLOPFEN...	83 CUSB	$\Upsilon(2S) \rightarrow \gamma X$
108.8 ±4.0	PAUSS	83 CUSB	$\Upsilon(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$

NODE=M204

NODE=M204

NODE=M204M

NODE=M204M

NODE=M204M;LINKAGE=AD

NODE=M204215;NODE=M204

DESIG=1

NODE=M204225

NODE=M204R01
NODE=M204R01

NODE=M204

REFID=53962
REFID=54718
REFID=53937

NODE=M078

NODE=M078

NODE=M078M

NODE=M078M
→ UNCHECKED ←

NODE=M078DM

NODE=M078DM

$\chi_{b2}(1P)$ DECAY MODES

NODE=M078215;NODE=M078

Mode	Fraction (Γ_i/Γ)	Confidence level
$\Gamma_1 \quad \gamma \Upsilon(1S)$	$(19.1 \pm 1.2) \%$	
$\Gamma_2 \quad D^0 X$	$< 7.9 \%$	90%
$\Gamma_3 \quad \pi^+ \pi^- K^+ K^- \pi^0$	$(8 \pm 5) \times 10^{-5}$	
$\Gamma_4 \quad 2\pi^+ \pi^- K^- K_S^0$	$< 1.0 \times 10^{-4}$	90%
$\Gamma_5 \quad 2\pi^+ \pi^- K^- K_S^0 2\pi^0$	$(5.3 \pm 2.4) \times 10^{-4}$	
$\Gamma_6 \quad 2\pi^+ 2\pi^- 2\pi^0$	$(3.5 \pm 1.4) \times 10^{-4}$	
$\Gamma_7 \quad 2\pi^+ 2\pi^- K^+ K^-$	$(1.1 \pm 0.4) \times 10^{-4}$	
$\Gamma_8 \quad 2\pi^+ 2\pi^- K^+ K^- \pi^0$	$(2.1 \pm 0.9) \times 10^{-4}$	
$\Gamma_9 \quad 2\pi^+ 2\pi^- K^+ K^- 2\pi^0$	$(3.9 \pm 1.8) \times 10^{-4}$	
$\Gamma_{10} \quad 3\pi^+ 2\pi^- K^- K_S^0 \pi^0$	$< 5 \times 10^{-4}$	90%
$\Gamma_{11} \quad 3\pi^+ 3\pi^-$	$(7.0 \pm 3.1) \times 10^{-5}$	
$\Gamma_{12} \quad 3\pi^+ 3\pi^- 2\pi^0$	$(1.0 \pm 0.4) \times 10^{-3}$	
$\Gamma_{13} \quad 3\pi^+ 3\pi^- K^+ K^-$	$< 8 \times 10^{-5}$	90%
$\Gamma_{14} \quad 3\pi^+ 3\pi^- K^+ K^- \pi^0$	$(3.6 \pm 1.5) \times 10^{-4}$	
$\Gamma_{15} \quad 4\pi^+ 4\pi^-$	$(8 \pm 4) \times 10^{-5}$	
$\Gamma_{16} \quad 4\pi^+ 4\pi^- 2\pi^0$	$(1.8 \pm 0.7) \times 10^{-3}$	
$\Gamma_{17} \quad J/\psi J/\psi$	$< 4 \times 10^{-5}$	90%
$\Gamma_{18} \quad J/\psi \psi(2S)$	$< 5 \times 10^{-5}$	90%
$\Gamma_{19} \quad \psi(2S) \psi(2S)$	$< 1.6 \times 10^{-5}$	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
0.191 ± 0.012 OUR AVERAGE				
$0.186 \pm 0.011 \pm 0.009$	1770	^{1,2} KORNICER	11	CLEO $e^+ e^- \rightarrow \gamma \gamma \ell^+ \ell^-$
$0.194^{+0.014}_{-0.017} \pm 0.009$	8k	³ LEES	11J	BABR $\Upsilon(2S) \rightarrow X \gamma$
$0.27 \pm 0.06 \pm 0.06$		WALK	86	CBAL $\Upsilon(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$
0.20 ± 0.05		KLOPFEN...	83	CUSB $\Upsilon(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$

¹ Assuming $B(\Upsilon(1S) \rightarrow \ell^+ \ell^-) = (2.48 \pm 0.05)\%$.² KORNICER 11 reports $[\Gamma(\chi_{b2}(1P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P))] = (1.33 \pm 0.04 \pm 0.07) \times 10^{-2}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P)) = (7.15 \pm 0.35) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.³ LEES 11J reports $[\Gamma(\chi_{b2}(1P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P))] = (13.9 \pm 0.5^{+0.9}_{-1.1}) \times 10^{-3}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P)) = (7.15 \pm 0.35) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M078R1

NODE=M078R1

NODE=M078R1;LINKAGE=KA

NODE=M078R1;LINKAGE=KR

NODE=M078R1;LINKAGE=LE

 $\Gamma(D^0 X)/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 7.9 \times 10^{-2}$	90	^{4,5} BRIERE	08	CLEO $\Upsilon(2S) \rightarrow \gamma D^0 X$

⁴ For $p_{D^0} > 2.5 \text{ GeV}/c$.⁵ 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
$0.84 \pm 0.50 \pm 0.04$	8	⁶ ASNER	08A	CLEO $\Upsilon(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^- \pi^0$

⁶ ASNER 08A reports $[\Gamma(\chi_{b2}(1P) \rightarrow \pi^+ \pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P))] = (6 \pm 3 \pm 2) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P)) = (7.15 \pm 0.35) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M078R02

NODE=M078R02

NODE=M078R02;LINKAGE=AS

 $\Gamma(2\pi^+ \pi^- K^- K_S^0)/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 1.0	90	⁷ ASNER	08A	CLEO $\Upsilon(2S) \rightarrow \gamma 2\pi^+ \pi^- K^- K_S^0$

⁷ ASNER 08A reports $[\Gamma(\chi_{b2}(1P) \rightarrow 2\pi^+ \pi^- K^- K_S^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P))] < 7 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P)) = 7.15 \times 10^{-2}$.

NODE=M078R03

NODE=M078R03

NODE=M078R03;LINKAGE=AS

$\Gamma(2\pi^+\pi^-K^-K_S^02\pi^0)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
5.3±2.4±0.3	11	⁸ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+\pi^-K^-2\pi^0$
⁸ ASNER 08A reports $[\Gamma(\chi_{b2}(1P) \rightarrow 2\pi^+\pi^-K^-K_S^02\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma\chi_{b2}(1P))]$ = $(38 \pm 14 \pm 10) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma\chi_{b2}(1P)) = (7.15 \pm 0.35) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M078R04
 NODE=M078R04

NODE=M078R04;LINKAGE=AS

 $\Gamma(2\pi^+2\pi^-2\pi^0)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
3.5±1.4±0.2	19	⁹ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+2\pi^-2\pi^0$
⁹ ASNER 08A reports $[\Gamma(\chi_{b2}(1P) \rightarrow 2\pi^+2\pi^-2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma\chi_{b2}(1P))]$ = $(25 \pm 8 \pm 6) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma\chi_{b2}(1P)) = (7.15 \pm 0.35) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M078R05
 NODE=M078R05

NODE=M078R05;LINKAGE=AS

 $\Gamma(2\pi^+2\pi^-K^+K^-)/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
1.1±0.4±0.1	14	¹⁰ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+2\pi^-K^+K^-$
¹⁰ ASNER 08A reports $[\Gamma(\chi_{b2}(1P) \rightarrow 2\pi^+2\pi^-K^+K^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma\chi_{b2}(1P))]$ = $(8 \pm 2 \pm 2) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma\chi_{b2}(1P)) = (7.15 \pm 0.35) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M078R06
 NODE=M078R06

NODE=M078R06;LINKAGE=AS

 $\Gamma(2\pi^+2\pi^-K^+K^-\pi^0)/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
2.1±0.9±0.1	13	¹¹ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+2\pi^-K^+K^-\pi^0$
¹¹ ASNER 08A reports $[\Gamma(\chi_{b2}(1P) \rightarrow 2\pi^+2\pi^-K^+K^-\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma\chi_{b2}(1P))]$ = $(15 \pm 5 \pm 4) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma\chi_{b2}(1P)) = (7.15 \pm 0.35) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M078R07
 NODE=M078R07

NODE=M078R07;LINKAGE=AS

 $\Gamma(2\pi^+2\pi^-K^+K^-2\pi^0)/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
3.9±1.8±0.2	11	¹² ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+2\pi^-K^+K^-2\pi^0$
¹² ASNER 08A reports $[\Gamma(\chi_{b2}(1P) \rightarrow 2\pi^+2\pi^-K^+K^-2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma\chi_{b2}(1P))]$ = $(28 \pm 11 \pm 7) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma\chi_{b2}(1P)) = (7.15 \pm 0.35) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M078R08
 NODE=M078R08

NODE=M078R08;LINKAGE=AS

 $\Gamma(3\pi^+2\pi^-K^-K_S^0\pi^0)/\Gamma_{\text{total}}$ Γ_{10}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<5	90	¹³ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+2\pi^-K^-K_S^0\pi^0$
¹³ ASNER 08A reports $[\Gamma(\chi_{b2}(1P) \rightarrow 3\pi^+2\pi^-K^-K_S^0\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma\chi_{b2}(1P))]$ < 36×10^{-6} which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma\chi_{b2}(1P)) = 7.15 \times 10^{-2}$.				

NODE=M078R09
 NODE=M078R09

NODE=M078R09;LINKAGE=AS

 $\Gamma(3\pi^+3\pi^-)/\Gamma_{\text{total}}$ Γ_{11}/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
0.70±0.31±0.03	9	¹⁴ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+3\pi^-$
¹⁴ ASNER 08A reports $[\Gamma(\chi_{b2}(1P) \rightarrow 3\pi^+3\pi^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma\chi_{b2}(1P))]$ = $(5 \pm 2 \pm 1) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma\chi_{b2}(1P)) = (7.15 \pm 0.35) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M078R10
 NODE=M078R10

NODE=M078R10;LINKAGE=AS

 $\Gamma(3\pi^+3\pi^-2\pi^0)/\Gamma_{\text{total}}$ Γ_{12}/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
10.2±3.6±0.5	34	¹⁵ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+3\pi^-2\pi^0$
¹⁵ ASNER 08A reports $[\Gamma(\chi_{b2}(1P) \rightarrow 3\pi^+3\pi^-2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma\chi_{b2}(1P))]$ = $(73 \pm 16 \pm 20) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma\chi_{b2}(1P)) = (7.15 \pm 0.35) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M078R11
 NODE=M078R11

NODE=M078R11;LINKAGE=AS

$\Gamma(3\pi^+ 3\pi^- K^+ K^-)/\Gamma_{\text{total}}$ Γ_{13}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<0.8	90	16 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+ 3\pi^- K^+ K^-$
16 ASNER 08A reports $[\Gamma(\chi_{b2}(1P) \rightarrow 3\pi^+ 3\pi^- K^+ K^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P))]$ $< 6 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P)) = 7.15 \times 10^{-2}$.				

NODE=M078R12
 NODE=M078R12

NODE=M078R12;LINKAGE=AS

 $\Gamma(3\pi^+ 3\pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}$ Γ_{14}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$3.6 \pm 1.5 \pm 0.2$	14	17 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+ 3\pi^- K^+ K^- \pi^0$
17 ASNER 08A reports $[\Gamma(\chi_{b2}(1P) \rightarrow 3\pi^+ 3\pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P))]$ $= (26 \pm 8 \pm 2) \times 10^{-6}$ 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=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	18 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 4\pi^+ 4\pi^-$
18 ASNER 08A reports $[\Gamma(\chi_{b2}(1P) \rightarrow 4\pi^+ 4\pi^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P))]$ $= (6 \pm 2 \pm 2) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P)) = (7.15 \pm 0.35) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M078R14
 NODE=M078R14

NODE=M078R14;LINKAGE=AS

 $\Gamma(4\pi^+ 4\pi^- 2\pi^0)/\Gamma_{\text{total}}$ Γ_{16}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$18 \pm 7 \pm 1$	29	19 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 4\pi^+ 4\pi^- 2\pi^0$
19 ASNER 08A reports $[\Gamma(\chi_{b2}(1P) \rightarrow 4\pi^+ 4\pi^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P))]$ $= (132 \pm 31 \pm 40) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P)) = (7.15 \pm 0.35) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M078R15
 NODE=M078R15

NODE=M078R15;LINKAGE=AS

 $\Gamma(J/\psi J/\psi)/\Gamma_{\text{total}}$ Γ_{17}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<5	90	20 SHEN	12 BELL	$\Upsilon(2S) \rightarrow \gamma \psi X$
20 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	21 SHEN	12 BELL	$\Upsilon(2S) \rightarrow \gamma \psi X$
21 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	22 SHEN	12 BELL	$\Upsilon(2S) \rightarrow \gamma \psi X$
22 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

$$\Gamma(\chi_{b2}(1P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P))/\Gamma_{\text{total}}$$

$$\Gamma_1/\Gamma \times \Gamma_{32}^{\Upsilon(2S)}/\Gamma \Upsilon(2S)$$

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
$3.29 \pm 0.09 \pm 0.16$	1770	KORNICER	11 CLEO	$e^+ e^- \rightarrow \gamma \gamma \ell^+ \ell^-$

NODE=M078B01
 NODE=M078B01

$$B(\chi_{b2}(1P) \rightarrow \gamma \Upsilon(1S)) \times B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(1P)) \times B(\Upsilon(1S) \rightarrow \ell^+ \ell^-)$$

VALUE (units 10^{-5})	EVS	DOCUMENT ID	TECN	COMMENT
$3.56 \pm 0.40 \pm 0.41$	126	KORNICER	11	CLEO $e^+ e^- \rightarrow \gamma \gamma \ell^+ \ell^-$

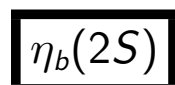
NODE=M078B02
NODE=M078B02

$$\chi_{b2}(1P) \text{ REFERENCES}$$

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+)

NODE=M078

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



$$I^G(J^{PC}) = 0^+(0^-+)$$

OMITTED FROM SUMMARY TABLE

Quantum numbers shown are quark-model predictions.

NODE=M200

NODE=M200

$$\eta_b(2S) \text{ MASS}$$

VALUE (MeV)	EVS	DOCUMENT ID	TECN	COMMENT
$9999.0 \pm 3.5^{+2.8}_{-1.9}$	26k	¹ MIZUK	12	BELL $e^+ e^- \rightarrow \gamma \pi^+ \pi^- +$ hadrons

• • • We do not use the following data for averages, fits, limits, etc. • • •

9974.6 $\pm$ 2.3 $\pm$ 2.1	11 $\pm$ 4	^{2,3} DOBBS	12	$\Upsilon(2S) \rightarrow \gamma$ hadrons

¹ Assuming $\Gamma_{\eta_b(2S)} = 4.9$ MeV. Not independent of the corresponding mass difference measurement.

² Obtained by analyzing CLEO III data but not authored by the CLEO Collaboration.

³ Assuming $\Gamma_{\eta_b(2S)} = 5$ MeV. Not independent of the corresponding mass difference measurement.

NODE=M200M

NODE=M200M

NODE=M200M;LINKAGE=MI

NODE=M200M;LINKAGE=DO

NODE=M200M;LINKAGE=NI

$$m \Upsilon(2S) - m \eta_b(2S)$$

VALUE (MeV)	EVS	DOCUMENT ID	TECN	COMMENT
$24.3 \pm 3.5^{+2.8}_{-1.9}$	26k	⁴ MIZUK	12	BELL $e^+ e^- \rightarrow \gamma \pi^+ \pi^- +$ hadrons

• • • We do not use the following data for averages, fits, limits, etc. • • •

48.7 $\pm$ 2.3 $\pm$ 2.1	11 $\pm$ 4	^{5,6} DOBBS	12	$\Upsilon(2S) \rightarrow \gamma$ hadrons

⁴ Assuming $\Gamma_{\eta_b(2S)} = 4.9$ MeV. Not independent of the corresponding mass measurement.

⁵ Obtained by analyzing CLEO III data but not authored by the CLEO Collaboration.

⁶ Assuming $\Gamma_{\eta_b(2S)} = 5$ MeV. Not independent of the corresponding mass measurement.

NODE=M200DM

NODE=M200DM

NODE=M200DM;LINKAGE=MI

NODE=M200DM;LINKAGE=DO

NODE=M200DM;LINKAGE=NI

$$\eta_b(2S) \text{ WIDTH}$$

VALUE (MeV)	CL%	DOCUMENT ID	TECN	COMMENT
<24	90	MIZUK	12	BELL $e^+ e^- \rightarrow \gamma \pi^+ \pi^-$ hadrons

NODE=M200W

NODE=M200W

$$\eta_b(2S) \text{ DECAY MODES}$$

Mode	Fraction (Γ_i/Γ)
Γ_1 hadrons	seen

NODE=M200215;NODE=M200

DESIG=1

$\eta_b(2S)$ BRANCHING RATIOS

$\Gamma(\text{hadrons})/\Gamma_{\text{total}}$				Γ_1/Γ	
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
seen	26k	MIZUK	12	BELL	$e^+e^- \rightarrow \gamma\pi^+\pi^-$ hadrons
• • • We do not use the following data for averages, fits, limits, etc. • • •					
seen		⁷ DOBBS	12		$\Upsilon(2S) \rightarrow \gamma$ hadrons
⁷ Obtained by analyzing CLEO III data but not authored by the CLEO Collaboration.					

NODE=M200225

NODE=M200R01
NODE=M200R01

NODE=M200R01;LINKAGE=DO

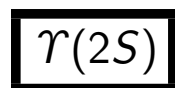
 $\eta_b(2S)$ REFERENCES

DOBBS	12	PRL 109 082001	S. Dobbs <i>et al.</i>	
MIZUK	12	PRL 109 232002	R. Mizuk <i>et al.</i>	(BELLE Collab.)

NODE=M200

REFID=54288
REFID=54718

NODE=M052



$$I^G(J^{PC}) = 0^-(1^{--})$$

 $\Upsilon(2S)$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
10023.26$\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

NODE=M052M;LINKAGE=AR
NODE=M052M;LINKAGE=C
NODE=M052M;LINKAGE=RZ $m\Upsilon(3S) - m\Upsilon(2S)$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
331.50$\pm$0.02$\pm$0.13	LEES	11C BABR	$e^+e^- \rightarrow \pi^+\pi^-X$

NODE=M052DM3

NODE=M052DM3

 $\Upsilon(2S)$ WIDTH

VALUE (keV)	DOCUMENT ID	COMMENT
31.98$\pm$2.63 OUR EVALUATION	See the Note on "Width Determinations of the Υ States"	

NODE=M052W

NODE=M052W
→ UNCHECKED ← $\Upsilon(2S)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
$\Gamma_1 \quad \Upsilon(1S)\pi^+\pi^-$	(17.85 $\pm$ 0.26) %	
$\Gamma_2 \quad \Upsilon(1S)\pi^0\pi^0$	(8.6 $\pm$ 0.4) %	
$\Gamma_3 \quad \tau^+\tau^-$	(2.00 $\pm$ 0.21) %	
$\Gamma_4 \quad \mu^+\mu^-$	(1.93 $\pm$ 0.17) %	S=2.2
$\Gamma_5 \quad e^+e^-$	(1.91 $\pm$ 0.16) %	
$\Gamma_6 \quad \Upsilon(1S)\pi^0$	< 4 $\times 10^{-5}$	CL=90%
$\Gamma_7 \quad \Upsilon(1S)\eta$	(2.9 $\pm$ 0.4) $\times 10^{-4}$	S=2.0
$\Gamma_8 \quad J/\psi(1S)$ anything	< 6 $\times 10^{-3}$	CL=90%
$\Gamma_9 \quad \bar{d}$ anything	(3.4 $\pm$ 0.6) $\times 10^{-5}$	
Γ_{10} hadrons	(94 $\pm$ 11) %	
$\Gamma_{11} \quad gg$	(58.8 $\pm$ 1.2) %	
$\Gamma_{12} \quad \gamma gg$	(8.8 $\pm$ 1.1) %	
$\Gamma_{13} \quad \phi K^+ K^-$	(1.6 $\pm$ 0.4) $\times 10^{-6}$	
$\Gamma_{14} \quad \omega\pi^+\pi^-$	< 2.58 $\times 10^{-6}$	CL=90%
$\Gamma_{15} \quad K^*(892)^0 K^- \pi^+ + \text{c.c.}$	(2.3 $\pm$ 0.7) $\times 10^{-6}$	

NODE=M052215;NODE=M052

DESIG=4

DESIG=5

DESIG=3

DESIG=1

DESIG=2

DESIG=10

DESIG=6

DESIG=20

DESIG=16

DESIG=101

DESIG=105

DESIG=106

DESIG=133

DESIG=134

DESIG=135

Γ ₁₆	$\phi f'_2(1525)$	< 1.33	$\times 10^{-6}$	CL=90%	DESIG=136
Γ ₁₇	$\omega f_2(1270)$	< 5.7	$\times 10^{-7}$	CL=90%	DESIG=137
Γ ₁₈	$\rho(770) a_2(1320)$	< 8.8	$\times 10^{-7}$	CL=90%	DESIG=138
Γ ₁₉	$K^*(892)^0 \bar{K}_2^*(1430)^0 + \text{c.c.}$	(1.5 ± 0.6)	$\times 10^{-6}$		DESIG=139
Γ ₂₀	$K_1(1270)^\pm K^\mp$	< 3.22	$\times 10^{-6}$	CL=90%	DESIG=140
Γ ₂₁	$K_1(1400)^\pm K^\mp$	< 8.3	$\times 10^{-7}$	CL=90%	DESIG=141
Γ ₂₂	$b_1(1235)^\pm \pi^\mp$	< 4.0	$\times 10^{-7}$	CL=90%	DESIG=142
Γ ₂₃	$\rho \pi$	< 1.16	$\times 10^{-6}$	CL=90%	DESIG=126
Γ ₂₄	$\pi^+ \pi^- \pi^0$	< 8.0	$\times 10^{-7}$	CL=90%	DESIG=127
Γ ₂₅	$\omega \pi^0$	< 1.63	$\times 10^{-6}$	CL=90%	DESIG=128
Γ ₂₆	$\pi^+ \pi^- \pi^0 \pi^0$	(1.30 ± 0.28)	$\times 10^{-5}$		DESIG=129
Γ ₂₇	$K_S^0 K^+ \pi^- + \text{c.c.}$	(1.14 ± 0.33)	$\times 10^{-6}$		DESIG=130
Γ ₂₈	$K^*(892)^0 \bar{K}^0 + \text{c.c.}$	< 4.22	$\times 10^{-6}$	CL=90%	DESIG=131
Γ ₂₉	$K^*(892)^- K^+ + \text{c.c.}$	< 1.45	$\times 10^{-6}$	CL=90%	DESIG=132
Γ ₃₀	Sum of 100 exclusive modes	(2.90 ± 0.30)	$\times 10^{-3}$		DESIG=121

Radiative decays

NODE=M052;CLUMP=A

Γ ₃₁	$\gamma \chi_{b1}(1P)$	(6.9 ± 0.4) %			DESIG=8
Γ ₃₂	$\gamma \chi_{b2}(1P)$	(7.15 ± 0.35) %			DESIG=7
Γ ₃₃	$\gamma \chi_{b0}(1P)$	(3.8 ± 0.4) %			DESIG=9
Γ ₃₄	$\gamma f_0(1710)$	< 5.9	$\times 10^{-4}$	CL=90%	DESIG=13
Γ ₃₅	$\gamma f'_2(1525)$	< 5.3	$\times 10^{-4}$	CL=90%	DESIG=12
Γ ₃₆	$\gamma f_2(1270)$	< 2.41	$\times 10^{-4}$	CL=90%	DESIG=11
Γ ₃₇	$\gamma f_J(2220)$				DESIG=14
Γ ₃₈	$\gamma \eta_c(1S)$	< 2.7	$\times 10^{-5}$	CL=90%	DESIG=111
Γ ₃₉	$\gamma \chi_{c0}$	< 1.0	$\times 10^{-4}$	CL=90%	DESIG=112
Γ ₄₀	$\gamma \chi_{c1}$	< 3.6	$\times 10^{-6}$	CL=90%	DESIG=113
Γ ₄₁	$\gamma \chi_{c2}$	< 1.5	$\times 10^{-5}$	CL=90%	DESIG=114
Γ ₄₂	$\gamma X(3872) \rightarrow \pi^+ \pi^- J/\psi$	< 8	$\times 10^{-7}$	CL=90%	DESIG=115
Γ ₄₃	$\gamma X(3872) \rightarrow \pi^+ \pi^- \pi^0 J/\psi$	< 2.4	$\times 10^{-6}$	CL=90%	DESIG=116
Γ ₄₄	$\gamma \chi_{c0}(2P) \rightarrow \omega J/\psi$	< 2.8	$\times 10^{-6}$	CL=90%	DESIG=117
Γ ₄₅	$\gamma X(4140) \rightarrow \phi J/\psi$	< 1.2	$\times 10^{-6}$	CL=90%	DESIG=118
Γ ₄₆	$\gamma X(4350) \rightarrow \phi J/\psi$	< 1.3	$\times 10^{-6}$	CL=90%	DESIG=119
Γ ₄₇	$\gamma \eta_b(1S)$	(3.9 ± 1.5)	$\times 10^{-4}$		DESIG=102
Γ ₄₈	$\gamma \eta_b(1S) \rightarrow \gamma$ Sum of 26 exclusive modes	< 3.7	$\times 10^{-6}$	CL=90%	DESIG=124
Γ ₄₉	$\gamma X_{b\bar{b}} \rightarrow \gamma$ Sum of 26 exclusive modes	< 4.9	$\times 10^{-6}$	CL=90%	DESIG=125
Γ ₅₀	$\gamma X \rightarrow \gamma + \geq 4$ prongs	[a] < 1.95	$\times 10^{-4}$	CL=95%	DESIG=103
Γ ₅₁	$\gamma A^0 \rightarrow \gamma$ hadrons	< 8	$\times 10^{-5}$	CL=90%	DESIG=108
Γ ₅₂	$\gamma a_1^0 \rightarrow \gamma \mu^+ \mu^-$	< 8.3	$\times 10^{-6}$	CL=90%	DESIG=123

Lepton Family number (LF) violating modes

NODE=M052;CLUMP=B

Γ ₅₃	$e^\pm \tau^\mp$	LF	< 3.2	$\times 10^{-6}$	CL=90%	DESIG=107
Γ ₅₄	$\mu^\pm \tau^\mp$	LF	< 3.3	$\times 10^{-6}$	CL=90%	DESIG=104

[a] 1.5 GeV < m_X < 5.0 GeV

LINKAGE=C52

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 $\langle \delta x_i \delta x_j \rangle / (\delta x_i \delta x_j)$, in percent, from the fit to the branching fractions, $x_i \equiv \Gamma_i / \Gamma_{\text{total}}$. The fit constrains the x_i whose labels appear in this array to sum to one.

$$x_7 \begin{vmatrix} & 2 \\ & x_1 \end{vmatrix}$$

$\Upsilon(2S) \Gamma(i) \Gamma(e^+ e^-) / \Gamma(\text{total})$

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

$$\Gamma(\Upsilon(1S) \pi^+ \pi^-) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$$

$$\Gamma_1 \Gamma_5 / \Gamma$$

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 $B(\Upsilon(1S) \rightarrow e^+ e^-) = (2.38 \pm 0.11)\%$ and $B(\Upsilon(1S) \rightarrow \mu^+ \mu^-) = (2.48 \pm 0.05)\%$.

NODE=M052G03;LINKAGE=AU

$$\Gamma(\text{hadrons}) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$$

$$\Gamma_{10} \Gamma_5 / \Gamma$$

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
0.577±0.009 OUR AVERAGE			
0.581±0.004±0.009	¹ ROSNER	06	CLEO $e^+ e^- \rightarrow \text{hadrons}$
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

 $\Upsilon(2S)$ PARTIAL WIDTHS

NODE=M052220

$$\Gamma(e^+ e^-)$$

$$\Gamma_5$$

VALUE (keV)	DOCUMENT ID
0.612±0.011 OUR EVALUATION	

NODE=M052W2
NODE=M052W2
→ UNCHECKED ←

 $\Upsilon(2S)$ BRANCHING RATIOS

NODE=M052225

$$\Gamma(\Upsilon(1S) \pi^+ \pi^-) / \Gamma_{\text{total}}$$

$$\Gamma_1 / \Gamma$$

Abbreviation MM in the COMMENT field below stands for missing mass.

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
17.85±0.26 OUR FIT				
17.92±0.26 OUR AVERAGE				
16.8 ±1.1 ±1.3	906k	¹ LEES	11C BABR	$e^+ e^- \rightarrow \pi^+ \pi^- X$
17.80±0.05±0.37	170k	² LEES	11L BABR	$\Upsilon(2S) \rightarrow \pi^+ \pi^- \mu^+ \mu^-$
18.02±0.02±0.61	851k	³ BHARI	09 CLEO	$e^+ e^- \rightarrow \pi^+ \pi^- \text{MM}$
17.22±0.17±0.75	11.8K	⁴ AUBERT	08BP BABR	$e^+ e^- \rightarrow \gamma \pi^+ \pi^- \ell^+ \ell^-$
19.2 ±0.2 ±1.0	52.6k	⁵ ALEXANDER	98 CLE2	$\pi^+ \pi^- \ell^+ \ell^-$, $\pi^+ \pi^- \text{MM}$
18.1 ±0.5 ±1.0	11.6k	ALBRECHT	87 ARG	$e^+ e^- \rightarrow \pi^+ \pi^- \text{MM}$
16.9 ±4.0		GELPHMAN	85 CBAL	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^-$
19.1 ±1.2 ±0.6		BESSON	84 CLEO	$\pi^+ \pi^- \text{MM}$
18.9 ±2.6		FONSECA	84 CUSB	$e^+ e^- \rightarrow \ell^+ \ell^- \pi^+ \pi^-$
21 ±7	7	NICZYPORUK	81B LENA	$e^+ e^- \rightarrow \ell^+ \ell^- \pi^+ \pi^-$

NODE=M052R4
NODE=M052R4
NODE=M052R4

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.

NODE=M052R4;LINKAGE=ES

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.

NODE=M052R4;LINKAGE=LE
NODE=M052R4;LINKAGE=BH
NODE=M052R4;LINKAGE=AU

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=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 $\pm$ 0.4 OUR AVERAGE				
8.43 $\pm$ 0.16 $\pm$ 0.42	38k	¹ BHARI	09	CLEO $e^+e^- \rightarrow \pi^0\pi^0\ell^+\ell^-$
9.2 $\pm$ 0.6 $\pm$ 0.8	275	² ALEXANDER	98	CLE2 $e^+e^- \rightarrow \pi^0\pi^0\ell^+\ell^-$
9.5 $\pm$ 1.9 $\pm$ 1.9	25	ALBRECHT	87	ARG $e^+e^- \rightarrow \pi^0\pi^0\ell^+\ell^-$
8.0 $\pm$ 1.5		GELPHMAN	85	CBAL $e^+e^- \rightarrow \pi^0\pi^0\ell^+\ell^-$
10.3 $\pm$ 2.3		FONSECA	84	CUSB $e^+e^- \rightarrow \pi^0\pi^0\ell^+\ell^-$

¹ Authors assume $B(\Upsilon(1S) \rightarrow e^+e^-) + B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = 4.96\%$.² Using $B(\Upsilon(1S) \rightarrow e^+e^-) = (2.52 \pm 0.17)\%$ and $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.07)\%$.NODE=M052R5
NODE=M052R5NODE=M052R5;LINKAGE=BH
NODE=M052R5;LINKAGE=T $\Gamma(\Upsilon(1S)\pi^0\pi^0)/\Gamma(\Upsilon(1S)\pi^+\pi^-)$ Γ_2/Γ_1

VALUE	DOCUMENT ID	TECN	COMMENT
0.462 $\pm$ 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

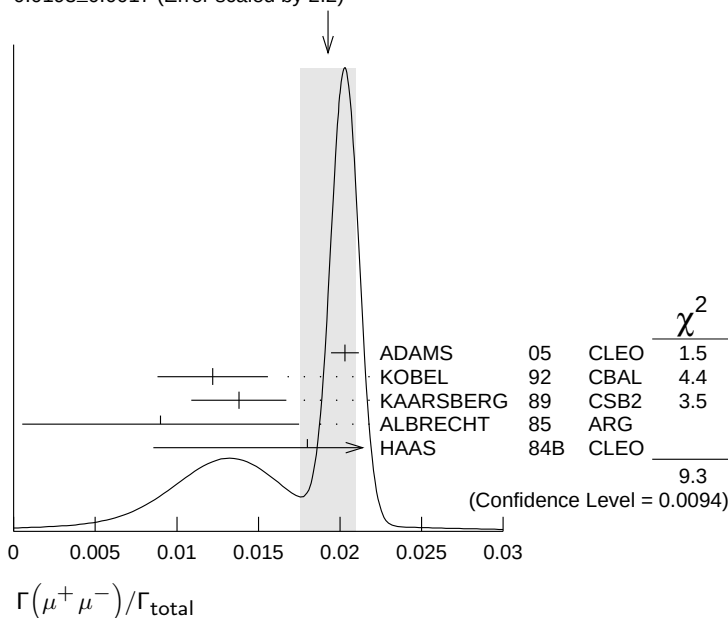
VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
2.00 $\pm$ 0.21 OUR AVERAGE				
2.00 $\pm$ 0.12 $\pm$ 0.18	22k	¹ BESSON	07	CLEO $e^+e^- \rightarrow \Upsilon(2S) \rightarrow \tau^+\tau^-$
1.7 $\pm$ 1.5 $\pm$ 0.6		HAAS	84B	CLEO $e^+e^- \rightarrow \tau^+\tau^-$

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 $\pm$ 0.0017 OUR AVERAGE					Error includes scale factor of 2.2. See the ideogram below.
0.0203 $\pm$ 0.0003 $\pm$ 0.0008		120k	ADAMS	05	CLEO $e^+e^- \rightarrow \mu^+\mu^-$
0.0122 $\pm$ 0.0028 $\pm$ 0.0019			¹ KOBEL	92	CBAL $e^+e^- \rightarrow \mu^+\mu^-$
0.0138 $\pm$ 0.0025 $\pm$ 0.0015			KAARSBERG	89	CSB2 $e^+e^- \rightarrow \mu^+\mu^-$
0.009 $\pm$ 0.006 $\pm$ 0.006			² ALBRECHT	85	ARG $e^+e^- \rightarrow \mu^+\mu^-$
0.018 $\pm$ 0.008 $\pm$ 0.005			HAAS	84B	CLEO $e^+e^- \rightarrow \mu^+\mu^-$
<0.038		90	NICZYPORUK	81C	LENA $e^+e^- \rightarrow \mu^+\mu^-$

¹ Taking into account interference between the resonance and continuum.² Re-evaluated using $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = 0.026$.NODE=M052R1
NODE=M052R1NODE=M052R1;LINKAGE=A
NODE=M052R1;LINKAGE=RWEIGHTED AVERAGE
0.0193 $\pm$ 0.0017 (Error scaled by 2.2)

$$\Gamma(\tau^+\tau^-)/\Gamma(\mu^+\mu^-)$$

$$\Gamma_3/\Gamma_4$$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
1.04±0.04±0.05	22k	BESSON	07	CLEO $e^+e^- \rightarrow \Upsilon(2S)$

NODE=M052R17
NODE=M052R17

$$\Gamma(\Upsilon(1S)\pi^0)/\Gamma_{\text{total}}$$

$$\Gamma_6/\Gamma$$

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT

NODE=M052R10
NODE=M052R10

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 4	90	¹ TAMPONI	13	BELL	$e^+e^- \rightarrow \Upsilon(1S)\pi^0$
< 18	90	² HE	08A	CLEO	$e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$
<110	90	ALEXANDER	98	CLE2	$e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$
<800	90	LURZ	87	CBAL	$e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$

¹ TAMPONI 13 reports $[\Gamma(\Upsilon(2S) \rightarrow \Upsilon(1S)\pi^0)/\Gamma_{\text{total}}] / [B(\Upsilon(2S) \rightarrow \Upsilon(1S)\pi^+\pi^-)]$
 $< 2.3 \times 10^{-4}$ which we multiply by our best value $B(\Upsilon(2S) \rightarrow \Upsilon(1S)\pi^+\pi^-) = 17.85 \times 10^{-2}$.

NODE=M052R10;LINKAGE=TA

² Authors assume $B(\Upsilon(1S) \rightarrow e^+e^-) + B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = 4.96\%$.

NODE=M052R10;LINKAGE=HE

$$\Gamma(\Upsilon(1S)\pi^0)/\Gamma(\Upsilon(1S)\pi^+\pi^-)$$

$$\Gamma_6/\Gamma_1$$

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<2.3	90	TAMPONI	13	BELL $e^+e^- \rightarrow \Upsilon(1S)\pi^0$

NODE=M052R09
NODE=M052R09

$$\Gamma(\Upsilon(1S)\eta)/\Gamma_{\text{total}}$$

$$\Gamma_7/\Gamma$$

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT

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	BESSON	84	CLEO	$e^+e^- \rightarrow \pi^+\pi^-\ell^+\ell^-$ MM
< 20	90	FONSECA	84	CUSB	$e^+e^- \rightarrow \ell^+\ell^-(\gamma\gamma, \pi^+\pi^-\pi^0)$

¹ Using $B(\Upsilon(1S) \rightarrow e^+e^-) = (2.38 \pm 0.11)\%$ and $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.05)\%$.

NODE=M052R6;LINKAGE=AU

² Authors assume $B(\Upsilon(1S) \rightarrow e^+e^-) + B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = 4.96\%$.

NODE=M052R6;LINKAGE=HE

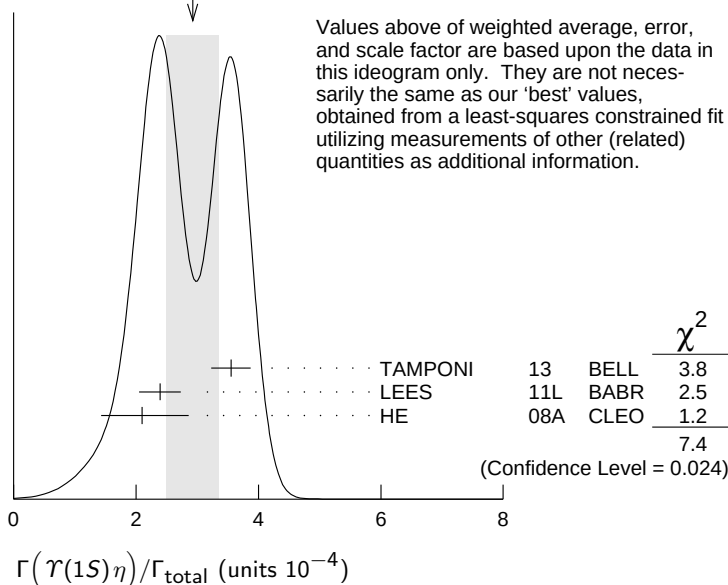
³ TAMPONI 13 reports $[\Gamma(\Upsilon(2S) \rightarrow \Upsilon(1S)\eta)/\Gamma_{\text{total}}] / [B(\Upsilon(2S) \rightarrow \Upsilon(1S)\pi^+\pi^-)]$
 $= (1.99 \pm 0.14 \pm 0.11) \times 10^{-3}$ which we multiply by our best value $B(\Upsilon(2S) \rightarrow \Upsilon(1S)\pi^+\pi^-) = (17.85 \pm 0.26) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M052R6;LINKAGE=TA

⁴ Using $\Gamma_{ee}(\Upsilon(2S)) = 0.612 \pm 0.011$ keV.

NODE=M052R6;LINKAGE=UB

WEIGHTED AVERAGE
2.9±0.4 (Error scaled by 1.9)



$\Gamma(\Upsilon(1S)\eta)/\Gamma(\Upsilon(1S)\pi^+\pi^-)$

Γ_7/Γ_1

VALUE (units 10^{-3}) CL% EVTS DOCUMENT ID TECN COMMENT

1.64±0.25 OUR FIT Error includes scale factor of 2.0.

1.99±0.14±0.11 241 TAMPONI 13 BELL $e^+e^- \rightarrow \Upsilon(1S)\eta$

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.35±0.17±0.08 ¹ LEES 11L BABR $\Upsilon(2S) \rightarrow (\pi^+\pi^-)(\gamma\gamma)\mu^+\mu^-$

< 5.2 90 ² AUBERT 08BP BABR $e^+e^- \rightarrow \gamma\pi^+\pi^-(\pi^0)\ell^+\ell^-$

¹ Not independent of other values reported by LEES 11L.

² Not independent of other values reported by AUBERT 08BP.

NODE=M052R22
NODE=M052R22

$\Gamma(\Upsilon(1S)\pi^0)/\Gamma(\Upsilon(1S)\eta)$

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

$\Gamma(\bar{d} \text{ anything})/\Gamma_{\text{total}}$

Γ_9/Γ

VALUE (units 10^{-5}) EVTS DOCUMENT ID TECN COMMENT

3.37±0.50±0.25 58 ASNER 07 CLEO $e^+e^- \rightarrow \bar{d}X$

NODE=M052R18
NODE=M052R18

$\Gamma(ggg)/\Gamma_{\text{total}}$

Γ_{11}/Γ

VALUE (units 10^{-2}) EVTS DOCUMENT ID TECN COMMENT

58.8±1.2 6M ¹ BESSON 06A CLEO $\Upsilon(2S) \rightarrow \text{hadrons}$

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
NODE=M052R01

NODE=M052R01;LINKAGE=BE

$\Gamma(\phi K^+ K^-)/\Gamma_{\text{total}}$

Γ_{13}/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_{14}/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_{15}/Γ

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
$2.32 \pm 0.40 \pm 0.54$	135	SHEN	12A BELL	$\Upsilon(1S) \rightarrow K^+ K^- \pi^+ \pi^-$

NODE=M052R45
NODE=M052R45

 $\Gamma(\phi f'_2(1525))/\Gamma_{\text{total}}$
 Γ_{16}/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_{17}/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_{18}/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_{19}/Γ

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.53 \pm 0.52 \pm 0.19$	32	SHEN	12A BELL	$\Upsilon(1S) \rightarrow K^+ K^- \pi^+ \pi^-$

NODE=M052R49
NODE=M052R49

 $\Gamma(K_1(1270)^\pm K^\mp)/\Gamma_{\text{total}}$
 Γ_{20}/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_{21}/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_{22}/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

 $\Gamma(\gamma g g)/\Gamma_{\text{total}}$
 Γ_{12}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
8.79 ± 1.05	100k	¹ BESSON	06A CLEO	$\Upsilon(2S) \rightarrow \gamma + \text{hadrons}$

NODE=M052R02
NODE=M052R02

¹ Calculated using BESSON 06A values of $\Gamma(\gamma g g)/\Gamma(g g g) = (3.18 \pm 0.04 \pm 0.22 \pm 0.41)\%$ and $\Gamma(g g g)/\Gamma_{\text{total}}$. The statistical error is negligible and the systematic error is partially correlated with that of $\Gamma(g g g)/\Gamma_{\text{total}}$ measurement of BESSON 06A.

NODE=M052R02;LINKAGE=BE

 $\Gamma(\gamma g g)/\Gamma(g g g)$
 Γ_{12}/Γ_{11}

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
$3.18 \pm 0.04 \pm 0.47$	6M	BESSON	06A CLEO	$\Upsilon(2S) \rightarrow (\gamma +) \text{hadrons}$

NODE=M052R03
NODE=M052R03

 $\Gamma(\rho\pi)/\Gamma_{\text{total}}$
 Γ_{23}/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_{24}/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_{25}/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_{26}/Γ

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
$13.0 \pm 1.9 \pm 2.1$	261 $\pm$ 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_{27}/Γ

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$1.14 \pm 0.30 \pm 0.13$	40	± 10	SHEN	13	BELL $\Upsilon(2S) \rightarrow K_S^0 K^- \pi^+$

• • • 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
NODE=M052R40

NODE=M052R40;LINKAGE=DO

 $\Gamma(K^*(892)^0 \bar{K}^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{28}/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_{29}/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_{30}/Γ

VALUE (units 10^{-2})	DOCUMENT ID	COMMENT
0.29 ± 0.03	^{1,2} DOBBS	12A $\Upsilon(2S) \rightarrow \text{hadrons}$

¹ DOBBS 12A presents individual exclusive branching fractions or upper limits for 100 modes of four to ten pions, kaons, or protons.

² Obtained by analyzing CLEO III data but not authored by the CLEO Collaboration.

NODE=M052R08
NODE=M052R08

NODE=M052R08;LINKAGE=DO

NODE=M052R08;LINKAGE=NC

 $\Gamma(\gamma \chi_{b1}(1P))/\Gamma_{\text{total}}$ Γ_{31}/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_{32}/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_{33}/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 $e^+ e^- \rightarrow \gamma \text{conv. } X$
0.035 ± 0.014		KLOPFEN...	83	CUSB $e^+ e^- \rightarrow \gamma X$

• • • We do not use the following data for averages, fits, limits, etc. • • •

NODE=M052R9
NODE=M052R9

 $\Gamma(\gamma f_0(1710))/\Gamma_{\text{total}}$ Γ_{34}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
< 59	90	¹ ALBRECHT	89	ARG $\Upsilon(2S) \rightarrow \gamma K^+ K^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 5.9	90	² ALBRECHT	89	ARG $\Upsilon(2S) \rightarrow \gamma \pi^+ \pi^-$

¹ Re-evaluated assuming $B(f_0(1710) \rightarrow K^+ K^-) = 0.19$.

² Includes unknown branching ratio of $f_0(1710) \rightarrow \pi^+ \pi^-$.

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_{35}/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_{36}/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

• • • We do not use the following data for averages, fits, limits, etc. • • •

<6.8	90	¹ ALBRECHT 89	ARG	$\Upsilon(2S) \rightarrow \gamma K^+ K^-$

¹ Includes unknown branching ratio of $f_J(2220) \rightarrow K^+ K^-$.

 Γ_{37}/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_{38}/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_{39}/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_{40}/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_{41}/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_{42}/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_{43}/Γ

NODE=M052R36
NODE=M052R36

 $\Gamma(\gamma \chi_{c0}(2P) \rightarrow \omega J/\psi)/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<2.8 $\times 10^{-6}$	90	WANG 11B	BELL	$\Upsilon(2S) \rightarrow \gamma X$

 Γ_{44}/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_{45}/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_{46}/Γ

NODE=M052R39
NODE=M052R39

 $\Gamma(\gamma \eta_b(1S))/\Gamma_{\text{total}}$

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	$\Upsilon(2S) \rightarrow \gamma X$

 Γ_{47}/Γ

NODE=M052R15
NODE=M052R15

• • • We do not use the following data for averages, fits, limits, etc. • • •

<21	90	LEES	11J	BABR	$\Upsilon(2S) \rightarrow X \gamma$
< 8.4	90	¹ BONVICINI	10	CLEO	$\Upsilon(2S) \rightarrow \gamma X$
< 5.1	90	² ARTUSO	05	CLEO	$e^+ e^- \rightarrow \gamma X$

¹ Assuming $\Gamma_{\eta_b(1S)} = 10$ MeV.

² Superseded by BONVICINI 10.

NODE=M052R15;LINKAGE=BO
NODE=M052R15;LINKAGE=SU

$\Gamma(\gamma\eta_b(1S) \rightarrow \gamma \text{Sum of 26 exclusive modes})/\Gamma_{\text{total}}$ Γ_{48}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<3.7 \times 10^{-6}$	90	SANDILYA	13 BELL	$\Upsilon(2S) \rightarrow \gamma \text{ hadrons}$

NODE=M052R25
NODE=M052R25

 $\Gamma(\gamma X_{b\bar{b}} \rightarrow \gamma \text{Sum of 26 exclusive modes})/\Gamma_{\text{total}}$ Γ_{49}/Γ

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
< 4.9	90		SANDILYA	13 BELL	$\Upsilon(2S) \rightarrow \gamma \text{ hadrons}$

NODE=M052R26
NODE=M052R26

• • • We do not use the following data for averages, fits, limits, etc. • • •

$46.2^{+29.7}_{-14.2} \pm 10.6$	10	¹ DOBBS	12		$\Upsilon(2S) \rightarrow \gamma \text{ hadrons}$

¹ Obtained by analyzing CLEO III data but not authored by the CLEO Collaboration.

NODE=M052R26;LINKAGE=DO

 $\Gamma(\gamma X \rightarrow \gamma + \geq 4 \text{ prongs})/\Gamma_{\text{total}}$ Γ_{50}/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_{51}/Γ

(0.3 GeV $< m_{A^0} < 7$ GeV)

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<8 \times 10^{-5}$	90	¹ LEES	11H BABR	$\Upsilon(2S) \rightarrow \gamma \text{ hadrons}$

NODE=M052R06

NODE=M052R06
NODE=M052R06

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;LINKAGE=LE

 $\Gamma(\gamma a_1^0 \rightarrow \gamma \mu^+ \mu^-)/\Gamma_{\text{total}}$ Γ_{52}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<8.3	90	¹ AUBERT	09Z BABR	$e^+e^- \rightarrow \gamma a_1^0 \rightarrow \gamma \mu^+ \mu^-$

NODE=M052R24
NODE=M052R24

¹ For a narrow scalar or pseudoscalar a_1^0 with mass in the range 212–9300 MeV, excluding J/ψ and $\psi(2S)$. Measured 90% CL limits as a function of $m_{a_1^0}$ range from 0.26–8.3 $\times 10^{-6}$.

NODE=M052R24;LINKAGE=AU

LEPTON FAMILY NUMBER (LF) VIOLATING MODES

 $\Gamma(e^\pm \tau^\mp)/\Gamma_{\text{total}}$ Γ_{53}/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_{54}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
< 3.3	90	LEES	10B BABR	$e^+e^- \rightarrow \mu^\pm \tau^\mp$

NODE=M052R20
NODE=M052R20

• • • We do not use the following data for averages, fits, limits, etc. • • •

<14.4	95	LOVE	08A CLEO	$e^+e^- \rightarrow \mu^\pm \tau^\mp$

$\Upsilon(2S)$ Cross-Particle Branching Ratios

NODE=M052240

 $B(\Upsilon(2S) \rightarrow \pi^+ \pi^-) \times B(\Upsilon(3S) \rightarrow \Upsilon(2S) X)$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.78 \pm 0.02 \pm 0.11$	906k	LEES	11C BABR	$e^+e^- \rightarrow \pi^+ \pi^- X$

NODE=M052R05
NODE=M052R05

$\Upsilon(2S)$ REFERENCES

NODE=M052

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. Buchmueller, S. Cooper	(HANN, DESY, MIT)	REFID=40034
Editors: A. Ali and P. Soeding, World Scientific, Singapore					
JAKUBOWSKI	88	ZPHY C40 49	Z. Jakubowski <i>et al.</i>	(Crystal Ball Collab.)	REFID=40742
ALBRECHT	87	ZPHY C35 283	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=40016
COHEN	87	RMP 59 1121	E.R. Cohen, B.N. Taylor	(RISC, NBS)	REFID=11616
LURZ	87	ZPHY C36 383	B. Lurz <i>et al.</i>	(Crystal Ball Collab.)	REFID=40021
BARU	86B	ZPHY C32 622 (erratum)	S.E. Baru <i>et al.</i>	(NOVO)	REFID=22338
ALBRECHT	85	ZPHY C28 45	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=22334
ALBRECHT	85E	PL 160B 331	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=22288
GELPHMAN	85	PR D32 2893	D. Gelphman <i>et al.</i>	(Crystal Ball Collab.)	REFID=22336
KURAEV	85	SJNP 41 466	E.A. Kuraev, V.S. Fadin	(NOVO)	REFID=40033
Translated from YAF 41 733.					
NERNST	85	PRL 54 2195	R. Nernst <i>et al.</i>	(Crystal Ball Collab.)	REFID=22289
ARTAMONOV	84	PL 137B 272	A.S. Artamonov <i>et al.</i>	(NOVO)	REFID=22278
BARBER	84	PL 135B 498	D.P. Barber <i>et al.</i>	(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.

$\Upsilon(1D)$ MASS

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

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \gamma\gamma \Upsilon(1S)$	seen
$\Gamma_2 \quad \gamma\chi_{bJ}(1P)$	seen
$\Gamma_3 \quad \eta \Upsilon(1S)$	not seen
$\Gamma_4 \quad \pi^+\pi^- \Upsilon(1S)$	$(6.6\pm 1.6) \times 10^{-3}$

$\Upsilon(1D)$ BRANCHING RATIOS

$\Gamma(\eta \Upsilon(1S))/\Gamma(\gamma\gamma \Upsilon(1S))$		Γ_3/Γ_1		
VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.25	90	BONVICINI 04	CLE3	$\Upsilon(3S) \rightarrow 4\gamma\ell^+\ell^-$

$\Gamma(\pi^+\pi^- \Upsilon(1S))/\Gamma_{\text{total}}$		Γ_4/Γ		
VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT	
$0.66^{+0.15}_{-0.14} \pm 0.06$	¹ DEL-AMO-SA..10R	BABR	$\Upsilon(3S) \rightarrow \gamma\gamma\pi^+\pi^-\ell^+\ell^-$	

¹ Using theoretical predictions for $B(\chi_{bJ}(2P) \rightarrow \gamma \Upsilon(1D))$.

NODE=M177

NODE=M177

NODE=M177M

NODE=M177M

NODE=M177215;NODE=M177

DESIG=1;OUR EVAL;→ UNCHECKED ←
DESIG=2;OUR EVAL;→ UNCHECKED ←
DESIG=3;OUR EVAL;→ UNCHECKED ←
DESIG=4

NODE=M177225

NODE=M177R01
NODE=M177R01

NODE=M177R03
NODE=M177R03

NODE=M177R03;LINKAGE=DE

$\Gamma(\pi^+\pi^-\Upsilon(1S))/\Gamma(\gamma\gamma\Upsilon(1S))$					Γ_4/Γ_1
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
<1.2	90	² BONVICINI	04	CLE3	$\Upsilon(3S) \rightarrow 4\gamma\ell^+\ell^-$
² Assuming $J = 2$.					

NODE=M177R02
NODE=M177R02

NODE=M177R02;LINKAGE=BO

NODE=M177
REFID=53634
REFID=49759

NODE=M079

$\Upsilon(1D)$ REFERENCES

DEL-AMO-SA... 10R	PR D82 111102	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)
BONVICINI 04	PR D70 032001	G. Bonvicini <i>et al.</i>	(CLEO Collab.)

$\chi_{b0}(2P)$

$I^G(J^{PC}) = 0^+(0^{++})$
 J needs confirmation.

Observed in radiative decay of the $\Upsilon(3S)$, therefore $C = +$. Branching ratio requires E1 transition, M1 is strongly disfavored, therefore $P = +$.

NODE=M079

$\chi_{b0}(2P)$ MASS

VALUE (MeV)	DOCUMENT ID
10232.5 ± 0.4 ± 0.5 OUR EVALUATION	From γ energy below, using $\Upsilon(3S)$ mass = 10355.2 ± 0.5 MeV

NODE=M079M
NODE=M079M
→ UNCHECKED ←

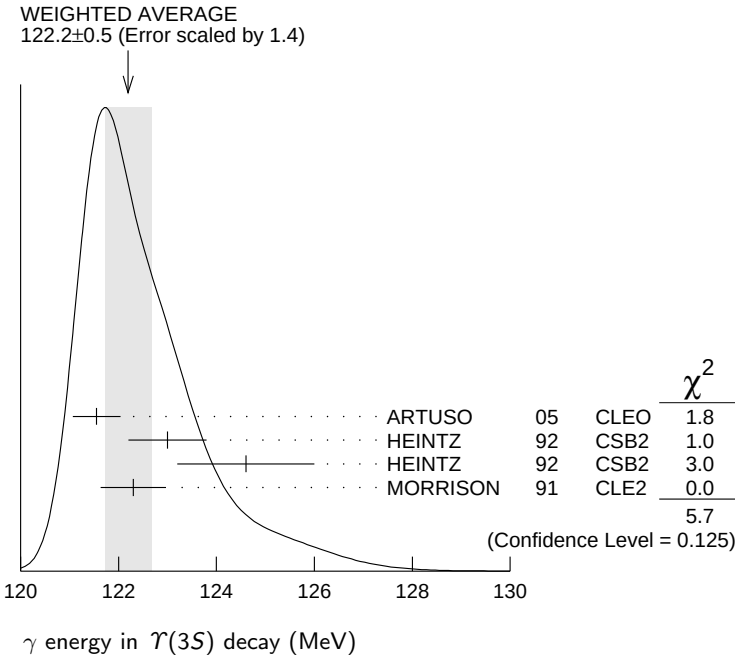
γ ENERGY IN $\Upsilon(3S)$ DECAY

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
121.9 ± 0.4 OUR EVALUATION		Treating systematic errors as correlated		
122.2 ± 0.5 OUR AVERAGE		Error includes scale factor of 1.4. See the ideogram below.		
121.55 ± 0.16 ± 0.46		ARTUSO	05	CLEO $\Upsilon(3S) \rightarrow \gamma X$
123.0 ± 0.8	4959	¹ HEINTZ	92	CSB2 $e^+e^- \rightarrow \gamma X$
124.6 ± 1.4	17	² HEINTZ	92	CSB2 $e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$
122.3 ± 0.3 ± 0.6	9903	MORRISON	91	CLE2 $e^+e^- \rightarrow \gamma X$
¹ A systematic uncertainty on the energy scale of 0.9% not included. Supersedes NARAIN 91.				
² A systematic uncertainty on the energy scale of 0.9% not included. Supersedes HEINTZ 91.				

NODE=M079DM
NODE=M079DM
→ UNCHECKED ←

OCCUR=2

NODE=M079DM;LINKAGE=A
NODE=M079DM;LINKAGE=B



$\chi_{b0}(2P)$ DECAY MODES

NODE=M079215;NODE=M079

Mode	Fraction (Γ_i/Γ)	Confidence level
$\Gamma_1 \quad \gamma \Upsilon(2S)$	$(4.6 \pm 2.1) \%$	
$\Gamma_2 \quad \gamma \Upsilon(1S)$	$(9 \pm 6) \times 10^{-3}$	
$\Gamma_3 \quad D^0 X$	$< 8.2 \%$	90%
$\Gamma_4 \quad \pi^+ \pi^- K^+ K^- \pi^0$	$< 3.4 \times 10^{-5}$	90%
$\Gamma_5 \quad 2\pi^+ \pi^- K^- K_S^0$	$< 5 \times 10^{-5}$	90%
$\Gamma_6 \quad 2\pi^+ \pi^- K^- K_S^0 2\pi^0$	$< 2.2 \times 10^{-4}$	90%
$\Gamma_7 \quad 2\pi^+ 2\pi^- 2\pi^0$	$< 2.4 \times 10^{-4}$	90%
$\Gamma_8 \quad 2\pi^+ 2\pi^- K^+ K^-$	$< 1.5 \times 10^{-4}$	90%
$\Gamma_9 \quad 2\pi^+ 2\pi^- K^+ K^- \pi^0$	$< 2.2 \times 10^{-4}$	90%
$\Gamma_{10} \quad 2\pi^+ 2\pi^- K^+ K^- 2\pi^0$	$< 1.1 \times 10^{-3}$	90%
$\Gamma_{11} \quad 3\pi^+ 2\pi^- K^- K_S^0 \pi^0$	$< 7 \times 10^{-4}$	90%
$\Gamma_{12} \quad 3\pi^+ 3\pi^-$	$< 7 \times 10^{-5}$	90%
$\Gamma_{13} \quad 3\pi^+ 3\pi^- 2\pi^0$	$< 1.2 \times 10^{-3}$	90%
$\Gamma_{14} \quad 3\pi^+ 3\pi^- K^+ K^-$	$< 1.5 \times 10^{-4}$	90%
$\Gamma_{15} \quad 3\pi^+ 3\pi^- K^+ K^- \pi^0$	$< 7 \times 10^{-4}$	90%
$\Gamma_{16} \quad 4\pi^+ 4\pi^-$	$< 1.7 \times 10^{-4}$	90%
$\Gamma_{17} \quad 4\pi^+ 4\pi^- 2\pi^0$	$< 6 \times 10^{-4}$	90%

 $\chi_{b0}(2P)$ BRANCHING RATIOS

NODE=M079220

 $\Gamma(\gamma \Upsilon(2S))/\Gamma_{\text{total}}$ Γ_1/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$0.046 \pm 0.020 \pm 0.007$		³ HEINTZ	92 CSB2	$e^+ e^- \rightarrow \ell^+ \ell^- \gamma \gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
< 0.028	90	⁴ LEES	11J BABR	$\Upsilon(3S) \rightarrow X \gamma$
< 0.089	90	⁵ CRAWFORD	92B CLE2	$e^+ e^- \rightarrow \ell^+ \ell^- \gamma \gamma$

³ Using $B(\Upsilon(2S) \rightarrow \mu^+ \mu^-) = (1.44 \pm 0.10)\%$, $B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P)) = (6.0 \pm 0.4 \pm 0.6)\%$ and assuming $e\mu$ universality. Supersedes HEINTZ 91.

⁴ LEES 11J quotes a central value of $\Gamma(\chi_{b0}(2P) \rightarrow \gamma \Upsilon(2S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P))/\Gamma_{\text{total}} = (-0.3 \pm 0.2^{+0.5}_{-0.4})\%$.

⁵ Using $B(\Upsilon(2S) \rightarrow \mu^+ \mu^-) = (1.37 \pm 0.26)\%$, $B(\Upsilon(3S) \rightarrow \gamma \gamma \Upsilon(2S)) \times 2 B(\Upsilon(2S) \rightarrow \mu^+ \mu^-) < 1.19 \times 10^{-4}$, and $B(\Upsilon(3S) \rightarrow \chi_{b0}(2P) \gamma) = 0.049$.

NODE=M079R2
NODE=M079R2

NODE=M079R2;LINKAGE=C

NODE=M079R2;LINKAGE=LE

NODE=M079R2;LINKAGE=B

 $\Gamma(\gamma \Upsilon(1S))/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$0.009 \pm 0.006 \pm 0.001$		⁶ HEINTZ	92 CSB2	$e^+ e^- \rightarrow \ell^+ \ell^- \gamma \gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
< 0.012	90	⁷ LEES	11J BABR	$\Upsilon(3S) \rightarrow X \gamma$
< 0.025	90	⁸ CRAWFORD	92B CLE2	$e^+ e^- \rightarrow \ell^+ \ell^- \gamma \gamma$

⁶ Using $B(\Upsilon(1S) \rightarrow \mu^+ \mu^-) = (2.57 \pm 0.07)\%$, $B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P)) = (6.0 \pm 0.4 \pm 0.6)\%$ and assuming $e\mu$ universality. Supersedes HEINTZ 91.

⁷ LEES 11J quotes a central value of $\Gamma(\chi_{b0}(2P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P))/\Gamma_{\text{total}} = (3.9 \pm 2.2^{+1.2}_{-0.6}) \times 10^{-4}$.

⁸ Using $B(\Upsilon(1S) \rightarrow \mu^+ \mu^-) = (2.57 \pm 0.07)\%$, $B(\Upsilon(3S) \rightarrow \gamma \gamma \Upsilon(1S)) \times 2 B(\Upsilon(1S) \rightarrow \mu^+ \mu^-) < 0.63 \times 10^{-4}$, and $B(\Upsilon(3S) \rightarrow \chi_{b0}(2P) \gamma) = 0.049$.

NODE=M079R1
NODE=M079R1

NODE=M079R1;LINKAGE=C

NODE=M079R1;LINKAGE=LE

NODE=M079R1;LINKAGE=B

 $\Gamma(D^0 X)/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 8.2 \times 10^{-2}$	90	^{9,10} BRIERE	08 CLEO	$\Upsilon(3S) \rightarrow \gamma D^0 X$

⁹ For $p_{D^0} > 2.5 \text{ GeV}/c$.

¹⁰ The authors also present their result as $(4.1 \pm 3.0 \pm 0.4) \times 10^{-2}$.

NODE=M079R01
NODE=M079R01NODE=M079R01;LINKAGE=BR
NODE=M079R01;LINKAGE=RI $\Gamma(\pi^+ \pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 0.34	90	¹¹ ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma \pi^+ \pi^- K^+ K^- \pi^0$

¹¹ ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \rightarrow \pi^+ \pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P))] < 2 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P)) = 5.9 \times 10^{-2}$.

NODE=M079R02
NODE=M079R02

NODE=M079R02;LINKAGE=AS

$\Gamma(2\pi^+\pi^-K^-K_S^0)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<0.5	90	12 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+\pi^-K^-K_S^0$
12 ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \rightarrow 2\pi^+\pi^-K^-K_S^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P))] < 3 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P)) = 5.9 \times 10^{-2}$.				

NODE=M079R03
 NODE=M079R03

NODE=M079R03;LINKAGE=AS

 $\Gamma(2\pi^+\pi^-K^-K_S^02\pi^0)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<2.2	90	13 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+\pi^-K^-2\pi^0$
13 ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \rightarrow 2\pi^+\pi^-K^-K_S^02\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P))] < 13 \times 10^{-6}$ 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	14 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+2\pi^-2\pi^0$
14 ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \rightarrow 2\pi^+2\pi^-2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P))] < 14 \times 10^{-6}$ 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	15 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+2\pi^-K^+K^-$
15 ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \rightarrow 2\pi^+2\pi^-K^+K^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P))] < 9 \times 10^{-6}$ 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	16 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+2\pi^-K^+K^-\pi^0$
16 ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \rightarrow 2\pi^+2\pi^-K^+K^-\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P))] < 13 \times 10^{-6}$ 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	17 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+2\pi^-K^+K^-2\pi^0$
17 ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \rightarrow 2\pi^+2\pi^-K^+K^-2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P))] < 63 \times 10^{-6}$ 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	18 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+2\pi^-K^-K_S^0\pi^0$
18 ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \rightarrow 3\pi^+2\pi^-K^-K_S^0\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P))] < 39 \times 10^{-6}$ 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	19 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+3\pi^-$
19 ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \rightarrow 3\pi^+3\pi^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P))] < 4 \times 10^{-6}$ 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	20 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+3\pi^-2\pi^0$
20 ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \rightarrow 3\pi^+3\pi^-2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P))] < 72 \times 10^{-6}$ 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	21 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+ 3\pi^- K^+ K^-$
21 ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \rightarrow 3\pi^+ 3\pi^- K^+ K^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P))] < 9 \times 10^{-6}$ 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	22 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+ 3\pi^- K^+ K^- \pi^0$
22 ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \rightarrow 3\pi^+ 3\pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P))] < 43 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P)) = 5.9 \times 10^{-2}$.				

NODE=M079R13
 NODE=M079R13

NODE=M079R13;LINKAGE=AS

 $\Gamma(4\pi^+ 4\pi^-)/\Gamma_{\text{total}}$ Γ_{16}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.7	90	23 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 4\pi^+ 4\pi^-$
23 ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \rightarrow 4\pi^+ 4\pi^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P))] < 10 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P)) = 5.9 \times 10^{-2}$.				

NODE=M079R14
 NODE=M079R14

NODE=M079R14;LINKAGE=AS

 $\Gamma(4\pi^+ 4\pi^- 2\pi^0)/\Gamma_{\text{total}}$ Γ_{17}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<6	90	24 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 4\pi^+ 4\pi^- 2\pi^0$
24 ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \rightarrow 4\pi^+ 4\pi^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P))] < 38 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P)) = 5.9 \times 10^{-2}$.				

NODE=M079R15
 NODE=M079R15

NODE=M079R15;LINKAGE=AS

 $\Gamma(\chi_{b0}(2P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P))/\Gamma_{\text{total}}$
 $\Gamma_2/\Gamma \times \Gamma_{21}^{\Upsilon(3S)}/\Gamma \Upsilon(3S)$

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<8.2	90	25 LEES	11J BABR	$\Upsilon(3S) \rightarrow X\gamma$
25 LEES 11J quotes a central value of $\Gamma(\chi_{b0}(2P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P))/\Gamma_{\text{total}} = (3.9 \pm 2.2^{+1.2}_{-0.6}) \times 10^{-4}$ and derives a 90% CL upper limit of $B(\chi_{b0}(2P) \rightarrow \gamma \Upsilon(1S)) < 1.2\%$ using $B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P)) = (5.9 \pm 0.6)\%$.				

NODE=M079B01
 NODE=M079B01

NODE=M079B01;LINKAGE=LE

 $\Gamma(\chi_{b0}(2P) \rightarrow \gamma \Upsilon(2S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P))/\Gamma_{\text{total}}$
 $\Gamma_1/\Gamma \times \Gamma_{21}^{\Upsilon(3S)}/\Gamma \Upsilon(3S)$

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<1.6	90	26 LEES	11J BABR	$\Upsilon(3S) \rightarrow X\gamma$
26 LEES 11J quotes a central value of $\Gamma(\chi_{b0}(2P) \rightarrow \gamma \Upsilon(2S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P))/\Gamma_{\text{total}} = (-0.3 \pm 0.2^{+0.5}_{-0.4})\%$ and derives a 90% CL upper limit of $B(\chi_{b0}(2P) \rightarrow \gamma \Upsilon(2S)) < 2.8\%$ using $B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P)) = (5.9 \pm 0.6)\%$.				

NODE=M079B02
 NODE=M079B02

NODE=M079B02;LINKAGE=LE

 $\chi_{b0}(2P)$ REFERENCES

LEES	11J	PR D84 072002	J.P. Lees <i>et al.</i>	(BABAR Collab.)
ASNER	08A	PR D78 091103	D.M. Asner <i>et al.</i>	(CLEO Collab.)
BRIERE	08	PR D78 092007	R.A. Briere <i>et al.</i>	(CLEO Collab.)
ARTUSO	05	PRL 94 032001	M. Artuso <i>et al.</i>	(CLEO Collab.)
CRAWFORD	92B	PL B294 139	G. Crawford, R. Fulton	(CLEO Collab.)
HEINTZ	92	PR D46 1928	U. Heintz <i>et al.</i>	(CUSB II Collab.)
HEINTZ	91	PRL 66 1563	U. Heintz <i>et al.</i>	(CUSB Collab.)
MORRISON	91	PRL 67 1696	R.J. Morrison <i>et al.</i>	(CLEO Collab.)
NARAIN	91	PRL 66 3113	M. Narain <i>et al.</i>	(CUSB Collab.)

NODE=M079

REFID=53936
 REFID=52574
 REFID=52577
 REFID=50454
 REFID=43177
 REFID=43604
 REFID=41580
 REFID=41634
 REFID=41586

$\chi_{b1}(2P)$

$I^G(J^{PC}) = 0^+(1^{++})$
 J needs confirmation.

Observed in radiative decay of the $\Upsilon(3S)$, therefore $C = +$. Branching ratio requires E1 transition, M1 is strongly disfavored, therefore $P = +$.

NODE=M080

NODE=M080

$\chi_{b1}(2P)$ MASS

NODE=M080M

NODE=M080M
→ UNCHECKED ←

VALUE (MeV)	DOCUMENT ID
10255.46±0.22±0.50 OUR EVALUATION	From γ energy below, using $\Upsilon(3S)$ mass = 10355.2 ± 0.5 MeV

$m_{\chi_{b1}(2P)} - m_{\chi_{b0}(2P)}$

NODE=M080M2

NODE=M080M2

NODE=M080M2;LINKAGE=A

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
23.5±0.7±0.7	¹ HEINTZ	92 CSB2	$e^+e^- \rightarrow \gamma X, \ell^+\ell^-\gamma\gamma$
¹ From the average photon energy for inclusive and exclusive events. Supersedes NARAIN 91.			

γ ENERGY IN $\Upsilon(3S)$ DECAY

NODE=M080DM

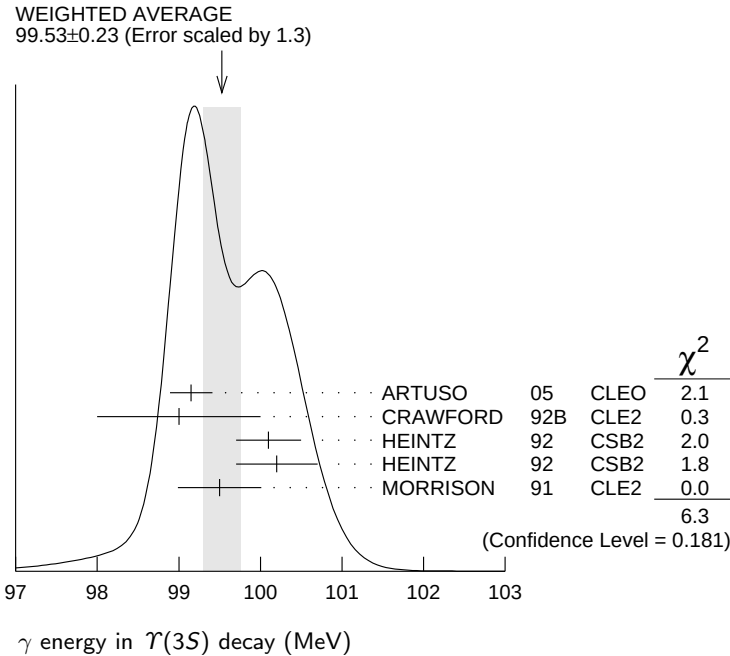
NODE=M080DM
→ UNCHECKED ←

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
99.26±0.22 OUR EVALUATION		Treating systematic errors as correlated		
99.53±0.23 OUR AVERAGE		Error includes scale factor of 1.3. See the ideogram below.		
99.15±0.07±0.25		ARTUSO	05 CLEO	$\Upsilon(3S) \rightarrow \gamma X$
99 ±1	169	CRAWFORD	92B CLE2	$e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$
100.1 ±0.4	11147	² HEINTZ	92 CSB2	$e^+e^- \rightarrow \gamma X$
100.2 ±0.5	223	³ HEINTZ	92 CSB2	$e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$
99.5 ±0.1 ±0.5	25759	MORRISON	91 CLE2	$e^+e^- \rightarrow \gamma X$
² A systematic uncertainty on the energy scale of 0.9% not included. Supersedes NARAIN 91.				
³ A systematic uncertainty on the energy scale of 0.9% not included. Supersedes HEINTZ 91.				

OCCUR=2

NODE=M080DM;LINKAGE=A

NODE=M080DM;LINKAGE=B



$\chi_{b1}(2P)$ DECAY MODES

NODE=M080215;NODE=M080

Mode	Fraction (Γ_i/Γ)	Scale factor	
$\Gamma_1 \quad \omega \mathcal{T}(1S)$	$(1.63^{+0.40}_{-0.34})\%$		DESIG=3
$\Gamma_2 \quad \gamma \mathcal{T}(2S)$	$(19.9 \pm 1.9)\%$		DESIG=2
$\Gamma_3 \quad \gamma \mathcal{T}(1S)$	$(9.2 \pm 0.8)\%$	1.1	DESIG=1
$\Gamma_4 \quad \pi\pi\chi_{b1}(1P)$	$(9.1 \pm 1.3) \times 10^{-3}$		DESIG=4
$\Gamma_5 \quad D^0 X$	$(8.8 \pm 1.7)\%$		DESIG=5
$\Gamma_6 \quad \pi^+\pi^-K^+K^-\pi^0$	$(3.1 \pm 1.0) \times 10^{-4}$		DESIG=6
$\Gamma_7 \quad 2\pi^+\pi^-K^-K_S^0$	$(1.1 \pm 0.5) \times 10^{-4}$		DESIG=7
$\Gamma_8 \quad 2\pi^+\pi^-K^-K_S^0 2\pi^0$	$(7.7 \pm 3.2) \times 10^{-4}$		DESIG=8
$\Gamma_9 \quad 2\pi^+2\pi^-2\pi^0$	$(5.9 \pm 2.0) \times 10^{-4}$		DESIG=9
$\Gamma_{10} \quad 2\pi^+2\pi^-K^+K^-$	$(10 \pm 4) \times 10^{-5}$		DESIG=10
$\Gamma_{11} \quad 2\pi^+2\pi^-K^+K^-\pi^0$	$(5.5 \pm 1.8) \times 10^{-4}$		DESIG=11
$\Gamma_{12} \quad 2\pi^+2\pi^-K^+K^-\pi^0$	$(10 \pm 4) \times 10^{-4}$		DESIG=12
$\Gamma_{13} \quad 3\pi^+2\pi^-K^-K_S^0\pi^0$	$(6.7 \pm 2.6) \times 10^{-4}$		DESIG=13
$\Gamma_{14} \quad 3\pi^+3\pi^-$	$(1.2 \pm 0.4) \times 10^{-4}$		DESIG=14
$\Gamma_{15} \quad 3\pi^+3\pi^-2\pi^0$	$(1.2 \pm 0.4) \times 10^{-3}$		DESIG=15
$\Gamma_{16} \quad 3\pi^+3\pi^-K^+K^-$	$(2.0 \pm 0.8) \times 10^{-4}$		DESIG=16
$\Gamma_{17} \quad 3\pi^+3\pi^-K^+K^-\pi^0$	$(6.1 \pm 2.2) \times 10^{-4}$		DESIG=17
$\Gamma_{18} \quad 4\pi^+4\pi^-$	$(1.7 \pm 0.6) \times 10^{-4}$		DESIG=18
$\Gamma_{19} \quad 4\pi^+4\pi^-2\pi^0$	$(1.9 \pm 0.7) \times 10^{-3}$		DESIG=19

 $\chi_{b1}(2P)$ BRANCHING RATIOS

NODE=M080220

 $\Gamma(\omega \mathcal{T}(1S))/\Gamma_{\text{total}}$ **Γ_1/Γ**

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.63^{+0.35+0.16}_{-0.31-0.15}$	$32.6^{+6.9}_{-6.1}$	4 CRONIN-HEN..04	CLE3	$\mathcal{T}(3S) \rightarrow \gamma\omega \mathcal{T}(1S)$

NODE=M080R3
NODE=M080R3

⁴ Using $B(\mathcal{T}(3S) \rightarrow \gamma\chi_{b1}(2P)) = (11.3 \pm 0.6)\%$ and $B(\mathcal{T}(1S) \rightarrow \ell^+\ell^-) = 2$
 $B(\mathcal{T}(1S) \rightarrow \mu^+\mu^-) = 2 (2.48 \pm 0.06)\%$.

NODE=M080R3;LINKAGE=CR

 $\Gamma(\gamma \mathcal{T}(2S))/\Gamma_{\text{total}}$ **Γ_2/Γ**

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.199 ± 0.019 OUR AVERAGE				
$0.190 \pm 0.018 \pm 0.017$	4.3k	⁵ LEES	11J BABR	$\mathcal{T}(3S) \rightarrow X\gamma$
$0.356 \pm 0.042 \pm 0.092$		⁶ CRAWFORD	92B CLE2	$e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$
$0.199 \pm 0.020 \pm 0.022$		⁷ HEINTZ	92 CSB2	$e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$

NODE=M080R2
NODE=M080R2

⁵ LEES 11J reports $[\Gamma(\chi_{b1}(2P) \rightarrow \gamma \mathcal{T}(2S))/\Gamma_{\text{total}}] \times [B(\mathcal{T}(3S) \rightarrow \gamma\chi_{b1}(2P))] = (2.4 \pm 0.1 \pm 0.2) \times 10^{-2}$ which we divide by our best value $B(\mathcal{T}(3S) \rightarrow \gamma\chi_{b1}(2P)) = (12.6 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M080R2;LINKAGE=LE

⁶ Using $B(\mathcal{T}(2S) \rightarrow \mu^+\mu^-) = (1.37 \pm 0.26)\%$, $B(\mathcal{T}(3S) \rightarrow \gamma\gamma \mathcal{T}(2S)) \times 2 B(\mathcal{T}(2S) \rightarrow \mu^+\mu^-) = (10.23 \pm 1.20 \pm 1.26) \times 10^{-4}$, and $B(\mathcal{T}(3S) \rightarrow \gamma\chi_{b1}(2P)) = 0.105^{+0.003}_{-0.002} \pm 0.013$.

NODE=M080R2;LINKAGE=B

⁷ Using $B(\mathcal{T}(2S) \rightarrow \mu^+\mu^-) = (1.44 \pm 0.10)\%$, $B(\mathcal{T}(3S) \rightarrow \gamma\chi_{b1}(2P)) = (11.5 \pm 0.5 \pm 0.5)\%$ and assuming $e\mu$ universality. Supersedes HEINTZ 91.

NODE=M080R2;LINKAGE=C

 $\Gamma(\gamma \mathcal{T}(1S))/\Gamma_{\text{total}}$ **Γ_3/Γ**

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.092 ± 0.008 OUR AVERAGE				Error includes scale factor of 1.1.
$0.098 \pm 0.005 \pm 0.009$	15k	⁸ LEES	11J BABR	$\mathcal{T}(3S) \rightarrow X\gamma$
$0.120 \pm 0.021 \pm 0.021$		⁹ CRAWFORD	92B CLE2	$e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$
$0.080 \pm 0.009 \pm 0.007$		¹⁰ HEINTZ	92 CSB2	$e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$

NODE=M080R1
NODE=M080R1

⁸ LEES 11J reports $[\Gamma(\chi_{b1}(2P) \rightarrow \gamma \mathcal{T}(1S))/\Gamma_{\text{total}}] \times [B(\mathcal{T}(3S) \rightarrow \gamma\chi_{b1}(2P))] = (12.4 \pm 0.3 \pm 0.6) \times 10^{-3}$ which we divide by our best value $B(\mathcal{T}(3S) \rightarrow \gamma\chi_{b1}(2P)) = (12.6 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M080R1;LINKAGE=LE

⁹ Using $B(\mathcal{T}(1S) \rightarrow \mu^+\mu^-) = (2.57 \pm 0.07)\%$, $B(\mathcal{T}(3S) \rightarrow \gamma\gamma \mathcal{T}(1S)) \times 2 B(\mathcal{T}(1S) \rightarrow \mu^+\mu^-) = (6.47 \pm 1.12 \pm 0.82) \times 10^{-4}$ and $B(\mathcal{T}(3S) \rightarrow \gamma\chi_{b1}(2P)) = 0.105^{+0.003}_{-0.002} \pm 0.013$.

NODE=M080R1;LINKAGE=B

¹⁰ Using $B(\mathcal{T}(1S) \rightarrow \mu^+\mu^-) = (2.57 \pm 0.07)\%$, $B(\mathcal{T}(3S) \rightarrow \gamma\chi_{b1}(2P)) = (11.5 \pm 0.5 \pm 0.5)\%$ and assuming $e\mu$ universality. Supersedes HEINTZ 91.

NODE=M080R1;LINKAGE=C

$\Gamma(\pi\pi\chi_{b1}(1P))/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
9.1±1.3 OUR AVERAGE				
9.2±1.1±0.8	31k	11 LEES	11C BABR	$e^+e^- \rightarrow \pi^+\pi^-X$
8.6±2.3±2.1		12 CAWLFIELD	06 CLE3	$\Upsilon(3S) \rightarrow 2(\gamma\pi\ell)$
11 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 $B(\Upsilon(3S) \rightarrow \chi_{b1}(2P)X) = B(\Upsilon(3S) \rightarrow \chi_{b1}(2P)\gamma) = (12.6 \pm 1.2) \times 10^{-2}$.				
12 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	13 BRIERE	08 CLEO	$\Upsilon(3S) \rightarrow \gamma D^0X$
13 For $p_{D^0} > 2.5$ GeV/c.				

NODE=M080R01
 NODE=M080R01

NODE=M080R01;LINKAGE=BR

 $\Gamma(\pi^+\pi^-K^+K^-\pi^0)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
3.1±1.0±0.3	30	14 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma\pi^+\pi^-K^+K^-\pi^0$
14 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

 $\Gamma(2\pi^+\pi^-K^-K_S^0)/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.1±0.5±0.1	10	15 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+\pi^-K^-K_S^0$
15 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

 $\Gamma(2\pi^+\pi^-K^-K_S^0 2\pi^0)/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
7.7±3.1±0.7	15	16 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+\pi^-K^-2\pi^0$
16 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

 $\Gamma(2\pi^+2\pi^-2\pi^0)/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
5.9±2.0±0.5	36	17 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+2\pi^-2\pi^0$
17 ASNER 08A reports $[\Gamma(\chi_{b1}(2P) \rightarrow 2\pi^+2\pi^-2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P))] = (74 \pm 16 \pm 19) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P)) = (12.6 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M080R05
 NODE=M080R05

NODE=M080R05;LINKAGE=AS

 $\Gamma(2\pi^+2\pi^-K^+K^-)/\Gamma_{\text{total}}$ Γ_{10}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.0±0.4±0.1	12	18 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+2\pi^-K^+K^-$
18 ASNER 08A reports $[\Gamma(\chi_{b1}(2P) \rightarrow 2\pi^+2\pi^-K^+K^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P))] = (12 \pm 4 \pm 3) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P)) = (12.6 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M080R06
 NODE=M080R06

NODE=M080R06;LINKAGE=AS

 $\Gamma(2\pi^+2\pi^-K^+K^-\pi^0)/\Gamma_{\text{total}}$ Γ_{11}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
5.5±1.7±0.5	38	19 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+2\pi^-K^+K^-\pi^0$
19 ASNER 08A reports $[\Gamma(\chi_{b1}(2P) \rightarrow 2\pi^+2\pi^-K^+K^-\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P))] = (69 \pm 13 \pm 17) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P)) = (12.6 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M080R07
 NODE=M080R07

NODE=M080R07;LINKAGE=AS

$\Gamma(2\pi^+ 2\pi^- K^+ K^- 2\pi^0)/\Gamma_{\text{total}}$ Γ_{12}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
9.6$\pm$3.5$\pm$0.9	27	20 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+ 2\pi^- K^+ K^- 2\pi^0$ 20 ASNER 08A reports $[\Gamma(\chi_{b1}(2P) \rightarrow 2\pi^+ 2\pi^- K^+ K^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P))]$ = $(121 \pm 29 \pm 33) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P)) = (12.6 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M080R08
 NODE=M080R08

NODE=M080R08;LINKAGE=AS

 $\Gamma(3\pi^+ 2\pi^- K^- K_S^0 \pi^0)/\Gamma_{\text{total}}$ Γ_{13}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
6.7$\pm$2.5$\pm$0.6	17	21 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+ 2\pi^- K^- K_S^0 \pi^0$ 21 ASNER 08A reports $[\Gamma(\chi_{b1}(2P) \rightarrow 3\pi^+ 2\pi^- K^- K_S^0 \pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P))]$ = $(85 \pm 23 \pm 22) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P)) = (12.6 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M080R09
 NODE=M080R09

NODE=M080R09;LINKAGE=AS

 $\Gamma(3\pi^+ 3\pi^-)/\Gamma_{\text{total}}$ Γ_{14}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.2$\pm$0.4$\pm$0.1	18	22 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+ 3\pi^-$ 22 ASNER 08A reports $[\Gamma(\chi_{b1}(2P) \rightarrow 3\pi^+ 3\pi^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P))]$ = $(15 \pm 4 \pm 3) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P)) = (12.6 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M080R10
 NODE=M080R10

NODE=M080R10;LINKAGE=AS

 $\Gamma(3\pi^+ 3\pi^- 2\pi^0)/\Gamma_{\text{total}}$ Γ_{15}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
12$\pm$4$\pm$1	44	23 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+ 3\pi^- 2\pi^0$ 23 ASNER 08A reports $[\Gamma(\chi_{b1}(2P) \rightarrow 3\pi^+ 3\pi^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P))]$ = $(150 \pm 30 \pm 40) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P)) = (12.6 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M080R11
 NODE=M080R11

NODE=M080R11;LINKAGE=AS

 $\Gamma(3\pi^+ 3\pi^- K^+ K^-)/\Gamma_{\text{total}}$ Γ_{16}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.0$\pm$0.7$\pm$0.2	16	24 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+ 3\pi^- K^+ K^-$ 24 ASNER 08A reports $[\Gamma(\chi_{b1}(2P) \rightarrow 3\pi^+ 3\pi^- K^+ K^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P))]$ = $(25 \pm 7 \pm 6) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P)) = (12.6 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M080R12
 NODE=M080R12

NODE=M080R12;LINKAGE=AS

 $\Gamma(3\pi^+ 3\pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}$ Γ_{17}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
6.1$\pm$2.1$\pm$0.6	25	25 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+ 3\pi^- K^+ K^- \pi^0$ 25 ASNER 08A reports $[\Gamma(\chi_{b1}(2P) \rightarrow 3\pi^+ 3\pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P))]$ = $(77 \pm 17 \pm 21) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P)) = (12.6 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M080R13
 NODE=M080R13

NODE=M080R13;LINKAGE=AS

 $\Gamma(4\pi^+ 4\pi^-)/\Gamma_{\text{total}}$ Γ_{18}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.7$\pm$0.6$\pm$0.2	16	26 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 4\pi^+ 4\pi^-$ 26 ASNER 08A reports $[\Gamma(\chi_{b1}(2P) \rightarrow 4\pi^+ 4\pi^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P))]$ = $(22 \pm 6 \pm 5) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P)) = (12.6 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M080R14
 NODE=M080R14

NODE=M080R14;LINKAGE=AS

 $\Gamma(4\pi^+ 4\pi^- 2\pi^0)/\Gamma_{\text{total}}$ Γ_{19}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
19$\pm$7$\pm$2	41	27 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 4\pi^+ 4\pi^- 2\pi^0$ 27 ASNER 08A reports $[\Gamma(\chi_{b1}(2P) \rightarrow 4\pi^+ 4\pi^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P))]$ = $(241 \pm 47 \pm 72) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P)) = (12.6 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M080R15
 NODE=M080R15

NODE=M080R15;LINKAGE=AS

$\chi_{b1}(2P)$ Cross-Particle Branching Ratios

NODE=M080230

$$\Gamma(\chi_{b1}(2P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P))/\Gamma_{\text{total}} \Gamma_3/\Gamma \times \Gamma_{20}^{\Upsilon(3S)}/\Gamma \Upsilon(3S)$$

NODE=M080B01
NODE=M080B01

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
12.4±0.3±0.6	15k	LEES	11J BABR	$\Upsilon(3S) \rightarrow X\gamma$

$$\Gamma(\chi_{b1}(2P) \rightarrow \gamma \Upsilon(2S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P))/\Gamma_{\text{total}} \Gamma_2/\Gamma \times \Gamma_{20}^{\Upsilon(3S)}/\Gamma \Upsilon(3S)$$

NODE=M080B02
NODE=M080B02

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
2.4±0.1±0.2	4.3k	LEES	11J BABR	$\Upsilon(3S) \rightarrow X\gamma$

$$B(\chi_{b1}(2P) \rightarrow \chi_{b1}(1P)\pi^+\pi^-) \times B(\Upsilon(3S) \rightarrow \chi_{b1}(2P)X)$$

NODE=M080R16
NODE=M080R16

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.16±0.07±0.12	31k	LEES	11C BABR	$e^+e^- \rightarrow \pi^+\pi^-X$

$$B(\chi_{b2}(2P) \rightarrow pX + \bar{p}X)/B(\chi_{b1}(2P) \rightarrow pX + \bar{p}X)$$

NODE=M080R20
NODE=M080R20

VALUE	DOCUMENT ID	TECN	COMMENT
1.109±0.007±0.040	BRIERE 07	CLEO	$\Upsilon(3S) \rightarrow \gamma \chi_{bJ}(2P)$

$$B(\chi_{b0}(2P) \rightarrow pX + \bar{p}X)/B(\chi_{b1}(2P) \rightarrow pX + \bar{p}X)$$

NODE=M080R21
NODE=M080R21

VALUE	DOCUMENT ID	TECN	COMMENT
1.082±0.025±0.060	BRIERE 07	CLEO	$\Upsilon(3S) \rightarrow \gamma \chi_{bJ}(2P)$

 $\chi_{b1}(2P)$ REFERENCES

NODE=M080

LEES	11C	PR D84 011104	J.P. Lees <i>et al.</i>	(BABAR Collab.)
LEES	11J	PR D84 072002	J.P. Lees <i>et al.</i>	(BABAR Collab.)
ASNER	08A	PR D78 091103	D.M. Asner <i>et al.</i>	(CLEO Collab.)
BRIERE	08	PR D78 092007	R.A. Briere <i>et al.</i>	(CLEO Collab.)
BRIERE	07	PR D76 012005	R.A. Briere <i>et al.</i>	(CLEO Collab.)
CAWLFIELD	06	PR D73 012003	C. Cawfield <i>et al.</i>	(CLEO Collab.)
ARTUSO	05	PRL 94 032001	M. Artuso <i>et al.</i>	(CLEO Collab.)
CRONIN-HENNESSY	04	PRL 92 222002	D. Cronin-Hennessy <i>et al.</i>	(CLEO Collab.)
CRAWFORD	92B	PL B294 139	G. Crawford, R. Fulton	(CLEO Collab.)
HEINTZ	92	PR D46 1928	U. Heintz <i>et al.</i>	(CUSB II Collab.)
HEINTZ	91	PRL 66 1563	U. Heintz <i>et al.</i>	(CUSB Collab.)
MORRISON	91	PRL 67 1696	R.J. Morrison <i>et al.</i>	(CLEO Collab.)
NARAIN	91	PRL 66 3113	M. Narain <i>et al.</i>	(CUSB Collab.)

REFID=16775
REFID=53936
REFID=52574
REFID=52577
REFID=51887
REFID=50997
REFID=50454
REFID=49766
REFID=43177
REFID=43604
REFID=41580
REFID=41634
REFID=41586 $h_b(2P)$

$$I^G(J^{PC}) = ?^?(1^{+-})$$

NODE=M205

OMITTED FROM SUMMARY TABLE

Quantum numbers are quark model predictions.

NODE=M205

 $h_b(2P)$ MASS

NODE=M205M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
10259.8±0.5±1.1	90k	MIZUK	12 BELL	$e^+e^- \rightarrow \pi^+\pi^-$ hadrons

NODE=M205M

• • • 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.

NODE=M205M;LINKAGE=AD

 $h_b(2P)$ DECAY MODES

NODE=M205215;NODE=M205

Mode	Fraction (Γ_i/Γ)
Γ_1 hadrons	not seen
Γ_2 $\eta_b(1S)\gamma$	(22± 5) %
Γ_3 $\eta_b(2S)\gamma$	(48±13) %

DESIG=1

DESIG=2

DESIG=3

 $h_b(2P)$ BRANCHING RATIOS

NODE=M205225

$\Gamma(\text{hadrons})/\Gamma_{\text{total}}$	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_1/Γ
not seen	83.9k	ADACHI	12 BELL	10.86 $e^+e^- \rightarrow \pi^+\pi^-$ MM	

NODE=M205R01
NODE=M205R01

$\Gamma(\eta_b(1S)\gamma)/\Gamma_{\text{total}}$ Γ_2/Γ VALUE (units 10^{-2}) EVTS

DOCUMENT ID

TECN

COMMENT

 $22.3 \pm 3.8^{+3.1}_{-3.3}$ 10k

MIZUK

12

BELL

 $e^+e^- \rightarrow (\gamma)\pi^+\pi^-$ hadronsNODE=M205R02
NODE=M205R02 $\Gamma(\eta_b(2S)\gamma)/\Gamma_{\text{total}}$ Γ_3/Γ VALUE (units 10^{-2}) EVTS

DOCUMENT ID

TECN

COMMENT

 $47.5 \pm 10.5^{+6.8}_{-7.7}$ 26k

MIZUK

12

BELL

 $e^+e^- \rightarrow (\gamma)\pi^+\pi^-$ hadronsNODE=M205R03
NODE=M205R03 $h_b(2P)$ REFERENCES

NODE=M205

ADACHI

12

PRL 108 032001

I. Adachi *et al.*

(BELLE Collab.)

REFID=53962

MIZUK

12

PRL 109 232002

R. Mizuk *et al.*

(BELLE Collab.)

REFID=54718

NODE=M081

 $\chi_{b2}(2P)$ $I^G(J^{PC}) = 0^+(2^{++})$ J needs confirmation.

Observed in radiative decay of the $\Upsilon(3S)$, therefore $C = +$. Branching ratio requires E1 transition, M1 is strongly disfavored, therefore $P = +$.

NODE=M081

 $\chi_{b2}(2P)$ MASS

NODE=M081M

VALUE (MeV)

DOCUMENT ID

10268.65 $\pm$ 0.22 $\pm$ 0.50 OUR EVALUATION From γ energy below, using $\Upsilon(3S)$ mass = 10355.2 $\pm$ 0.5 MeV

NODE=M081M

 $\rightarrow$ UNCHECKED $\leftarrow$ $m_{\chi_{b2}(2P)} - m_{\chi_{b1}(2P)}$

NODE=M081M2

VALUE (MeV)

DOCUMENT ID

TECN

COMMENT

13.5 $\pm$ 0.4 $\pm$ 0.5¹ HEINTZ

92

CSB2

 $e^+e^- \rightarrow \gamma X, \ell^+\ell^-\gamma\gamma$

NODE=M081M2

¹From the average photon energy for inclusive and exclusive events. Supersedes NARAIN 91.

NODE=M081M2;LINKAGE=A

 γ ENERGY IN $\Upsilon(3S)$ DECAY

NODE=M081DM

VALUE (MeV)

EVTS

DOCUMENT ID

TECN

COMMENT

86.19 $\pm$ 0.22 OUR EVALUATION Treating systematic errors as correlated**86.40 $\pm$ 0.18 OUR AVERAGE**86.04 $\pm$ 0.06 $\pm$ 0.27

ARTUSO

05

CLEO

 $\Upsilon(3S) \rightarrow \gamma X$ 86 $\pm$ 1

101

CRAWFORD

92B

CLE2

 $e^+e^- \rightarrow$ $\ell^+\ell^-\gamma\gamma$ 86.7 $\pm$ 0.4

10319

² HEINTZ

92

CSB2

 $e^+e^- \rightarrow \gamma X$ 86.9 $\pm$ 0.4

157

³ HEINTZ

92

CSB2

 $e^+e^- \rightarrow$ $\ell^+\ell^-\gamma\gamma$ 86.4 $\pm$ 0.1 $\pm$ 0.4

30741

MORRISON

91

CLE2

 $e^+e^- \rightarrow \gamma X$

OCCUR=2

²A systematic uncertainty on the energy scale of 0.9% not included. Supersedes NARAIN 91.

NODE=M081DM;LINKAGE=A

³A systematic uncertainty on the energy scale of 0.9% not included. Supersedes HEINTZ 91.

NODE=M081DM;LINKAGE=B

 $\chi_{b2}(2P)$ DECAY MODES

NODE=M081215;NODE=M081

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
$\Gamma_1 \quad \omega \Upsilon(1S)$	(1.10 $^{+0.34}_{-0.30}$) %	
$\Gamma_2 \quad \gamma \Upsilon(2S)$	(10.6 $\pm$ 2.6) %	S=2.0
$\Gamma_3 \quad \gamma \Upsilon(1S)$	(7.0 $\pm$ 0.7) %	
$\Gamma_4 \quad \pi\pi\chi_{b2}(1P)$	(5.1 $\pm$ 0.9) $\times 10^{-3}$	
$\Gamma_5 \quad D^0 X$	< 2.4 %	CL=90%
$\Gamma_6 \quad \pi^+\pi^- K^+ K^- \pi^0$	< 1.1 $\times 10^{-4}$	CL=90%
$\Gamma_7 \quad 2\pi^+\pi^- K^- K_S^0$	< 9 $\times 10^{-5}$	CL=90%
$\Gamma_8 \quad 2\pi^+\pi^- K^- K_S^0 2\pi^0$	< 7 $\times 10^{-4}$	CL=90%
$\Gamma_9 \quad 2\pi^+ 2\pi^- 2\pi^0$	(3.9 $\pm$ 1.6) $\times 10^{-4}$	

DESIG=3

DESIG=2

DESIG=1

DESIG=4

DESIG=5

DESIG=6

DESIG=7

DESIG=8

DESIG=9

Γ_{10}	$2\pi^+ 2\pi^- K^+ K^-$	$(9 \pm 4) \times 10^{-5}$	DESIG=10
Γ_{11}	$2\pi^+ 2\pi^- K^+ K^- \pi^0$	$(2.4 \pm 1.1) \times 10^{-4}$	DESIG=11
Γ_{12}	$2\pi^+ 2\pi^- K^+ K^- 2\pi^0$	$(4.7 \pm 2.3) \times 10^{-4}$	DESIG=12
Γ_{13}	$3\pi^+ 2\pi^- K^- K_S^0 \pi^0$	$< 4 \times 10^{-4}$	DESIG=13
Γ_{14}	$3\pi^+ 3\pi^-$	$(9 \pm 4) \times 10^{-5}$	DESIG=14
Γ_{15}	$3\pi^+ 3\pi^- 2\pi^0$	$(1.2 \pm 0.4) \times 10^{-3}$	DESIG=15
Γ_{16}	$3\pi^+ 3\pi^- K^+ K^-$	$(1.4 \pm 0.7) \times 10^{-4}$	DESIG=16
Γ_{17}	$3\pi^+ 3\pi^- K^+ K^- \pi^0$	$(4.2 \pm 1.7) \times 10^{-4}$	DESIG=17
Γ_{18}	$4\pi^+ 4\pi^-$	$(9 \pm 5) \times 10^{-5}$	DESIG=18
Γ_{19}	$4\pi^+ 4\pi^- 2\pi^0$	$(1.3 \pm 0.5) \times 10^{-3}$	DESIG=19

$\chi_{b2}(2P)$ BRANCHING RATIOS

NODE=M081220

$\Gamma(\omega \Upsilon(1S))/\Gamma_{\text{total}}$ Γ_1/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.10^{+0.32+0.11}_{-0.28-0.10}$	$20.1^{+5.8}_{-5.1}$	⁴ CRONIN-HEN..04	CLE3	$\Upsilon(3S) \rightarrow \gamma \omega \Upsilon(1S)$

NODE=M081R3
NODE=M081R3

⁴ Using $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) = (11.4 \pm 0.8)\%$ and $B(\Upsilon(1S) \rightarrow \ell^+ \ell^-) = 2$
 $B(\Upsilon(1S) \rightarrow \mu^+ \mu^-) = 2 (2.48 \pm 0.06)\%$.

NODE=M081R3;LINKAGE=CR

$\Gamma(\gamma \Upsilon(2S))/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.106 ± 0.026 OUR AVERAGE		Error includes scale factor of 2.0. See the ideogram below.		
$0.084 \pm 0.011 \pm 0.010$	2.5k	⁵ LEES	11J BABR	$\Upsilon(3S) \rightarrow X \gamma$
$0.135 \pm 0.025 \pm 0.035$		⁶ CRAWFORD	92B CLE2	$e^+ e^- \rightarrow \ell^+ \ell^- \gamma \gamma$
$0.173 \pm 0.021 \pm 0.019$		⁷ HEINTZ	92 CSB2	$e^+ e^- \rightarrow \ell^+ \ell^- \gamma \gamma$

NODE=M081R2
NODE=M081R2

⁵ LEES 11J reports $[\Gamma(\chi_{b2}(2P) \rightarrow \gamma \Upsilon(2S))/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))] = (1.1 \pm 0.1 \pm 0.1) \times 10^{-2}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) = (13.1 \pm 1.6) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M081R2;LINKAGE=LE

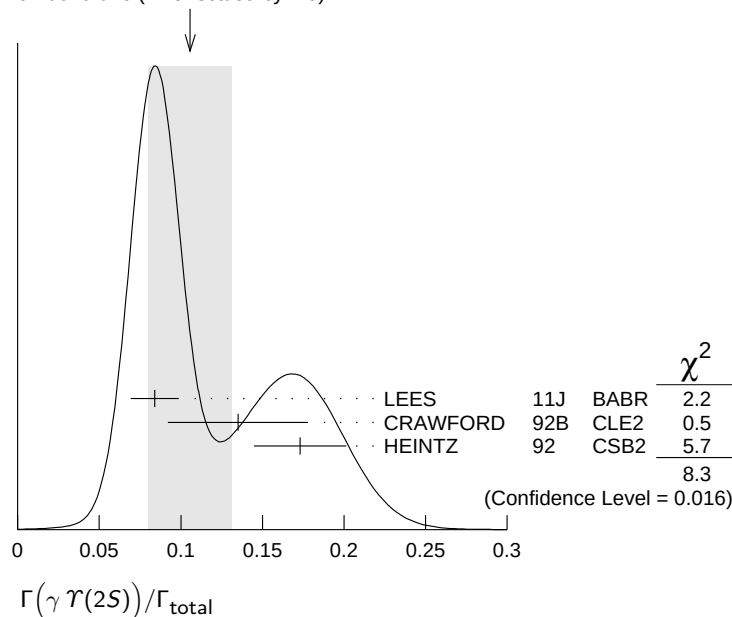
⁶ Using $B(\Upsilon(2S) \rightarrow \mu^+ \mu^-) = (1.37 \pm 0.26)\%$, $B(\Upsilon(3S) \rightarrow \gamma \gamma \Upsilon(2S)) \times 2 B(\Upsilon(2S) \rightarrow \mu^+ \mu^-) = (4.98 \pm 0.94 \pm 0.62) \times 10^{-4}$, and $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) = 0.135 \pm 0.003 \pm 0.017$.

NODE=M081R2;LINKAGE=B

⁷ Using $B(\Upsilon(2S) \rightarrow \mu^+ \mu^-) = (1.44 \pm 0.10)\%$, $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) = (11.1 \pm 0.5 \pm 0.4)\%$ and assuming $e\mu$ universality. Supersedes HEINTZ 91.

NODE=M081R2;LINKAGE=C

WEIGHTED AVERAGE
 0.106 ± 0.026 (Error scaled by 2.0)



$\Gamma(\gamma \Upsilon(1S))/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.070±0.007 OUR AVERAGE				
0.070±0.004±0.008	11k	⁸ LEES	11J BABR	$\Upsilon(3S) \rightarrow X\gamma$
0.072±0.014±0.013		⁹ CRAWFORD	92B CLE2	$e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$
0.070±0.010±0.006		¹⁰ HEINTZ	92 CSB2	$e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$

NODE=M081R1
NODE=M081R1

⁸ LEES 11J reports $[\Gamma(\chi_{b2}(2P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))] = (9.2 \pm 0.3 \pm 0.4) \times 10^{-3}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) = (13.1 \pm 1.6) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M081R1;LINKAGE=LE

⁹ Using $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.57 \pm 0.07)\%$, $B(\Upsilon(3S) \rightarrow \gamma\gamma \Upsilon(2S)) \times 2 B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (5.03 \pm 0.94 \pm 0.63) \times 10^{-4}$, and $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) = 0.135 \pm 0.003 \pm 0.017$.

NODE=M081R1;LINKAGE=B

¹⁰ Using $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.57 \pm 0.07)\%$, $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) = (11.1 \pm 0.5 \pm 0.4)\%$ and assuming $e\mu$ universality. Supersedes HEINTZ 91.

NODE=M081R1;LINKAGE=C

 $\Gamma(\pi\pi\chi_{b2}(1P))/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
5.1±0.9 OUR AVERAGE				
4.9±0.7±0.6	17k	¹¹ LEES	11C BABR	$e^+e^- \rightarrow \pi^+\pi^-X$
6.0±1.6±1.4		¹² CAWLFIELD	06 CLE3	$\Upsilon(3S) \rightarrow 2(\gamma\pi\ell)$

NODE=M081R4
NODE=M081R4

¹¹ $(0.64 \pm 0.05 \pm 0.08) \times 10^{-3}$. We derive the value assuming $B(\Upsilon(3S) \rightarrow \chi_{b2}(2P)X) = B(\Upsilon(3S) \rightarrow \chi_{b2}(2P)\gamma) = (13.1 \pm 1.6) \times 10^{-2}$.

NODE=M081R4;LINKAGE=LE

¹² CAWLFIELD 06 quote $\Gamma(\chi_{b2}(2P) \rightarrow \pi\pi\chi_b(1P)) = 0.83 \pm 0.22 \pm 0.08 \pm 0.19$ keV assuming l-spin conservation, no D-wave contribution, $\Gamma(\chi_{b1}(2P)) = 96 \pm 16$ keV, and $\Gamma(\chi_{b2}(2P)) = 138 \pm 19$ keV.

NODE=M081R4;LINKAGE=CA

 $\Gamma(D^0X)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<2.4 × 10⁻²	90	^{13,14} BRIERE	08 CLEO	$\Upsilon(3S) \rightarrow \gamma D^0X$

NODE=M081R01
NODE=M081R01

¹³ For $p_{D^0} > 2.5$ GeV/c.

NODE=M081R01;LINKAGE=BR

¹⁴ The authors also present their result as $(0.2 \pm 1.4 \pm 0.1) \times 10^{-2}$.

NODE=M081R01;LINKAGE=RI

 $\Gamma(\pi^+\pi^-K^+K^-\pi^0)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.1	90	¹⁵ ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma\pi^+\pi^-K^+K^-\pi^0$

NODE=M081R02
NODE=M081R02

¹⁵ ASNER 08A reports $[\Gamma(\chi_{b2}(2P) \rightarrow \pi^+\pi^-K^+K^-\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))] < 14 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) = 13.1 \times 10^{-2}$.

NODE=M081R02;LINKAGE=AS

 $\Gamma(2\pi^+\pi^-K^-K_S^0)/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<0.9	90	¹⁶ ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+\pi^-K^-K_S^0$

NODE=M081R03
NODE=M081R03

¹⁶ ASNER 08A reports $[\Gamma(\chi_{b2}(2P) \rightarrow 2\pi^+\pi^-K^-K_S^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))] < 12 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) = 13.1 \times 10^{-2}$.

NODE=M081R03;LINKAGE=AS

 $\Gamma(2\pi^+\pi^-K^-K_S^0 2\pi^0)/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<7	90	¹⁷ ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+\pi^-K^-2\pi^0$

NODE=M081R04
NODE=M081R04

¹⁷ ASNER 08A reports $[\Gamma(\chi_{b2}(2P) \rightarrow 2\pi^+\pi^-K^-K_S^0 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))] < 87 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) = 13.1 \times 10^{-2}$.

NODE=M081R04;LINKAGE=AS

 $\Gamma(2\pi^+2\pi^-2\pi^0)/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
3.9±1.6±0.5	23	¹⁸ ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+2\pi^-2\pi^0$

NODE=M081R05
NODE=M081R05

¹⁸ ASNER 08A reports $[\Gamma(\chi_{b2}(2P) \rightarrow 2\pi^+2\pi^-2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))] = (51 \pm 16 \pm 13) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) = (13.1 \pm 1.6) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M081R05;LINKAGE=AS

$\Gamma(2\pi^+ 2\pi^- K^+ K^-)/\Gamma_{\text{total}}$ Γ_{10}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
0.9±0.4±0.1	11	19 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+ 2\pi^- K^+ K^-$ 19 ASNER 08A reports $[\Gamma(\chi_{b2}(2P) \rightarrow 2\pi^+ 2\pi^- K^+ K^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))] = (12 \pm 4 \pm 3) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) = (13.1 \pm 1.6) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M081R06
NODE=M081R06

NODE=M081R06;LINKAGE=AS

 $\Gamma(2\pi^+ 2\pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}$ Γ_{11}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.4±1.0±0.3	16	20 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+ 2\pi^- K^+ K^- \pi^0$ 20 ASNER 08A reports $[\Gamma(\chi_{b2}(2P) \rightarrow 2\pi^+ 2\pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))] = (32 \pm 11 \pm 8) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) = (13.1 \pm 1.6) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M081R07
NODE=M081R07

NODE=M081R07;LINKAGE=AS

 $\Gamma(2\pi^+ 2\pi^- K^+ K^- 2\pi^0)/\Gamma_{\text{total}}$ Γ_{12}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
4.7±2.2±0.6	14	21 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+ 2\pi^- K^+ K^- 2\pi^0$ 21 ASNER 08A reports $[\Gamma(\chi_{b2}(2P) \rightarrow 2\pi^+ 2\pi^- K^+ K^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))] = (62 \pm 23 \pm 17) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) = (13.1 \pm 1.6) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M081R08
NODE=M081R08

NODE=M081R08;LINKAGE=AS

 $\Gamma(3\pi^+ 2\pi^- K^- K_S^0 \pi^0)/\Gamma_{\text{total}}$ Γ_{13}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<4	90	22 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+ 2\pi^- K^- K_S^0 \pi^0$ 22 ASNER 08A reports $[\Gamma(\chi_{b2}(2P) \rightarrow 3\pi^+ 2\pi^- K^- K_S^0 \pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))] < 58 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) = 13.1 \times 10^{-2}$.

NODE=M081R09
NODE=M081R09

NODE=M081R09;LINKAGE=AS

 $\Gamma(3\pi^+ 3\pi^-)/\Gamma_{\text{total}}$ Γ_{14}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
0.9±0.4±0.1	14	23 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+ 3\pi^-$ 23 ASNER 08A reports $[\Gamma(\chi_{b2}(2P) \rightarrow 3\pi^+ 3\pi^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))] = (12 \pm 4 \pm 3) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) = (13.1 \pm 1.6) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M081R10
NODE=M081R10

NODE=M081R10;LINKAGE=AS

 $\Gamma(3\pi^+ 3\pi^- 2\pi^0)/\Gamma_{\text{total}}$ Γ_{15}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
12±4±1	45	24 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+ 3\pi^- 2\pi^0$ 24 ASNER 08A reports $[\Gamma(\chi_{b2}(2P) \rightarrow 3\pi^+ 3\pi^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))] = (159 \pm 33 \pm 43) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) = (13.1 \pm 1.6) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M081R11
NODE=M081R11

NODE=M081R11;LINKAGE=AS

 $\Gamma(3\pi^+ 3\pi^- K^+ K^-)/\Gamma_{\text{total}}$ Γ_{16}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.4±0.7±0.2	12	25 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+ 3\pi^- K^+ K^-$ 25 ASNER 08A reports $[\Gamma(\chi_{b2}(2P) \rightarrow 3\pi^+ 3\pi^- K^+ K^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))] = (19 \pm 7 \pm 5) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) = (13.1 \pm 1.6) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M081R12
NODE=M081R12

NODE=M081R12;LINKAGE=AS

 $\Gamma(3\pi^+ 3\pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}$ Γ_{17}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
4.2±1.7±0.5	16	26 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+ 3\pi^- K^+ K^- \pi^0$ 26 ASNER 08A reports $[\Gamma(\chi_{b2}(2P) \rightarrow 3\pi^+ 3\pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))] = (55 \pm 16 \pm 15) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) = (13.1 \pm 1.6) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M081R13
NODE=M081R13

NODE=M081R13;LINKAGE=AS

$\Gamma(4\pi^+4\pi^-)/\Gamma_{\text{total}}$ Γ_{18}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$0.9 \pm 0.4 \pm 0.1$	9	27 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 4\pi^+ 4\pi^-$

NODE=M081R14
 NODE=M081R14

²⁷ ASNER 08A reports $[\Gamma(\chi_{b2}(2P) \rightarrow 4\pi^+ 4\pi^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))]$
 $= (12 \pm 5 \pm 3) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) =$
 $(13.1 \pm 1.6) \times 10^{-2}$. Our first error is their experiment's error and our second error is
 the systematic error from using our best value.

NODE=M081R14;LINKAGE=AS

 $\Gamma(4\pi^+4\pi^-2\pi^0)/\Gamma_{\text{total}}$ Γ_{19}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$13 \pm 5 \pm 2$	27	28 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 4\pi^+ 4\pi^- 2\pi^0$

NODE=M081R15
 NODE=M081R15

²⁸ ASNER 08A reports $[\Gamma(\chi_{b2}(2P) \rightarrow 4\pi^+ 4\pi^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))]$
 $= (165 \pm 46 \pm 50) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) =$
 $(13.1 \pm 1.6) \times 10^{-2}$. Our first error is their experiment's error and our second error
 is the systematic error from using our best value.

NODE=M081R15;LINKAGE=AS

 $\chi_{b2}(2P)$ Cross-Particle Branching Ratios

NODE=M081230

$$\Gamma(\chi_{b2}(2P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))/\Gamma_{\text{total}}$$

$$\Gamma_3/\Gamma \times \Gamma_{19}^{\Upsilon(3S)}/\Gamma \Upsilon(3S)$$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$9.2 \pm 0.3 \pm 0.4$	11k	LEES	11J BABR	$\Upsilon(3S) \rightarrow X\gamma$

NODE=M081B01
 NODE=M081B01

$$\Gamma(\chi_{b2}(2P) \rightarrow \gamma \Upsilon(2S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))/\Gamma_{\text{total}}$$

$$\Gamma_2/\Gamma \times \Gamma_{19}^{\Upsilon(3S)}/\Gamma \Upsilon(3S)$$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.1 \pm 0.1 \pm 0.1$	2.5k	LEES	11J BABR	$\Upsilon(3S) \rightarrow X\gamma$

NODE=M081B02
 NODE=M081B02

 $B(\chi_{b2}(2P) \rightarrow \chi_{b2}(1P)\pi^+\pi^-) \times B(\Upsilon(3S) \rightarrow \chi_{b2}(2P)X)$

NODE=M081R16
 NODE=M081R16

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$0.64 \pm 0.05 \pm 0.08$	17k	LEES	11C BABR	$e^+e^- \rightarrow \pi^+\pi^-X$

 $\chi_{b2}(2P)$ REFERENCES

NODE=M081

LEES	11C	PR D84 011104	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=16775
LEES	11J	PR D84 072002	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=53936
ASNER	08A	PR D78 091103	D.M. Asner <i>et al.</i>	(CLEO Collab.)	REFID=52574
BRIERE	08	PR D78 092007	R.A. Briere <i>et al.</i>	(CLEO Collab.)	REFID=52577
CAWLFIELD	06	PR D73 012003	C. Cawfield <i>et al.</i>	(CLEO Collab.)	REFID=50997
ARTUSO	05	PRL 94 032001	M. Artuso <i>et al.</i>	(CLEO Collab.)	REFID=50454
CRONIN-HEN...	04	PRL 92 222002	D. Cronin-Hennessy <i>et al.</i>	(CLEO Collab.)	REFID=49766
CRAWFORD	92B	PL B294 139	G. Crawford, R. Fulton	(CLEO Collab.)	REFID=43177
HEINTZ	92	PR D46 1928	U. Heintz <i>et al.</i>	(CUSB II Collab.)	REFID=43604
HEINTZ	91	PRL 66 1563	U. Heintz <i>et al.</i>	(CUSB Collab.)	REFID=41580
MORRISON	91	PRL 67 1696	R.J. Morrison <i>et al.</i>	(CLEO Collab.)	REFID=41634
NARAIN	91	PRL 66 3113	M. Narain <i>et al.</i>	(CUSB Collab.)	REFID=41586

$\Upsilon(3S)$

$$J^{PC} = 0^{-}(1^{-}-)$$

NODE=M048

 $\Upsilon(3S)$ MASS

NODE=M048M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
10355.2±0.5	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
$\Upsilon_1(2S)$ anything	(10.6 ± 0.8) %	
$\Upsilon_2(2S)\pi^+\pi^-$	(2.82±0.18) %	S=1.6
$\Upsilon_3(2S)\pi^0\pi^0$	(1.85±0.14) %	
$\Upsilon_4(2S)\gamma\gamma$	(5.0 ± 0.7) %	
$\Upsilon_5(2S)\pi^0$	< 5.1 × 10 ⁻⁴	CL=90%
$\Upsilon_6(1S)\pi^+\pi^-$	(4.37±0.08) %	
$\Upsilon_7(1S)\pi^0\pi^0$	(2.20±0.13) %	
$\Upsilon_8(1S)\eta$	< 1 × 10 ⁻⁴	CL=90%
$\Upsilon_9(1S)\pi^0$	< 7 × 10 ⁻⁵	CL=90%
$\Upsilon_{10}h_b(1P)\pi^0$	< 1.2 × 10 ⁻³	CL=90%
$\Upsilon_{11}h_b(1P)\pi^0 \rightarrow \gamma\eta_b(1S)\pi^0$	(4.3 ± 1.4) × 10 ⁻⁴	
$\Upsilon_{12}h_b(1P)\pi^+\pi^-$	< 1.2 × 10 ⁻⁴	CL=90%
$\Upsilon_{13}\tau^+\tau^-$	(2.29±0.30) %	
$\Upsilon_{14}\mu^+\mu^-$	(2.18±0.21) %	S=2.1
$\Upsilon_{15}e^+e^-$	seen	
Υ_{16} hadrons		
$\Upsilon_{17}ggg$	(35.7 ± 2.6) %	
$\Upsilon_{18}\gamma gg$	(9.7 ± 1.8) × 10 ⁻³	

DESIG=8
 DESIG=4
 DESIG=10
 DESIG=12
 DESIG=107
 DESIG=3
 DESIG=11
 DESIG=9
 DESIG=106
 DESIG=112
 DESIG=113
 DESIG=114
 DESIG=16
 DESIG=1
 DESIG=2;OUR EVAL;→ UNCHECKED ←
 DESIG=101
 DESIG=109
 DESIG=110

Radiative decays

NODE=M048;CLUMP=B

$\Upsilon_{19}\gamma\chi_{b2}(2P)$	(13.1 ± 1.6) %	S=3.4
$\Upsilon_{20}\gamma\chi_{b1}(2P)$	(12.6 ± 1.2) %	S=2.4
$\Upsilon_{21}\gamma\chi_{b0}(2P)$	(5.9 ± 0.6) %	S=1.4
$\Upsilon_{22}\gamma\chi_{b2}(1P)$	(9.9 ± 1.3) × 10 ⁻³	S=2.0
$\Upsilon_{23}\gamma A^0 \rightarrow \gamma \text{hadrons}$	< 8 × 10 ⁻⁵	CL=90%
$\Upsilon_{24}\gamma\chi_{b1}(1P)$	(9 ± 5) × 10 ⁻⁴	S=1.9
$\Upsilon_{25}\gamma\chi_{b0}(1P)$	(2.7 ± 0.4) × 10 ⁻³	
$\Upsilon_{26}\gamma\eta_b(2S)$	< 6.2 × 10 ⁻⁴	CL=90%
$\Upsilon_{27}\gamma\eta_b(1S)$	(5.1 ± 0.7) × 10 ⁻⁴	
$\Upsilon_{28}\gamma X \rightarrow \gamma + \geq 4 \text{ prongs}$	[a] < 2.2 × 10 ⁻⁴	CL=95%
$\Upsilon_{29}\gamma a_1^0 \rightarrow \gamma \mu^+\mu^-$	< 5.5 × 10 ⁻⁶	CL=90%
$\Upsilon_{30}\gamma a_1^0 \rightarrow \gamma \tau^+\tau^-$	[b] < 1.6 × 10 ⁻⁴	CL=90%

DESIG=5
 DESIG=6
 DESIG=7
 DESIG=103
 DESIG=115
 DESIG=104
 DESIG=13
 DESIG=14
 DESIG=15
 DESIG=102
 DESIG=116
 DESIG=108

Lepton Family number (LF) violating modes

Γ_{31}	$e^{\pm}\tau^{\mp}$	LF	< 4.2	$\times 10^{-6}$	CL=90%
Γ_{32}	$\mu^{\pm}\tau^{\mp}$	LF	< 3.1	$\times 10^{-6}$	CL=90%

NODE=M048;CLUMP=C

DESIG=111

DESIG=105

[a] $1.5 \text{ GeV} < m_X < 5.0 \text{ GeV}$

LINKAGE=C48

[b] For $m_{\tau^+\tau^-}$ in the ranges 4.03–9.52 and 9.61–10.10 GeV.

LINKAGE=MRG

 $\Upsilon(3S) \Gamma(i) \Gamma(e^+ e^-) / \Gamma(\text{total})$

NODE=M048218

 $\Gamma(\text{hadrons}) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$ **$\Gamma_{16} \Gamma_{15} / \Gamma$**

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
0.414 ± 0.007 OUR AVERAGE			
0.413 ± 0.004 ± 0.006	ROSNER	06	CLEO $10.4 e^+ e^- \rightarrow \text{hadrons}$
0.45 ± 0.03 ± 0.03	⁴ GILES	84B	CLEO $e^+ e^- \rightarrow \text{hadrons}$

NODE=M048G2

NODE=M048G2

⁴ Radiative corrections reevaluated by BUCHMUELLER 88 following KURAEV 85.

NODE=M048G2;LINKAGE=R

 $\Gamma(\Upsilon(1S)\pi^+\pi^-) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$ **$\Gamma_6 \Gamma_{15} / \Gamma$**

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
18.46 ± 0.27 ± 0.77	6.4K	⁵ AUBERT	08BP BABR	$e^+ e^- \rightarrow \gamma \pi^+ \pi^- \ell^+ \ell^-$

NODE=M048G01

NODE=M048G01

⁵ Using $B(\Upsilon(1S) \rightarrow e^+ e^-) = (2.38 \pm 0.11)\%$ and $B(\Upsilon(1S) \rightarrow \mu^+ \mu^-) = (2.48 \pm 0.05)\%$.

NODE=M048G01;LINKAGE=AU

 $\Upsilon(3S)$ PARTIAL WIDTHS

NODE=M048220

 $\Gamma(e^+ e^-)$ **Γ_{15}**

VALUE (keV)	DOCUMENT ID
0.443 ± 0.008 OUR EVALUATION	

NODE=M048W2

NODE=M048W2

→ UNCHECKED ←

 $\Upsilon(3S)$ BRANCHING RATIOS

NODE=M048225

 $\Gamma(\Upsilon(2S) \text{ anything}) / \Gamma_{\text{total}}$ **Γ_1 / Γ**

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.106 ± 0.008 OUR AVERAGE				
0.1023 ± 0.0105	4625	^{6,7,8} BUTLER	94B	CLE2 $e^+ e^- \rightarrow \ell^+ \ell^- X$
0.111 ± 0.012	4891	^{7,8,9} BROCK	91	CLEO $e^+ e^- \rightarrow \pi^+ \pi^- X, \pi^+ \pi^- \ell^+ \ell^-$

NODE=M048R8

NODE=M048R8

⁶ Using $B(\Upsilon(2S) \rightarrow \Upsilon(1S)\gamma\gamma) = (0.038 \pm 0.007)\%$, and $B(\Upsilon(2S) \rightarrow \Upsilon(1S)\pi^0\pi^0) = (1/2)B(\Upsilon(2S) \rightarrow \Upsilon(1S)\pi^+\pi^-)$.

NODE=M048R;LINKAGE=A

⁷ Using $B(\Upsilon(1S) \rightarrow \mu^+ \mu^-) = (2.48 \pm 0.06)\%$. With the assumption of $e\mu$ universality.

NODE=M048R;LINKAGE=B

⁸ Using $B(\Upsilon(2S) \rightarrow \Upsilon(1S)\pi^+\pi^-) = (18.5 \pm 0.8)\%$.

NODE=M048R;LINKAGE=D

⁹ Using $B(\Upsilon(2S) \rightarrow \mu^+ \mu^-) = (1.31 \pm 0.21)\%$, $B(\Upsilon(2S) \rightarrow \Upsilon(1S)\gamma\gamma) \times 2B(\Upsilon(1S) \rightarrow \mu^+ \mu^-) = (0.188 \pm 0.035)\%$, and $B(\Upsilon(2S) \rightarrow \Upsilon(1S)\pi^0\pi^0) \times 2B(\Upsilon(1S) \rightarrow \mu^+ \mu^-) = (0.436 \pm 0.056)\%$. With the assumption of $e\mu$ universality.

NODE=M048R;LINKAGE=C

 $\Gamma(\Upsilon(2S)\pi^+\pi^-) / \Gamma_{\text{total}}$ **Γ_2 / Γ**

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
2.82 ± 0.18 OUR AVERAGE				Error includes scale factor of 1.6. See the ideogram below.
3.00 ± 0.02 ± 0.14	543k	LEES	11C	BABR $e^+ e^- \rightarrow \pi^+ \pi^- X$
2.40 ± 0.10 ± 0.26	800	¹⁰ AUBERT	08BP BABR	$e^+ e^- \rightarrow \gamma \pi^+ \pi^- e^+ e^-$
3.12 ± 0.49	980	^{11,12} BUTLER	94B	CLE2 $e^+ e^- \rightarrow \pi^+ \pi^- \ell^+ \ell^-$
2.13 ± 0.38	974	¹³ BROCK	91	CLEO $e^+ e^- \rightarrow \pi^+ \pi^- X, \pi^+ \pi^- \ell^+ \ell^-$

NODE=M048R4

NODE=M048R4

• • • We do not use the following data for averages, fits, limits, etc. • • •

4.82 ± 0.65 ± 0.53	138	¹³ WU	93	CUSB $\Upsilon(3S) \rightarrow \pi^+ \pi^- \ell^+ \ell^-$
3.1 ± 2.0	5	MAGERAS	82	CUSB $\Upsilon(3S) \rightarrow \pi^+ \pi^- \ell^+ \ell^-$

¹⁰ Using $B(\Upsilon(1S) \rightarrow e^+ e^-) = (2.38 \pm 0.11)\%$, $B(\Upsilon(1S) \rightarrow \mu^+ \mu^-) = (2.48 \pm 0.05)\%$, and $\Gamma_{ee}(\Upsilon(3S)) = 0.443 \pm 0.008 \text{ keV}$.

NODE=M048R4;LINKAGE=AU

¹¹ From the exclusive mode.

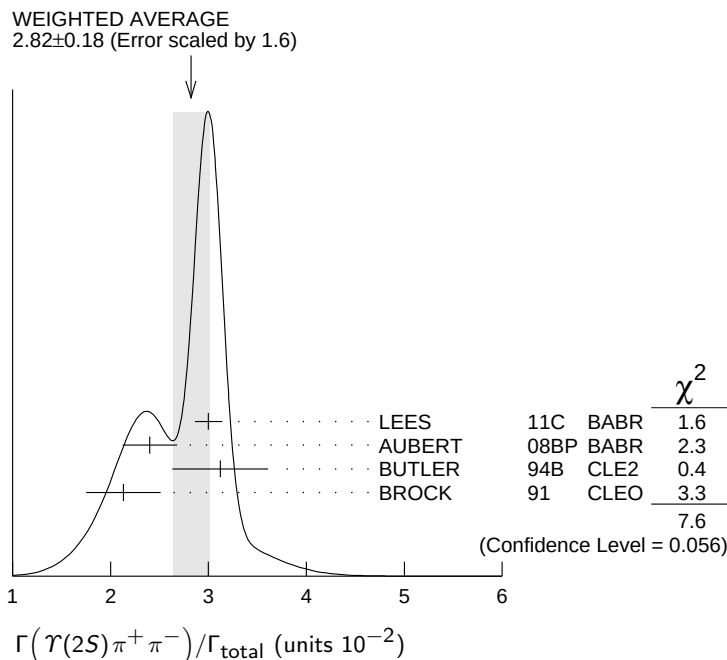
NODE=M048R;LINKAGE=M

¹² Using $B(\Upsilon(2S) \rightarrow \Upsilon(1S)\gamma\gamma) = (0.038 \pm 0.007)\%$, and $B(\Upsilon(2S) \rightarrow \Upsilon(1S)\pi^0\pi^0) = (1/2)B(\Upsilon(2S) \rightarrow \Upsilon(1S)\pi^+\pi^-)$.

NODE=M048R4;LINKAGE=A

¹³ Using $B(\Upsilon(2S) \rightarrow \mu^+ \mu^-) = (1.31 \pm 0.21)\%$, $B(\Upsilon(2S) \rightarrow \Upsilon(1S)\gamma\gamma) \times 2B(\Upsilon(1S) \rightarrow \mu^+ \mu^-) = (0.188 \pm 0.035)\%$, and $B(\Upsilon(2S) \rightarrow \Upsilon(1S)\pi^0\pi^0) \times 2B(\Upsilon(1S) \rightarrow \mu^+ \mu^-) = (0.436 \pm 0.056)\%$. With the assumption of $e\mu$ universality.

NODE=M048R4;LINKAGE=C



$\Gamma(\Upsilon(2S)\pi^0\pi^0)/\Gamma_{\text{total}}$

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	$e^+e^- \rightarrow \pi^0\pi^0\ell^+\ell^-$

NODE=M048R10
NODE=M048R10

- 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;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	$e^+e^- \rightarrow \ell^+\ell^-2\gamma$

NODE=M048R12
NODE=M048R12

- ¹⁸ From the exclusive mode.

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	$e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$

NODE=M048R25
NODE=M048R25

- ¹⁹ Authors assume $B(\Upsilon(2S) \rightarrow e^+e^-) + B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = 4.06\%$.

NODE=M048R25;LINKAGE=HE

$\Gamma(\Upsilon(1S)\pi^+\pi^-)/\Gamma_{\text{total}}$

Γ_6/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
4.37±0.08 OUR AVERAGE				

NODE=M048R3
 NODE=M048R3
 NODE=M048R3

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 $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.05)\%$.

NODE=M048R3;LINKAGE=LE

- ²¹ A weighted average of the inclusive and exclusive results.

NODE=M048R3;LINKAGE=BH
 NODE=M048R3;LINKAGE=AU

- 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;LINKAGE=B

$\Gamma(\Upsilon(2S)\pi^+\pi^-)/\Gamma(\Upsilon(1S)\pi^+\pi^-)$ Γ_2/Γ_6

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.577 ± 0.026 ± 0.060	800	²⁴ AUBERT	08BP BABR	$e^+e^- \rightarrow \gamma\pi^+\pi^-\ell^+\ell^-$

²⁴ Using $B(\Upsilon(1S) \rightarrow e^+e^-) = (2.38 \pm 0.11)\%$, $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.05)\%$, $B(\Upsilon(2S) \rightarrow e^+e^-) = (1.91 \pm 0.16)\%$, and $B(\Upsilon(2S) \rightarrow \mu^+\mu^-) = (1.93 \pm 0.17)\%$. Not independent of other values reported by AUBERT 08BP.

NODE=M048R28
NODE=M048R28

NODE=M048R28;LINKAGE=AU

 $\Gamma(\Upsilon(1S)\pi^0\pi^0)/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT

2.20 ± 0.13 OUR AVERAGE

2.24 ± 0.09 ± 0.11	6584	²⁵ BHARI	09 CLEO	$e^+e^- \rightarrow \pi^0\pi^0\ell^+\ell^-$
1.99 ± 0.34	56	²⁶ BUTLER	94B CLE2	$e^+e^- \rightarrow \pi^0\pi^0\ell^+\ell^-$
2.2 ± 0.4 ± 0.3	33	²⁷ HEINTZ	92 CSB2	$e^+e^- \rightarrow \pi^0\pi^0\ell^+\ell^-$

²⁵ Authors assume $B(\Upsilon(1S) \rightarrow e^+e^-) + B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = 4.96\%$.

²⁶ Using $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.06)\%$ and assuming $e\mu$ universality.

²⁷ Using $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.57 \pm 0.07)\%$ and assuming $e\mu$ universality. Supersedes HEINTZ 91.

NODE=M048R11
NODE=M048R11

NODE=M048R11;LINKAGE=BH
NODE=M048R11;LINKAGE=B
NODE=M048R;LINKAGE=I

 $\Gamma(\Upsilon(1S)\pi^0\pi^0)/\Gamma(\Upsilon(1S)\pi^+\pi^-)$ Γ_7/Γ_6

VALUE	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.501 ± 0.043	²⁸ BHARI	09 CLEO	$e^+e^- \rightarrow \Upsilon(3S)$

²⁸ Not independent of other values reported by BHARI 09.

NODE=M048R26
NODE=M048R26

NODE=M048R26;LINKAGE=BH

 $\Gamma(\Upsilon(1S)\eta)/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT

<0.1	90	²⁹ LEES	11L BABR	$\Upsilon(3S) \rightarrow (\pi^+\pi^-)(\gamma\gamma)\ell^+\ell^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.8	90	^{29,30} AUBERT	08BP BABR	$e^+e^- \rightarrow \gamma\pi^+\pi^-\pi^0\ell^+\ell^-$

<0.18	90	³¹ HE	08A CLEO	$e^+e^- \rightarrow \ell^+\ell^-\eta$

<2.2	90	BROCK	91 CLEO	$e^+e^- \rightarrow \ell^+\ell^-\eta$

²⁹ Using $B(\Upsilon(1S) \rightarrow e^+e^-) = (2.38 \pm 0.11)\%$, $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.05)\%$.

³⁰ Using $\Gamma_{ee}(\Upsilon(3S)) = 0.443 \pm 0.008$ keV.

³¹ Authors assume $B(\Upsilon(1S) \rightarrow e^+e^-) + B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = 4.96\%$.

NODE=M048R9
NODE=M048R9

NODE=M048R9;LINKAGE=LE
NODE=M048R9;LINKAGE=AU
NODE=M048R9;LINKAGE=HE

 $\Gamma(\Upsilon(1S)\eta)/\Gamma(\Upsilon(1S)\pi^+\pi^-)$ Γ_8/Γ_6

VALUE (units 10^{-2})	CL%	DOCUMENT ID	TECN	COMMENT

<0.23	90	³² LEES	11L BABR	$\Upsilon(3S) \rightarrow (\pi^+\pi^-)(\gamma\gamma)\ell^+\ell^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<1.9	90	³³ AUBERT	08BP BABR	$e^+e^- \rightarrow \gamma\pi^+\pi^-(\pi^0)\ell^+\ell^-$

³² Not independent of other values reported by LEES 11L.

³³ Not independent of other values reported by AUBERT 08BP.

NODE=M048R27
NODE=M048R27

NODE=M048R27;LINKAGE=LE
NODE=M048R27;LINKAGE=AU

 $\Gamma(\Upsilon(1S)\pi^0)/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT

<0.07	90	³⁴ HE	08A CLEO	$e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$

³⁴ Authors assume $B(\Upsilon(1S) \rightarrow e^+e^-) + B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = 4.96\%$.

NODE=M048R24
NODE=M048R24

NODE=M048R24;LINKAGE=HE

 $\Gamma(h_b(1P)\pi^0)/\Gamma_{\text{total}}$ Γ_{10}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<1.2 × 10 ⁻³	90	³⁵ GE	11 CLEO	$\Upsilon(3S) \rightarrow \pi^0$ anything

³⁵ Assuming $M(h_b(1P)) = 9900$ MeV and $\Gamma(h_b(1P)) = 0$ MeV, and allowing $B(h_b(1P) \rightarrow \gamma\eta_b(1S))$ to vary from 0–100%.

NODE=M048R03
NODE=M048R03

NODE=M048R03;LINKAGE=GE

 $\Gamma(h_b(1P)\pi^0 \rightarrow \gamma\eta_b(1S)\pi^0)/\Gamma_{\text{total}}$ Γ_{11}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT

4.3 ± 1.1 ± 0.9	LEES	11K BABR	$\Upsilon(3S) \rightarrow \eta_b\gamma\pi^0$

NODE=M048R33
NODE=M048R33

$\Gamma(h_b(1P)\pi^+\pi^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 1.2	90	³⁶ LEES	11C BABR	$e^+e^- \rightarrow \pi^+\pi^- X$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<18		³⁶ BUTLER	94B CLE2	$e^+e^- \rightarrow \pi^+\pi^- X$
<15		³⁶ BROCK	91 CLEO	$e^+e^- \rightarrow \pi^+\pi^- X$
³⁶ For $M(h_b(1P)) = 9900$ MeV.				

NODE=M048R34
 NODE=M048R34

NODE=M048R34;LINKAGE=MH

 $\Gamma(\tau^+\tau^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
2.29±0.21±0.22	15k	³⁷ BESSON	07 CLEO	$e^+e^- \rightarrow \Upsilon(3S) \rightarrow \tau^+\tau^-$
³⁷ BESSON 07 reports $[\Gamma(\Upsilon(3S) \rightarrow \tau^+\tau^-)/\Gamma_{\text{total}}] / [B(\Upsilon(3S) \rightarrow \mu^+\mu^-)] = 1.05 \pm 0.08 \pm 0.05$ which we multiply by our best value $B(\Upsilon(3S) \rightarrow \mu^+\mu^-) = (2.18 \pm 0.21) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M048R18
 NODE=M048R18

NODE=M048R18;LINKAGE=BE

 $\Gamma(\tau^+\tau^-)/\Gamma(\mu^+\mu^-)$

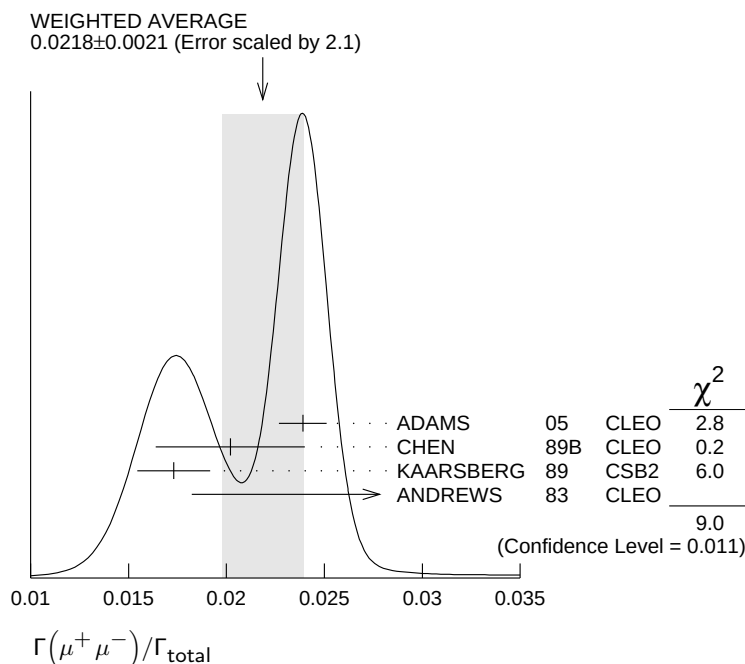
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
1.05±0.08±0.05	15k	BESSON	07 CLEO	$e^+e^- \rightarrow \Upsilon(3S)$

NODE=M048R19
 NODE=M048R19

 $\Gamma(\mu^+\mu^-)/\Gamma_{\text{total}}$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.0218±0.0021 OUR AVERAGE		Error includes scale factor of 2.1. See the ideogram below.		
0.0239±0.0007±0.0010	81k	ADAMS	05 CLEO	$e^+e^- \rightarrow \mu^+\mu^-$
0.0202±0.0019±0.0033		CHEN	89B CLEO	$e^+e^- \rightarrow \mu^+\mu^-$
0.0173±0.0015±0.0011		KAARSBERG	89 CSB2	$e^+e^- \rightarrow \mu^+\mu^-$
0.033 ±0.013 ±0.007	1096	ANDREWS	83 CLEO	$e^+e^- \rightarrow \mu^+\mu^-$

NODE=M048R1
 NODE=M048R1

 $\Gamma(ggg)/\Gamma_{\text{total}}$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
35.7±2.6	3M	³⁸ BESSON	06A CLEO	$\Upsilon(3S) \rightarrow \text{hadrons}$

NODE=M048R30
 NODE=M048R30

NODE=M048R30;LINKAGE=BE

³⁸ Calculated using BESSON 06A value of $\Gamma(\gamma gg)/\Gamma(ggg) = (2.72 \pm 0.06 \pm 0.32 \pm 0.37)\%$ and the PDG 08 values of $B(\Upsilon(2S) + \text{anything}) = (10.6 \pm 0.8)\%$, $B(\pi^+\pi^-\Upsilon(1S)) = (4.40 \pm 0.10)\%$, $B(\pi^0\pi^0\Upsilon(1S)) = (2.20 \pm 0.13)\%$, $B(\gamma\chi_{b2}(2P)) = (13.1 \pm 1.6)\%$, $B(\gamma\chi_{b1}(2P)) = (12.6 \pm 1.2)\%$, $B(\gamma\chi_{b0}(2P)) = (5.9 \pm 0.6)\%$, $B(\gamma\chi_{b0}(1P)) = (0.30 \pm 0.11)\%$, $B(\mu^+\mu^-) = (2.18 \pm 0.21)\%$, and $R_{\text{hadrons}} = 3.51$. The statistical error is negligible and the systematic error is partially correlated with $\Gamma(\gamma gg)/\Gamma_{\text{total}}$ BESSON 06A value.

$\Gamma(\gamma g g)/\Gamma_{\text{total}}$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
0.97±0.18	60k	³⁹ BESSON	06A CLEO	$\Upsilon(3S) \rightarrow \gamma + \text{hadrons}$

³⁹ Calculated using BESSON 06A values of $\Gamma(\gamma g g)/\Gamma(g g g) = (2.72 \pm 0.06 \pm 0.32 \pm 0.37)\%$ and $\Gamma(g g g)/\Gamma_{\text{total}}$. The statistical error is negligible and the systematic error is partially correlated with $\Gamma(g g g)/\Gamma_{\text{total}}$ BESSON 06A value.

 Γ_{18}/Γ

NODE=M048R31
NODE=M048R31

NODE=M048R31;LINKAGE=BE

 $\Gamma(\gamma g g)/\Gamma(g g g)$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
2.72±0.06±0.49	3M	BESSON	06A CLEO	$\Upsilon(3S) \rightarrow (\gamma +) \text{hadrons}$

 Γ_{18}/Γ_{17}

NODE=M048R32
NODE=M048R32

 $\Gamma(\gamma \chi_{b2}(2P))/\Gamma_{\text{total}}$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.131 ±0.016 OUR AVERAGE		Error includes scale factor of 3.4. See the ideogram below.		

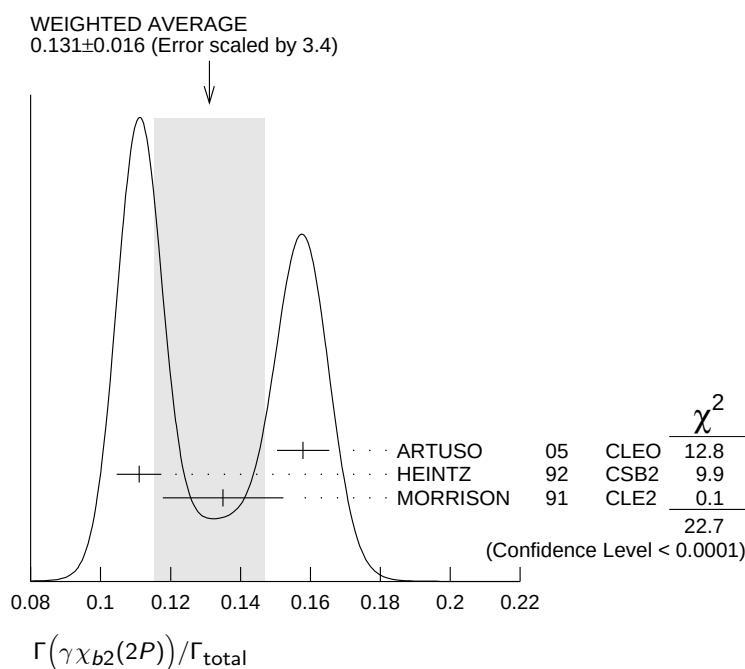
0.1579±0.0017±0.0073	568k	ARTUSO	05	CLEO	$e^+e^- \rightarrow \gamma X$
0.111 ±0.005 ±0.004	10319	⁴⁰ HEINTZ	92	CSB2	$e^+e^- \rightarrow \gamma X$
0.135 ±0.003 ±0.017	30741	MORRISON	91	CLE2	$e^+e^- \rightarrow \gamma X$

⁴⁰ Supersedes NARAIN 91.

 Γ_{19}/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.		

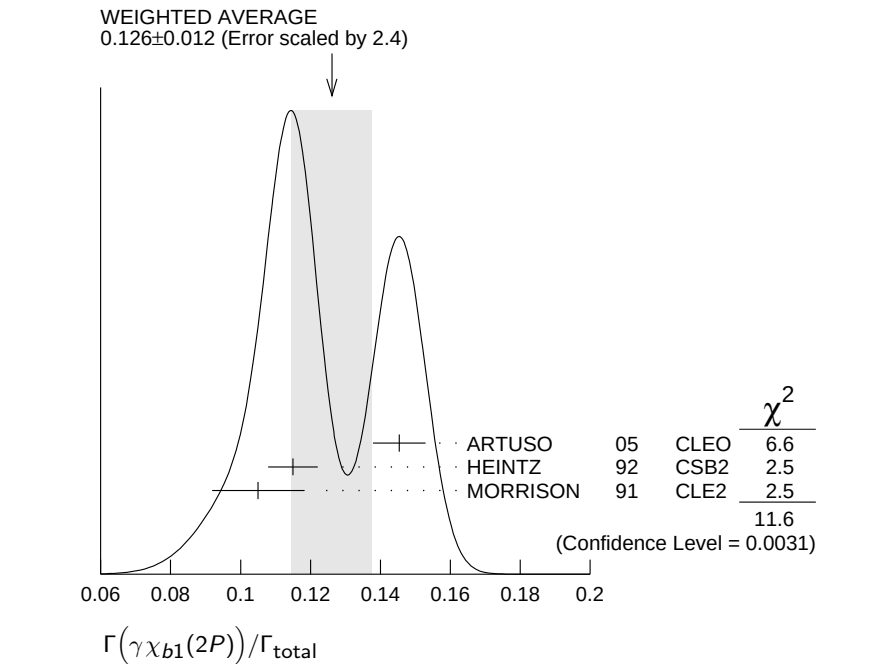
0.1454±0.0018±0.0073	537k	ARTUSO	05	CLEO	$e^+e^- \rightarrow \gamma X$
0.115 ±0.005 ±0.005	11147	⁴¹ HEINTZ	92	CSB2	$e^+e^- \rightarrow \gamma X$
0.105 $\begin{smallmatrix} +0.003 \\ -0.002 \end{smallmatrix}$ ±0.013	25759	MORRISON	91	CLE2	$e^+e^- \rightarrow \gamma X$

⁴¹ Supersedes NARAIN 91.

 Γ_{20}/Γ

NODE=M048R6
NODE=M048R6

NODE=M048R6;LINKAGE=H

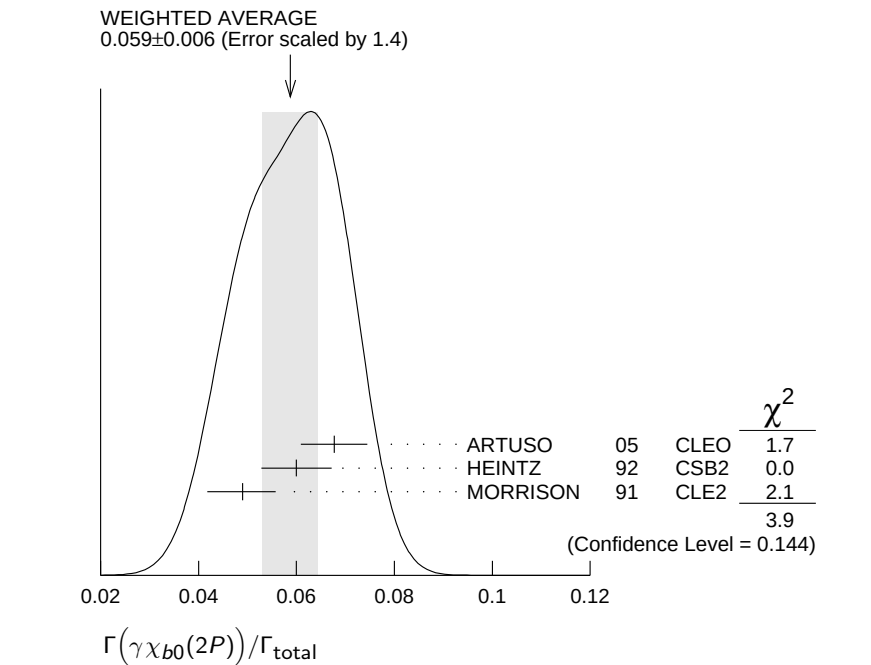


$\Gamma(\gamma\chi_{b0}(2P))/\Gamma_{\text{total}}$					Γ_{21}/Γ	
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT		
0.059 ±0.006 OUR AVERAGE					Error includes scale factor of 1.4. See the ideogram below.	
0.0677 ±0.0020 ±0.0065	225k	ARTUSO	05	CLEO	$e^+e^- \rightarrow \gamma X$	
0.060 ±0.004 ±0.006	4959	42 HEINTZ	92	CSB2	$e^+e^- \rightarrow \gamma X$	
0.049 $^{+0.003}_{-0.004}$ ±0.006	9903	MORRISON	91	CLE2	$e^+e^- \rightarrow \gamma X$	

⁴²Supersedes NARAIN 91.

NODE=M048R7
NODE=M048R7

NODE=M048R7;LINKAGE=H



$\Gamma(\gamma\chi_{b2}(1P))/\Gamma_{\text{total}}$					Γ_{22}/Γ	
VALUE (units 10 ⁻³)	CL% EVTS	DOCUMENT ID	TECN	COMMENT		
9.9±1.3 OUR AVERAGE					Error includes scale factor of 2.0.	
7.5±1.2±0.5	126	43,44 KORNICER	11	CLEO	$e^+e^- \rightarrow \gamma\gamma\ell^+\ell^-$	
10.5±0.3 $^{+0.7}_{-0.6}$	9.7k	LEES	11J	BABR	$\Upsilon(3S) \rightarrow X\gamma$	

• • • We do not use the following data for averages, fits, limits, etc. • • •

<19 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

⁴³ Assuming $B(\Upsilon(1S) \rightarrow \ell^+ \ell^-) = (2.48 \pm 0.05)\%$.

⁴⁴ KORNICER 11 reports $[\Gamma(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(1P))/\Gamma_{\text{total}}] \times [B(\chi_{b2}(1P) \rightarrow \gamma \Upsilon(1S))]$
 $= (1.435 \pm 0.162 \pm 0.169) \times 10^{-3}$ which we divide by our best value $B(\chi_{b2}(1P) \rightarrow \gamma \Upsilon(1S)) = (19.1 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

⁴⁵ ASNER 08A reports $[\Gamma(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(1P))/\Gamma_{\text{total}}] / [B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P))]$
 $< 27.1 \times 10^{-2}$ which we multiply by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P)) = 7.15 \times 10^{-2}$.

⁴⁶ HEINTZ 92, while unable to distinguish between different J states, measures $\sum_J B(\Upsilon(3S) \rightarrow \gamma \chi_{bJ}) \times B(\chi_{bJ} \rightarrow \gamma \Upsilon(1S)) = (1.7 \pm 0.4 \pm 0.6) \times 10^{-3}$ for $J = 0, 1, 2$ using inclusive $\Upsilon(1S)$ decays and $(1.2^{+0.4}_{-0.3} \pm 0.09) \times 10^{-3}$ for $J = 1, 2$ using $\Upsilon(1S) \rightarrow \ell^+ \ell^-$.

NODE=M048R21;LINKAGE=KA

NODE=M048R21;LINKAGE=KR

NODE=M048R21;LINKAGE=AS

NODE=M048R21;LINKAGE=HE

$\Gamma(\gamma \chi_{b1}(1P))/\Gamma_{\text{total}}$

Γ_{24}/Γ

VALUE (units 10^{-3})	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
0.9±0.5 OUR AVERAGE Error includes scale factor of 1.9.					
$1.6 \pm 0.5 \pm 0.1$		50	^{47,48} KORNICER	11 CLEO	$e^+ e^- \rightarrow \gamma \gamma \ell^+ \ell^-$
$0.5 \pm 0.3^{+0.2}_{-0.1}$			LEES	11J BABR	$\Upsilon(3S) \rightarrow X \gamma$

NODE=M048R22
 NODE=M048R22

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 1.7 90 ⁴⁹ ASNER 08A CLEO $\Upsilon(3S) \rightarrow \gamma + \text{hadrons}$
 seen ⁵⁰ HEINTZ 92 CSB2 $e^+ e^- \rightarrow \gamma \gamma \ell^+ \ell^-$

⁴⁷ Assuming $B(\Upsilon(1S) \rightarrow \ell^+ \ell^-) = (2.48 \pm 0.05)\%$.

⁴⁸ KORNICER 11 reports $[\Gamma(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(1P))/\Gamma_{\text{total}}] \times [B(\chi_{b1}(1P) \rightarrow \gamma \Upsilon(1S))]$
 $= (5.38 \pm 1.20 \pm 0.95) \times 10^{-4}$ which we divide by our best value $B(\chi_{b1}(1P) \rightarrow \gamma \Upsilon(1S)) = (33.9 \pm 2.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

⁴⁹ ASNER 08A reports $[\Gamma(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(1P))/\Gamma_{\text{total}}] / [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))]$
 $< 2.5 \times 10^{-2}$ which we multiply by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = 6.9 \times 10^{-2}$.

⁵⁰ HEINTZ 92, while unable to distinguish between different J states, measures $\sum_J B(\Upsilon(3S) \rightarrow \gamma \chi_{bJ}) \times B(\chi_{bJ} \rightarrow \gamma \Upsilon(1S)) = (1.7 \pm 0.4 \pm 0.6) \times 10^{-3}$ for $J = 0, 1, 2$ using inclusive $\Upsilon(1S)$ decays and $(1.2^{+0.4}_{-0.3} \pm 0.09) \times 10^{-3}$ for $J = 1, 2$ using $\Upsilon(1S) \rightarrow \ell^+ \ell^-$.

NODE=M048R22;LINKAGE=KA

NODE=M048R22;LINKAGE=KR

NODE=M048R22;LINKAGE=AS

NODE=M048R22;LINKAGE=HE

$\Gamma(\gamma \chi_{b0}(1P))/\Gamma_{\text{total}}$

Γ_{25}/Γ

VALUE (units 10^{-2})	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
0.27±0.04 OUR AVERAGE					
$0.27 \pm 0.04 \pm 0.02$		2.3k	LEES	11J BABR	$\Upsilon(3S) \rightarrow X \gamma$
$0.30 \pm 0.04 \pm 0.10$		8.7k	ARTUSO	05 CLEO	$e^+ e^- \rightarrow \gamma X$

NODE=M048R15
 NODE=M048R15

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 0.8 90 ⁵¹ ASNER 08A CLEO $\Upsilon(3S) \rightarrow \gamma + \text{hadrons}$

⁵¹ ASNER 08A reports $[\Gamma(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(1P))/\Gamma_{\text{total}}] / [B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))]$
 $< 21.9 \times 10^{-2}$ which we multiply by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P)) = 3.8 \times 10^{-2}$.

NODE=M048R15;LINKAGE=AS

$\Gamma(\gamma \eta_b(2S))/\Gamma_{\text{total}}$

Γ_{26}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 6.2 90 ARTUSO 05 CLEO $e^+ e^- \rightarrow \gamma X$				
• • • We do not use the following data for averages, fits, limits, etc. • • •				
< 19	90	LEES	11J BABR	$\Upsilon(3S) \rightarrow X \gamma$

NODE=M048R16
 NODE=M048R16

$\Gamma(\gamma \eta_b(1S))/\Gamma_{\text{total}}$

Γ_{27}/Γ

VALUE (units 10^{-4})	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
5.1±0.7 OUR AVERAGE					
$7.1 \pm 1.8 \pm 1.3$	$2.3 \pm 0.5k$	⁵² BONVICINI	10 CLEO	$\Upsilon(3S) \rightarrow \gamma X$	
$4.8 \pm 0.5 \pm 0.6$	$19 \pm 3k$	⁵² AUBERT	09AQ BABR	$\Upsilon(3S) \rightarrow \gamma X$	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 8.5	90	LEES	11J BABR	$\Upsilon(3S) \rightarrow X \gamma$	
$4.8 \pm 0.5 \pm 1.2$	$19 \pm 3k$	^{52,53} AUBERT	08V BABR	$\Upsilon(3S) \rightarrow \gamma X$	
< 4.3	90	⁵⁴ ARTUSO	05 CLEO	$e^+ e^- \rightarrow \gamma X$	

NODE=M048R17
 NODE=M048R17

⁵² Assuming $\Gamma_{\eta_b(1S)} = 10 \text{ MeV}$.

⁵³ Systematic error re-evaluated by AUBERT 09AQ.

⁵⁴ Superseded by BONVICINI 10.

NODE=M048R17;LINKAGE=BO

NODE=M048R17;LINKAGE=AU

NODE=M048R17;LINKAGE=SU

$\Gamma(\gamma X \rightarrow \gamma + \geq 4 \text{ prongs})/\Gamma_{\text{total}}$ (1.5 GeV < m_X < 5.0 GeV) Γ_{28}/Γ

NODE=M048R20

NODE=M048R20

NODE=M048R20

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<2.2	95	ROSNER	07A CLEO	$e^+e^- \rightarrow \gamma X$

 $\Gamma(\gamma a_1^0 \rightarrow \gamma \mu^+ \mu^-)/\Gamma_{\text{total}}$ Γ_{29}/Γ

NODE=M048R04

NODE=M048R04

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<5.5	90	⁵⁵ AUBERT	09Z BABR	$e^+e^- \rightarrow \gamma a_1^0 \rightarrow \gamma \mu^+ \mu^-$

⁵⁵ For a narrow scalar or pseudoscalar a_1^0 with mass in the range 212–9300 MeV, excluding J/ψ and $\psi(2S)$. Measured 90% CL limits as a function of $m_{a_1^0}$ range from $0.27\text{--}5.5 \times 10^{-6}$.

NODE=M048R04;LINKAGE=AU

 $\Gamma(\gamma a_1^0 \rightarrow \gamma \tau^+ \tau^-)/\Gamma_{\text{total}}$ Γ_{30}/Γ

NODE=M048R29

NODE=M048R29

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
< 1.6×10^{-4}	90	⁵⁶ AUBERT	09P BABR	$e^+e^- \rightarrow \gamma a_1^0 \rightarrow \gamma \tau^+ \tau^-$

⁵⁶ For a narrow scalar or pseudoscalar a_1^0 with $M(\tau^+ \tau^-)$ in the ranges 4.03–9.52 and 9.61–10.10 GeV. Measured 90% CL limits as a function of $M(\tau^+ \tau^-)$ range from $1.5\text{--}16 \times 10^{-5}$.

NODE=M048R29;LINKAGE=AU

 $\Gamma(\gamma A^0 \rightarrow \gamma \text{hadrons})/\Gamma_{\text{total}}$ (0.3 GeV < m_{A^0} < 7 GeV) Γ_{23}/Γ

NODE=M048R02

NODE=M048R02

NODE=M048R02

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
< 8×10^{-5}	90	⁵⁷ LEES	11H BABR	$\Upsilon(3S) \rightarrow \gamma \text{hadrons}$

⁵⁷ For a narrow scalar or pseudoscalar A^0 , excluding known resonances, with mass in the range 0.3–7 GeV. Measured 90% CL limits as a function of m_{A^0} range from 1×10^{-6} to 8×10^{-5} .

NODE=M048R02;LINKAGE=LE

LEPTON FAMILY NUMBER (LF) VIOLATING MODES

NODE=M048230

 $\Gamma(e^\pm \tau^\mp)/\Gamma_{\text{total}}$ Γ_{31}/Γ

NODE=M048R01

NODE=M048R01

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<4.2	90	LEES	10B BABR	$e^+e^- \rightarrow e^\pm \tau^\mp$

 $\Gamma(\mu^\pm \tau^\mp)/\Gamma_{\text{total}}$ Γ_{32}/Γ

NODE=M048R23

NODE=M048R23

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
< 3.1	90	LEES	10B BABR	$e^+e^- \rightarrow \mu^\pm \tau^\mp$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<20.3	95	LOVE	08A CLEO	$e^+e^- \rightarrow \mu^\pm \tau^\mp$

 $\Upsilon(3S)$ REFERENCES

NODE=M048

GE	11	PR D84 032008	J.Y. Ge <i>et al.</i>	(CLEO Collab.)	REFID=53960
KORNICER	11	PR D83 054003	M. Kornicer <i>et al.</i>	(CLEO Collab.)	REFID=16769
LEES	11C	PR D84 011104	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=16775
LEES	11H	PRL 107 221803	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=53877
LEES	11J	PR D84 072002	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=53936
LEES	11K	PR D84 091101	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=53937
LEES	11L	PR D84 092003	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=53938
BONVICINI	10	PR D81 031104	G. Bonvicini <i>et al.</i>	(CLEO Collab.)	REFID=53231
LEES	10B	PRL 104 151802	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=53355
AUBERT	09AQ	PRL 103 161801	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=53106
AUBERT	09P	PRL 103 181801	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=53062
AUBERT	09Z	PRL 103 081803	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52930
BHARI	09	PR D79 011103	S.R. Bhari <i>et al.</i>	(CLEO Collab.)	REFID=52662
ASNER	08A	PR D78 091103	D.M. Asner <i>et al.</i>	(CLEO Collab.)	REFID=52574
AUBERT	08BP	PR D78 112002	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52660
AUBERT	08V	PRL 101 071801	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52262
HE	08A	PRL 101 192001	Q. He <i>et al.</i>	(CLEO Collab.)	REFID=52587
LOVE	08A	PRL 101 201601	W. Love <i>et al.</i>	(CLEO Collab.)	REFID=52592
PDG	08	PL B667 1	C. Amsler <i>et al.</i>	(PDG Collab.)	REFID=52166
BESSION	07	PRL 98 052002	D. Besson <i>et al.</i>	(CLEO Collab.)	REFID=51620
ROSNER	07A	PR D76 117102	J.L. Rosner <i>et al.</i>	(CLEO Collab.)	REFID=52079
BESSION	06A	PR D74 012003	D. Besson <i>et al.</i>	(CLEO Collab.)	REFID=51147
ROSNER	06	PRL 96 092003	J.L. Rosner <i>et al.</i>	(CLEO Collab.)	REFID=51035
ADAMS	05	PRL 94 012001	G.S. Adams <i>et al.</i>	(CLEO Collab.)	REFID=50452
ARTUSO	05	PRL 94 032001	M. Artuso <i>et al.</i>	(CLEO Collab.)	REFID=50454
ARTAMONOV	00	PL B474 427	A.S. Artamonov <i>et al.</i>		REFID=47424
BUTLER	94B	PR D49 40	F. Butler <i>et al.</i>	(CLEO Collab.)	REFID=43799

WU	93	PL B301 307	Q.W. Wu <i>et al.</i>	(CUSB Collab.)
HEINTZ	92	PR D46 1928	U. Heintz <i>et al.</i>	(CUSB II Collab.)
BROCK	91	PR D43 1448	I.C. Brock <i>et al.</i>	(CLEO Collab.)
HEINTZ	91	PRL 66 1563	U. Heintz <i>et al.</i>	(CUSB Collab.)
MORRISON	91	PRL 67 1696	R.J. Morrison <i>et al.</i>	(CLEO Collab.)
NARAIN	91	PRL 66 3113	M. Narain <i>et al.</i>	(CUSB Collab.)
CHEN	89B	PR D39 3528	W.Y. Chen <i>et al.</i>	(CLEO Collab.)
KAARSBERG	89	PRL 62 2077	T.M. Kaarsberg <i>et al.</i>	(CUSB Collab.)
BUCHMUEL...	88	HE e^+e^- Physics 412	W. Buchmueller, S. Cooper	(HANN, DESY, MIT)
Editors: A. Ali and P. Soeding, World Scientific, Singapore				
COHEN	87	RMP 59 1121	E.R. Cohen, B.N. Taylor	(RISC, NBS)
BARU	86B	ZPHY C32 622 (erratum)	S.E. Baru <i>et al.</i>	(NOVO)
KURAEV	85	SJNP 41 466	E.A. Kuraev, V.S. Fadin	(NOVO)
Translated from YAF 41 733.				
ARTAMONOV	84	PL 137B 272	A.S. Artamonov <i>et al.</i>	(NOVO)
GILES	84B	PR D29 1285	R. Giles <i>et al.</i>	(CLEO Collab.)
ANDREWS	83	PRL 50 807	D.E. Andrews <i>et al.</i>	(CLEO Collab.)
GREEN	82	PRL 49 617	J. Green <i>et al.</i>	(CLEO Collab.)
MAGERAS	82	PL 118B 453	G. Mageras <i>et al.</i>	(COLU, CORN, LSU+)

REFID=43313
REFID=43604
REFID=41579
REFID=41580
REFID=41634
REFID=41586
REFID=40919
REFID=40733
REFID=40034

REFID=11616
REFID=22338
REFID=40033

REFID=22278
REFID=22280
REFID=22273
REFID=22321
REFID=22359

NODE=M206

$\chi_b(3P)$

$$I^G(J^{PC}) = ?^?(?^{?+})$$

A mixture of $J = 0, 1$, and 2 spin components observed in the radiative decay to $\Upsilon(1S)$ and $\Upsilon(2S)$, therefore $C = +$.

NODE=M206

$\chi_b(3P)$ MASS

NODE=M206M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
10534 ± 9 OUR AVERAGE			
10530 ± 5 ± 9	¹ AAD	12A ATLS	$pp \rightarrow \gamma \mu^+ \mu^- X$
10551 ± 14 ± 17	¹ ABAZOV	12Q D0	$p\bar{p} \rightarrow \gamma \mu^+ \mu^- X$

NODE=M206M

¹ The mass barycenter of the merged lineshapes from the $J = 1$ and 2 states.

NODE=M206M;LINKAGE=AA

$\chi_b(3P)$ DECAY MODES

NODE=M206215;NODE=M206

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \Upsilon(1S)\gamma$	seen
$\Gamma_2 \quad \Upsilon(2S)\gamma$	seen

DESIG=1

DESIG=2

$\chi_b(3P)$ BRANCHING RATIOS

NODE=M206225

$\Gamma(\Upsilon(1S)\gamma)/\Gamma_{\text{total}}$	DOCUMENT ID	TECN	COMMENT	Γ_1/Γ
VALUE				
seen	AAD	12A ATLS	$pp \rightarrow \gamma \mu^+ \mu^- X$	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
seen	ABAZOV	12Q D0	$p\bar{p} \rightarrow \gamma \mu^+ \mu^- X$	
$\Gamma(\Upsilon(2S)\gamma)/\Gamma_{\text{total}}$	DOCUMENT ID	TECN	COMMENT	Γ_2/Γ
VALUE				
seen	AAD	12A ATLS	$pp \rightarrow \gamma \mu^+ \mu^- X$	

NODE=M206R01
NODE=M206R01

NODE=M206R02
NODE=M206R02

$\chi_b(3P)$ REFERENCES

NODE=M206

AAD	12A	PRL 108 152001	G. Aad <i>et al.</i>	(ATLAS Collab.)
ABAZOV	12Q	PR D86 031103	V.M. Abazov <i>et al.</i>	(D0 Collab.)

REFID=54037
REFID=54264

$\Upsilon(4S)$
or $\Upsilon(10580)$

$$J^{PC} = 0^-(1^{--})$$

NODE=M047

$\Upsilon(4S)$ MASS

NODE=M047M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
10579.4±1.2 OUR AVERAGE			
10579.3±0.4±1.2	AUBERT	05Q BABR	$e^+e^- \rightarrow$ hadrons
10580.0±3.5	¹ BEBEK	87 CLEO	$e^+e^- \rightarrow$ hadrons
• • • We do not use the following data for averages, fits, limits, etc. • • •			
10577.4±1.0	² LOVELOCK	85 CUSB	$e^+e^- \rightarrow$ hadrons
¹ Reanalysis of BESSON 85.			
² No systematic error given.			

NODE=M047M

NODE=M047M;LINKAGE=C
NODE=M047M;LINKAGE=B

$\Upsilon(4S)$ WIDTH

NODE=M047W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
20.5±2.5 OUR AVERAGE			
20.7±1.6±2.5	AUBERT	05Q BABR	$e^+e^- \rightarrow$ hadrons
20 ±2 ±4	BESSON	85 CLEO	$e^+e^- \rightarrow$ hadrons
• • • We do not use the following data for averages, fits, limits, etc. • • •			
25 ±2.5	LOVELOCK	85 CUSB	$e^+e^- \rightarrow$ hadrons

NODE=M047W

$\Upsilon(4S)$ DECAY MODES

NODE=M047215;NODE=M047

Mode	Fraction (Γ_i/Γ)	Confidence level
$\Gamma_1 \quad B\bar{B}$	> 96 %	95%
$\Gamma_2 \quad B^+B^-$	(51.4 ±0.6) %	
$\Gamma_3 \quad D_s^+ \text{ anything } + \text{ c.c.}$	(17.8 ±2.6) %	
$\Gamma_4 \quad B^0\bar{B}^0$	(48.6 ±0.6) %	
$\Gamma_5 \quad J/\psi K_S^0 (J/\psi, \eta_c) K_S^0$	< 4 × 10 ⁻⁷	90%
$\Gamma_6 \quad \text{non-} B\bar{B}$	< 4 %	95%
$\Gamma_7 \quad e^+e^-$	(1.57±0.08) × 10 ⁻⁵	
$\Gamma_8 \quad \rho^+\rho^-$	< 5.7 × 10 ⁻⁶	90%
$\Gamma_9 \quad K^*(892)^0 \bar{K}^0$	< 2.0 × 10 ⁻⁶	90%
$\Gamma_{10} \quad J/\psi(1S) \text{ anything}$	< 1.9 × 10 ⁻⁴	95%
$\Gamma_{11} \quad D^{*+} \text{ anything } + \text{ c.c.}$	< 7.4 %	90%
$\Gamma_{12} \quad \phi \text{ anything}$	(7.1 ±0.6) %	
$\Gamma_{13} \quad \phi\eta$	< 1.8 × 10 ⁻⁶	90%
$\Gamma_{14} \quad \phi\eta'$	< 4.3 × 10 ⁻⁶	90%
$\Gamma_{15} \quad \rho\eta$	< 1.3 × 10 ⁻⁶	90%
$\Gamma_{16} \quad \rho\eta'$	< 2.5 × 10 ⁻⁶	90%
$\Gamma_{17} \quad \Upsilon(1S) \text{ anything}$	< 4 × 10 ⁻³	90%
$\Gamma_{18} \quad \Upsilon(1S)\pi^+\pi^-$	(8.1 ±0.6) × 10 ⁻⁵	
$\Gamma_{19} \quad \Upsilon(1S)\eta$	(1.96±0.28) × 10 ⁻⁴	
$\Gamma_{20} \quad \Upsilon(2S)\pi^+\pi^-$	(8.6 ±1.3) × 10 ⁻⁵	
$\Gamma_{21} \quad h_b(1P)\pi^+\pi^-$	not seen	
$\Gamma_{22} \quad \bar{d} \text{ anything}$	< 1.3 × 10 ⁻⁵	90%

DESIG=8;OUR EST;→ UNCHECKED ←
DESIG=10
DESIG=12
DESIG=11
DESIG=15
DESIG=6
DESIG=1
DESIG=16
DESIG=22
DESIG=2
DESIG=3
DESIG=4
DESIG=13
DESIG=18
DESIG=19
DESIG=20
DESIG=5
DESIG=7
DESIG=17
DESIG=9
DESIG=21
DESIG=14

$\Upsilon(4S)$ PARTIAL WIDTHS

NODE=M047220

$\Gamma(e^+e^-)$

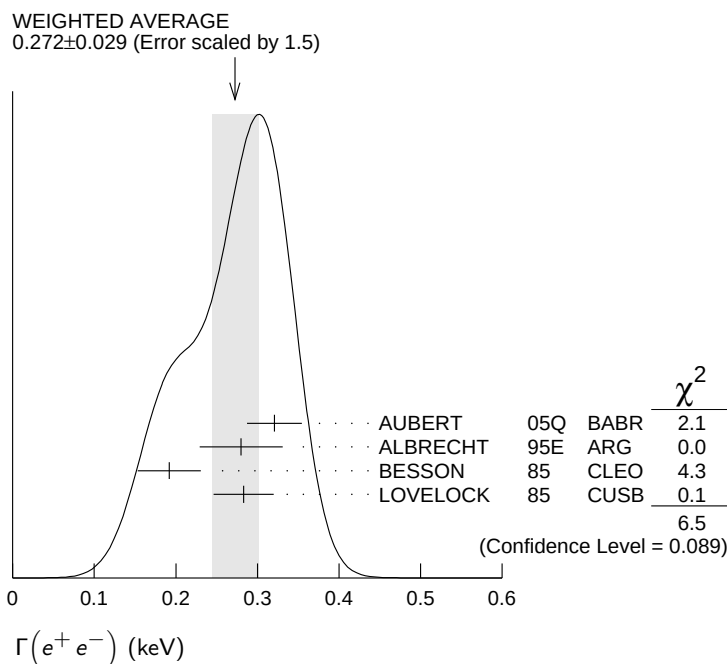
Γ_7

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
0.272±0.029 OUR AVERAGE	Error includes scale factor of 1.5. See the ideogram below.		
0.321±0.017±0.029	AUBERT	05Q BABR	$e^+e^- \rightarrow$ hadrons
0.28 ±0.05 ±0.01	³ ALBRECHT	95E ARG	$e^+e^- \rightarrow$ hadrons
0.192±0.007±0.038	BESSON	85 CLEO	$e^+e^- \rightarrow$ hadrons
0.283±0.037	LOVELOCK	85 CUSB	$e^+e^- \rightarrow$ hadrons

NODE=M047W1
NODE=M047W1

³ Using LEYAOUANC 77 parametrization of $\Gamma(s)$.

NODE=M047W1;LINKAGE=A



$\Upsilon(4S)$ BRANCHING RATIOS

$B\bar{B}$ DECAYS

The ratio of branching fraction to charged and neutral B mesons is often derived assuming isospin invariance in the decays, and relies on the knowledge of the B^+/B^0 lifetime ratio. "OUR EVALUATION" is obtained based on averages of rescaled data listed below. The average and rescaling were performed by the Heavy Flavor Averaging Group (HFAG) and are described at <http://www.slac.stanford.edu/xorg/hfag/>. The averaging/rescaling procedure takes into account the common dependence of the measurement on the value of the lifetime ratio.

NODE=M047230

NODE=M047BBD

NODE=M047BBD

$\Gamma(B^+B^-)/\Gamma_{\text{total}}$

Γ_2/Γ

VALUE

DOCUMENT ID

0.514±0.006 OUR EVALUATION
OUR 2013 EVALUATION]

Assuming $B(\Upsilon(4S) \rightarrow B\bar{B}) = 1$ [0.513 ± 0.006

NODE=M047R11

NODE=M047R11

NEW;→ 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 $e^+e^- \rightarrow D_s X$

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

NODE=M047R13

NODE=M047R13;LINKAGE=AR

$\Gamma(B^0\bar{B}^0)/\Gamma_{\text{total}}$

Γ_4/Γ

VALUE

DOCUMENT ID

TECN

COMMENT

0.486±0.006 OUR EVALUATION
OUR 2013 EVALUATION]

Assuming $B(\Upsilon(4S) \rightarrow B\bar{B}) = 1$ [0.487 ± 0.006

• • • 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

NODE=M047R12

NEW;→ UNCHECKED ←

NODE=M047R12;LINKAGE=AR

$\Gamma(B^+ B^-)/\Gamma(B^0 \bar{B}^0)$ Γ_2/Γ_4

VALUE	DOCUMENT ID	TECN	COMMENT
1.058 ± 0.024 OUR EVALUATION			
[1.055 ± 0.025 OUR 2013 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 $\Upsilon(4S) \rightarrow B \bar{B} \rightarrow$ 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 $\Upsilon(4S) \rightarrow B \bar{B} \rightarrow J/\psi K^*$

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
 NODE=M047R10
 NEW;→ UNCHECKED ←

NODE=M047R10;LINKAGE=F
 NODE=M047R10;LINKAGE=D
 NODE=M047R10;LINKAGE=E
 NODE=M047R10;LINKAGE=C

 $\Gamma(J/\psi K_S^0(J/\psi, \eta_c) K_S^0)/\Gamma_{\text{total}}$ Γ_5/Γ Forbidden by CP invariance.

VALUE (units 10^{-7})	CL%	DOCUMENT ID	TECN	COMMENT
<4	90	¹⁰ TAJIMA	07A	BELL $\Upsilon(4S) \rightarrow B^0 \bar{B}^0$
¹⁰ $\Upsilon(4S)$ with $CP = +1$ decays to the final state with $CP = -1$.				

NODE=M047R16
 NODE=M047R16
 NODE=M047R16

NODE=M047R16;LINKAGE=TA

NODE=M047NBB

non- $B \bar{B}$ DECAYS $\Gamma(\text{non-} B \bar{B})/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.04	95	BARISH	96B	CLEO $e^+ e^-$

NODE=M047R6
 NODE=M047R6

 $\Gamma(e^+ e^-)/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
1.57 ± 0.08 OUR AVERAGE			
1.55 ± 0.04 ± 0.07	AUBERT	05Q	BABR $e^+ e^- \rightarrow$ hadrons
2.77 ± 0.50 ± 0.49	¹¹ ALBRECHT	95E	ARG $e^+ e^- \rightarrow$ 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	08B0	BABR $e^+ e^- \rightarrow \pi^+ \pi^- 2\pi^0$

NODE=M047R17
 NODE=M047R17

 $\Gamma(K^*(892)^0 \bar{K}^0)/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<2.0 × 10⁻⁶	90	SHEN	13A	BELL $e^+ e^- \rightarrow K^*(892)^0 \bar{K}^0$

NODE=M047R02
 NODE=M047R02

 $\Gamma(J/\psi(1S) \text{ anything})/\Gamma_{\text{total}}$ Γ_{10}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.9	95	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 ± 0.1 ± 0.6		HUANG	07	CLEO $\Upsilon(4S) \rightarrow \phi X$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.23	90	¹⁴ ALEXANDER	90C	CLEO $e^+ e^-$

¹⁴ For $x > 0.52$.

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 ± 1.3 ± 0.2	113 ± 16	¹⁹	SOKOLOV 09	BELL	$e^+e^- \rightarrow \pi^+\pi^-\mu^+\mu^-$
8.00 ± 0.64 ± 0.27	430	²⁰	AUBERT 08BP	BABR	$\Upsilon(4S) \rightarrow \pi^+\pi^-\ell^+\ell^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
17.8 ± 4.0 ± 0.3		^{21,22}	SOKOLOV 07	BELL	$e^+e^- \rightarrow \pi^+\pi^-\mu^+\mu^-$
9.0 ± 1.5 ± 0.2	167 ± 19	²³	AUBERT 06R	BABR	$e^+e^- \rightarrow \pi^+\pi^-\mu^+\mu^-$
<12	90		GLENN 99	CLE2	e^+e^-

NODE=M047R7
 NODE=M047R7

NODE=M047R7;LINKAGE=SK

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 $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.05)\%$.

NODE=M047R7;LINKAGE=UB

²¹ SOKOLOV 07 reports $[\Gamma(\Upsilon(4S) \rightarrow \Upsilon(1S)\pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(1S) \rightarrow \mu^+\mu^-)] = (4.42 \pm 0.81 \pm 0.56) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.05) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M047R7;LINKAGE=SO

²² According to the authors, systematic errors were underestimated.

²³ Superseded by AUBERT 08BP. AUBERT 06R reports $[\Gamma(\Upsilon(4S) \rightarrow \Upsilon(1S)\pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(1S) \rightarrow \mu^+\mu^-)] = (2.23 \pm 0.25 \pm 0.27) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.05) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M047R7;LINKAGE=US
 NODE=M047R7;LINKAGE=AU

 $\Gamma(\Upsilon(1S)\eta)/\Gamma_{\text{total}}$ Γ_{19}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.96 ± 0.26 ± 0.09	56	²⁴ AUBERT	08BP BABR	$\Upsilon(4S) \rightarrow \pi^+\pi^-\pi^0\ell^+\ell^-$
²⁴ Using $B(\Upsilon(1S) \rightarrow e^+e^-) = (2.38 \pm 0.11)\%$ and $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.05)\%$.				

NODE=M047R18
 NODE=M047R18

NODE=M047R18;LINKAGE=UB

 $\Gamma(\Upsilon(1S)\eta)/\Gamma(\Upsilon(1S)\pi^+\pi^-)$ Γ_{19}/Γ_{18}

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
2.41 ± 0.40 ± 0.12	56	²⁵ AUBERT	08BP BABR	$\Upsilon(4S) \rightarrow \pi^+\pi^-(\pi^0)\ell^+\ell^-$
²⁵ Not independent of other values reported by AUBERT 08BP.				

NODE=M047R19
 NODE=M047R19

NODE=M047R19;LINKAGE=UB

$$\Gamma(\Upsilon(2S)\pi^+\pi^-)/\Gamma_{\text{total}} \quad \Gamma_{20}/\Gamma$$

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$0.86 \pm 0.11 \pm 0.07$		220	²⁶ AUBERT	08BP BABR	$\Upsilon(4S) \rightarrow \pi^+\pi^-\ell^+\ell^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$0.88 \pm 0.17 \pm 0.08$	97 ± 15		²⁷ AUBERT	06R BABR	$e^+e^- \rightarrow \pi^+\pi^-\mu^+\mu^-$
<3.9	90		GLENN	99 CLE2	e^+e^-

²⁶ Using $B(\Upsilon(2S) \rightarrow e^+e^-) = (1.91 \pm 0.16)\%$ and $B(\Upsilon(2S) \rightarrow \mu^+\mu^-) = (1.93 \pm 0.17)\%$.

²⁷ Superseded by AUBERT 08BP. AUBERT 06R reports $[\Gamma(\Upsilon(4S) \rightarrow \Upsilon(2S)\pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \mu^+\mu^-)] = (1.69 \pm 0.26 \pm 0.20) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \mu^+\mu^-) = (1.93 \pm 0.17) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M047R9
NODE=M047R9

NODE=M047R9;LINKAGE=UB

NODE=M047R9;LINKAGE=AU

$$\Gamma(\Upsilon(2S)\pi^+\pi^-)/\Gamma(\Upsilon(1S)\pi^+\pi^-) \quad \Gamma_{20}/\Gamma_{18}$$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$1.16 \pm 0.16 \pm 0.14$	220	²⁸ AUBERT	08BP BABR	$\Upsilon(4S) \rightarrow \pi^+\pi^-\ell^+\ell^-$
²⁸ Using $B(\Upsilon(1S) \rightarrow e^+e^-) = (2.38 \pm 0.11)\%$, $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.05)\%$, $B(\Upsilon(2S) \rightarrow e^+e^-) = (1.91 \pm 0.16)\%$, and $B(\Upsilon(2S) \rightarrow \mu^+\mu^-) = (1.93 \pm 0.17)\%$. Not independent of other values reported by AUBERT 08BP.				

NODE=M047R20
NODE=M047R20

NODE=M047R20;LINKAGE=UB

$$\Gamma(h_b(1P)\pi^+\pi^-)/\Gamma_{\text{total}} \quad \Gamma_{21}/\Gamma$$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
not seen	$35 \pm 21k$	²⁹ ADACHI	12 BELL	$10.58 e^+e^- \rightarrow h_b(1P)\pi^+\pi^-$

²⁹ From the upper limit on the ratio of $\sigma(e^+e^- \rightarrow h_b(1P)\pi^+\pi^-)$ at the $\Upsilon(4S)$ to that at the $\Upsilon(5S)$ of 0.27.

NODE=M047R01
NODE=M047R01

NODE=M047R01;LINKAGE=AD

$$\Gamma(\bar{d} \text{ anything})/\Gamma_{\text{total}} \quad \Gamma_{22}/\Gamma$$

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<1.3	90	ASNER	07 CLEO	$e^+e^- \rightarrow \bar{d}X$

NODE=M047R15
NODE=M047R15

$\Upsilon(4S)$ REFERENCES

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.)
AUBERT	05Q	PR D72 032005	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT,B	05H	PRL 95 042001	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT	04F	PR D69 071101	B. Aubert <i>et al.</i>	
HASTINGS	03	PR D67 052004	N.C. Hastings <i>et al.</i>	(BELLE Collab.)
ABE	02D	PRL 88 052001	K. Abe <i>et al.</i>	(BELLE Collab.)
ATHAR	02	PR D66 052003	S.B. Athar <i>et al.</i>	(CLEO Collab.)
AUBERT	02	PR D65 032001	B. Aubert <i>et al.</i>	(BaBar Collab.)
ALEXANDER	01	PRL 86 2737	J.P. Alexander <i>et al.</i>	(CLEO Collab.)
AUBERT	01C	PRL 87 162002	B. Aubert <i>et al.</i>	(BaBar Collab.)
GLENN	99	PR D59 052003	S. Glenn <i>et al.</i>	
BARISH	96B	PRL 76 1570	B.C. Barish <i>et al.</i>	(CLEO Collab.)
ALBRECHT	95E	ZPHY C65 619	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
BARISH	95	PR D51 1014	B.C. Barish <i>et al.</i>	(CLEO Collab.)
ALEXANDER	90C	PRL 64 2226	J. Alexander <i>et al.</i>	(CLEO Collab.)
BEBEK	87	PR D36 1289	C. Bebek <i>et al.</i>	(CLEO Collab.)
BESSON	85	PRL 54 381	D. Besson <i>et al.</i>	(CLEO Collab.)
LOVELOCK	85	PRL 54 377	D.M.J. Lovelock <i>et al.</i>	(CUSP Collab.)
LEYAOUANC	77	PL B71 397	A. Le Yaouanc <i>et al.</i>	(ORSAY)

NODE=M047

REFID=55591
REFID=53962
REFID=53107
REFID=52760
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REFID=22369
REFID=44695

$X(10610)^\pm$

$$J^G(J^P) = 1^+(1^+)$$

NODE=M207

OMITTED FROM SUMMARY TABLE

Observed by BONDAR 12 in $\Upsilon(5S)$ decays to $\Upsilon(nS)\pi^+\pi^-$ ($n = 1, 2, 3$) and $h_b(mP)\pi^+\pi^-$ ($m = 1, 2$). $J^P = 1^+$ is favored from angular analyses. 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

 $X(10610)^\pm$ MASS

NODE=M207M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
10607.2$\pm$2.0	¹ BONDAR	12	BELL $e^+e^- \rightarrow$ hadrons
• • • We do not use the following data for averages, fits, limits, etc. • • •			
10611 $\pm 4 \pm 3$	² BONDAR	12	BELL $e^+e^- \rightarrow \Upsilon(1S)\pi^+\pi^-$
10609 $\pm 2 \pm 3$	² BONDAR	12	BELL $e^+e^- \rightarrow \Upsilon(2S)\pi^+\pi^-$
10608 $\pm 2 \pm 3$	² BONDAR	12	BELL $e^+e^- \rightarrow \Upsilon(3S)\pi^+\pi^-$
10605 $\pm 2 \begin{smallmatrix} +3 \\ -1 \end{smallmatrix}$	² BONDAR	12	BELL $e^+e^- \rightarrow h_b(1P)\pi^+\pi^-$
10599 $\begin{smallmatrix} +6 \\ -3 \end{smallmatrix} \begin{smallmatrix} +5 \\ -4 \end{smallmatrix}$	² BONDAR	12	BELL $e^+e^- \rightarrow h_b(2P)\pi^+\pi^-$

NODE=M207M

¹ Average of the BONDAR 12 measurements in separate channels.² Superseded by the average measurement of BONDAR 12.

NODE=M207M;LINKAGE=BO

NODE=M207M;LINKAGE=BN

 $X(10610)^\pm$ WIDTH

NODE=M207W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
18.4$\pm$ 2.4	³ BONDAR	12	BELL $e^+e^- \rightarrow$ hadrons
• • • We do not use the following data for averages, fits, limits, etc. • • •			
22.3 $\pm$ 7.7 $\begin{smallmatrix} +3.0 \\ -4.0 \end{smallmatrix}$	⁴ BONDAR	12	BELL $e^+e^- \rightarrow \Upsilon(1S)\pi^+\pi^-$
24.2 $\pm$ 3.1 $\begin{smallmatrix} +2.0 \\ -3.0 \end{smallmatrix}$	⁴ BONDAR	12	BELL $e^+e^- \rightarrow \Upsilon(2S)\pi^+\pi^-$
17.6 $\pm$ 3.0 $\pm$ 3.0	⁴ BONDAR	12	BELL $e^+e^- \rightarrow \Upsilon(3S)\pi^+\pi^-$
11.4 $\begin{smallmatrix} + \\ - \end{smallmatrix} \begin{smallmatrix} 4.5+2.1 \\ 3.9-1.2 \end{smallmatrix}$	⁴ BONDAR	12	BELL $e^+e^- \rightarrow h_b(1P)\pi^+\pi^-$
13 $\begin{smallmatrix} +10 \\ -8 \end{smallmatrix} \begin{smallmatrix} +9 \\ -7 \end{smallmatrix}$	⁴ BONDAR	12	BELL $e^+e^- \rightarrow h_b(2P)\pi^+\pi^-$

NODE=M207W

³ Average of the BONDAR 12 measurements in separate channels.⁴ Superseded by the average measurement of BONDAR 12.

NODE=M207W;LINKAGE=BO

NODE=M207W;LINKAGE=BN

 $X(10610)^+$ DECAY MODES

NODE=M207215;NODE=M207

 $X(10610)^-$ decay modes are charge conjugates of the modes below.

NODE=M207

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \Upsilon(1S)\pi^+$	seen
$\Gamma_2 \quad \Upsilon(2S)\pi^+$	seen
$\Gamma_3 \quad \Upsilon(3S)\pi^+$	seen
$\Gamma_4 \quad h_b(1P)\pi^+$	seen
$\Gamma_5 \quad h_b(2P)\pi^+$	seen

DESIG=1

DESIG=2

DESIG=3

DESIG=4

DESIG=5

 $X(10610)^\pm$ BRANCHING RATIOS

NODE=M207225

 $\Gamma(\Upsilon(1S)\pi^+)/\Gamma_{\text{total}}$ **Γ_1/Γ**

VALUE	DOCUMENT ID	TECN	COMMENT
seen	BONDAR	12	BELL $e^+e^- \rightarrow \Upsilon(1S)\pi^+\pi^-$

NODE=M207R01

NODE=M207R01

 $\Gamma(\Upsilon(2S)\pi^+)/\Gamma_{\text{total}}$ **Γ_2/Γ**

VALUE	DOCUMENT ID	TECN	COMMENT
seen	BONDAR	12	BELL $e^+e^- \rightarrow \Upsilon(2S)\pi^+\pi^-$

NODE=M207R02

NODE=M207R02

$\Gamma(\Upsilon(3S)\pi^+)/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE

DOCUMENT ID

TECN

COMMENT

seen

BONDAR

12

BELL

 $e^+e^- \rightarrow \Upsilon(3S)\pi^+\pi^-$ NODE=M207R03
NODE=M207R03 $\Gamma(h_b(1P)\pi^+)/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE

DOCUMENT ID

TECN

COMMENT

seen

BONDAR

12

BELL

 $e^+e^- \rightarrow h_b(1P)\pi^+\pi^-$ NODE=M207R04
NODE=M207R04 $\Gamma(h_b(2P)\pi^+)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE

DOCUMENT ID

TECN

COMMENT

seen

BONDAR

12

BELL

 $e^+e^- \rightarrow h_b(2P)\pi^+\pi^-$ NODE=M207R05
NODE=M207R05 **$X(10610)^\pm$ REFERENCES**

NODE=M207

KROKOVNY 13 PR D88 052016
BONDAR 12 PRL 108 122001P. Krokovny *et al.*
A. Bondar *et al.*(BELLE Collab.)
(BELLE Collab.)REFID=55588
REFID=53963 **$X(10610)^0$**

$$J^G(J^P) = 1^+(1^+)$$

NODE=M214

OMITTED FROM SUMMARY TABLE

Observed by KROKOVNY 13 in $\Upsilon(10860) \rightarrow \Upsilon(nS)\pi^0\pi^0$ (n=2,3).

NODE=M214

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. **$X(10610)^0$ MASS**

NODE=M214M

VALUE (MeV)

DOCUMENT ID

TECN

COMMENT

 $10609 \pm 4 \pm 4$ ¹ KROKOVNY 13 BELL $e^+e^- \rightarrow \Upsilon(2S)/\Upsilon(3S)\pi^0\pi^0$

NODE=M214M

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;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

 $e^+e^- \rightarrow \Upsilon(1S)\pi^0\pi^0$ NODE=M214R01
NODE=M214R01 $\Gamma(\Upsilon(2S)\pi^0)/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE

DOCUMENT ID

TECN

COMMENT

seen

² KROKOVNY

13

BELL

 $e^+e^- \rightarrow \Upsilon(2S)\pi^0\pi^0$ NODE=M214R02
NODE=M214R02² Combined significance in $e^+e^- \rightarrow \Upsilon(2S)/\Upsilon(3S)\pi^0\pi^0$, including systematics, of 6.5σ .

NODE=M214R02;LINKAGE=A

 $\Gamma(\Upsilon(3S)\pi^0)/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE

DOCUMENT ID

TECN

COMMENT

seen

³ KROKOVNY

13

BELL

 $e^+e^- \rightarrow \Upsilon(3S)\pi^0\pi^0$ NODE=M214R03
NODE=M214R03³ Combined significance in $e^+e^- \rightarrow \Upsilon(2S)/\Upsilon(3S)\pi^0\pi^0$, including systematics, of 6.5σ .

NODE=M214R03;LINKAGE=A

 $X(10610)^0$ REFERENCES

NODE=M214

KROKOVNY 13 PR D88 052016
BONDAR 12 PRL 108 122001P. Krokovny *et al.*
A. Bondar *et al.*(BELLE Collab.)
(BELLE Collab.)REFID=55588
REFID=53963

X(10650)[±]

$$I^G(J^P) = ?^+(1^+)$$

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)[±] MASS

NODE=M208M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
10652.2±1.5	¹ BONDAR 12	BELL	$e^+e^- \rightarrow \text{hadrons}$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
10657 ±6 ±3	² BONDAR 12	BELL	$e^+e^- \rightarrow \Upsilon(1S)\pi^+\pi^-$
10651 ±2 ±3	² BONDAR 12	BELL	$e^+e^- \rightarrow \Upsilon(2S)\pi^+\pi^-$
10652 ±1 ±2	² BONDAR 12	BELL	$e^+e^- \rightarrow \Upsilon(3S)\pi^+\pi^-$
10654 ±3 $^{+1}_{-2}$	² BONDAR 12	BELL	$e^+e^- \rightarrow h_b(1P)\pi^+\pi^-$
10651 $^{+2}_{-3}$ $^{+3}_{-2}$	² BONDAR 12	BELL	$e^+e^- \rightarrow h_b(2P)\pi^+\pi^-$

NODE=M208M

¹ Average of the BONDAR 12 measurements in separate channels.² Superseded by the average measurement of BONDAR 12.NODE=M208M;LINKAGE=BO
NODE=M208M;LINKAGE=BN**X(10650)[±] WIDTH**

NODE=M208W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
11.5±2.2	³ BONDAR 12	BELL	$e^+e^- \rightarrow \text{hadrons}$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
16.3±9.8 $^{+6.0}_{-2.0}$	⁴ BONDAR 12	BELL	$e^+e^- \rightarrow \Upsilon(1S)\pi^+\pi^-$
13.3±3.3 $^{+4.0}_{-3.0}$	⁴ BONDAR 12	BELL	$e^+e^- \rightarrow \Upsilon(2S)\pi^+\pi^-$
8.4±2.0±2.0	⁴ BONDAR 12	BELL	$e^+e^- \rightarrow \Upsilon(3S)\pi^+\pi^-$
20.9 $^{+5.4}_{-4.7}$ $^{+2.1}_{-5.7}$	⁴ BONDAR 12	BELL	$e^+e^- \rightarrow h_b(1P)\pi^+\pi^-$
19 ±7 $^{+11}_{-7}$	⁴ BONDAR 12	BELL	$e^+e^- \rightarrow h_b(2P)\pi^+\pi^-$

NODE=M208W

³ Average of the BONDAR 12 measurements in separate channels.⁴ Superseded by the average measurement of BONDAR 12.NODE=M208W;LINKAGE=BO
NODE=M208W;LINKAGE=BN**X(10650)⁺ DECAY MODES**

NODE=M208215;NODE=M208

X(10650)[−] decay modes are charge conjugates of the modes below.

NODE=M208

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \Upsilon(1S)\pi^+$	seen
$\Gamma_2 \quad \Upsilon(2S)\pi^+$	seen
$\Gamma_3 \quad \Upsilon(3S)\pi^+$	seen
$\Gamma_4 \quad h_b(1P)\pi^+$	seen
$\Gamma_5 \quad h_b(2P)\pi^+$	seen

DESIG=1

DESIG=2

DESIG=3

DESIG=4

DESIG=5

X(10650)[±] BRANCHING RATIOS

NODE=M208225

$\Gamma(\Upsilon(1S)\pi^+)/\Gamma_{\text{total}}$				Γ_1/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
seen	BONDAR	12	BELL	$e^+e^- \rightarrow \Upsilon(1S)\pi^+\pi^-$
$\Gamma(\Upsilon(2S)\pi^+)/\Gamma_{\text{total}}$				Γ_2/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
seen	BONDAR	12	BELL	$e^+e^- \rightarrow \Upsilon(2S)\pi^+\pi^-$
$\Gamma(\Upsilon(3S)\pi^+)/\Gamma_{\text{total}}$				Γ_3/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
seen	BONDAR	12	BELL	$e^+e^- \rightarrow \Upsilon(3S)\pi^+\pi^-$

NODE=M208R01
NODE=M208R01NODE=M208R02
NODE=M208R02NODE=M208R03
NODE=M208R03

$\Gamma(h_b(1P)\pi^+)/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	BONDAR	12	BELL $e^+e^- \rightarrow h_b(1P)\pi^+\pi^-$

NODE=M208R04
 NODE=M208R04

 $\Gamma(h_b(2P)\pi^+)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	BONDAR	12	BELL $e^+e^- \rightarrow h_b(2P)\pi^+\pi^-$

NODE=M208R05
 NODE=M208R05

 $X(10650)^\pm$ REFERENCES

BONDAR 12 PRL 108 122001 A. Bondar *et al.* (BELLE Collab.)

NODE=M208

REFID=53963

NODE=M092

 $\Upsilon(10860)$

$$I^G(J^{PC}) = 0^-(1^{--})$$

 $\Upsilon(10860)$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

10876 ±11 OUR EVALUATION Weighted-average of Belle and BaBar results, but tripling the scaling S -factors applied to the uncertainties to account for model-dependence, handling of radiative corrections, and interference effects.

• • • We do not use the following data for averages, fits, limits, etc. • • •

10879 ± 3	^{1,2} CHEN	10	BELL $e^+e^- \rightarrow \text{hadrons}$
10888.4 ^{+2.7} _{-2.6} ±1.2	³ CHEN	10	BELL $e^+e^- \rightarrow \Upsilon(1S, 2S, 3S)\pi^+\pi^-$
10876 ± 2	¹ AUBERT	09E	BABR $e^+e^- \rightarrow \text{hadrons}$
10869 ± 2	⁴ AUBERT	09E	BABR $e^+e^- \rightarrow \text{hadrons}$
10868 ± 6 ±5	⁵ BESSON	85	CLEO $e^+e^- \rightarrow \text{hadrons}$
10845 ±20	⁶ LOVELOCK	85	CUSB $e^+e^- \rightarrow \text{hadrons}$

NODE=M092M

NODE=M092M
 → UNCHECKED ←

OCCUR=2

OCCUR=2

NODE=M092M;LINKAGE=AU

NODE=M092M;LINKAGE=CH
 NODE=M092M;LINKAGE=CE

NODE=M092M;LINKAGE=UB

NODE=M092M;LINKAGE=BE
 NODE=M092M;LINKAGE=LO

¹ In a model where a flat non-resonant $b\bar{b}$ -continuum is incoherently added to a second flat component interfering with two Breit-Wigner resonances. Systematic uncertainties not estimated.

² The parameters of the $\Upsilon(11020)$ are fixed to those in AUBERT 09E.

³ In a model where a flat nonresonant $\Upsilon(1S, 2S, 3S)\pi^+\pi^-$ continuum interferes with a single Breit-Wigner resonance.

⁴ In a model where a non-resonant $b\bar{b}$ -continuum represented by a threshold function at $\sqrt{s}=2m_B$ is incoherently added to a flat component interfering with two Breit-Wigner resonances. Not independent of other AUBERT 09E results. Systematic uncertainties not estimated.

⁵ Assuming four Gaussians with radiative tails and a single step in R .

⁶ In a coupled-channel model with three resonances and a smooth step in R .

 $\Upsilon(10860)$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

55 ±28 OUR EVALUATION Weighted-average of Belle and BaBar results, but tripling the scaling S -factors applied to the uncertainties to account for model-dependence, handling of radiative corrections, and interference effects.

• • • We do not use the following data for averages, fits, limits, etc. • • •

46 ⁺⁹ ₋₇	^{7,8} CHEN	10	BELL $e^+e^- \rightarrow \text{hadrons}$
30.7 ^{+8.3} _{-7.0} ± 3.1	⁹ CHEN	10	BELL $e^+e^- \rightarrow \Upsilon(1S, 2S, 3S)\pi^+\pi^-$
43 ± 4	⁷ AUBERT	09E	BABR $e^+e^- \rightarrow \text{hadrons}$
74 ± 4	¹⁰ AUBERT	09E	BABR $e^+e^- \rightarrow \text{hadrons}$
112 ±17 ±23	¹¹ BESSON	85	CLEO $e^+e^- \rightarrow \text{hadrons}$
110 ±15	¹² LOVELOCK	85	CUSB $e^+e^- \rightarrow \text{hadrons}$

NODE=M092W

NODE=M092W
 → UNCHECKED ←

OCCUR=2

OCCUR=2

NODE=M092W;LINKAGE=AU

NODE=M092W;LINKAGE=CH
 NODE=M092W;LINKAGE=CE

NODE=M092W;LINKAGE=UB

NODE=M092W;LINKAGE=BE
 NODE=M092W;LINKAGE=LO

⁷ In a model where a flat non-resonant $b\bar{b}$ -continuum is incoherently added to a second flat component interfering with two Breit-Wigner resonances. Systematic uncertainties not estimated.

⁸ The parameters of the $\Upsilon(11020)$ are fixed to those in AUBERT 09E.

⁹ In a model where a flat nonresonant $\Upsilon(1S, 2S, 3S)\pi^+\pi^-$ continuum interferes with a single Breit-Wigner resonance.

¹⁰ In a model where a non-resonant $b\bar{b}$ -continuum represented by a threshold function at $\sqrt{s}=2m_B$ is incoherently added to a flat component interfering with two Breit-Wigner resonances. Not independent of other AUBERT 09E results. Systematic uncertainties not estimated.

¹¹ Assuming four Gaussians with radiative tails and a single step in R .

¹² In a coupled-channel model with three resonances and a smooth step in R .

$\Upsilon(10860)$ 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^-	(5.6 ± 3.1) $\times 10^{-6}$		DESIG=1
Γ_{16} $K^*(892)^0\bar{K}^0$	< 1.0 $\times 10^{-5}$	90%	DESIG=29
Γ_{17} $\Upsilon(1S)\pi^+\pi^-$	(5.3 ± 0.6) $\times 10^{-3}$		DESIG=17
Γ_{18} $\Upsilon(2S)\pi^+\pi^-$	(7.8 ± 1.3) $\times 10^{-3}$		DESIG=18
Γ_{19} $\Upsilon(3S)\pi^+\pi^-$	(4.8 $^{+1.9}_{-1.7}$) $\times 10^{-3}$		DESIG=19
Γ_{20} $\Upsilon(1S)K^+K^-$	(6.1 ± 1.8) $\times 10^{-4}$		DESIG=20
Γ_{21} $h_b(1P)\pi^+\pi^-$	(3.5 $^{+1.0}_{-1.3}$) $\times 10^{-3}$		DESIG=26
Γ_{22} $h_b(2P)\pi^+\pi^-$	(6.0 $^{+2.1}_{-1.8}$) $\times 10^{-3}$		DESIG=27

Inclusive Decays.

NODE=M092;CLUMP=I

These decay modes are submodes of one or more of the decay modes above.

NODE=M092

Γ_{23} ϕ anything	(13.8 $^{+2.4}_{-1.7}$) %	DESIG=12
Γ_{24} D^0 anything + c.c.	(108 ± 8) %	DESIG=13
Γ_{25} D_s anything + c.c.	(46 ± 6) %	DESIG=6
Γ_{26} J/ψ anything	(2.06 ± 0.21) %	DESIG=14
Γ_{27} B^0 anything + c.c.	(77 ± 8) %	DESIG=21
Γ_{28} 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 $\pm 0.05 \pm 0.07$	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**

NODE=M092230

"OUR EVALUATION" is obtained based on averages of rescaled data listed below. The averages and rescaling were performed by the Heavy Flavor Averaging Group (HFAG) and are described at <http://www.slac.stanford.edu/xorg/hfag/>.

NODE=M092230

 $\Gamma(B\bar{B}X)/\Gamma_{\text{total}}$ **Γ_1/Γ**

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.762 $^{+0.027}_{-0.043}$ OUR EVALUATION				
[0.759 $^{+0.027}_{-0.040}$ OUR 2013 EVALUATION]				
0.71 ± 0.06 OUR AVERAGE				
0.737 $\pm 0.032 \pm 0.051$	1063	¹³ DRUTSKOY	10 BELL	$\Upsilon(5S) \rightarrow B^+X, B^0X$
0.589 $\pm 0.100 \pm 0.092$		¹⁴ HUANG	07 CLEO	$\Upsilon(5S) \rightarrow \text{hadrons}$

NODE=M092R13
NODE=M092R13NEW; $\rightarrow$ UNCHECKED $\leftarrow$

$\Gamma(B\bar{B})/\Gamma_{\text{total}}$
 Γ_2/Γ

VALUE (units 10^{-2})	CL%	DOCUMENT ID	TECN	COMMENT
$5.5^{+1.0}_{-0.9} \pm 0.4$		15 DRUTSKOY 10	BELL	$\Upsilon(5S) \rightarrow B^+ X, B^0 X$

NODE=M092R16
NODE=M092R16

• • • We do not use the following data for averages, fits, limits, etc. • • •

<13.8	90	14 HUANG 07	CLEO	$\Upsilon(5S) \rightarrow \text{hadrons}$

 $\Gamma(B\bar{B})/\Gamma(B\bar{B}X)$
 Γ_2/Γ_1

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.22	90	AQUINES 06	CLE3	$\Upsilon(5S) \rightarrow \text{hadrons}$

NODE=M092R05
NODE=M092R05

 $\Gamma(B\bar{B}^* + \text{c.c.})/\Gamma_{\text{total}}$
 Γ_3/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
0.137 ± 0.016 OUR AVERAGE			
0.137 ± 0.013 ± 0.011	15 DRUTSKOY 10	BELL	$\Upsilon(5S) \rightarrow B^+ X, B^0 X$
0.143 ± 0.053 ± 0.027	14 HUANG 07	CLEO	$\Upsilon(5S) \rightarrow \text{hadrons}$

NODE=M092R15
NODE=M092R15

 $\Gamma(B\bar{B}^* + \text{c.c.})/\Gamma(B\bar{B}X)$
 Γ_3/Γ_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

 $\Gamma(B^*\bar{B}^*)/\Gamma_{\text{total}}$
 Γ_4/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
0.381 ± 0.034 OUR AVERAGE			
$0.375^{+0.021}_{-0.019} \pm 0.030$	15 DRUTSKOY 10	BELL	$\Upsilon(5S) \rightarrow B^+ X, B^0 X$
$0.436 \pm 0.083 \pm 0.072$	14 HUANG 07	CLEO	$\Upsilon(5S) \rightarrow \text{hadrons}$

NODE=M092R14
NODE=M092R14

 $\Gamma(B^*\bar{B}^*)/\Gamma(B\bar{B}X)$
 Γ_4/Γ_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

 $\Gamma(B\bar{B}^{(*)}\pi)/\Gamma_{\text{total}}$
 Γ_5/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.197	90	14 HUANG 07	CLEO	$\Upsilon(5S) \rightarrow \text{hadrons}$

NODE=M092R17
NODE=M092R17

 $\Gamma(B\bar{B}^{(*)}\pi)/\Gamma(B\bar{B}X)$
 Γ_5/Γ_1

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.32	90	AQUINES 06	CLE3	$\Upsilon(5S) \rightarrow \text{hadrons}$

NODE=M092R08
NODE=M092R08

 $\Gamma(B\bar{B}\pi)/\Gamma_{\text{total}}$
 Γ_6/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
0.0 ± 1.2 ± 0.3	0	15 DRUTSKOY 10	BELL	$\Upsilon(5S) \rightarrow B^{+,0}\pi^- X$

NODE=M092R28
NODE=M092R28

 $[\Gamma(B^*\bar{B}\pi) + \Gamma(B\bar{B}^*\pi)]/\Gamma_{\text{total}}$
 Γ_7/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
$7.3^{+2.3}_{-2.1} \pm 0.8$	38	15 DRUTSKOY 10	BELL	$\Upsilon(5S) \rightarrow B^{+,0}\pi^- X$

NODE=M092R29
NODE=M092R29

 $\Gamma(B^*\bar{B}^*\pi)/\Gamma_{\text{total}}$
 Γ_8/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.0^{+1.4}_{-1.3} \pm 0.4$	5	15 DRUTSKOY 10	BELL	$\Upsilon(5S) \rightarrow B^{+,0}\pi^- X$

NODE=M092R30
NODE=M092R30

 $\Gamma(B\bar{B}\pi\pi)/\Gamma_{\text{total}}$
 Γ_9/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.089	90	14 HUANG 07	CLEO	$\Upsilon(5S) \rightarrow \text{hadrons}$

NODE=M092R18
NODE=M092R18

 $\Gamma(B\bar{B}\pi\pi)/\Gamma(B\bar{B}X)$
 Γ_9/Γ_1

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.14	90	AQUINES 06	CLE3	$\Upsilon(5S) \rightarrow \text{hadrons}$

NODE=M092R09
NODE=M092R09

$$\Gamma(B_s^{(*)}\bar{B}_s^{(*)})/\Gamma_{\text{total}}$$

VALUE

DOCUMENT ID

TECN

COMMENT

$$\Gamma_{10}/\Gamma = (\Gamma_{11} + \Gamma_{12} + \Gamma_{13})/\Gamma$$

NODE=M092R01
NODE=M092R01

$$0.201^{+0.030}_{-0.031} \text{ OUR EVALUATION}$$

[0.199 ± 0.030 OUR 2013 EVALUATION]

NEW; → UNCHECKED ←

$$0.189^{+0.027}_{-0.021} \text{ OUR AVERAGE}$$

0.172 ± 0.030 16 ESEN 13 BELL $\Upsilon(5S) \rightarrow D^0 X, D_s X$ 0.21 $^{+0.06}_{-0.03}$ 17 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 18 DRUTSKOY 07 BELL $\Upsilon(5S) \rightarrow D^0 X, D_s X$ 0.160 ± 0.026 ± 0.058 19 ARTUSO 05B CLEO $e^+ e^- \rightarrow D_s X$

$$\Gamma(B_s^{(*)}\bar{B}_s^{(*)})/\Gamma(B\bar{B}X)$$

VALUE

DOCUMENT ID

$$\Gamma_{10}/\Gamma_1$$

NODE=M092R34
NODE=M092R34

$$0.264^{+0.052}_{-0.045} \text{ OUR EVALUATION}$$

[0.262 $^{+0.051}_{-0.043}$ OUR 2013 EVALUATION]

NEW; → UNCHECKED ←

$$\Gamma(B_s^* \bar{B}_s^*)/\Gamma(B_s^{(*)}\bar{B}_s^{(*)})$$

VALUE (units 10⁻²)

EVTs

DOCUMENT ID

$$\Gamma_{13}/\Gamma_{10} = \Gamma_{13}/(\Gamma_{11} + \Gamma_{12} + \Gamma_{13})$$

TECN

COMMENT

NODE=M092R19
NODE=M092R19

$$87.8 \pm 1.5 \text{ OUR AVERAGE}$$

87.0 ± 1.7 20,21 ESEN 13 BELL $B_s^0 \rightarrow D_s^- \pi^+$ 90.5 ± 3.2 ± 0.1 227 21,22 LI 12 BELL $B_s^0 \rightarrow J/\psi \eta^{(\prime)}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

90.1 $^{+3.8}_{-4.0} \pm 0.2$ 23 LOUVOT 09 BELL $10.86 e^+ e^- \rightarrow B_s^{(*)} \bar{B}_s^{(*)}$ 93 $^{+7}_{-9} \pm 1$ 23 DRUTSKOY 07A BELL Superseded by LOUVOT 09

$$\Gamma(B_s \bar{B}_s)/\Gamma(B_s^{(*)}\bar{B}_s^{(*)})$$

VALUE (units 10⁻²)

DOCUMENT ID

$$\Gamma_{11}/\Gamma_{10} = \Gamma_{11}/(\Gamma_{11} + \Gamma_{12} + \Gamma_{13})$$

TECN

COMMENT

NODE=M092R24
NODE=M092R24

$$2.6^{+2.6}_{-2.5}$$

LOUVOT 09 BELL $10.86 e^+ e^- \rightarrow B_s^{(*)} \bar{B}_s^{(*)}$

$$\Gamma(B_s \bar{B}_s)/\Gamma(B_s^* \bar{B}_s^*)$$

VALUE

CL%

DOCUMENT ID

TECN

COMMENT

$$\Gamma_{11}/\Gamma_{13}$$

NODE=M092R03
NODE=M092R03

$$<0.16$$

90

BONVICINI

06

CLE3

 $e^+ e^-$

$$\Gamma(B_s \bar{B}_s^* + \text{c.c.})/\Gamma(B_s^{(*)}\bar{B}_s^{(*)})$$

VALUE (units 10⁻²)

EVTs

DOCUMENT ID

$$\Gamma_{12}/\Gamma_{10} = \Gamma_{12}/(\Gamma_{11} + \Gamma_{12} + \Gamma_{13})$$

TECN

COMMENT

NODE=M092R25
NODE=M092R25

$$6.7 \pm 1.2 \text{ OUR AVERAGE}$$

7.3 ± 1.4 20,21 ESEN 13 BELL $B_s^0 \rightarrow D_s^- \pi^+$ 4.9 ± 2.5 ± 0.0 227 21,22 LI 12 BELL $B_s^0 \rightarrow J/\psi \eta^{(\prime)}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

7.3 $^{+3.3}_{-3.0} \pm 0.1$ LOUVOT 09 BELL $10.86 e^+ e^- \rightarrow B_s^{(*)} \bar{B}_s^{(*)}$

$$\Gamma(B_s \bar{B}_s^* + \text{c.c.})/\Gamma(B_s^* \bar{B}_s^*)$$

VALUE

CL%

DOCUMENT ID

TECN

COMMENT

$$\Gamma_{12}/\Gamma_{13}$$

NODE=M092R04
NODE=M092R04

$$<0.16$$

90

BONVICINI

06

CLE3

 $e^+ e^-$

$$\Gamma(\text{no open-bottom})/\Gamma_{\text{total}}$$

VALUE

DOCUMENT ID

$$\Gamma_{14}/\Gamma$$

NODE=M092R33
NODE=M092R33

$$0.038^{+0.051}_{-0.005} \text{ OUR EVALUATION}$$

[0.042 $^{+0.046}_{-0.006}$ OUR 2013 EVALUATION]

NEW; → UNCHECKED ←

$$\Gamma(K^*(892)^0 \bar{K}^0)/\Gamma_{\text{total}}$$

VALUE

CL%

DOCUMENT ID

TECN

COMMENT

$$\Gamma_{16}/\Gamma$$

NODE=M092R35
NODE=M092R35

$$<1.0 \times 10^{-5}$$

90

SHEN

13A

BELL

 $e^+ e^- \rightarrow K^*(892)^0 \bar{K}^0$

$$\Gamma(\Upsilon(1S)\pi^+\pi^-)/\Gamma_{\text{total}} \quad \Gamma_{17}/\Gamma$$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$5.3 \pm 0.3 \pm 0.5$	325	²⁴ CHEN 08	BELL	$10.87 e^+ e^- \rightarrow \Upsilon(1S)\pi^+\pi^-$

NODE=M092R20
NODE=M092R20

$$\Gamma(\Upsilon(2S)\pi^+\pi^-)/\Gamma_{\text{total}} \quad \Gamma_{18}/\Gamma$$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$7.8 \pm 0.6 \pm 1.1$	186	²⁴ CHEN 08	BELL	$10.87 e^+ e^- \rightarrow \Upsilon(2S)\pi^+\pi^-$

NODE=M092R21
NODE=M092R21

$$\Gamma(\Upsilon(3S)\pi^+\pi^-)/\Gamma_{\text{total}} \quad \Gamma_{19}/\Gamma$$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$4.8^{+1.8}_{-1.5} \pm 0.7$	10	²⁴ CHEN 08	BELL	$10.87 e^+ e^- \rightarrow \Upsilon(3S)\pi^+\pi^-$

NODE=M092R22
NODE=M092R22

$$\Gamma(\Upsilon(1S)K^+K^-)/\Gamma_{\text{total}} \quad \Gamma_{20}/\Gamma$$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$6.1^{+1.6}_{-1.4} \pm 1.0$	20	²⁴ CHEN 08	BELL	$10.87 e^+ e^- \rightarrow \Upsilon(1S)K^+K^-$

NODE=M092R23
NODE=M092R23

$$\Gamma(h_b(1P)\pi^+\pi^-)/\Gamma(\Upsilon(2S)\pi^+\pi^-) \quad \Gamma_{21}/\Gamma_{18}$$

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

$$\Gamma(\phi \text{ anything})/\Gamma_{\text{total}} \quad \Gamma_{23}/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
$0.138 \pm 0.007^{+0.023}_{-0.015}$	HUANG	07	CLEO $\Upsilon(5S) \rightarrow \phi X$

NODE=M092R12
NODE=M092R12

$$\Gamma(D^0 \text{ anything} + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_{24}/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
$1.076 \pm 0.040 \pm 0.068$	DRUTSKOY	07	BELL $\Upsilon(5S) \rightarrow D^0 X$

NODE=M092R10
NODE=M092R10

$$\Gamma(D_s \text{ anything} + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_{25}/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
0.46 ± 0.06 OUR AVERAGE			
$0.472 \pm 0.024 \pm 0.072$	¹⁸ DRUTSKOY	07	BELL $\Upsilon(5S) \rightarrow D_s X$
$0.44 \pm 0.09 \pm 0.04$	²⁵ ARTUSO	05B	CLE3 $e^+ e^- \rightarrow D_s X$

NODE=M092R02
NODE=M092R02

$$\Gamma(J/\psi \text{ anything})/\Gamma_{\text{total}} \quad \Gamma_{26}/\Gamma$$

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
$2.060 \pm 0.160 \pm 0.134$	DRUTSKOY	07	BELL $\Upsilon(5S) \rightarrow J/\psi X$

NODE=M092R11
NODE=M092R11

$$\Gamma(B^0 \text{ anything} + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_{27}/\Gamma$$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
$0.770^{+0.058}_{-0.056} \pm 0.061$	352	DRUTSKOY	10	BELL $\Upsilon(5S) \rightarrow B^0 X$

NODE=M092R26
NODE=M092R26

$$\Gamma(B^+ \text{ anything} + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_{28}/\Gamma$$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
$0.721^{+0.039}_{-0.038} \pm 0.050$	711	DRUTSKOY	10	BELL $\Upsilon(5S) \rightarrow B^+ X$

NODE=M092R27
NODE=M092R27

¹³ Not independent of DRUTSKOY 10 values for $\Upsilon(5S) \rightarrow B^{\pm,0} \text{ anything}$.

¹⁴ Using measurements or limits from AQUINES 06.

¹⁵ Assuming isospin conservation.

¹⁶ Supersedes DRUTSKOY 07.

¹⁷ Supersedes ARTUSO 05B. Combining inclusive ϕ , D_s , and B measurements. Using

$B(D_s^+ \rightarrow \phi \pi^+) = 4.4 \pm 0.6\%$ from PDG 06.

¹⁸ Using $B(D_s^+ \rightarrow \phi \pi^+) = (4.4 \pm 0.6)\%$ from PDG 06.

¹⁹ Uses a model-dependent estimate $B(B_s \rightarrow D_s X) = (92 \pm 11)\%$.

²⁰ Supersedes LOUVOT 09.

²¹ With $N(B_s^{(*)} \bar{B}_s^{(*)}) = (7.11 \pm 1.30) \times 10^6$.

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

- 22 The ratios $N(B_s^* \bar{B}_s^*) / N(B_s^{(*)} \bar{B}_s^{(*)})$ and $N(B_s^* \bar{B}_s^0) / N(B_s^{(*)} \bar{B}_s^{(*)})$ are measured with a correlation coefficient of -0.72 .
- 23 From a measurement of $\sigma(e^+ e^- \rightarrow B_s^* \bar{B}_s^*) / \sigma(e^+ e^- \rightarrow B_s^{(*)} \bar{B}_s^{(*)})$ at $\sqrt{s} = 10.86$ GeV.
- 24 Assuming that the observed events are solely due to the $\Upsilon(5S)$ resonance.
- 25 ARTUSO 05B reports $[\Gamma(\Upsilon(10860) \rightarrow D_s \text{ anything} + \text{c.c.}) / \Gamma_{\text{total}}] \times [B(D_s^+ \rightarrow \phi \pi^+)] = 0.0198 \pm 0.0019 \pm 0.0038$ which we divide by our best value $B(D_s^+ \rightarrow \phi \pi^+) = (4.5 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M092R19;LINKAGE=LI

NODE=M092R19;LINKAGE=DR

NODE=M092R20;LINKAGE=CH

NODE=M092R02;LINKAGE=AR

$\Upsilon(10860)$ REFERENCES

ESEN	13	PR D87 031101	S. Esen <i>et al.</i>	(BELLE Collab.)
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=54894
REFID=55591
REFID=53962
REFID=54116
REFID=53531
REFID=53358
REFID=52661
REFID=52646
REFID=52153
REFID=51621
REFID=51852
REFID=51624
REFID=51106
REFID=50995
REFID=51004
REFID=50992
REFID=22368
REFID=22369

NODE=M093

$\Upsilon(11020)$

$$J^{PC} = 0^-(1^{--})$$

$\Upsilon(11020)$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
11019 ± 8 OUR AVERAGE			
11019 ± 5 ± 7	BESSION	85	CLEO $e^+ e^- \rightarrow \text{hadrons}$
11020 ± 30	LOVELOCK	85	CUSB $e^+ e^- \rightarrow \text{hadrons}$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
10996 ± 2	¹ AUBERT	09E	BABR $e^+ e^- \rightarrow \text{hadrons}$

NODE=M093M

NODE=M093M

¹ In a model where a flat non-resonant $b\bar{b}$ -continuum is incoherently added to a second flat component interfering with two Breit-Wigner resonances. Systematic uncertainties not estimated.

NODE=M093M;LINKAGE=AU

$\Upsilon(11020)$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
79 ± 16 OUR AVERAGE			
61 ± 13 ± 22	BESSION	85	CLEO $e^+ e^- \rightarrow \text{hadrons}$
90 ± 20	LOVELOCK	85	CUSB $e^+ e^- \rightarrow \text{hadrons}$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
37 ± 3	² AUBERT	09E	BABR $e^+ e^- \rightarrow \text{hadrons}$

NODE=M093W

NODE=M093W

² In a model where a flat non-resonant $b\bar{b}$ -continuum is incoherently added to a second flat component interfering with two Breit-Wigner resonances. Systematic uncertainties not estimated.

NODE=M093W;LINKAGE=AU

$\Upsilon(11020)$ DECAY MODES

Mode	Fraction (Γ_i / Γ)
$\Gamma_1 \quad e^+ e^-$	$(1.6 \pm 0.5) \times 10^{-6}$

NODE=M093215;NODE=M093

DESIG=1

$\Upsilon(11020)$ PARTIAL WIDTHS

$\Gamma(e^+ e^-)$	DOCUMENT ID	TECN	COMMENT	Γ_1
0.130 ± 0.030 OUR AVERAGE				
0.095 ± 0.03 ± 0.035	BESSION	85	CLEO $e^+ e^- \rightarrow \text{hadrons}$	
0.156 ± 0.040	LOVELOCK	85	CUSB $e^+ e^- \rightarrow \text{hadrons}$	

NODE=M093220

NODE=M093W1
NODE=M093W1

$T(11020)$ REFERENCES

AUBERT	09E	PRL 102 012001	B. Aubert <i>et al.</i>	(BABAR Collab.)
BESSON	85	PRL 54 381	D. Besson <i>et al.</i>	(CLEO Collab.)
LOVELOCK	85	PRL 54 377	D.M.J. Lovelock <i>et al.</i>	(CUSB Collab.)

NODE=M093

REFID=52661
REFID=22368
REFID=22369